



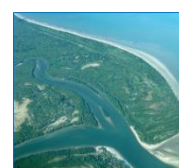
Coastal Profile for Tanzania 2014

Volume IV - Mitigation of Threats

Investment Prioritization for Resilient Livelihoods and Ecosystems in Coastal Zones of Tanzania



Investment Prioritisation for Resilient Livelihoods and Ecosystems in Coastal Zones of Tanzania





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Introduction

Tanzania Coastal Zone

The coastal zone in Tanzania is under development pressure induced by population growth and economic activities and the area is experiencing a range of management problems giving rise to increased concern, including ecosystem encroachment, pollution, salinization of soils, estuaries and aquifers, degradation of resources, shoreline erosion and conflicts of interest among stakeholders depending on the coast for their livelihood. Climate change will further aggravate this situation due to sea level rise and more frequent extreme weather.

In order to address these management challenges the Government of Tanzania with World Bank assistance has through the project “Investment Prioritization for Resilient Livelihoods and Ecosystems in Coastal Zones of Tanzania” embarked on identifying and prioritising threats with the view of developing fundable adaptation measures to address the most pertinent threats.

The Project

The Government of Tanzania with World Bank assistance has through the project “Investment Prioritisation for Resilient Livelihoods and Ecosystems in Coastal Zones of Tanzania” embarked on identifying and prioritising threats with the view of developing fundable adaptation measures to address the most pertinent threats.

The objective of the study is to prioritise geographically and thematically the actions to promote sustainable coastal livelihoods and ecosystems in Tanzania (both Mainland and Zanzibar). The results comprise proposals for measures for coastal management and climate change adaptation in Tanzania, which the Government of Tanzania, NGOs, and donors can use to guide their support and investments over a five year period.

Further details on the project are provided in the thematic part of the Coastal Profile for Tanzania and Zanzibar (Volume I).

Partners

The study is financed by the World Bank (WB) with trust funds provided by Nordic Development Fund (NDF).

The client for the project is Fisheries Department at the Ministry for Livestock and Fisheries Development (MLFD) in Dar es Salaam and the Department of Fisheries and Marine Resources at the Ministry of Agriculture, Livestock and Environment (MALE) in Zanzibar.

The consultants carrying out the study are DHI from Denmark and SAMAKI Consultants from Tanzania.

Study Objectives

The objective of the study is to prioritize geographically and thematically the actions to promote sustainable coastal livelihoods and ecosystems in Tanzania (both Mainland and Zanzibar). The results will comprise proposals for measures for coastal management and climate change adaptation in Tanzania, which the Government of Tanzania, NGOs, and donors can use to guide their support and investments over a five year period. Specific objectives are:

1. Conduct a review of current coastal management and climate change adaptation studies and planning activities in Tanzania Mainland and Zanzibar, including an inventory of data and information available;
2. Identify, analyse and geographically locate the most important livelihood sources of Tanzania’s coastal communities, and the ecosystems on which they depend;
3. Assess the economic costs of climate change on coastal communities and analyse the adaptive capacity of these communities;
4. Identify and geographically locate a gross list of major climate-related threats to sustain these livelihood sources and the ecosystems they depend on;

5. Evaluate the gross list of threats in terms of probability of occurrence, prediction confidence, and consequences if a 'business as usual' scenario is applied;
6. Identify possible adaptation measures to mitigate the threats and evaluate these measures in terms of cost-benefit efficiency and reasonability to implement;
7. Analyse the characteristics of the threats and adaptation measures to prioritize them and identify the most urgent and important investments for sustainable coastal livelihoods and ecosystems;
8. Identify on-going and planned projects supporting coastal management and climate change initiatives in coastal areas, and recognize overlaps with the above found priorities;
9. Identify data monitoring and research needs that should be addressed to augment the implementation and sustainability of the recommended investments;
10. Establish a GIS data base to document the results from the above objectives to the extent possible. The data base should be used as the basis upon which to undertake spatial analysis and thereby assist in prioritizing adaptation investments, based in large part on the characteristics and geographic locations of the major threats to sustainable livelihood sources.;
11. Develop an action plan for priority investment in the short-term (next five years) under multiple funding scenarios. The action plan should consider the prioritization results, total estimated costs compared to assumed available funds, and possible overlaps with existing initiatives. It should be specified whether the investments are targeted for Tanzania Mainland or Zanzibar.

The Coastal Profile

The coastal profile is based primarily on secondary data, acquired from key stakeholders. A database has been established listing all relevant documents identified and linkages to soft copies have been included as available.

A Geographical Information Systems (GIS) has been established to contain acquired themes. The GIS has furthermore been used to examine inundation and flooding consequences of various Sea Level Rise scenarios. These analyses have been based on a Digital Elevation Model (DEM) developed for the coastal areas of the country. The GIS has also been used to produce district level statistical information.

The coastal profile is presented in five volumes:

Volume I: Coastal Themes, presenting the situation in the coastal zone thematically, i.e. from the perspective of various sectors and other country wide themes. There are separate volumes for Mainland Tanzania and Zanzibar.

Volume II: Coastal Districts/Regions, offering an overview of the situation in the coastal zone of each district or region, localising and adding detail to the information in Volume I. There are separate volumes for Mainland Tanzania and Zanzibar.

Volume III: Maps and Tables, presenting thematic and district/region maps in A3 format and offering tabulated information, collected from documents consulted or generated from the GIS. This is a combined volume for Mainland Tanzania and Zanzibar.

Volume IV: Overall Threat Mitigation, presenting action areas for the identified threats emerging from discussions in the two working groups established after the Inception stakeholder meetings. The working groups, one in Zanzibar and one in Dar es Salaam, assisted in validating and prioritising threats and in proposing overall adaptation measures to address such threats. This is a combined volume for Mainland Tanzania and Zanzibar.

Volume V: A portfolio of prioritised actions to address threats to local communities and ecosystems in the coastal areas of Mainland Tanzania and Zanzibar. There are separate volumes for Mainland Tanzania and Zanzibar.

This is Volume IV of the Coastal Profile.

Organization of Volume IV

Volume IV is organised in the following Sections:

- Introduction

A general introduction to the project as provided in all volumes of the coastal profile. This is followed by the current overview of the organization of Volume IV of the Coastal Profile.

- Climate Change in Tanzania

A short recapitulation of the thematic section on climate change from Volume 1 of the coastal Profile, commenting on global warming, climate change in coastal Tanzania and a general outlook for the future climate.

- Methodological Approach

The development of actions targeted by the study has been carried in a sequence of steps. The methodology applied is presented and discussed in this section. The steps are: i) Identification and prioritization of threats to coastal communities and livelihoods first through a structured update of coastal information based on available information and dialogues with key stakeholders and then followed by validation and threat prioritization efforts in broader stakeholder workshops; ii) a rapid assessment of threat susceptibility to climate change applying a coarse ranking approach for each identified threat within different climate impact dimensions; iii) participatory identification of broad management measures that could be applied to mitigate threats; iv) a screening of action areas with the view of generating a shortlist of priority interventions for further detailing and v) structured action formulation and compilation of a portfolio priority actions.

- Prioritized Action Areas

This section synthesizes the outcome of thematic and district/region assessments of threat mitigation measures (see below) into a series of recommendations for interventions to address threats in the coastal areas of mainland Tanzania and Zanzibar. The recommended interventions are subjected to a screening leading to a ranked outline of prioritized actions for further processing into a portfolio of detailed action sheets.

- Mainland Tanzania Themes

For each of the Mainland Tanzania themes a narrative introduction to the theme is provided. The prioritized threats are tabulated with the results of the rapid assessment of susceptibility to climate change. This is followed by a listing of overall adaptation measures emerging from broad measures identified in the working group sessions. The results of the group work identification is also tabulated in a special table section to Volume IV of the coastal profile. A concluding sub-section for each theme presents an assessment of the importance of each of the broad measures in addressing the threats for the theme in question and briefly outlines the most important measures for further processing in the section on prioritized action areas mentioned above.

- Mainland Districts

The prioritized threats are tabulated with the results of the rapid assessment of susceptibility to climate change. This is followed by a listing of overall adaptation measures emerging from broad measures identified in the working group sessions. The results of the group work identification is also tabulated in a special table section to Volume IV of the Coastal Profile (see below). A concluding sub-section for each district presents an assessment of the importance of each of the broad measures in addressing the threats for the district in question and briefly outlines the most important measures for further processing in the section on prioritized action areas mentioned above.

- Zanzibar Themes

Organised as for Mainland Tanzania themes (see above), but concerning Zanzibar and Pemba themes.

- Zanzibar Regions

Organised as for Mainland Districts (see above), but concerning Zanzibar and Pemba Regions.

- Tables of Overall Threat Mitigation Measures

This section contains four series of tables systematically presenting the mitigation measures brought forward in the working group sessions for all identified threats. The four series are for; i) Mainland Tanzania Themes ii) Zanzibar Themes, iii) Mainland Tanzania Districts and iv) Zanzibar Regions.

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Climate Change in Brief

Global Warming

Global warming is caused by the increased emissions of greenhouse gases (GHG) (carbon dioxide CO₂, methane CH₄, nitrous oxides N₂O).

The concentrations of all these gases have increased in the atmosphere since 1750 due to human activities. In December 2013 the carbon dioxide levels were 396.8 ppm, in 2011 methane concentrations 1803 ppb, and nitrous oxide 324 ppb, meaning an increase from pre-industrial concentrations by about 40%, 150% and 20% respectively. The concentrations of these gases are now higher than in at least 800,000 years.



The effects of the increasing emissions on the earth's atmospheric and oceanic temperatures are projected using models that currently are valid primarily on the global level. The global climate models are the only information available for decisions about the response at the local level, which is a major problem as local conditions may vary significantly affect the degrees of impacts at local and regional levels.

On a global level the IPCC (2013) concludes that the global surface temperature (land and sea) has increased during the last 60 years by 0.5-0.84°C. Furthermore IPCC (2013) forecasts, based on the available models that the average global temperature by 2100 will be more than 1.5°C higher than today and probably more than 2.0°C.

The following Climate Change impact areas are commented on in the updated thematic and district coastal profile for Tanzania and Zanzibar:

- Changes in weather patterns influencing precipitation, and water availability
- Extreme weather events including excessive precipitation and storms
- Sea level rise caused by thermal expansion and melting glaciers and ice caps but also influenced by other factors regionally and locally
- Seawater temperature rise that can dramatically influence ecosystems and influence weather systems
- Seawater acidification from increasing levels of carbon dioxide shifting the pH towards lower values that influence shell forming organisms in the marine environment.

Climate Changes in Coastal Tanzania

- The air temperatures in coastal Tanzania are increasing rapidly and there are indications the increase is accelerating.
- The temperature increase is particularly pronounced in Dar es Salaam, Zanzibar and Pemba.
- Increasing air temperatures are likely to affect patterns and intensity of precipitation. However, rainfall data from Tanzania does not indicate wetter conditions as might be expected from the increasing temperatures. In a few places along the coast a trend towards drier conditions can be seen.
- The ocean water off the coast is highly influenced by atmospheric processes including El Nino and La Nina phenomena which results in periods of very high temperatures interrupted by periods of relatively cold surface temperatures.

- Changes in wind speeds/directions and intensity of storm events have not yet been noticed in the area but increasing air and sea surface temperatures should be expected to result in higher wind/cyclone/hurricane intensities.
- Data on the changing sea levels that are available from the region show both rising and falling trends from up to 41 years. Data from Zanzibar since 1986 indicate an initial decrease in the water levels followed by an increase since about 2000.

Outlook

Our understanding of the likely future development of the climate is based on models that to a largely base their assumptions on historic events. It should be remembered that we know very little about feedbacks, additive, antagonistic and synergistic effects as well as thresholds above which the trends change. With this in mind, based on current knowledge and the different models that are used to predict the future climate we can say the following:

- All models show that temperatures are likely to increase in air and water. The average yearly temperatures at the end of the century is likely to be 2 to 2.5°C higher than today. Temperature increases of such magnitudes will have drastic effects on the ecosystem and very likely eliminate certain species almost totally (for example scleractinian corals);
- The models forecasting precipitation in future scenarios are not conclusive but could indicate dryer conditions during the non-rainy seasons and wetter during the wet seasons. There are also indications that we may expect changes in the pattern of the seasons, indicating possibly longer dry seasons and shorter but wetter rainy seasons;
- The models forecasting dry spells are not totally conclusive but there are indications that in the short to medium term dry spells during the beginning of the year and end of the year are decreasing and the mid-year dry spells increase in length;
- Models for the future wind speeds and intensity and frequency of strong winds/hurricanes indicates increasing trends. We can assume increasing problems related to incidences of extreme winds and that these will affect coastal areas with significant impacts on coastal infrastructures, agriculture biodiversity, and ground water;
- Global sea level rise due to thermal expansion and melting of glaciers and ice caps will continue for centuries irrespective of mitigation measures. Additional factors influence the sea levels locally.
- The issues related to acidification of the tropical Indian Ocean waters are not likely to seriously affect the conditions in Tanzania until towards the end of the century.



Methodological Approach

The study has adopted a sequential approach to formulate actions to promote sustainable coastal livelihoods and ecosystem as illustrated in Figure 1. It is recognised that the methodology applied is rapid to satisfy the requirement for early mobilization of urgent actions and that analyses and assessments in many cases rely on experiences and local knowledge, rather than on a comprehensive information base. The portfolio of actions formulated through the process serves to provide a holistic overview of the most pertinent interventions required in the short term to mitigate the current development problems in coastal areas. Each of these intervention requires further appraisals before decisions are made to develop full projects.

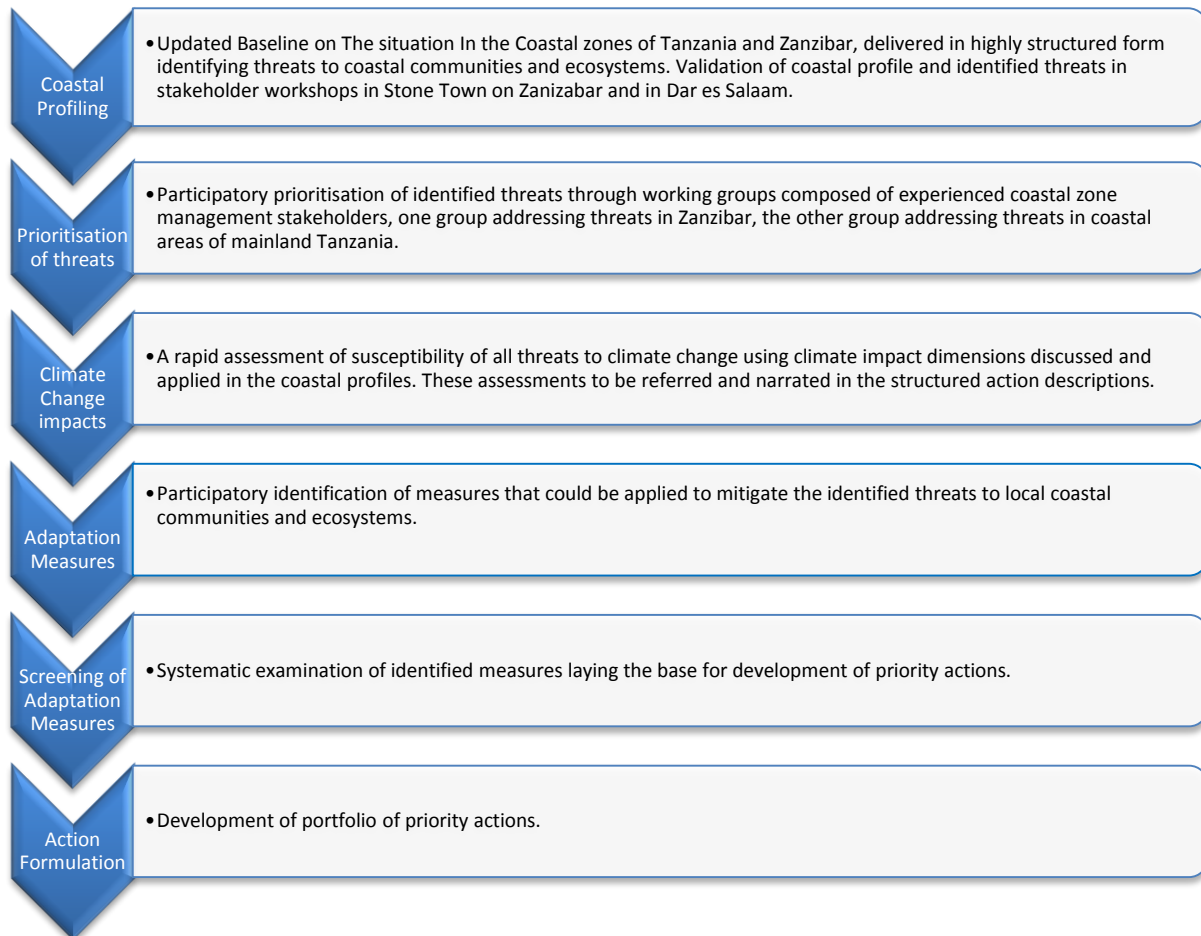


Figure 1: Sequence of study activities towards action formulation.

The lack of information in itself is one of major constraints to good decision making and planning in the complex situations prevailing along the coasts, and the development of a comprehensive information infrastructure to support development planning is a major requirement.

The following sections add some more information on each of the steps.

Identification and Prioritisation of Threats to Coastal Communities and Livelihoods

Structured update of Coastal Profile

The first step in the study examined current information available in Tanzania and Zanzibar on the situation in the coastal areas. A very structured approach has been applied to provide the systematic and holistic description offered in the first edition of the coastal profiles. The first edition was organized in three separate volumes for Tanzania mainland and Zanzibar respectively:

- One giving a thematic overview covering natural resources and economic sectors and also discussing local communities, climate change and shoreline conditions. A general description of each sector was provided covering resources and their management, discussing economic and socio-economic importance and identifying sector associated threats to local communities. These threats were further discussed to evaluate to which extent they were influenced by climate change and a brief general outlook for the sector was given.
- One providing a geographical perspective presenting the coastal situation by district for mainland Tanzania and by region for Zanzibar. For each district or region an overview is given covering climate, population and the economy basis. This is followed by a more detailed description of the local coastal environment, encompassing physical, ecological, water, marine species, natural resources, settlements and infrastructure dimensions. Major threats to local communities has been identified and vulnerability to climate change assessed in brought terms particularly with respect to sea level rise. Finally significant local projects and plans are described with a bearing on coastal conditions.
- One presenting maps and statistical information generated from the geographical information system that has been built to support the coastal profiles and analyses under the study.

The initial baseline is available in digital versions (pdf) of the following documents:

- Coastal Profile for Tanzania Mainland 2014 Thematic Volume – Draft 0
- Coastal Profile for Tanzania Mainland 2014 District Volume – Draft 0
- Coastal Profile for Zanzibar 2014 Thematic Volume – Draft 0
- Coastal Profile for Zanzibar 2014 Region Volume – Draft 0
- Coastal Profile for Tanzania 2014 Map and Table Volume – Draft 0

Participatory evaluation and prioritization of threats

The initial coastal profiles were developed based on a compilation of existing documents and information and on dialogues with a range of stakeholders in the data acquisition process. More comprehensive validation of the coastal profiles were given through two stakeholder workshops held in Stone Town for the Zanzibar Profile and in Dar Es Salaam for the Mainland Tanzania Profile, both in April 2014. These workshops were attended by government and non-government stakeholders and encompassing central as well as local administration, private sector professionals, academia, civil society and NGOs. The workshops were designed to provide feedback on the coastal profiles with a special emphasis on the identified threats to local communities and coastal livelihoods, while at the same time initiating a discussion on prioritization of these threats.

A tool to support the prioritization of threats was presented and tested during the workshops. The “Coastal Rapid Impact Assessment Matrix (CRIAM)” uses a set of 5 criteria (geographical extent, magnitude, permanence, reversibility and cumulativeness) to rank the severity of threats and it was applied to all threats in the thematic volumes of the coastal profiles looking at the severity from a central management level and all the threats identified in the district and regional volumes applying a local management angle.

To consolidate the CRIAM assessments two smaller working groups were formed in Dar es Salaam and Zanzibar to systematically review, assess and prioritise all identified threats. The results from the working group sessions in June 2014 have since been incorporated into separate sub-chapters in an

expanded Version 1 of the coastal profiles. The overall ranking of problems are also tabulated in the thematic and district/region sections of the current IV of Version 1 of the Coastal Profile.

More details about the CRIAM method, the participation in the stakeholder workshops and the composition of the working groups are provided in annexes to the thematic and district volumes of the coastal profiles.

Rapid Assessment of Threat Susceptibility to Climate Change

A further step in the study has then been to carry out a broad examination of all identified threats as to how susceptible these threats are to be further impacted by climate change using the following areas of impact, discussed in the thematic coastal profiles:

- Changes in weather patterns
- Extreme weather events
- Sea-level rise
- Seawater temperature rise
- Seawater acidification

Within each area the climate change impact has been ranked as follows:

- +++ Threat is severely aggravated from climate change dimension
- ++ Threat is aggravated from climate change dimension
- + Threat is slightly aggravated from climate change dimension
- 0 No influence of threat from climate change dimension
- Remediating effect on threat from climate change dimension

The examination of such climate change impacts is presented in the thematic and sector sections of the current Volume IV of the Coastal Profile.

Additional comments are given in the tabulations as relevant. The evaluations are intended to inform the final portfolio of prioritized actions in climate change sub-sections of each action profile.

Threat Mitigation Measures

The two working groups also in the June 2014 work sessions considered what broad measures could be taken to mitigate the prioritized threats. The broad measures brought forward fell into a series of management dimensions. For many threats measures suggested included several to many of these dimensions, reflecting the complexity of the situation in the coastal areas and underscoring the need for management to adopt a holistic approach and consider integrated solutions in a framework that provides for coordination between many actors. The management dimensions identified for threat mitigation included:

- Integrated Coastal Zone Management (ICZM)
- Integrated Water Resources Management (IWRM)
- Land Use Management
- Shoreline Management Planning
- Solid and Liquid Waste Management
- Sanitation
- Capacity building
- Technology
- Law enforcement
- Legal Review
- Alternative/Improved Livelihood
- Awareness raising
- Education

The measures suggested by the working groups have been further processed and organized in tables by theme and by district/region in the current Volume IV of the Coastal Profile Version 1. From these tables a number of action areas have been extracted for final screening before developing more detailed action sheets.

Screening Matrices

The extracted action areas have been entered into screening matrices and subjected to an initial evaluation based on general knowledge and site-specific conditions. This is a qualitative evaluation, where each measure is narratively evaluated against the following criteria:

Win/win¹. Does the action measure have positive impact on other management challenges or opportunities?

Regret/No Regret². Is the action measure beneficial without climate change impact?

Flexibility. Is the action measure receptive for adjustments according to new knowledge? The predictions of threat impact/development and of climate change impacts may at present be associated with high degree of uncertainty and new knowledge and information may require adjusted or different adaptation measures.

Resilience³. Does the action measure make the management system more robust in responding to the threat and climate change impacts?

Urgency. How will the implementation of the action measure be influenced if it is delayed? Impact of threat and climate change may not be catastrophic events, but may develop gradually. As the impact however may influence decisions/structures with long lifetimes (planning horizons), lack of actions can eventually have huge implications on adaptation options and costs.

Political acceptability. Does the action measure require awareness raising and sensitization of the political process or has it already been addressed in policies.

Costs. Are huge investments associated with the action measure?

In an attempt to provide a prioritized assessment, each action area has been translated into scores ranging from “+ + +” for the best positive score, through “0” as neutral, to “-- -” as the worst score. Positive and negative scores are added separately allowing the following rating of the implementation measures:

High positive score = high priority in implementation

High negative score = a high level of controversy, high cost or otherwise problematic measure.

In the matrices the adaptation measures have been ranked according to the level of positive scoring. The negative score, if any, for a given adaptation measure emphasizes that careful planning and design must be carried out specifically seeking to minimize these negative aspects prior to implementation.

The currently evaluated measures, the evaluation criteria and the actual scores might be incomplete and may not reflect the actual situation in a fully objective manner. Therefore the screening matrices need to be updated and/or extended appropriately through interactive participation of local stakeholders.

¹ Where everyone gains an advantage – in this case: initiatives that benefits more than one aspect/interest group.

²No-regrets solutions' are those which are feasible and beneficial even if the climate does not change as expected (or does not change at all, for that sake). They are attractive in a context where action is required, but set against a background of incomplete financial resources and uncertainty about exactly how the climate will change in the time to come.

³Climate resilience is the ability to withstand a climate-related pressure, or to recover from an adverse climate-related event. Climate resilience is an important cross-cutting development goal in a context of high vulnerability and increasing exposure to climate-related pressures and events.

The assessments made have been included as tables in the thematic and district/region sections of the current Volume IV of the Coastal Profile Version 1. In the narrative part of these sections recommendations are made for which action areas should be further processed into action sheets for inclusion in the portfolio of prioritised actions.

Action Formulation

The final step in the study has been to develop a portfolio of actions constituting a holistically generated overview of actions to address threats faced by local communities and ecosystems. Each action is presented in a uniform manner applying the format presented in Table 1, below. This format has been chosen as it is aligned to LFA formats extensively used as basis for development of Project Documents. It should be understood that the action sheets thus prepared do not provide the basis for committing financing for the action. Such commitment necessitates further much more dedicated evaluations. The portfolio of actions on the other hand does give a holistic overview of high priority interventions required to mitigate the most pertinent threats to local communities and ecosystems in coastal areas of Mainland Tanzania and Zanzibar. As such the portfolio can provide the basis for government and development partners to agree on distribution of efforts needed to further appraise the feasibility of implementing actions contained in the portfolio.

The portfolio of actions has been prepared as a separate Volume V of the Coastal Profile Version 1.

Table 1: Format for Action Sheets

Prioritized Actions		
Background:	<i>A brief presentation of the setting for the prioritised action. This presentation will as relevant draw on the GIS and make reference to information and knowledge acquired in reviews and in stakeholder dialogue.</i>	
Title:	<i>The title of the actions agreed upon in stakeholder dialogues.</i>	
Action Reference:	<i>Unique identifier for action database and other references.</i>	
Justification:	<i>Provide statements justifying that this action should be considered for funding. The statements can draw on the outcome of the prioritization and screening efforts.</i>	
Objective:	<i>Establish what the action if implemented is expected to achieve.</i>	
Expected outputs:	<i>Identify key outputs required to fulfil the objective.</i>	
Activities:	<i>List key activities that have to take place to produce the outputs.</i>	
Assumptions:	<i>State what assumptions concerning conditions outside the control of the action that must be met.</i>	
Risks:	<i>Identify risks that the source of funding and the responsible for the action should be aware of and try to mitigate.</i>	
Means of implementation:	Logistics, technical, scientific	<i>Outline expectations for logistic requirements, technical and scientific environment.</i>
	Human Resources	<i>Outline expectations on human resources engagement</i>
Budget estimate:	<i>Provide an assessment of budget requirements in very broad terms as detailed assessments can only be made in project appraisal and detailed design. The budget requirements may assess both project preparation (appraisal and design) and project implementation dimensions</i>	
Source of funding:	<i>Identify potential funding sources, including government, development partners, private sector, etc. or combination thereof if applicable. The identification should to the extent possible be aligned with strategies and plans of the funding sources.</i>	
Responsible for the action:	<i>Identify which institutions would be responsible for implementing the action, government and or non-government. One institution should be overall responsible but contributing institutions should as applicable also be identified.</i>	
Beneficiary from the action:	<i>Make qualitative assessment of beneficiary (ies). Quantitative assessment of beneficiary (ies) can at best made in very broad terms until appraisal.</i>	
Schedule:	<i>Indicate a time schedule for the implementation of the action The time schedule overarching the actions is 5 years.</i>	
Links to other actions:	<i>Identify and explain linkages to other actions</i>	
Performance indicators:	<i>Identify verifiable performance indicators that can be used to monitor the implementation of the action.</i>	
Comments	<i>Provide any comments that are considered useful for the considerations by funding sources and institutions responsible for the action.</i>	

Prioritized Action Areas

The threats to coastal communities and ecosystems in Tanzania and Zanzibar, which were presented in Volumes I – III of the coastal profiles, have been further considered in this Volume IV with the view of identifying and recommending mitigation measures as presented in thematic and district/regional sections for Mainland Tanzania and Zanzibar. This chapter synthesises the outcome of these considerations which is a prioritised series of measures forming the basis for the portfolio of actions contained in Volume V of the coastal profile.

Measures emerging fall into two main groups:

- Systemic mitigation measures

These measures address shortcomings in the management system and are critical for pursuing long term sustainable development in the coastal areas. Measures identified respond to the need for better informed decision support, coordination between different sectors, integration of various capacities and interests in management processes, holistic planning, general and targeted awareness raising and aligning basic education more to understanding challenges associated with complex development.

- Local mitigation measures

These measures address concrete problems often experienced locally, which may be considered a result of past and current shortcomings in management systems, but which need to be addressed before systemic measures take effect. Measures identified respond to imposing environmental, social and natural resources concerns, including pollution from solid and liquid waste, competition for land and other resources, degradation of habitats and ecosystems, socio-economic development constraints and shortages in water resources.

The systemic measures identified by the working groups in Zanzibar and Dar es Salaam are similar in nature reflecting fundamental shortcomings or requirements in managing high development pressure in complex environments as characteristic for coastal areas not only in Tanzania but throughout the world and in particular in developing countries where institutional, financial and human resources are falling short.

Mainland Tanzania

Overall Action Area Weighing by Theme

Table 2 below aggregates the assessments made in each of this report's thematic sections for Mainland Tanzania.

Altogether 120 threats have been considered in these sections with the greatest numbers identified in sectors linked to natural resources and primary production such as fisheries, agriculture and livestock and forestry, but concern at similar level appeared linked to tourism and sand and rock extraction. Fewer threats were identified linked to infrastructure, ports and harbours, urbanisation and industry. The same picture emerges when taking the threat ranking into account as illustrated in Figure 2 below.

The working group in Dar es Salaam identified a number of main intervention dimensions within which mitigation measures were required to address the ranked threats to coastal communities and ecosystems. Table 2 provides an overview of the importance of these intervention dimensions in addressing threats within each sector and overall. In Table 3 the relative importance of the intervention dimensions have been calculated for threats within each sector and overall and Figure 3 offers a simple graphical indication on how important each intervention dimension is considered to be to mitigate the threats identified within each sector.

Table 2: Overall Action Area Weighing by Theme for Mainland Tanzania. The table summarises the number of threats identified within each theme and their total weight (sum of severity rank values of threats) in the first two light grey rows. In the following rows totals of weighted threats “calling” for mitigation efforts within each intervention dimension have been tabulated. All threats call for efforts from more than one intervention dimension.

Intervention Dimension	Fisheries	Tourism	Agriculture	Forestry	Industry	Ports & Harbours	Infrastructure	Urbanisation	Hydrocarbons	Sand & Rock	Salt	Natural Resources	Freshwater Resources	Management Framework	# Threats	Total
Number of Threats	11	13	12	11	5	5	3	6	4	11	6	18	8	7	120	
Weighted Threats	37	40	39	39	15	8	12	19	13	25	13	31	25	22	338	
Integrated Coastal Zone Management (ICZM)	37	14	19	37	8	2	4	10	4	24	13	21	24	11	76	228
Integrated Water Resources Management (IWRM)	27	6	21	11	8	1	4	0	0	18	0	13	24	7	45	140
Land Use Management	37	17	22	39	11	2	4	13	4	20	12	19	18	3	77	221
Shoreline Management Planning	35	14	4	27	0	2	4	10	4	20	12	18	4	3	53	157
Solid and Liquid Waste Management	5	7	3	2	9	1	4	7	0	2	0	6	8	0	21	54
Sanitation	5	4	3	0	0	0	4	7	0	2	0	4	0	0	11	29
Capacity Building	37	32	35	39	15	6	12	17	10	20	9	23	25	21	100	301
Technology	37	11	35	39	15	4	8	14	11	20	8	28	25	7	93	262
Law Enforcement	37	28	19	39	9	6	12	15	9	25	9	23	18	13	91	262
Legal Review	22	17	12	15	0	3	12	0	8	17	5	21	5	25	55	162
Alternative/ Improved Livelihood	35	22	6	30	0	1	0	4	0	17	3	11	9	11	45	149
Awareness Raising	37	14	34	39	11	2	4	12	7	25	4	30	25	13	93	257
Education	23	11	18	39	9	2	8	7	0	25	4	20	25	9	75	200
Totals for Mainland Tanzania	374	197	231	356	95	32	80	116	57	235	79	237	210	123	120	2422

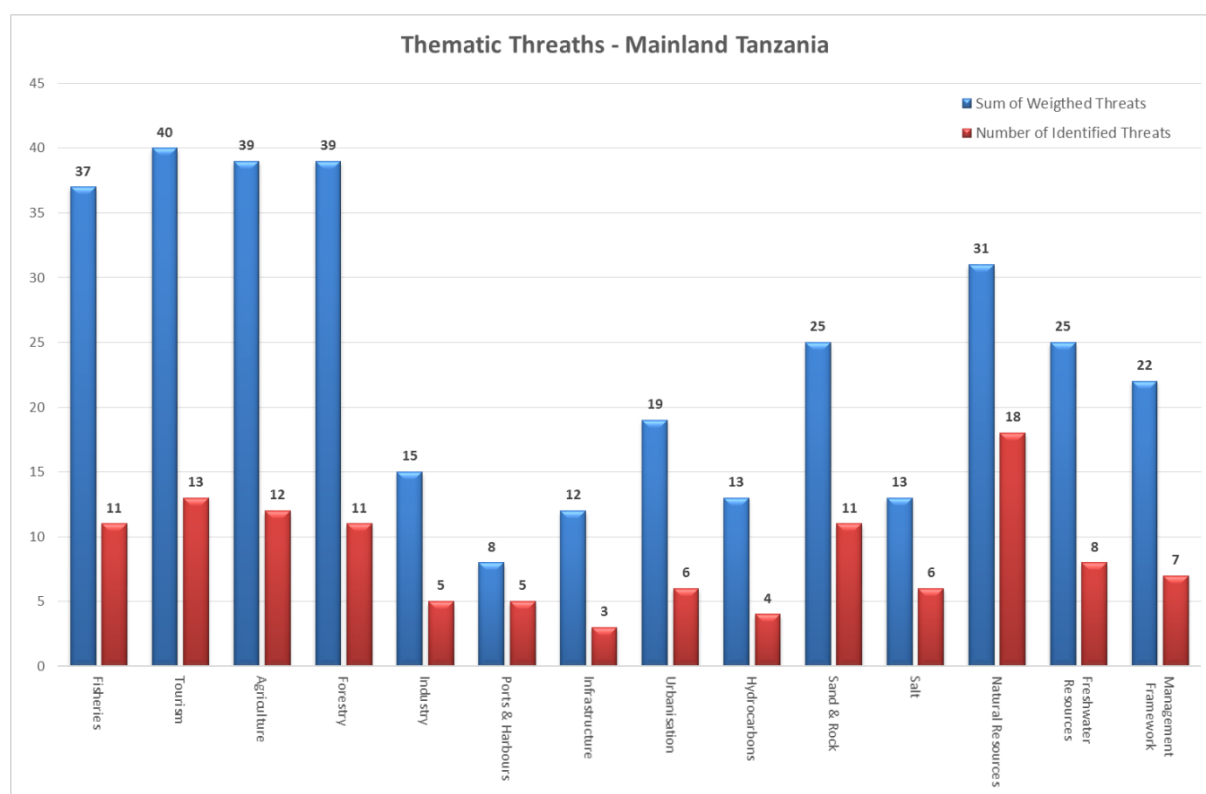


Figure 2: Numbers of threats and weighted threat distribution by theme for Mainland Tanzania. The weighing of threats is based on the severity ranking undertaken with stakeholders and presented in volume 2 of the coastal profile.

Table 3: Overview of relative importance of intervention dimensions in mitigating identified threats within each theme for Mainland Tanzania.

Intervention Dimension	Fisheries	Tourism	Agriculture	Forestry	Industry	Ports & Harbours	Infrastructure	Urbanisation	Hydrocarbons	Sand & Rock	Salt	Natural Resources	Freshwater Resources	Management Framework	# of threats	Total
Integrated Coastal Zone Management (ICZM)	10%	7%	8%	10%	8%	6%	5%	9%	7%	10%	16%	9%	11%	9%	63%	9%
Integrated Water Resources Management (IWRM)	7%	3%	9%	3%	8%	3%	5%	0%	0%	8%	0%	5%	11%	6%	38%	6%
Land Use Management	10%	9%	10%	11%	12%	6%	5%	11%	7%	9%	15%	8%	9%	2%	64%	9%
Shoreline Management Planning	9%	7%	2%	8%	0%	6%	5%	9%	7%	9%	15%	8%	2%	2%	44%	6%
Solid and Liquid Waste Management	1%	4%	1%	1%	9%	3%	5%	6%	0%	1%	0%	3%	4%	0%	18%	2%
Sanitation	1%	2%	1%	0%	0%	0%	5%	6%	0%	1%	0%	2%	0%	0%	9%	1%
Capacity Building	10%	16%	15%	11%	16%	19%	15%	15%	18%	9%	11%	10%	12%	17%	83%	12%
Technology	10%	6%	15%	11%	16%	13%	10%	12%	19%	9%	10%	12%	12%	6%	78%	11%
Law Enforcement	10%	14%	8%	11%	9%	19%	15%	13%	16%	11%	11%	10%	9%	11%	76%	11%
Legal Review	6%	9%	5%	4%	0%	9%	15%	0%	14%	7%	6%	9%	2%	20%	46%	7%
Alternative/Improved Livelihood	9%	11%	3%	8%	0%	3%	0%	3%	0%	7%	4%	5%	4%	9%	38%	6%
Awareness Raising	10%	7%	15%	11%	12%	6%	5%	10%	12%	11%	5%	13%	12%	11%	78%	11%
Education	6%	6%	8%	11%	9%	6%	10%	6%	0%	11%	5%	8%	12%	7%	63%	8%
Totals for Mainland Tanzania	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

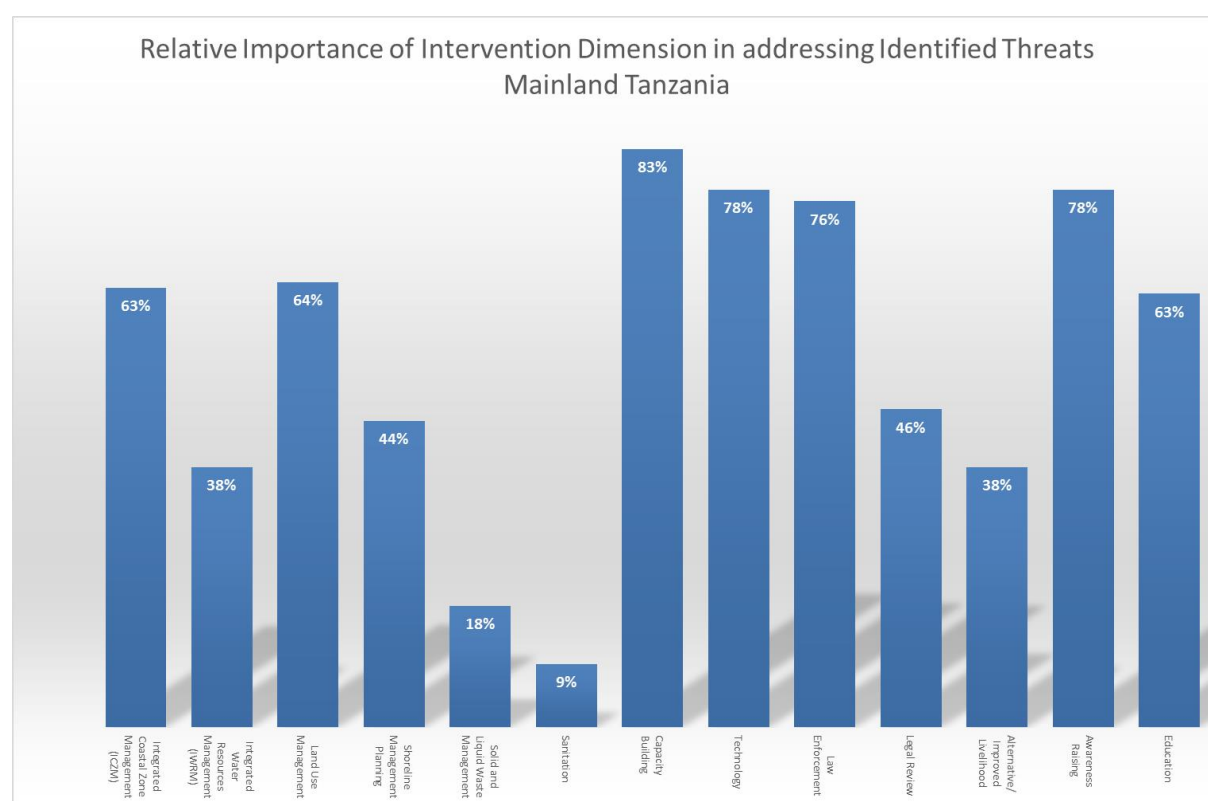


Figure 3: Relative importance of broad mitigation measures in addressing identified thematic threats in Mainland Tanzania. The percentages in the graph show the proportion of the 120 identified threats that call for interventions in each of the broad mitigation measure categories suggested by the working groups.

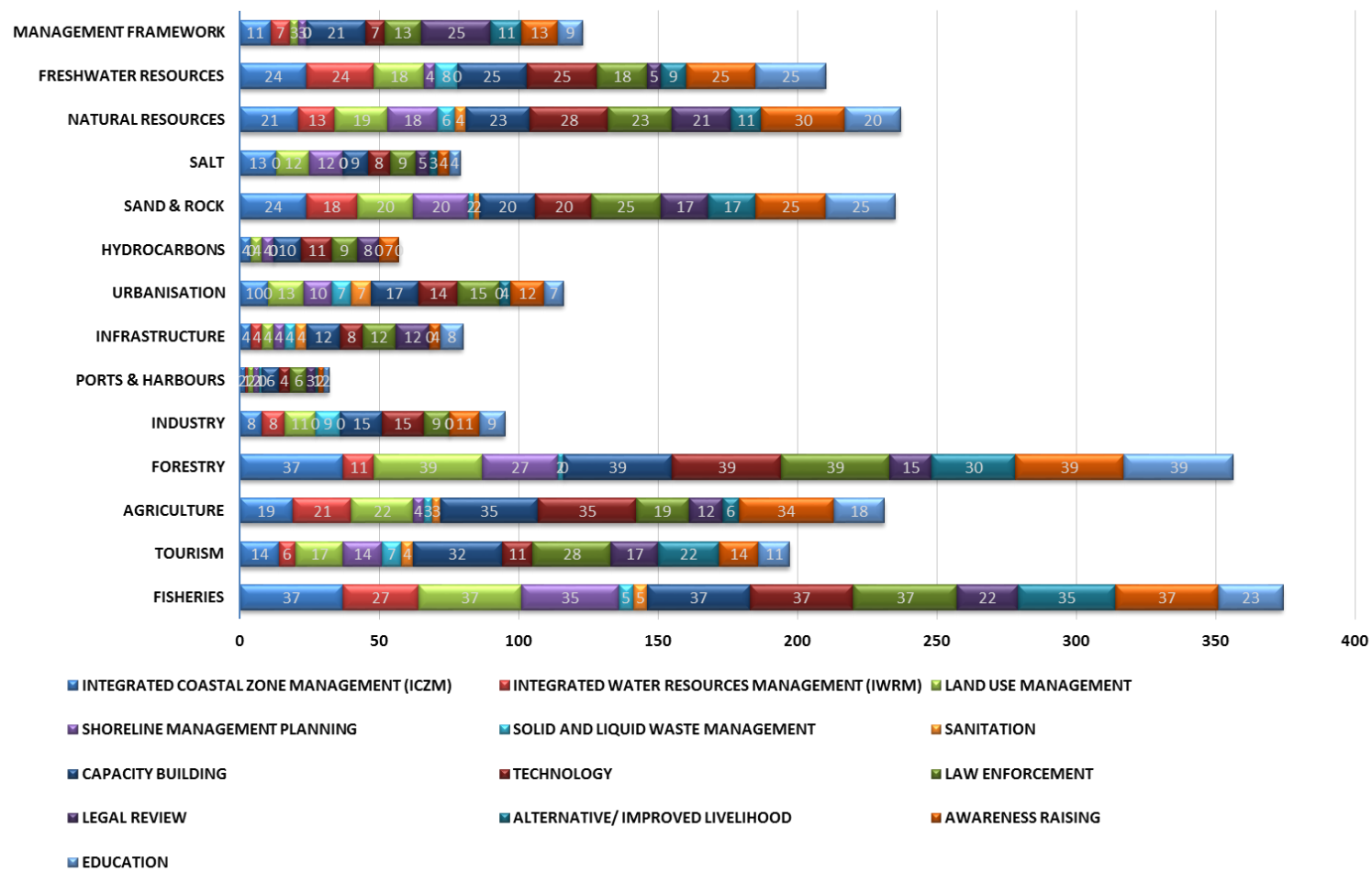


Figure 4: An overview of broad intervention measures required by theme to address identified threats. The importance or weight attributed to each intervention dimension is calculated as the sum of ranked threats requesting effort within the dimension as suggested by the working group in Dar es Salaam. These sum values are given in white with each bar.

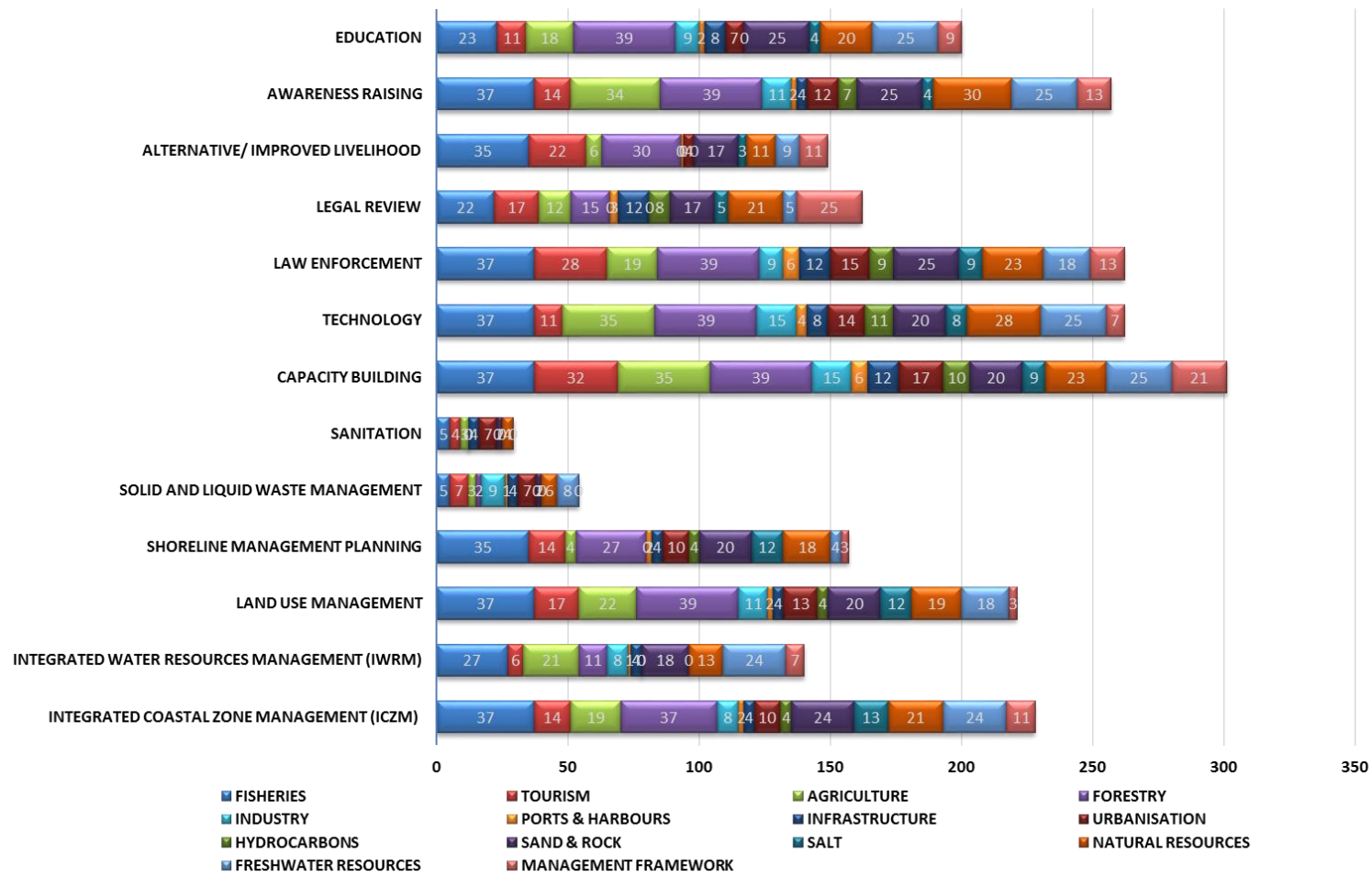


Figure 5: An overview of sector threat levels calling for measures within each intervention dimension suggested by the working group in Dar es Salaam. The importance or weight attributed by each sector to each intervention dimension is calculated as the sum of ranked threats within the sector requesting effort within the dimension.

Overall Action Area Weighing by District

Table 4 below aggregates the assessments made in each of this report's district sections for Mainland Tanzania.

Altogether 119 threats have been considered in these sections with the greatest numbers identified in districts in the middle and upper part of the Tanzania Coastline and with the lowest number of threats in the southern districts and in Kilwa. This pattern also appears when taking threat ranking into account as illustrated in Figure 6 below.

The working group in Dar es Salaam identified a number of main intervention dimensions within which mitigation measures were required to address the ranked threats to coastal communities and ecosystems. Table 4 provides an overview of the importance of these intervention dimensions in addressing threats within each district and overall. In Table 5 the relative importance of the intervention dimensions have been calculated for threats within each sector and overall and Figure 7 offers a simple graphical indication on how important each intervention dimension is considered to be to mitigate the threats identified within the districts.

Table 4: Overall Action Area Weighing by District for Mainland Tanzania. The table summarises the number of threats identified for each district and their total weight (sum of severity rank values of threats) in the first two light grey rows. In the following rows totals of weighted threats "calling" for mitigation efforts within each intervention dimension have been tabulated. All threats call for efforts from more than one intervention dimension.

Intervention Dimension	Mkinga District	Tanga Urban District	Mtweza District	Pangani District	Bganoyo District	Kinondoni District	Lala District	Temeke District	Mkuranga District	Rufiji District	Mafia District	Kilwa District	Lindi Rural District	Lindi Urban District	Mtwara Rural District	Mtwara Urban District	# Threats	Total
Number of Threats	6	10	7	9	8	8	8	10	8	8	8	4	6	6	7	6	119	
Weighted Threats	17	26	21	28	28	29	27	31	22	28	22	10	15	13	17	19	353	
Integrated Coastal Zone Management (ICZM)	14	22	20	26	25	29	27	31	22	28	16	13	15	10	16	17	110	331
Integrated Water Resources Management (IWRM)	13	16	15	12	10	25	13	18	8	21	5	6	8	5	9	9	67	193
Land Use Management	14	26	20	22	25	29	23	28	22	28	17	13	15	13	17	19	111	331
Shoreline Management Planning	12	21	16	19	25	26	23	25	19	15	14	13	11	9	15	13	87	276
Solid and Liquid Waste Management	9	10	6	10	3	14	20	18	6	14	8	13	2	3	4	7	51	147
Sanitation	7	8	6	6	3	14	13	6	6	7	6	6	1	3	3	6	33	101
Capacity Building	17	22	21	28	25	29	27	31	22	28	22	3	15	13	17	19	119	339
Technology	17	18	21	20	25	29	27	31	22	28	19	13	15	13	17	19	113	334
Law Enforcement	17	22	20	28	25	29	27	31	22	25	22	13	15	13	17	19	117	345
Legal Review	4	10	13	11	11	12	7	8	8	0	6	13	6	6	10	8	37	133
Alternative/ Improved Livelihood	8	11	9	11	22	11	7	19	16	11	12	7	13	10	13	13	58	193
Awareness Raising	17	24	19	28	25	29	27	31	22	28	22	13	15	13	17	15	116	345
Education	17	22	20	28	25	29	23	31	22	24	20	13	14	13	17	15	109	333
Totals for Mainland Tanzania	166	232	206	249	249	305	264	308	217	257	189	139	145	124	172	179	119	3401

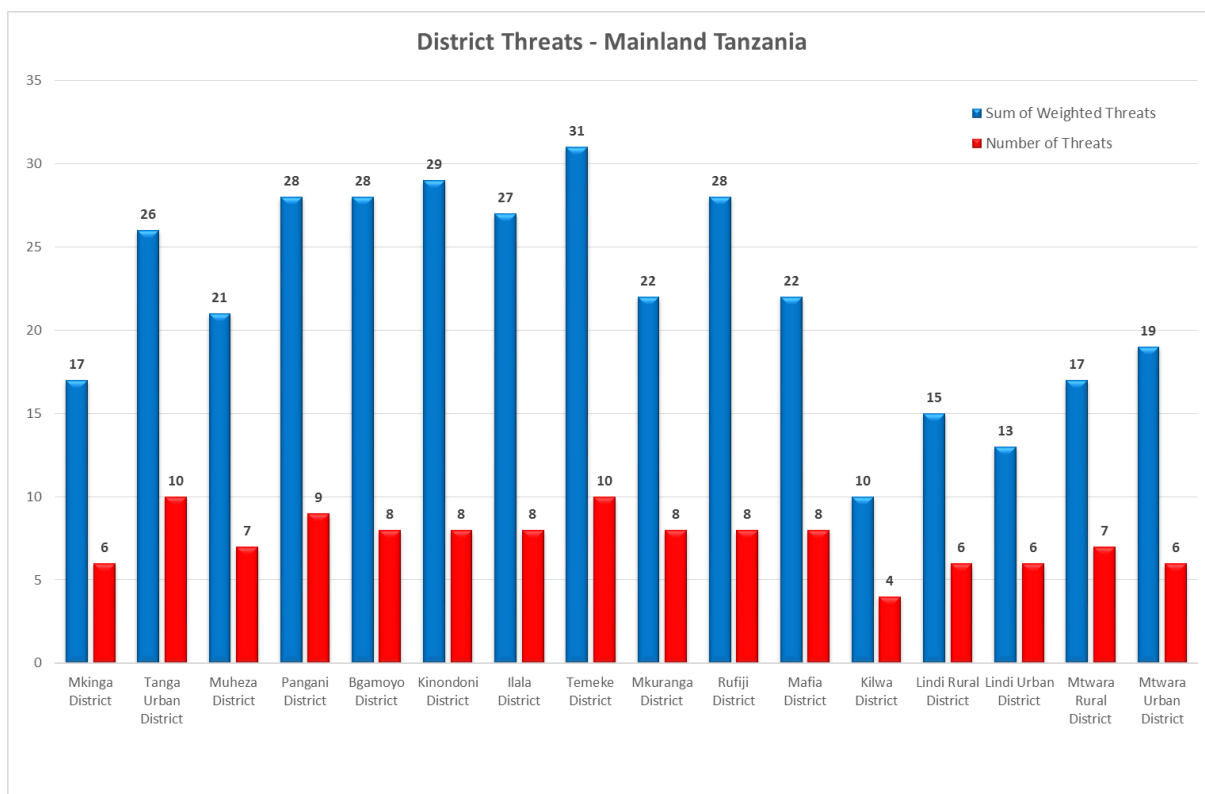


Figure 6: Numbers of threats and weighted threat distribution by district for Mainland Tanzania. The weighing of threats is based on the severity ranking undertaken with stakeholders and presented in volume 2 of the coastal profile.

Table 5: Overview of relative importance of intervention dimensions in mitigating identified threats within each coastal district in Mainland Tanzania.

Intervention Dimension	Mkinga District	Tanga Urban District	Muheza District	Pangani District	Bgamojo District	Kinondoni District	Ilala District	Temeke District	Mkuranga District	Rufiji District	Mafia District	Kilwa District	Lindi Rural District	Lindi Urban District	Mtwara Rural	Mtwara Urban	# Threats	Total
Integrated Coastal Zone Management (ICZM)	8%	9%	10%	10%	10%	10%	10%	10%	10%	11%	8%	9%	10%	8%	9%	9%	92%	10%
Integrated Water Resources Management (IWRM)	8%	7%	7%	5%	4%	8%	5%	6%	4%	8%	3%	4%	6%	4%	5%	5%	56%	6%
Land Use Management	8%	11%	10%	9%	10%	10%	9%	9%	10%	11%	9%	9%	10%	10%	10%	11%	93%	10%
Shoreline Management Planning	7%	9%	8%	8%	10%	9%	9%	8%	9%	6%	7%	9%	8%	7%	9%	7%	73%	8%
Solid and Liquid Waste Management	5%	4%	3%	4%	1%	5%	8%	6%	3%	5%	4%	9%	1%	2%	2%	4%	43%	4%
Sanitation	4%	3%	3%	2%	1%	5%	5%	2%	3%	3%	3%	4%	1%	2%	2%	3%	28%	3%
Capacity Building	10%	9%	10%	11%	10%	10%	10%	10%	10%	11%	12%	2%	10%	10%	10%	11%	100%	10%
Technology	10%	8%	10%	8%	10%	10%	10%	10%	10%	11%	10%	9%	10%	10%	10%	11%	95%	10%
Law Enforcement	10%	9%	10%	11%	10%	10%	10%	10%	10%	10%	12%	9%	10%	10%	10%	11%	98%	10%
Legal Review	2%	4%	6%	4%	4%	4%	3%	3%	4%	0%	3%	9%	4%	5%	6%	4%	31%	4%
Alternative/ Improved Livelihood	5%	5%	4%	4%	9%	4%	3%	6%	7%	4%	6%	5%	9%	8%	8%	7%	49%	6%
Awareness Raising	10%	10%	9%	11%	10%	10%	10%	10%	10%	11%	12%	9%	10%	10%	10%	8%	97%	10%
Education	10%	9%	10%	11%	10%	10%	9%	10%	10%	9%	11%	9%	10%	10%	10%	8%	92%	10%
Totals for Mainland Tanzania	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

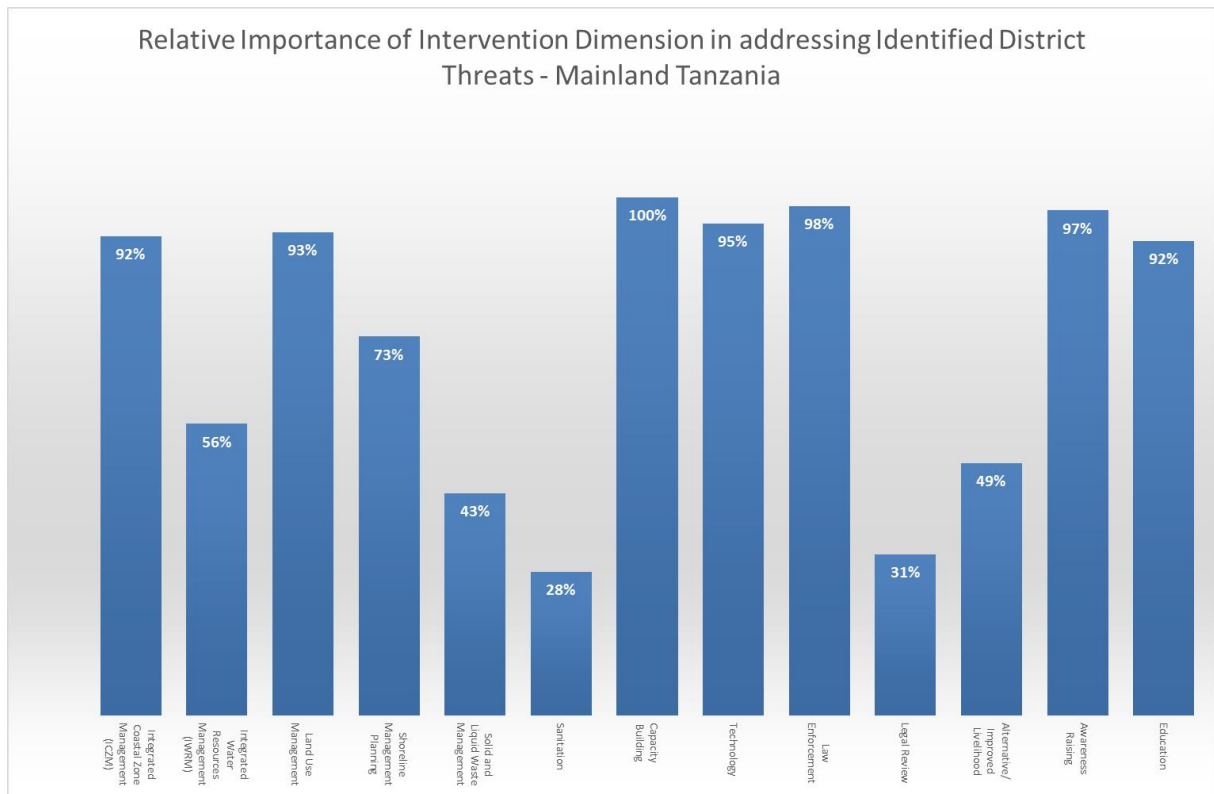


Figure 7: Relative importance of broad mitigation measures in addressing identified district threats in Mainland Tanzania. The percentages in the graph show the proportion of the 119 identified threats that call for interventions in each of the broad mitigation measure categories suggested by the working groups.

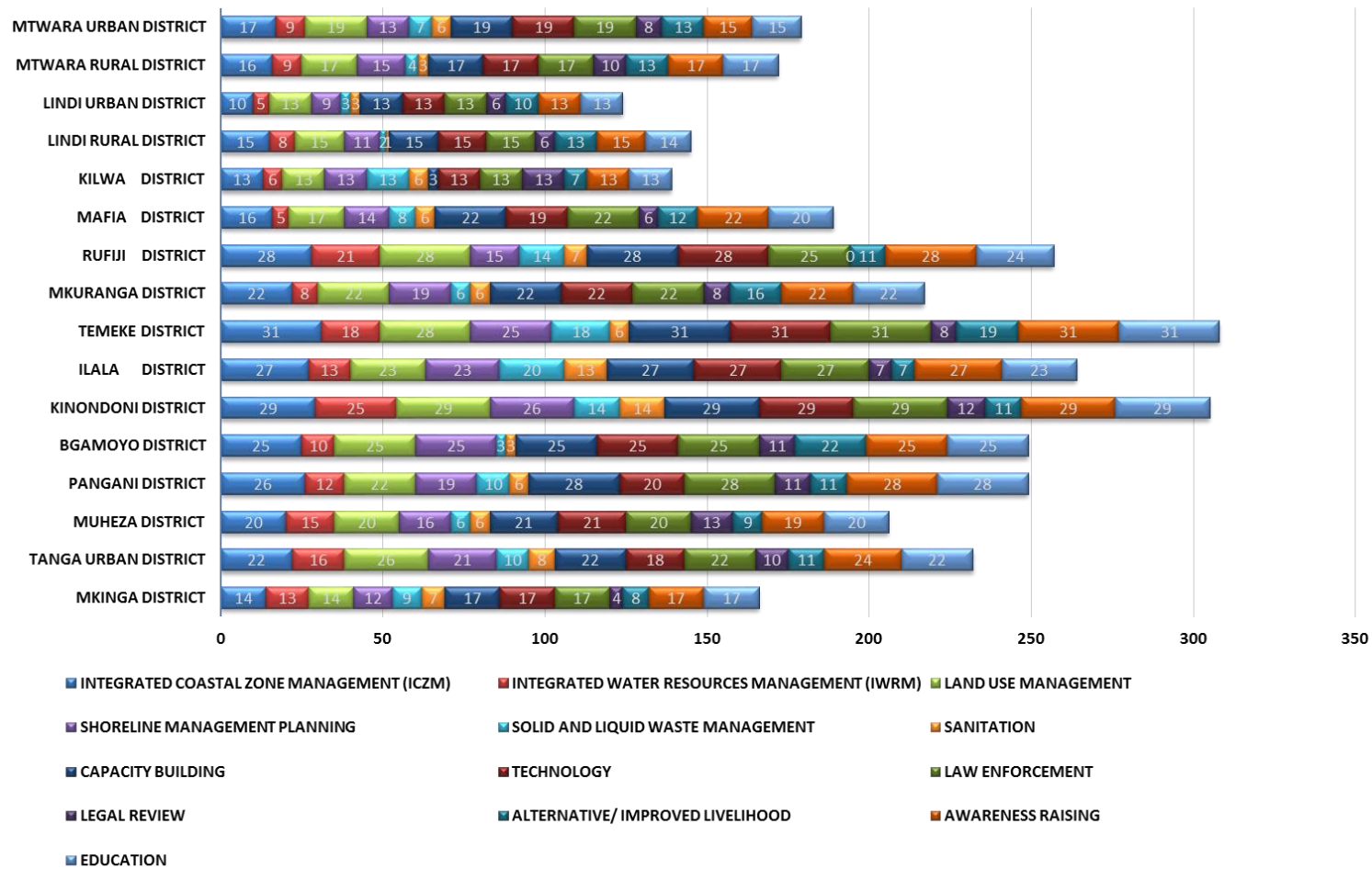


Figure 8: An overview of broad intervention measures required by district to address identified threats. The importance or weight attributed to each intervention dimension is calculated as the sum of ranked threats requesting effort within the dimension as suggested by the working group in Dar es Salaam. These sum values are given in white with each bar.

Systemic Action Areas

Tan-S01 Integrated Coastal Zone Management Framework

The working group in Dar es Salaam found that in Mainland Tanzania the mitigation of

- 76 out of the 120 identified thematic threats to local coastal communities and ecosystems in Mainland Tanzania corresponding to 63%, and
- 110 out of the 119 identified district level threats to local coastal communities corresponding to 92 %,

would benefit from an Integrated Coastal Management Framework providing for better coordination within government and between government and non-government organisations.

Traditional sector planning falls short in coping with the complex development situation in the coastal areas, which has contributed to unsustainable land uses, and it is recognised that more integrated approaches are required for development management. Such approaches have matured internationally over the past decades and are increasingly embraced by the international community and considered particularly suited to address the challenges of climate change. It is important that integrated management appreciates the need for linking upstream catchment management arrangements with coastal zone management arrangements to address impacts from inland activities on coastal conditions.

Tan-S02 Spatial Planning

Physical planning targets the optimization of land uses in support of socio-economic and economic development. It is institutionally embedded with statutory status used for forward land use planning (zoning) and in development control. Physical planning ideally operates in a nested or hierarchical manner at different administrative management levels. Structural planning provides a planning framework spatially expressing policies for overall infrastructure and other sector priorities, regional plans translate these into more detailed infrastructure and land use zoning plans and local area plans provide details for development control.

An overall spatial development strategy and plan for the coastal areas of Tanzania are therefore important entry points for mainstreaming climate change adaptation measures into national planning. In the context of sea level rise, vulnerability and risk mapping vis-à-vis erosion and inundation become significant themes in spatial analyses. Mainstreamed spatial plans needs to be accompanied by directions and or guidelines for environmental impact assessments for development in vulnerable areas ensuring that climate change mitigation measures are incorporated in plan and project design and implementation.

The working group in Dar es Salaam found that in Mainland Tanzania the mitigation of

- 77 out of the 120 identified thematic threats to local coastal communities and ecosystems in Mainland Tanzania corresponding to 64%, and
- 111 out of the 119 identified district level threats to local coastal communities corresponding to 93 %,

would benefit from strengthened spatial planning providing for sustainable land use and development control

Support has been provided from the World Bank financed MACEMP to the development of District Land Use Frame Work Plans. These efforts provides an opportunity and foundation to further capacitating the spatial planning system and it is imperative to thoroughly align this action to these activities.

Tan-S03 Shoreline Management

Shoreline erosion and accretion are natural processes shaping coastlines where land meets the sea. Influencing factors include winds, waves, currents, tides, storm and surge conditions, sea level rise, land subsidence and sediment supply from rivers. Anthropogenic interference with underlying processes may significantly alter the rates of accretion or sedimentation. This can be through land use changes in catchments, which may impact on sedimentation processes that play a role in shoreline

morphology. It may also alter the hydrological regime which can impact on erosion/accretion patterns along the sea adjacent to estuaries. Interference with the shoreline itself by infrastructure and other development can also influence erosion and accretion long distances along the coast.

The dynamic interface between land and sea will move landwards with sea level rise emphasising the demand for specialised studies and planning to develop policies and strategies for land uses along the shoreline to feed into spatial planning.

The working group in Dar es Salaam found that in Mainland Tanzania the mitigation of

- 53 out of the 120 identified thematic threats to local coastal communities and ecosystems in Mainland Tanzania corresponding to 44%, and
- 87 out of the 119 identified district level threats to local coastal communities corresponding to 33 %,

would benefit from shoreline management interventions.

A systematic assessment of the shorelines of Tanzania to determine vulnerabilities related to erosion and inundation is a matter of urgency to develop local policies that can be incorporated/mainstreamed into development planning and at the same time consider impacts of climate variability and change.

Tan-S04 Information Management

Development management decisions in complex settings such as is the case in Tanzania's coastal zone need to be based on a solid information base that enables analyses across many dimensions, including socioeconomic, economic, natural resources, land uses, and climate. Measures to mitigate threats to local communities and ecosystems must be defined based on analyses spanning these dimensions. An overarching and crucial mitigation measure is therefore to ensure that a solid information base is continually available as decision support for planning, that systematic monitoring is carried out to maintain the information base updated and that mechanisms are in place that ensures shared access to information and systematic dissemination of information on the management situation through state reporting.

Whereas considerable information may be available from numerous government as well as non-government sources, some is not up-to-date, is incomplete in geographical coverage and is not readily interchanged between information suppliers. Much information is produced as part of studies thus representing one-off focused data acquisition efforts, where data may escape integration into government information management systems.

Tan-S05 Education in Primary and Secondary Schools

For the long term sustainable management and use of coastal areas it is important that the coming generations have an adequate understanding of the issues arising when development imposes pressure on these complex and highly dynamic ecosystems. Hence curricula for primary and secondary education should be reviewed and consolidated to ensure that the development of such an understanding is supported among students.

The working group in Dar es Salaam found that in Mainland Tanzania the mitigation of

- 75 out of the 120 identified thematic threats to local coastal communities and ecosystems in Mainland Tanzania corresponding to 63%, and
- 109 out of the 119 identified district level threats to local coastal communities corresponding to 92 %,

would benefit from interaction with education in primary and secondary schools.

The working group in these discussion highlighted issues related to

- Sustainable fisheries and fisheries ecology.
- Importance of environmentally sound industrial production
- Sustainable development in areas under high demographic and economic development pressure (coastal areas, urban areas).

- Importance of coasts and coastal habitats and resources.
- Importance of beaches.
- Pollution, environment, health.
- Waste minimisation and recycling.
- Coastal forest ecology
- Coastal forest management;
- Hydrologic cycle
- Importance of disease vector control.
- Complex requirements in coastal areas (high population and economic pressure).
- Sustainable development.
- Spatial planning to service Population requirements.
- Importance of environmentally sound agriculture production.

Tan-S06 Awareness Raising

An important factor in unsustainable practises among stakeholders in complex and rapidly developing environments is a lack of understanding of the long term consequences of such practises on communities, environment and ecosystems. A key element in development management is therefore to ensure that all stakeholders groups are continuously informed.

The working group in Dar es Salaam found that in Mainland Tanzania the mitigation of

- 93 out of the 120 identified thematic threats to local coastal communities and ecosystems in Mainland Tanzania corresponding to 78%, and
- 116 out of the 119 identified district level threats to local coastal communities corresponding to 97 %,

calls for increased awareness concerning coastal issues, in particular vulnerability and complexity of coastal systems facing development pressure.

The working group in these discussion for each threat assessed and outlined target for awareness raising activities and subject areas as comprehensively tabulated in Volume IV of the coastal profile. A comprehensive and very diverse list of targets for awareness raising emerges from these tables while also identifying a wide range of areas where awareness needs to be raised. There is a requirement to develop and implement a comprehensive awareness raising effort.

Tan-S07 Integrated Legal Review

The working group in Dar es Salaam found that in Mainland Tanzania the mitigation of

- 55 out of the 120 identified thematic threats to local coastal communities and ecosystems in Mainland Tanzania corresponding to 46%, and
- 37 out of the 119 identified district level threats to local coastal communities corresponding to 31 %,

called for review of legal provisions. The work group further found that the mitigation of

- 91 out of the 120 identified thematic threats to local coastal communities and ecosystems in Mainland Tanzania corresponding to 76%, and
- 117 out of the 119 identified district level threats to local coastal communities corresponding to 98 %,

required intervention related to enforcement.

Tan-S08 Support for NEMC

The lack of capacity at the NEMC to follow up, enforce and resolve development issues is seen as the main weakness which would significantly benefit from support, training, and expansion in staff, facilities and expertise, particularly with respect to the mining, biofuel and oil and gas sectors.

The working group in Dar es Salaam found that in Mainland Tanzania the mitigation of

- 77 out of the 120 identified thematic threats to local coastal communities and ecosystems in Mainland Tanzania corresponding to 64%, and
- 111 out of the 119 identified district level threats to local coastal communities corresponding to 93%,

would benefit from an Integrated Coastal Management Framework providing for better coordination within government and between government and non-government organisations. In addition, as seen above,

- 53 out of the 120 identified thematic threats to local coastal communities and ecosystems in Mainland Tanzania corresponding to 44%, and
- 87 out of the 119 identified district level threats to local coastal communities corresponding to 33%,

would benefit from shoreline management interventions. Furthermore, at the district level,

- 91 out of the 120 identified thematic threats to local coastal communities and ecosystems in Mainland Tanzania corresponding to 76%, and
- 117 out of the 119 identified district level threats to local coastal communities corresponding to 98%,

required intervention related to enforcement. The working group in these discussion recognised the need to support and help strengthen the capacity of the national regulator of development, the National Environment Management Council (NEMC), whose mandate addresses the above issues through review and enforcement of findings of environmental and social impact assessments.

Tan-S09 Support for Tourism Management Planning

Coastal tourism shows a promising future as evidenced by the number, variety and diversity of accommodation facilities that have been constructed or are planned. Recommendations in the Tourism Master Plan (URT, 2002) relevant to the coast include development of a strong Southern Circuit comprising the coastal areas beach resort tourism including Mafia, offshore islands, Bagamoyo, Saadani Game Reserve and Kilwa. However, there are concerns that Mafia, Pangani and Kilwa require more urgent management intervention within the tourism sector to safeguard the main attractions at these locations. For example, inadequate sewage infrastructure and waste management resulting in pollution of the coastal zone, from some developments illegally dumping waste and litter, and, reduction in iconic marine life with illegal killing of whale sharks, dolphins, dugongs, turtles and other exotic marine animals that are tourist attractions degrading the value of the experience and creating a poor image of Tanzania as an eco-friendly destination were ranked as very important and important problems respectively.

In addition, the working group in Dar es Salaam found that in Mainland Tanzania the mitigation of

- 32 out of the 197 identified thematic threats to local coastal communities and ecosystems in Mainland Tanzania corresponding to 16%,

called for capacity building. Landuse management was the second highest intervention identified, reflected in 28 of the 197 identified threats.

To achieve an effective and speedy action, there is a requirement to develop and implement a comprehensive capacity building effort within the tourism management sector, specifically addressing the coastal sites of Mafia, Kilwa and Pangani.

Local Action Areas

Tan-L01: Rehabilitation and clean-up of four east-flowing rivers in Mkinga District

Nutrient and chemical pollution discharged through these rivers into the coastal environment on the western shores of the Pemba Channel is well documented, visible especially after heavy rains, with solid wastes and sediments discharged being indicative of degraded and polluted watersheds.

There are four major river basins plus several much smaller streams, either perennial or semi-seasonal, that extend from the northern border of Kwale Bay (the effective border between Mkinga and Tanga Municipality) to the border with Kenya. Visible from the 1:50,000 topo maps, the larger basins are:

- Ngole River, with various sources including the longest, Msimbazi River, and the Mkaka and Pangarowe rivers, draining from 20-25 km inland to the west and northwest, and discharging through the Mayumboni mangrove forest, close to Kwale Island.
- Kombe River, extending for approximately 25 km from the northwest, before emptying at Doda mangrove forested estuary.
- Ndoyo River, with a source some 20 km to the north, emptying into the same Doda mangrove forested estuary as the Kombe River.
- Mwambalazi River, draining Changanyiko area for over 30 km, discharging at Vibambani, as the major contributor of freshwater into the mangrove estuary inshore of the Boma Peninsula

Beach pollution and marine pollution were identified as severity level 3 and 2 respectively, for Mkinga District, with beach pollution sources including uncontrolled dumping (particularly in creeks), as well as from lack of toilets and sewage systems. Agrochemicals were contributing to marine pollution. Decline in fisheries yields, regarded as a threat of level 4, are also attributed to loss of fish nurseries like mangrove forests, themselves affected by pollution from the catchments that drain into these coastal habitats.

The east flowing streams of Mkinga are some of the largest conduits for liquid and solid waste, chemicals and sediment to the north Tanga Region coastline, causing beach and sea pollution which affects health (e.g. of fishermen, bathers, tourists) and marine life (e.g. turtles, fish and habitats), extending many kilometres along the coast (likely affecting nearby small islands and coral reefs, and resulting in negative publicity of this important tourist destinations and neighbouring Coelacanth Marine Park to the south.

Tan-L02: Rehabilitation and clean-up of Sigi and Mkulumzi rivers through Tanga Urban and Muheza Districts

There are two major river basins plus several much smaller streams, either perennial or semi-seasonal, that discharge in the vicinity of Tanga Town, within Tanga Urban District. These are:

- Sigi River, arising in the Amani Nature Reserve in the Eastern Usambara Mountains and Manga Forest Reserve area, for almost 100 km, passing sisal plantations, the Gombero Forest Reserve, the Mabayani Reservoir, and various waterfall stretches, before emptying at Amboni mangrove creek in the western part of Tanga Bay.
- Mkulumzi River, draining from the eastern Usumbara Mountains, for over 40 km to the west passing through sisal plantation areas, close to Muheza town, with numerous long tributaries, before emptying into Udofu Creek, a mangrove forested estuary in the western part of Tanga Bay.

Nutrient and chemical pollution discharged through these rivers into the coastal environment on the western shores of the Pemba Channel is well-documented (e.g. Yanda and Munishi, 2007), visible especially after heavy rains, with solid wastes and sediments discharged being indicative of degraded and polluted watersheds.

Beach pollution and marine pollution were both identified as severity level 4, for Tanga Urban District, pollution sources including uncontrolled dumping (particularly in creeks), as well as from lack of toilets and sewage systems. Agrochemicals were contributing to marine pollution. Decline in fisheries yields, regarded as a threat of level 5 is also attributed to loss of fish nurseries like mangrove forests, themselves affected by pollution from the catchments that drain into these coastal habitats.

The two east flowing streams that drain northern Muheza are some of the largest conduits for liquid and solid waste, chemicals and sediment to the north Tanga Region coastline, causing beach and sea pollution which affects health (e.g. of fishermen, bathers, tourists) and marine life (e.g. turtles, fish and habitats), extending many kilometres along the coast (likely affecting nearby small islands and coral reefs, and resulting in negative publicity of this important tourist destinations and neighbouring Coelacanth Marine Park to the south.

Tan-L03: Rehabilitation and clean-up of lower Pangani River, Muheza and Pangani districts

The Pangani River is over 500 km long, with a basin that begins on the slopes of Kilimanjaro Mountain, covering 43,000 km². Several tributaries and smaller streams, either perennial or seasonal, feed the main river - many passing through sisal and other plantation areas. There are five main sub-basins, each with distinctive hydrological characteristics. The lower Pangani River (including the rejuvenated river section and estuary portion) are the focus of this action, all within the Tanga Region, mainly Muheza and Pangani districts.

Sources of pollution include agrochemicals, uncontrolled solid wastes, and sewage that enter the Pangani River at various locations. Nutrient and chemical pollution discharged through these rivers into the coastal environment on the western shores of the Pemba Channel is well-documented, visible especially after heavy rains, with solid wastes and sediments discharged being indicative of degraded and polluted watersheds. However, the Pangani estuary is also well-documented as suffering from severe erosion, believed to be due to the hydroelectric installations in the Tanga Region portion of the river that are preventing sediment transport downstream and from river water abstraction for agriculture, with resulting reduced flow, both needed to supply sediments to the now retreating river mouth.

Beach pollution and marine pollution were both identified as severity level 4 and 2 respectively, for Pangani District, with pollution sources including uncontrolled dumping (particularly in creeks), as well as from lack of toilets and sewage systems. Agrochemicals were contributing to marine pollution. Decline in fisheries yields, regarded as a threat of level 4, are also attributed to loss of fish nurseries like mangrove forests, themselves affected by pollution from the catchments that drain into these coastal habitats.

The Pangani River is the largest conduit in the region for liquid and solid waste, chemicals and sediment to the Tanga Region coastline, causing beach and sea pollution which affects health (e.g. of fishermen, bathers, tourists) and marine life (e.g. turtles, fish and habitats), extending many kilometres along the coast (likely affecting nearby small islands and coral reefs, and resulting in negative publicity of this important tourist destinations and neighbouring Coelacanth Marine Park to the south.

Tan-L04: Safeguarding of the Wami River, Bagamoyo

The Wami River basin is the largest that passes through Bagamoyo District, with tributaries such as the Kangasungwa River beginning in Kondoa District (north of Dodoma), passing through Kilosa District (west of Morogoro) where it is called the Mkondoa River before becoming the Wami River, in all, extending some 350 km before discharging on the coast in the middle of the Saadani National Park.

Nutrient and chemical pollution associated with the Wami River is not well-documented, and likely to be very little at present, though the expected growth in population and associated land and river water usage are certain to increase pressure on the river and its catchment.

Beach pollution was identified as severity level 3, for Bagamoyo District, with pollution sources including uncontrolled dumping (particularly in creeks), as well as from lack of toilets and sewage systems. Agrochemicals were also contributing to marine pollution.

While there is no documented evidence of agrochemical or solid wastes discharged from the Wami River, there is strong likelihood that over the coming years, with increasing pressure on the land that the Wami River basin drains that agrochemical and solid wastes will increasingly become disposed of or leach into the tributaries of the Wami, eventually reaching the coast at Saadani National Park.

Furthermore, any marine pollution from Bagamoyo District will be transported northwards on the prevailing coastal current where it will negatively affect the Tanga Region coastline, in particular the newly established Coelacanth Marine Park and the sensitive coral reef and other habitat therein.

Tan-L05: Rehabilitation and clean-up of the Ruvu River, Bagamoyo District

The Ruvu River basin is the second largest that passes through Bagamoyo District, with tributaries extending from the southwest, over 270 km from beyond Morogoro. The Ruvu River originates in the Uluguru mountains, where small streams combine to form three main tributaries: Mgeta and Ruvu rivres that drain the south side and the Ngerengere River drains the north, in total covering a catchment area of 25,000 km².

Nutrient and chemical pollution discharged through the Ruvu River into the coastal environment on the western shores of the Zanzibar Channel is well-documented, visible especially after heavy rains, with solid wastes and sediments discharged being indicative of degraded and polluted watershed. There are deforestation issues in the upper catchment, water abstraction throughout the river's length and pollution in certain areas.

Beach pollution was identified as severity level 3, for Bagamoyo District, with pollution sources including uncontrolled dumping (particularly in creeks), as well as from lack of toilets and sewage systems. Agrochemicals were also contributing to river and marine pollution.

Equally important, the Ruvu River accounts for over 90 % of Dar es Salaam's daily water supply, which in recent times has reduced its capacity to meet the growing demand. There are reports of deteriorating volumes and water quality

(e.g. Yanda and Munishi 2007; IUCN, 2010) and evidence of agrochemical and solid wastes discharged into the Ruvu River, that reach the coast. Furthermore, there is strong likelihood that over the coming years, with increasing pressure on the land that the Ruvu River basin drains that agrochemical and solid wastes will increasingly become disposed of or leach into the tributaries of the Ruvu, eventually reaching the coast at Saadani National Park and beyond.

Furthermore, marine pollution from the Bagamoyo District will be transported northwards on the prevailing coastal current where it will negatively affect the Tanga Region coastline, in particular the newly established Coelacanth Marine Park and the sensitive coral reef and other habitat therein.

Tan-L06: Rehabilitation and clean-up of Mkuza and Mpiji rivers, Bagamoyo and Kinondoni districts

Nutrient and chemical pollution discharged through these rivers into the coastal environment on the western shores of the Zanzibar Channel is well-documented, visible especially after heavy rains, with solid wastes and sediments discharged being indicative of degraded and polluted watersheds.

Southern Bagamoyo District is drained by two large rivers, both of 25-30 km length: the Mkuza River with sources in the streams

The Mpiji River forms the seaward part of the district border between Bagamoyo and Kinondoni. Both rivers begin in the higher ground around the forest reserves of Pande. These water sources are threatened from overharvest and land changes and are in need on continued support to ensure their contributions to the flows of the Mkuza and Mpiji rivers.

Beach pollution and marine pollution were both identified as severity level 4, for Kinondoni District, pollution sources including uncontrolled dumping (particularly in creeks), as well as from lack of toilets and sewage systems. Agrochemicals were contributing to marine pollution. Beach pollution was also identified as severity level 3, for Bagamoyo District, with pollution sources including uncontrolled dumping (particularly in creeks), as well as from lack of toilets and sewage systems. Agrochemicals were also contributing to river and marine pollution.

Decline in fisheries yields, regarded as a threat of level 4, in both districts that share the Mpiji River, is also attributed to loss of fish nurseries like mangrove forests, themselves affected by pollution from the catchments that drain into these coastal habitats.

The two east flowing rivers (Mkuza and Mpiji) that drain western Kinondoni are some of the largest conduits for liquid and solid waste, chemicals and sediment to the north Dar es Salaam coastline, causing beach and sea pollution which affects health (e.g. of fishermen, bathers, tourists) and marine life (e.g. turtles, fish and habitats), extending many kilometres along the coast (likely affecting nearby small islands and coral reefs, and resulting in negative publicity of this important tourist destinations in northern Dar es Salaam.

Protecting the sources of these two rivers, particularly in the Pange area is a high priority, especially protection from fire (e.g. Doggart, 2003), while other areas of focus identified include water user association formulation and capacity building essential to secure water sources for most of the district towns in the basin to ensure water supply, a borehole inventory in Dar es Salaam, investment to construct more storage facilities (reservoirs, ground water storage) and human resource development, among others (IUCN 2010).

Tan-L07: Rehabilitation and clean-up of seven rivers, Kinondoni District

Within Kinondoni District, excluding border rivers such as Mpiji (see previous action Tan: L06) and Msimbazi (see next action Tan: L08) There are seven principle, each with several much smaller streams, that discharge into the coastal waters between Ras Kankadya (Msasani Peninsula) and Ras Kiromoni. This stretch of coast, approximately 20 km long, is one of the most polluted in the country. From Ras Kiromoni southwards, with the approximate length of the rivers, these are Nyakasangwe (22 km), Tegeta 28 km, Manyema (17 km), Ndumbwi (3 km), Mbezi (18 km), Mlalakuwa (16 km) and Kijitonyama (25 km).

Nutrient and chemical pollution discharged through these rivers into the coastal environment on the western shores of the Zanzibar Channel is well-documented, visible especially after heavy rains, with solid wastes and sediments discharged being indicative of degraded and polluted watersheds. These water are important marine biodiversity and fisheries areas, reflected by the presence of the dare s Salaam Marine Reserves (that include the islands and reefs of Bongoyo, Mbudya, Fungu Yasin).

Beach pollution and marine pollution were both identified as severity level 4, for Kinondoni District, pollution sources including uncontrolled dumping (particularly in creeks), as well as from lack of toilets and sewage systems. Agrochemicals were contributing to marine pollution. Pollution sources including uncontrolled dumping (particularly in creeks), as well as from lack of toilets and sewage systems. Agrochemicals were also contributing to river and marine pollution.

Decline in fisheries yields, regarded as a threat of level 4 in both Kinondoni Districts, is also attributed to loss of fish nurseries like mangrove forests, themselves affected by pollution from the catchments that drain into these coastal habitats.

The seven relatively short-lengthed east-flowing rivers that drain Kinondoni are some of the largest conduits for liquid and solid waste, chemicals and sediment to the north Dar es Salaam coastline, causing beach and sea pollution which affects health (e.g. of fishermen, bathers, tourists) and marine life (e.g. turtles, fish and habitats), extending many kilometres along the coast (likely affecting nearby small islands and coral reefs, and resulting in negative publicity of this important tourist destinations in northern Dar es Salaam.

Protecting the sources of these rivers, particularly in western higher ground areas is a high priority, especially protection from fire if Pande Forest Reserve (e.g. Doggart, 2003). Other areas of focus for intervention include water user association formulation and capacity building essential to secure water sources for most of the district towns in the basin to ensure water supply, a borehole inventory in Dar es Salaam, investment to construct more storage facilities (reservoirs, ground water storage) and human resource development, among others (e.g. Babybonela, 2005; IUCN, 2010).

Tan-L08: Rehabilitation and clean-up of Msimbazi River Basin, Kinondoni and Ilala districts

The Mzimbazi River is the major river basin that drains the Ilala District, bordering to the north in places with Kinondoni District. The Msimbazi River is about 25 km long, with head waters in Pugu Hills Forest Reserve, but includes a basin with at least eight major tributaries on the north banks, themselves mostly 15-25 km long, that feed into the main river. Upriver from the mouth the tributaries are the Sinza, Minyonyoni, Mborohadi, Ubungo, Mngigawa, Makulamula, Luhanga and Kimanga.

Msimbazi Creek is the most studied area of Dar es Salaam. A comprehensive body of literature (e.g. Machiwa, 1992; Mwandya, 1993; Lyantagaye, 1996; Kondoro, 1997; Othman 2002) documents the nutrients, chemical, faecal and solid waste pollution discharged through this rivers into the coastal environment as it passes under Selander Bridge, visible especially after heavy rains.

Beach pollution and marine pollution were both identified as severity level 4, for Kinondoni District, with sources including uncontrolled dumping (particularly in creeks), as well as from lack of toilets and sewage systems. Pollution of the beach and nearshore, industrial, sewage and heavy metal were all forms of pollution ranked as level 3 threats in Ilala District. Pollution sources including uncontrolled dumping (particularly in creeks), as well as from lack of toilets and sewage systems.

Decline in fisheries yields, regarded as a threat of level 4 in both Kinondoni and Ilala districts, is also attributed to loss of fish nurseries like mangrove forests, themselves affected by pollution from the catchments that drain into these coastal habitats. Disease outbreaks was ranked at severity level 4 and 3 respectively for Ilala and Kinondoni, with causes linked to flooding and sewage.

The Msimbazi River basin is the largest conduit for liquid and solid waste, chemicals and sediment to the north Dar es Salaam coastline, causing beach and sea pollution which affects health (e.g. of fishermen, bathers, tourists) and marine life (e.g. turtles, fish and habitats), extending many kilometres along the coast (likely affecting nearby small islands and coral reefs, and resulting in negative publicity of this important tourist destinations in northern Dar es Salaam.

Cleaning up and rehabilitating this river and its sources is a high priority. As with other rivers in the Wami-Ruvu Basin, additional areas of focus for intervention include water user association formulation and capacity building essential to secure water sources for most of the district towns in the basin to ensure water supply, a borehole inventory in Dar es Salaam, investment to construct more storage facilities (reservoirs, ground water storage) and human resource development, among others (e.g. Babybonela, 2005; IUCN, 2010).

Tan-L09: Rehabilitation and clean-up of Kizinga and Mzinga river basins, Ilala and Temeke districts

The Dar es Salaam Harbour is the seaward portion of Mzinga Creek, fed by two main tributaries, the Kizinga and Mzinga rivers, of 17 km and 10 km in length respectively. The Kizinga and Mzinga river systems originate from the Pugu/Kisarawe hills with the Kizinga having a catchment area of 432 km², and the Mzinga 41 km² (IUCN, 2004). The water in the Mzinga and Kizinga rivers meets domestic standards for drinking water, notably in the upper reaches. Mzinga is not perennial while Kizinga flows throughout the year and support domestic water supply in the Mbagala area (Mjemah, 2007).

The outflows from the two rivers that drain southern Dar es Salaam are well documented sources of various pollutants (e.g. Machiwa, 1992; Mwandya, 1993; Lyantagaye, 1996; Othman, 2002; Abbu and Lyimo, 2007), including nutrients, chemicals, oils, faecal and solid waste pollution, that are carried into coastal environment as these waters discharge through Mzinga Creek and pass the Dar es Salaam Port.

Pollution of the beach and nearshore, industrial, sewage and heavy metal were all forms of pollution ranked as level 3 threats in Ilala District. Beach and marine pollution from heavy metals, industrial and oil pollution were all identified as severity level 3, for Temeke District, with sources including uncontrolled dumping (particularly in creeks), as well as from lack of toilets and sewage systems, industry and garages dumping into the Kizinga and Mzinga rivers.

Decline in fisheries yields, regarded as a threat of level 4 in both Ilala and Temeke districts, is also attributed to loss of fish nurseries like mangrove forests, themselves affected by pollution from the catchments that drain into these coastal habitats. Disease outbreaks was ranked at severity level 4 for Ilala, with causes linked to flooding and sewage.

The Kizinga and Mzinga rivers are the largest conduit for liquid and solid waste, chemicals and sediment to the central Dar es Salaam coastline, causing beach and sea pollution which affects health (e.g. of fishermen, bathers, tourists) and marine life (e.g. turtles, fish and habitats), extending many kilometres along the coast, likely affecting nearby small islands and coral reefs, and resulting in negative publicity of this important tourist destinations in northern Dar es Salaam.

Cleaning up and rehabilitating these two rivers that converge at Mzinga Creek is a high priority. As with other rivers in the Wami-Ruvu Basin, additional areas of focus for intervention include water user association formulation and capacity building essential to secure water sources for most of the district towns in the basin to ensure water supply, a borehole inventory in Dar es Salaam, investment to construct more storage facilities (reservoirs, ground water storage) and human resource development, among others (e.g. Babybonela, 2005; IUCN, 2010).

Tan-L10: Safeguarding Nguva River and other rivers, Temeke District

The Nguva River basin is the largest in Temeke District, extending some 30 km from the raised plateau in the west and to the south, traversing some 20 km of farmland and shrub area before discharging on the coast in the mangrove creek at Gezaulole. There are five other, small rivers in the district, mostly between 3-10 km in length. The Mbasi River forms the border with Mkuranga District to the south.

The outflows from rivers in northern Temeke (associated with Mzinga Creek and the harbour) and two other Dar es Salaam districts are well documented sources of various pollutants (e.g. Machiwa, 1992; Mwandya, 1993; Lyantagaye, 1996; Othman, 2002), including nutrients, chemicals, oils, faecal and solid waste pollution, that are carried into coastal environment as these waters discharge through Mzinga Creek and pass the Dar es Salaam Port.

With the exception of these northern rivers (see Tan-L09), Temeke's other 10-12 principle rivers and streams are clean (see Abbu and Lyimo, 2007). Existing threats are minor in the present day and include river sand and water abstraction in a few places. As the city of Dar es Salaam expands south, following completion of the Kurasini Bridge, the pressure on the smaller Temeke catchments is bound to increase dramatically. Development of new settlements and industry has already begun in Temeke and is projected to accelerate once the Kurasini Bridge is completed, expected by June 2015.

Beach and marine pollution from heavy metals, industrial and oil pollution were all identified as severity level 3, for Temeke District, with sources including uncontrolled dumping (particularly in creeks), as well as from lack of toilets and sewage systems, industry and garages dumping into the Kizinga and Mzinga rivers.

Decline in fisheries yields, regarded as a threat of level 4 in both Ilala and Temeke districts, is also attributed to loss of fish nurseries like mangrove forests, themselves affected by pollution from the catchments that drain into these coastal habitats. Disease outbreaks was ranked at severity level 4 for Ilala, with causes linked to flooding and sewage.

The Nguva River is the largest potential conduit for liquid and solid waste, chemicals and sediment to the central Dar es Salaam coastline, that would cause beach and sea pollution which affects health and marine life, likely affecting nearby small islands and coral reefs (including the Sinda Island Marine Reserve), an important tourist destination in southern Dar es Salaam.

While there is no documented evidence of agrochemical or solid wastes discharged from the Nguva River, there is strong likelihood that over the coming years, with increasing pressure on the land that the Nguva River basin drains that agrochemical and solid wastes will increasingly become disposed of or leach into its tributaries, eventually reaching the coast. The emphasis of this action is to prevent the degradation and pollution to the 10-12 principle watercourse in Temeke (excluding Mzinga and Mzinga rivers) that has been witnessed in the neighbouring districts of Ilala and Kinondoni.

Tan-L11: Rehabilitation and clean-up of lower Rufiji River and safeguarding the Mohoro River, Rufiji District

One major water body, the Rufiji River, drains approximately 30 % of Tanzania area (some 177,000 sq. km) and is the largest river in the country, penetrates the district. Numerous tributaries exist on both banks of the Rufiji River and other four small coastal rivers drain directly into the sea, the largest being the Mohoro River in the southern section of the Rufiji delta. The Rufiji delta is the largest estuarine mangrove forest in East Africa, with an estimated surface area of 53 km². The Mohoro River extends from the wooded hills of Kilwa District to the south, for some 70 km in length, discharging in the southern part of the Rufiji delta.

Large plantations in the highland drain into Rufiji basin and hence fertilizers, pesticides, herbicides and fungicides may pose a threat. Organochlorine pesticides are reportedly used to control crab pest in rice paddies in the lower Rufiji River portion (Stadlinger et al 2003), potentially affecting carapace formation in prawn and other shellfish. The Mohoro River has not been studied in terms of water quality or threats, but given the increasing development in the southern part of the Rufiji District since the completion of the Mkapa Bridge across the Rufiji River, it is anticipated that catchment and pollution problems associated with the Mohoro River are potential future threats.

Any sediment, nutrient or chemical pollution discharged through these rivers into the coastal environment on the western shores of the Mafia Channel could potentially impact on the Mafia Island Marine Park, as well as the population of whale sharks now known to be attracted to the feeding grounds in the Mafia Channel.

Beach pollution and marine pollution were both identified as severity level 4 for Rufiji District, with pollution sources including uncontrolled dumping (particularly in creeks), as well as from lack of toilets and sewage systems. Agrochemicals were contributing to marine pollution. Decline in fisheries yields, was also regarded as a threat of level 4, attributed in part to loss of fish nurseries like mangrove forests, themselves affected by pollution from the catchments that drain into these coastal habitats.

The Rufiji River (and to a much lesser extent the Mohoro River) is the largest conduit for liquid and solid waste, chemicals and sediment into the Mafia Channel, potentially causing beach and sea pollution which affects health (e.g. of fishermen, bathers, tourists) and marine life (e.g. turtles, fish and habitats). Pollution and sediment from these rivers extend many kilometres along the coast (affecting nearby small islands and coral reefs that are part of the Mafia Island Marine Park), and potentially resulting in negative publicity of this important tourist destination.

The need to address the use of pesticides in the lower Rufiji River (floodplain and delta) and safeguard the catchment and land uses that impact on the Mohoro River combine urgent action and mitigation of future impacts.

Tan-L12: Sewage collection and treatment facilities for Tanga City, Tanga Urban District

A body of literature documents high nutrient and faecal coliform bacteria levels in waters off the Tanga City, discharged through the city sewerage system with only primary screening, and from seepage of sewage into small rivers and streams, directly into the coastal environment, Tanga Bay and western shores of the Pemba Channel.

Beach pollution and marine pollution were both identified as severity level 4, for Tanga Urban District, pollution sources including uncontrolled dumping (particularly in creeks), as well as from lack of toilets and sewage systems. Decline in fisheries yields, regarded as a threat of level 5, is also attributed to loss of fish nurseries like mangrove forests, themselves affected by pollution from the catchments that drain into these coastal habitats.

Sewage from over 50,000 households in Tanga City (almost 300,000 people) is treated only to primary (screening) level and sewage pollution to the marine environment is continuous; causing beach and sea pollution which affects health (e.g. of fishermen, bathers, tourists) and marine life (e.g. fish and habitats), extending many kilometres along the west coast of Pemba Channel (likely affecting nearby small islands and coral reefs, and resulting in negative publicity to the city). Further, inadequate urban sanitation, also causes health problems from contaminated ground and surface water as well as from water-borne diseases.

Tan-L13: Sewage collection and treatment facilities for Pangani town, Pangani District

Currently there is no evidence of high nutrient and faecal coliform bacteria levels in waters off the Pangani town, despite there being no sewage treatment system other than simple soak-aways. Low level but constant sewage and nutrient seepage into the marine environment is likely taking place though not documented. The projected increase in population in this important coastal town is likely to be accompanied by more seepage of sewage into small rivers and streams, directly into the coastal environment, the western shores of the Pemba Channel and drifting north to the Coelacanth Marine Park.

Beach pollution was identified as severity level 4, for Tanga Urban District, pollution sources including uncontrolled dumping (particularly in creeks), as well as from lack of toilets and sewage systems. Marine pollution was ranked with severity level 2. Decline in fisheries yields, regarded as a threat of level 5, is also attributed to loss of fish nurseries like mangrove forests, themselves affected by pollution from the catchments that drain into these coastal habitats. Agrochemicals were contributing to marine pollution.

Sewage from over 8,000 inhabitants in Pangani Town is not treated and ultimately enters local aquifers and the marine environment is continuous; causing beach and sea pollution which affects health (e.g. of fishermen, bathers, tourists) and marine life (e.g. fish and habitats), extending many kilometres along the west coast of Pemba Channel (likely affecting nearby small islands and coral reefs, and resulting in negative publicity to the city).

Tan-L14: Sewage collection and treatment facilities for Bagamoyo town, Bagamoyo District

Currently there is no evidence of high nutrient and faecal coliform bacteria levels in waters off Bagamoyo town, despite there being no sewage treatment system other than simple soak-aways. Low level but constant sewage and nutrient seepage into the marine environment is likely taking place though not documented. The projected increase in population in this important coastal town is likely to be accompanied by more seepage of sewage into small rivers and streams, directly into the coastal environment, the western shores of the Pemba Channel and drifting north to the Saadani National Park.

Beach pollution was both identified as severity level 3 for Bagamoyo District, pollution sources including uncontrolled dumping (particularly in creeks), as well as from lack of toilets and sewage systems. Decline in fisheries yields, regarded as a threat of level 4, is also attributed to loss of fish nurseries like mangrove forests, themselves affected by pollution from the catchments that drain into these coastal habitats.

Sewage from over households in Bagamoyo Town (two hundred thousand people) have only primary sewage treatment systems and sewage pollution to the marine environment is continuous; causing beach and sea pollution which affects health (e.g. of fishermen, bathers, tourists) and marine life (e.g. fish and habitats), extending many kilometres along the west coast of Zanzibar Channel (likely affecting nearby small islands and coral reefs), and resulting in negative publicity to the city. Sewage and water are also responsible for water-borne disease in Bagamoyo (e.g. [Mattioli et al 2012](#)).

The district has experienced a high average annual growth rate between 2002 and 2012 of 3.45 % leading to more than 42.30 % increase of the population over the ten-year period and documenting a significant in-migration. The population density in the district has grown to 37 persons/km² in 2012 from 26 persons/km² of 2002. Bagamoyo town and surrounding urban and peri-urban areas witness the greatest impacts from increasing population. The absence of a suitable sewage collection and treatment facility will over time lead to greater pollution and health issues if not addressed.

Tan-L15: Sewage collection and treatment facilities for Kinondoni Municipality

Nutrient and chemical pollution discharged through local rivers into the coastal environment on the western shores of the Zanzibar Channel is well-documented, visible especially after heavy rains, with solid wastes and sediments discharged being indicative of degraded and polluted watersheds. These waters are important marine biodiversity and fisheries areas, reflected by the presence of the dare s Salaam Marine Reserves (that include the islands and reefs of Bongoyo, Mbudya, Fungu Yasin).

Currently there is low level but constant sewage and nutrient seepage into the marine environment though not documented. The projected increase in population is likely to be accompanied by more seepage of sewage into small rivers and streams, directly into the coastal environment. The need exists for a comprehensive treatment of sewage for inhabitants of Kinondoni.

Beach pollution and marine pollution were both identified as severity level 4, for Kinondoni District, pollution sources including uncontrolled dumping (particularly in creeks), as well as from lack of toilets and sewage systems. Agrochemicals were contributing to marine pollution. Pollution sources including uncontrolled dumping (particularly in creeks), as well as from lack of toilets and sewage systems.

Untreated sewage presently enters the marine environment from seven relatively short-lengthed east-flowing rivers that drain Kinondoni. Together with storm drains, these are some of the largest conduits for liquid and solid waste, chemicals and sediment to the north Dar es Salaam coastline, causing beach and sea pollution which affects health (e.g. of fishermen, bathers, tourists) and marine life (e.g. turtles, fish and habitats), extending many kilometres along the coast (likely affecting nearby small islands and coral reefs, and resulting in negative publicity of this important tourist destinations in northern Dar es Salaam.

Decline in fisheries yields, regarded as a threat of level 4 in Kinondoni District, is also attributed to loss of fish nurseries like mangrove forests, themselves affected by pollution from the catchments that drain into these coastal habitats. The absence of a suitable sewage collection and treatment facility will over time lead to greater pollution and health issues if not addressed.

Tan-L16: Sewage collection and treatment facilities for Ilala Municipality

Msimbazi Creek is the most studied area of Dar es Salaam (see Tan-L08). Nutrients, chemical, faecal and solid waste pollution discharged through this rivers into the coastal environment as it passes under Selander Bridge, visible especially after heavy rains. Despite there being no sewage treatment system other than simple soak-aways, low level but constant sewage and nutrient seepage into the marine environment is likely taking place. The projected increase in population is likely to be accompanied by more seepage of sewage into small rivers and streams, directly into the coastal environment.

Beach pollution and marine pollution were both identified as severity level 4, for Kinondoni District, with sources including uncontrolled dumping (particularly in creeks), as well as from lack of toilets and sewage systems. Pollution of the beach and nearshore, industrial, sewage and heavy metal were all forms of pollution ranked as level 3 threats in Ilala District. Pollution sources including uncontrolled dumping (particularly in creeks), as well as from lack of toilets and sewage systems.

Decline in fisheries yields, regarded as a threat of level 4 in both Kinondoni and Ilala districts, is also attributed to loss of fish nurseries like mangrove forests, themselves affected by pollution from the catchments that drain into these coastal habitats. Disease outbreaks was ranked at severity level 4 and 3 respectively for Ilala and Kinondoni, with causes linked to flooding and sewage.

Establishing a sewage collection and treatment facility is the greatest measure to reducing pollution into the coastal waters of Dar es Salaam.

Tan-L17: Sewage collection and treatment facilities for Temeke Municipality

The Dar es Salaam Harbour is the seaward portion of Mzinga Creek, fed by two main tributaries, the Kizinga and Mzinga rivers that drain southern Dar es Salaam. Pollution is well documented, including nutrients, chemicals, oils, faecal and solid waste pollution, that are carried into coastal environment as these waters discharge through Mzinga Creek and pass the Dar es Salaam Port.

Low level but constant sewage and nutrient seepage into the marine environment is likely taking place though not documented. The projected increase in population in this important coastal town is likely to be accompanied by more seepage of sewage into small rivers and streams, directly into the coastal environment, drifting into the Dar es Salaam Marine Reserves (both north and south areas).

Pollution of the beach and nearshore, industrial, sewage and heavy metal were all forms of pollution ranked as level 3 threats in Ilala District. Beach and marine pollution from heavy metals, industrial and oil pollution were all identified as severity level 3, for Temeke District, with sources including uncontrolled dumping (particularly in creeks), as well as from lack of toilets and sewage systems, industry and garages dumping into the Kizinga and Mzingira rivers.

Decline in fisheries yields, regarded as a threat of level 4 in both Ilala and Temeke districts, is also attributed to loss of fish nurseries like mangrove forests, themselves affected by pollution from the catchments that drain into these coastal habitats. Disease outbreaks was ranked at severity level 4 for Ilala, with causes linked to flooding and sewage. Installing a complete sewage system for Temeke is a high priority.

Tan-L18: Sewage collection and treatment facilities for Kilindoni Town, Mafia District

Mafia District's economy relies on agricultural cultivation and fisheries, with a substantial amount of revenue also contributed by trade and, increasingly by tourism. Although Mafia ecology offers one of the best diving and snorkeling center in East Africa the number of tourists is still low. This is expected to change dramatically once the 1.4 km Kilindoni jetty is inaugurated, allowing ferries, transporters and tourist vessels to dock with safety.

The settlement and built-up portion of Mafia is very small, concentrated in the western district headquarters town of Kilindoni, where the airport and docks are situated. Most of the remaining villages are within the Mafia Island Marine Park (MIMP).

Responding to the recognised need to address waste development and the MIMP General Management Plan (2001) includes recommendations to develop solid waste (and sewage) disposal. With local town inhabitants reliant on informal and inadequate solid waste collection and processing services, large amounts of waste directly enter the natural environment including coastal waters. This affects productivity and tourism potential.

Beach pollution was identified as severity level 3 for Mafia Island, with sources including uncontrolled dumping (particularly in creeks), as well as from lack of toilets and sewage systems. Marine pollution was ranked as severity level 2.

Uncontrolled solid and liquid waste disposal, lack of toilets for public as well as residential houses. Disease outbreaks in Kilindoni was also ranked at severity level 3. Based on 2002 census data, the under five years of age mortality was 176 per 1,000 live births.

The projected increase in population accompanied by development tourism, is certain to aggravate the problem of solid waste collection and treatment. The local NGO Seasense, reports that Mafia Island is Tanzania's most important sea turtle nesting site, with over 250 green turtle nests laid each year, and the critically endangered hawksbill turtle is also known to nest on the tiny islands around Mafia. A small but developing sea turtle ecotourism initiative is generating much needed income for communities near to the nesting beaches and is helping to raise awareness of the importance of sea 2 of 3 turtle conservation. However, nesting beaches are on the east coast of the island and are continually covered in large amounts of plastic waste that washes in on the east African current from as far away as Indonesia and the Philippines. The amount of plastic debris on the nesting beaches poses a significant threat to sea turtles in Mafia and also threatens the long term sustainability of the ecotourism project. Complaints from visitors are becoming increasingly common.

Mafia Island is part of the Mafia-Rufiji-Kilwa Ramsar Site, was in late 2004 formally gazetted under the Ramsar Convention as an 'Area of Wetlands of Global Importance', and referred to as the Rufiji-Mafia-Kilwa Marine Ramsar Site. The island, together with the Rufiji Delta and neighbouring Songo Songo Archipelago (Kilwa District) was identified during a WWF process (2004) as having globally important biodiversity richness within the Eastern African Marine Ecoregion, and was the focus of the WWF Rufiji-Mafia-Kilwa Seascape Programme (or RUMAKI), that ended in 2010. The internationally recognised importance in terms of marine and coastal biodiversity gives added justification for comprehensively addressing the issue of solid (and other) wastes.

Tan-L19: Sewage collection and treatment facilities for Kilwa Kivinje, Kilwa District

Currently there are no reports of high nutrient and faecal coliform bacteria levels in waters off Kilwa Kivinje coastal waters, despite there being no sewage treatment system other than simple soak-aways. Low level but constant sewage and nutrient seepage into the marine environment is likely taking place though not documented. The projected increase in population in this important coastal town is likely to be accompanied by more seepage of sewage into small rivers and streams, directly into the coastal environment, drifting north to the Ramsar site (that includes the Songo Songo Archipelago).

Beach and marine pollution were both identified as severity level 2 for Kilwa District, pollution sources including uncontrolled dumping (particularly in creeks), as well as from lack of toilets and sewage systems. Decline in fisheries yields, regarded as a threat of level 4, is also attributed to loss of fish nurseries like mangrove forests, themselves affected by pollution from the catchments that drain into these coastal habitats.

Sewage from over households in Kilwa Kivinje Town (tens of thousands) causes beach and sea pollution which affects health (e.g. of fishermen, bathers, tourists) and marine life (e.g. fish and habitats), extending many kilometres into the Songo Songo Archipelago (Ramsar site), likely affecting nearby small islands and coral reefs, and resulting in negative publicity to the city. Sewage and water are also responsible for water-borne disease. The absence of a suitable sewage collection and treatment facility will over time lead to greater pollution and health issues if not addressed.

Tan-L20: Sewage collection and treatment facilities for Kilwa Masoko, Kilwa District

Currently there are no reports of high nutrient and faecal coliform bacteria levels in waters off Kilwa Kivinje coastal waters, despite there being no sewage treatment system other than simple soak-aways. Low level but constant sewage and nutrient seepage into the marine environment is likely taking place though not documented. The projected increase in population in this important coastal town is likely to be accompanied by more seepage of sewage into small rivers and streams, directly into the coastal environment, drifting north to the Ramsar site (that includes the Songo Songo Archipelago).

Beach and marine pollution were both identified as severity level 2 for Kilwa District, pollution sources including uncontrolled dumping (particularly in creeks), as well as from lack of toilets and sewage systems. Decline in fisheries yields, regarded as a threat of level 4, is also attributed to loss of fish nurseries like mangrove forests, themselves affected by pollution from the catchments that drain into these coastal habitats.

Sewage from over households in Kilwa Masoko Town (tens of thousands) causes beach and sea pollution which affects health (e.g. of fishermen, bathers, tourists) and marine life (e.g. fish and habitats), extending many kilometres into the Songo Songo Archipelago (Ramsar site), likely affecting nearby small islands and coral reefs, and resulting in negative publicity to the city. Sewage and water are also responsible for water-borne disease. The absence of a suitable sewage collection and treatment facility will over time lead to greater pollution and health issues if not addressed.

Tan-L21: Sewage collection and treatment facilities for Lindi town, Lindi Urban District

Currently there is no evidence of high nutrient and faecal coliform bacteria levels in waters off Lindi town, despite there being no sewage treatment system other than simple soak-aways. Low level but constant sewage and nutrient seepage into the marine environment is likely taking place though not documented. The projected increase in population in this important coastal town is likely to be accompanied by more seepage of sewage into small rivers and streams, directly into the coastal environment.

Beach pollution was identified as severity level 2 for Lindi Urban District, pollution sources including uncontrolled dumping (particularly in creeks), as well as from lack of toilets and sewage systems. Decline in fisheries yields, regarded as a threat of level 4, is also attributed to loss of fish nurseries like mangrove forests, themselves affected by pollution from the catchments that drain into these coastal habitats.

Sewage from over households in Lindi Urban town (tens of thousands) causes beach and sea pollution which affects health (e.g. of fishermen, bathers, tourists) and marine life (e.g. fish and habitats),

extending many kilometres coastal waters, likely affecting nearby small islands and coral reefs, and resulting in negative publicity to the city. Sewage and water are also responsible for water-borne disease. The absence of a suitable sewage collection and treatment facility will over time lead to greater pollution and health issues if not addressed.

Tan-L22: Sewage collection and treatment facilities for Mikindani town, Mtwara Urban District

Currently there are no reports of high nutrient and faecal coliform bacteria levels in waters off Mikindani coastal waters, despite there being no sewage treatment system other than simple soak-aways. Low level but constant sewage and nutrient seepage into the marine environment is likely taking place though not documented. The projected increase in population in this important coastal town is likely to be accompanied by more seepage of sewage into small rivers and streams, directly into the coastal environment, potentially affecting the Mnazi Bay-Ruvuma Estuary Marine Park (MBREMP).

Beach pollution was both identified as severity level 4 for Mtwara Urban District, pollution sources including uncontrolled dumping (particularly in creeks), as well as from lack of toilets and sewage systems. Decline in fisheries yields, regarded as a threat of level 4, is also attributed to loss of fish nurseries like mangrove forests, themselves affected by pollution from the catchments that drain into these coastal habitats.

Sewage from over households in Mtwara Urban Town (tens of thousands) enters the marine environment continuously, at low levels, causing beach and sea pollution which affects health (e.g. of fishermen, bathers, tourists) and marine life (e.g. fish and habitats), extending many kilometres and resulting in negative publicity to the city. Sewage and water are also responsible for water-borne disease, ranked at severity level 2. The absence of a suitable sewage collection and treatment facility will over time lead to greater pollution and health issues if not addressed.

Tan-L23: Sewage collection and treatment facilities for Mtwara town, Mtwara Urban District

Currently there are no reports of high nutrient and faecal coliform bacteria levels in waters off Mtwara coastal waters, despite there being no sewage treatment system other than simple soak-aways. Low level but constant sewage and nutrient seepage into the marine environment is likely taking place though not documented. The projected increase in population in this important coastal town is likely to be accompanied by more seepage of sewage into small rivers and streams, directly into the coastal environment, potentially affecting the Mnazi Bay-Ruvuma Estuary Marine Park (MBREMP).

Beach pollution was both identified as severity level 4 for Mtwara Urban District, pollution sources including uncontrolled dumping (particularly in creeks), as well as from lack of toilets and sewage systems. Decline in fisheries yields, regarded as a threat of level 4, is also attributed to loss of fish nurseries like mangrove forests, themselves affected by pollution from the catchments that drain into these coastal habitats.

Sewage from over households in Mtwara Urban Town (tens of thousands) enters the marine environment continuously, at low levels, causing beach and sea pollution which affects health (e.g. of fishermen, bathers, tourists) and marine life (e.g. fish and habitats), extending many kilometres and resulting in negative publicity to the city. Sewage and water are also responsible for water-borne disease, ranked at severity level 2. The absence of a suitable sewage collection and treatment facility will over time lead to greater pollution and health issues if not addressed.

Tan-L24: Safe toilet facilities for Bwejuu and Jibondo islands, Mafia District

Mafia District's economy relies on agricultural cultivation and fisheries, with a substantial amount of revenue also contributed by trade and, increasingly by tourism. Although Mafia ecology offers one of the best diving and snorkeling centers in East Africa the number of tourists is still low. This is expected to change dramatically once the 1.4 km Kilindoni jetty is inaugurated, allowing ferries, transporters and tourist vessels to dock with safety.

The settlement and built-up portion of Mafia is very small, concentrated in the western district headquarters town of Kilindoni, where the airport and docks are situated. Most of the remaining villages are within the Mafia Island Marine Park (MIMP).

Responding to the recognised need to address waste development and the MIMP General Management Plan (2001) includes recommendations to develop solid waste (and sewage) disposal. With local town inhabitants reliant on informal and inadequate solid waste collection and processing services, large amounts of waste directly enter the natural environment including coastal waters. This affects productivity and tourism potential.

Beach pollution was identified as severity level 3 for Mafia Island, with sources including uncontrolled dumping (particularly in creeks), as well as from lack of toilets and sewage systems. Marine pollution was ranked as severity level 2.

Uncontrolled solid and liquid waste disposal, lack of toilets for public as well as residential houses. Disease outbreaks in Kilondoni was also ranked at severity level 3. Based on 2002 census data, the under five years of age mortality was 176 per 1,000 live births.

The projected increase in population accompanied by development tourism, is certain to aggravate the problem of solid waste collection and treatment. The local NGO Seasense, reports that Mafia Island is Tanzania's most important sea turtle nesting site, with over 250 green turtle nests laid each year, and the critically endangered hawksbill turtle is also known to nest on the tiny islands around Mafia. A small but developing sea turtle ecotourism initiative is generating much needed income for communities near to the nesting beaches and is helping to raise awareness of the importance of sea 2 of 3 turtle conservation. However, nesting beaches are on the east coast of the island and are continually covered in large amounts of plastic waste that washes in on the east African current from as far away as Indonesia and the Philippines. The amount of plastic debris on the nesting beaches poses a significant threat to sea turtles in Mafia and also threatens the long term sustainability of the ecotourism project. Complaints from visitors are becoming increasingly common.

Mafia Island is part of the Mafia-Rufiji-Kilwa Ramsar Site, was in late 2004 formally gazetted under the Ramsar Convention as an 'Area of Wetlands of Global Importance', and referred to as the Rufiji-Mafia-Kilwa Marine Ramsar Site. The island, together with the Rufiji Delta and neighbouring Songo Songo Archipelago (Kilwa District) was identified during a WWF process (2004) as having globally important biodiversity richness within the Eastern African Marine Ecoregion, and was the focus of the WWF Rufiji-Mafia-Kilwa Seascape Programme (or RUMAKI), that ended in 2010. The internationally recognises importance in terms of marine and coastal biodiversity gives added justification for comprehensively addressing the issue of solid (and other) wastes.

Tan-L25: Urban Solid Waste Collection and Processing facility for Tanga Town, Tanga Urban District

A body of literature documents high nutrient and faecal coliform bacteria levels in waters off the Tanga City, discharged through the city sewerage system with only primary screening, and from seepage of sewage into small rivers and streams, directly into the coastal environment, Tanga Bay and western shores of the Pemba Channel. Other forms of waste that are ever present are solid wastes from urban dwellings.

Currently there is no evidence of high solid waste levels in waters off the Tanga Town, despite there being no formal solid waste processing facility. Low level but constant waste entry to the marine environment is likely taking place though not documented. The projected increase in population in this important coastal town is likely to be accompanied by more seepage of sewage into small rivers and streams, directly into the coastal environment, the western shores of the Pemba Channel and drifting north to the Coelacanth Marine Park.

Beach pollution and marine pollution were both identified as severity level 4, for Tanga Urban District, pollution sources including uncontrolled dumping (particularly in creeks), as well as from lack of toilets and sewage systems. Decline in fisheries yields, regarded as a threat of level 5, is also attributed to loss of fish nurseries like mangrove forests, themselves affected by pollution from the catchments that drain into these coastal habitats. The projected increase in population accompanied by development tourism, is certain to aggravate the problem of solid waste collection and treatment.

Tan-L26: Urban Solid Waste Collection and Processing facility for Pangani Town, Pangani District

Currently there is no evidence of high solid waste levels in waters off the Pangani town, despite there being no formal solid waste processing facility. Low level but constant waste entry to the marine environment is likely taking place though not documented. The projected increase in population in this important coastal town is likely to be accompanied by more seepage of sewage into small rivers and streams, directly into the coastal environment, the western shores of the Pemba Channel and drifting north to the Coelacanth Marine Park.

Beach pollution and marine pollution were both identified as severity level 4 and 2 respectively, for Pangani District, with pollution sources including uncontrolled dumping (particularly in creeks), as well as from lack of toilets and sewage systems. Agrochemicals were contributing to marine pollution. Decline in fisheries yields, regarded as a threat of level 4, is also attributed to loss of fish nurseries like mangrove forests, themselves affected by pollution from the catchments that drain into these coastal habitats. A formal and efficient solid waste collection and treatment facility is needed before the problem becomes severe.

Tan-L27: Urban Solid Waste Collection and Processing facility for Bagamoyo Town, Bagamoyo District

Currently there is no evidence of high solid waste levels in waters off Bagamoyo town, despite there being no formal domestic waste treatment systems. Low level but constant of waste into the marine environment is likely taking place though not documented. The projected increase in population in this important coastal town is likely to be accompanied by more solid waste generated and disposed into small rivers and streams, directly into the coastal environment, the western shores of the Pemba Channel and drifting north to the Saadani National Park.

Beach pollution was both identified as severity level 3 for Bagamoyo District, pollution sources including uncontrolled dumping (particularly in creeks), as well as from lack of toilets and sewage systems. Decline in fisheries yields, regarded as a threat of level 4, is also attributed to loss of fish nurseries like mangrove forests, themselves affected by pollution from the catchments that drain into these coastal habitats.

The district has experienced a high average annual growth rate between 2002 and 2012 of 3.45 % leading to more than 42.30 % increase of the population over the ten-year period and documenting a significant in-migration. The population density in the district has grown to 37 persons/km² in 2012 from 26 persons/km² of 2002. Bagamoyo town and surrounding urban and peri-urban areas witness the greatest impacts from increasing population. The absence of a suitable solid waste collection and treatment facility will over time lead to greater pollution and health issues if not addressed.

Tan-L28: Urban Solid Waste Collection and Processing facility for Kinondoni Municipality

Diverse forms of pollution, discharged through local rivers into the coastal environment on the western shores of the Zanzibar Channel, is well-documented, visible especially after heavy rains, with solid wastes and sediments discharged being indicative of degraded and polluted watersheds. These water are important marine biodiversity and fisheries areas, reflected by the presence of the dare s Salaam Marine Reserves (that include the islands and reefs of Bongoyo, Mbudya, Fungu Yasin).

Currently there is low level but constant solid waste disposal into the marine environment though not documented. The projected increase in population is likely to be accompanied by more waste entry through small rivers and streams, directly into the coastal environment. The need exists for a comprehensive solid waste treatment facility for inhabitants of Kinondoni.

Beach pollution and marine pollution were both identified as severity level 4, for Kinondoni District, pollution sources including uncontrolled dumping (particularly in creeks), as well as from lack of toilets and sewage systems. Agrochemicals were contributing to marine pollution. Pollution sources including uncontrolled dumping (particularly in creeks), as well as from lack of toilets and sewage systems.

Solid waste presently enters the marine environment from seven relatively short-lengthed east-flowing rivers that drain Kinondoni. Together with storm drains, these are some of the largest conduits for

liquid and solid waste, chemicals and sediment to the north Dar es Salaam coastline, causing beach and sea pollution which affects health (e.g. of fishermen, bathers, tourists) and marine life (e.g. turtles, fish and habitats), extending many kilometres along the coast (likely affecting nearby small islands and coral reefs, and resulting in negative publicity of this important tourist destinations in northern Dar es Salaam.

Decline in fisheries yields, regarded as a threat of level 4 in Kinondoni District, is also attributed to loss of fish nurseries like mangrove forests, themselves affected by pollution from the catchments that drain into these coastal habitats. The absence of a suitable solid waste collection and treatment facility will over time lead to greater pollution and health issues if not addressed.

Tan-L29: Urban Solid Waste Collection and Processing facility for Ilala Municipality

Msimbazi Creek is the most studied area of Dar es Salaam (see Tan-L08). Nutrients, chemical, faecal and solid waste pollution discharged through this rivers into the coastal environment as it passes under Selander Bridge, visible especially after heavy rains. Despite there being no sewage treatment system other than simple soak-aways, low level but constant sewage, nutrient and solid waste seepage into the marine environment is taking place. The projected increase in population is likely to be accompanied by greater volumes of solid waste, much of which ends up in small rivers and streams, or directly into the coastal environment.

Beach pollution and marine pollution were both identified as severity level 4, for Kinondoni District, with sources including uncontrolled dumping (particularly in creeks), as well as from lack of toilets and sewage systems. Pollution of the beach and nearshore, industrial, sewage and heavy metal were all forms of pollution ranked as level 3 threats in Ilala District. Pollution sources including uncontrolled dumping (particularly in creeks), as well as from lack of toilets and sewage systems.

Decline in fisheries yields, regarded as a threat of level 4 in both Kinondoni and Ilala districts, is also attributed to loss of fish nurseries like mangrove forests, themselves affected by pollution from the catchments that drain into these coastal habitats. Disease outbreaks was ranked at severity level 4 and 3 respectively for Ilala and Kinondoni, with causes linked to flooding and sewage.

Establishing an efficient solid waste collection and treatment facility is the greatest measure to reducing pollution into the coastal waters of Dar es Salaam.

Tan-L30: Urban Solid Waste Collection and Processing facility for Temeke Municipality

The Dar es Salaam Harbour is the seaward portion of Mzinga Creek, fed by two main tributaries, the Kizinga and Mzinga rivers that drain southern Dar es Salaam. Pollution is well documented, including nutrients, chemicals, oils, faecal and solid waste pollution, that are carried into coastal environment as these waters discharge through Mzinga Creek and pass the Dar es Salaam Port.

Low level but constant waste enters the marine environment. The projected increase in population is likely to be accompanied by more seepage of sewage into small rivers and streams, directly into the coastal environment, the western shores of the Zanzibar Channel and drifting into the Dar es Salaam Marine Reserve.

Pollution of the beach and nearshore, industrial, sewage and heavy metal were all forms of pollution ranked as level 3 threats in Ilala District. Beach and marine pollution from heavy metals, industrial and oil pollution were all identified as severity level 3, for Temeke District, with sources including uncontrolled dumping (particularly in creeks), as well as from lack of toilets and sewage systems, industry and garages dumping into the Kizinga and Mzinga rivers.

Decline in fisheries yields, regarded as a threat of level 4 in both Ilala and Temeke districts, is also attributed to loss of fish nurseries like mangrove forests, themselves affected by pollution from the catchments that drain into these coastal habitats. Disease outbreaks was ranked at severity level 4 for Ilala, with causes linked to flooding and sewage. Installing a complete waste system for Temeke is a high priority.

Tan-L31: Urban Solid Waste Collection and Processing facility for Kilindoni, Mafia District

Mafia District's economy relies on agricultural cultivation and fisheries, with a substantial amount of revenue also contributed by trade and, increasingly by tourism. Although Mafia ecology offers one of the best diving and snorkelling center in East Africa the number of tourists is still low. This is expected to change dramatically once the 1.4 km Kilindoni jetty is inaugurated, allowing ferries, transporters and tourist vessels to dock with safety.

The settlement and built-up portion of Mafia is very small, concentrated in the western district headquarters town of Kilindoni, where the airport and docks are situated. Most of the remaining villages are within the Mafia Island Marine Park (MIMP).

Responding to the recognised need to address waste development and the MIMP General Management Plan (2001) includes recommendations to develop solid waste (and sewage) disposal. With local town inhabitants reliant on informal and inadequate solid waste collection and processing services, large amounts of waste directly enter the natural environment including coastal waters. This affects productivity and tourism potential.

Beach pollution was identified as severity level 3 for Mafia Island, with sources including uncontrolled dumping (particularly in creeks), as well as from lack of toilets and sewage systems. Marine pollution was ranked as severity level 2.

Uncontrolled solid and liquid waste disposal, lack of toilets for public as well as residential houses. Disease outbreaks in Kilindoni was also ranked at severity level 3. Based on 2002 census data, the under five years of age mortality was 176 per 1,000 live births.

The projected increase in population accompanied by development tourism, is certain to aggravate the problem of solid waste collection and treatment. The local NGO Seasense, reports that Mafia Island is Tanzania's most important sea turtle nesting site, with over 250 green turtle nests laid each year, and the critically endangered hawksbill turtle is also known to nest on the tiny islands around Mafia. A small but developing sea turtle ecotourism initiative is generating much needed income for communities near to the nesting beaches and is helping to raise awareness of the importance of sea 2 of 3 turtle conservation. However, nesting beaches are on the east coast of the island and are continually covered in large amounts of plastic waste that washes in on the east African current from as far away as Indonesia and the Philippines. The amount of plastic debris on the nesting beaches poses a significant threat to sea turtles in Mafia and also threatens the long term sustainability of the ecotourism project. Complaints from visitors are becoming increasingly common.

Mafia Island is part of the Mafia-Rufiji-Kilwa Ramsar Site, was in late 2004 formally gazetted under the Ramsar Convention as an 'Area of Wetlands of Global Importance', and referred to as the Rufiji-Mafia-Kilwa Marine Ramsar Site. The island, together with the Rufiji Delta and neighbouring Songo Songo Archipelago (Kilwa District) was identified during a WWF process (2004) as having globally important biodiversity richness within the Eastern African Marine Ecoregion, and was the focus of the WWF Rufiji-Mafia-Kilwa Seascape Programme (or RUMAKI), that ended in 2010. The internationally recognises importance in terms of marine and coastal biodiversity gives added justification for comprehensively addressing the issue of solid (and other) wastes.

Tan-L32: Urban Solid Waste Collection and Processing facility for Kilwa Kivinje, Kilwa District

Kilwa District's economy relies on agricultural cultivation and fisheries, with a substantial amount of revenue also contributed by trade. Kilwa is described as the district with the best fishing grounds in the country and the population is highly dependent on fisheries as a main source of protein and income, mainly from marine sources. The inshore waters off Kilwa District, especially northwards into the Songo Songo Archipelago are relatively shallow and calm, protected by a line of islands and reefs to the east that create ideal conditions for the fishery for small pelagic fish species (sardines and anchovies). Kilwa Kivinje is the most important landing site in the district, with seasonal visiting fishers boosting the number of inhabitants.

Tourism is not a major contributor to the economy of Kilwa at present, partly due to difficult and expensive access from Dar es Salaam. When the Kilwa Road construction is finally completed tourism is likely to increase, as the potential is high.

The settlement and built-up portion of Kilwa is very small and concentrated in Kilwa Masoko town and Kilwa Kivinje. The districts's population is some 200,000, though the two later towns accommodate the greatest proportion, with Kilwa Kivinje housing an estimated 10,000, though figures are not readily available. With local town inhabitants reliant on informal and inadequate solid waste collection and processing services, large amounts of waste directly enter the natural environment including coastal waters. This affects productivity and tourism potential.

Beach pollution and marine pollution were identified as severity level 2 for Kilwa District, notably at Kilwa Kivinje and to a lesser extent at Kilwa Masoko, with sources including uncontrolled dumping (particularly in creeks), as well as from lack of toilets and sewage systems.

Based on 2002 census data, the percentage of the population living below the poverty line in Kilwa was 35 %, the over 15 years of age literacy coverage was only 52 % and under five years of age mortality was 217 per 1,000 live births.

There was until recently, very limited industrial activities, but the installation of electricity powered by Songo Songo gas reserves, is expected to boost development. In addition, the projected increase in population, accompanied by the development tourism, is certain to aggravate the problem of solid waste collection and treatment.

Kilwa is part of the Mafia-Rufiji-Kilwa Ramsar Site, was in late 2004 formally gazetted under the Ramsar Convention as an 'Area of Wetlands of Global Importance', and referred to as the Rufiji-Mafia-Kilwa Marine Ramsar Site. The island, together with the Rufiji Delta and neighbouring Songo Songo Archipelago (Kilwa District) was identified during a WWF process (2004) as having globally important biodiversity richness within the Eastern African Marine Ecoregion, and was the focus of the WWF Rufiji-Mafia-Kilwa Seascape Programme (or RUMAKI), that ended in 2010. The internationally recognised importance in terms of marine and coastal biodiversity gives added justification for comprehensively addressing the issue of solid (and other) wastes.

Tan-L33: Urban Solid Waste Collection and Processing facility for Kilwa Masoko, Kilwa District

Kilwa District's economy relies on agricultural cultivation and fisheries, with a substantial amount of revenue also contributed by trade. Kilwa is described as the district with the best fishing grounds in the country and the population is highly dependent on fisheries as a main source of protein and income, mainly from marine sources. The inshore waters off Kilwa District, especially northwards into the Songo Songo Archipelago are relatively shallow and calm, protected by a line of islands and reefs to the east that create ideal conditions for the fishery for small pelagic fish species (sardines and anchovies). Kilwa Masoko is the second most important landing site in the district, with seasonal visiting fishers boosting the number of inhabitants.

Tourism is not a major contributor to the economy of Kilwa at present, partly due to difficult and expensive access from Dar es Salaam. When the Kilwa Road construction is finally completed tourism is likely to increase, as the potential is high.

The settlement and built-up portion of Kilwa is very small and concentrated in Kilwa Masoko town and Kilwa Kivinje. The districts's population is some 200,000, though the two later towns accommodate the greatest proportion, with Kilwa Masoko housing an estimated 10,000, though figures are not readily available. With local town inhabitants reliant on informal and inadequate solid waste collection and processing services, large amounts of waste directly enter the natural environment including coastal waters. This affects productivity and tourism potential.

Beach pollution and marine pollution were identified as severity level 2 for Kilwa District, notably at Kilwa Kivinje and to a lesser extent at Kilwa Masoko, with sources including uncontrolled dumping (particularly in creeks), as well as from lack of toilets and sewage systems.

Based on 2002 census data, the percentage of the population living below the poverty line in Kilwa was 35 %, the over 15 years of age literacy coverage was only 52 % and under five years of age mortality was 217 per 1,000 live births.

There was until recently, very limited industrial activities, but the installation of electricity powered by Songo Songo gas reserves, is expected to boost development. In addition, the projected increase in

population, accompanied by the development tourism, is certain to aggravate the problem of solid waste collection and treatment.

Kilwa is part of the Mafia-Rufiji-Kilwa Ramsar Site, was in late 2004 formally gazetted under the Ramsar Convention as an 'Area of Wetlands of Global Importance', and referred to as the Rufiji-Mafia-Kilwa Marine Ramsar Site. The island, together with the Rufiji Delta and neighbouring Songo Songo Archipelago (Kilwa District) was identified during a WWF process (2004) as having globally important biodiversity richness within the Eastern African Marine Ecoregion, and was the focus of the WWF Rufiji-Mafia-Kilwa Seascape Programme (or RUMAKI), that ended in 2010. The internationally recognised importance in terms of marine and coastal biodiversity gives added justification for comprehensively addressing the issue of solid (and other) wastes.

Tan-L34: Urban Solid Waste Collection and Processing facility for Lindi Town, Lindi Urban District

Currently there is no evidence of high solid waste levels in waters off Lindi town, despite there being no efficient solid waste collections and treatment system. Low level but constant waste entry to the marine environment is likely taking place though not documented. The projected increase in population in this important coastal town is likely to be accompanied by greater generation of solid waste with disposal into small rivers and streams, or directly into the coastal environment.

Beach pollution was identified as severity level 2 for Lindi Urban District, pollution sources including uncontrolled dumping (particularly in creeks), as well as from lack of toilets and sewage systems. Decline in fisheries yields, regarded as a threat of level 4, is also attributed to loss of fish nurseries like mangrove forests, themselves affected by pollution from the catchments that drain into these coastal habitats.

Solid waste from over ten thousand inhabitants in Lindi Urban town causes beach and sea pollution which affects health (e.g. of fishermen, bathers, tourists) and marine life (e.g. fish and habitats), extending many kilometres coastal waters, likely affecting nearby small islands and coral reefs, and resulting in negative publicity to the city. Sewage and water are also responsible for water-borne disease. The absence of a suitable solid waste collection and treatment facility will over time lead to greater pollution and health issues if not addressed.

Tan-L35: Urban Solid Waste Collection and Processing facility for Mikindani-Mtwara towns, Mtwara Urban District

Currently there are no reports of high nutrient and faecal coliform bacteria levels in waters off Mikindani or Mtwara coastal waters, despite there being no efficient solid waste collection and treatment facility. Low level but constant solid waste entry to the marine environment is likely taking place though not documented. The projected increase in population in this important coastal town is likely to be accompanied by more waste dumped into small rivers and streams, directly into the coastal environment, potentially affecting the Mnazi Bay-Ruvuma Estuary Marine Park (MBREMP).

Beach pollution was both identified as severity level 4 for Mtwara Urban District, pollution sources including uncontrolled dumping (particularly in creeks), as well as from lack of toilets and sewage systems. Decline in fisheries yields, regarded as a threat of level 4, is also attributed to loss of fish nurseries like mangrove forests, themselves affected by pollution from the catchments that drain into these coastal habitats.

Solid waste from Mtwara Urban (tens of thousands) enters the marine environment continuously, at low levels, causing beach and sea pollution which affects health (e.g. of fishermen, bathers, tourists) and marine life (e.g. fish and habitats), extending many kilometres and resulting in negative publicity to the city. Sewage and water are also responsible for water-borne disease, ranked at severity level 2. The absence of a suitable solid waste collection and treatment facility will over time lead to greater pollution and health issues if not addressed.

Tan-L36: Study, review and design of freshwater supply options for Tanga Town, Tanga Urban District

A comprehensive study is needed to ascertain the freshwater supply options for Tanga Town before the shortages become acute.

For Tanga District, water shortages were ranked as a threat of severity level 2, a situation made more pertinent by the uncertainties of climate change impacts. Reasons given include forest clearing for agricultural purposes, burning charcoal and shifting cultivation. Rainfall, with its current supply and usage, cannot meet local demands. Demand from population and economic growth is expected to increase significantly in the coming years.

Tan-L37: Study, review and design of freshwater supply options for Lindi Town, Lindi Urban District

For Lindi District, water shortages were ranked as a threat of severity level 4, a situation made more pertinent by the uncertainties of climate change impacts. Reasons given include forest clearing for agricultural purposes, burning charcoal and shifting cultivation. Rainfall, with its current supply and usage, cannot meet local demands. Demand from population and economic growth is expected to increase significantly in the coming years.

Tan-L38: Study, review, design and trial freshwater supply options for outlying small islands in the Mafia Island Marine Park, Mafia District

The population of Mafia Island (including smaller islands of Jibondo and Juani) has reached its highest, at over 45,000. The economy relies on agricultural cultivation and fisheries, with a substantial amount of revenue also contributed by trade and, increasingly by tourism. Although Mafia ecology offers one of the best diving and snorkeling center in East Africa the number of tourists is still low. This is expected to change dramatically once the 1.4 km Kilindoni jetty is inaugurated, allowing ferries, transporters and tourist vessels to dock with safety.

Mafia receives a moderate annual rainwater volume (ranging from 1,479 mm to 2,663 mm), yet freshwater supply is an ever-present, low ranking problem for most of the district, except for a few smaller outlying islands where it is severe.

Mafia has few surface water streams but does have aquifers, though these are not well charted.

Responding to the recognised need to address freshwater issues the MIMP General Management Plan (2001) acknowledges that “freshwater supplies during the dry season already appears to be under pressure, though no hydrological survey has been undertaken”. The GMP also recommends the development of freshwater supply regulations.

Jibondo is Mafia best-known fishing village, about 30 minutes away by boat from Utende village. There is always a water shortage and many of the younger people spend a great deal of time carrying water from sources on the main island. A similar situation exists at Bewjuu Island off the west coast.

On Mafia Island, freshwater problems were not highlighted, though disease outbreaks were ranked at severity level 3, especially to the higher concentration areas of Kilindoni, Jibondo Island and Bwejuu Island. The later two islands have no sources of freshwater which has to be sourced from wells on the main island and transported by boat.

The lack of documented threat of freshwater availability in the Mafia Island District from the background study should not be seen as a reason to neglect the future needs of freshwater on Mafia and its surrounding islands. The focus of this action is therefore to assess the ground water potential, define solutions for the outlying smaller islands (especially Jibondo and Bewjuu – possibly with water pipe installation) and develop a master plan for the entire district.

Given the expected growth in population, development and tourism, much of which is associated with the new Kilindoni Jetty facility, and the importance of the MIMP as a tourist destination and marine biodiversity hotspot, the action to improve freshwater supplies is seen as an essential infrastructure development.

Tan-L39: Study, review, design and trial freshwater supply options for outlying villages in the Mnazi Bay-Ruvuma Estuary Marine Park, Mtwara Rural District

The population of Mnazi Bay-Ruvuma Estuary Marine Park (MBREMP), including smaller islands, has reached its highest, at over 20,000. The economy relies on agricultural cultivation and fisheries, with a substantial amount of revenue also contributed by trade and, increasingly by tourism. Although MBREMP ecology offers one of the best diving and snorkeling center in East Africa the number of tourists is still low. This is expected to change dramatically once the benefits for the recently discovered gas reserves comes to fruition, adding to the local population.

Mtwara Rural receives a low annual rainwater volume (ranging from 515 mm to 1,589 mm), with freshwater supply an ever-present, low ranking problem for most of the district, except for a few smaller outlying islands where it is severe, such as in the MBREMP area.

The lack of documented threat of freshwater availability in the MBREMP area from the background study should not be seen as a reason to neglect the future needs of freshwater in the park and its surrounding islands. The focus of this action is therefore to assess the ground water potential, define solutions for the general MBREMP area and develop a master plan for the entire park.

Given the expected growth in population, development and tourism, much of which is associated with new developments in Mtwara area, and the importance of the MBREMP as a tourist destination and marine biodiversity hotspot, the action to improve freshwater supplies is seen as an essential infrastructure development.

Tan-L40: Tanzania mainland fisheries sector review by fishery type and management areas

The artisanal/small-scale fishery sector in mainland Tanzania supports a significant proportion of local livelihoods. In 2009, the Joint Frame Survey estimated that the activity provided full time employment for over 36,321 people with thousands more part time fishermen, yet the increased effort in fishing has not resulted in increases in fish catches per unit.

The pragmatic outlook on the fisheries sector on Tanzania's mainland coast is that there is little room for expansion and the current and increasing pressure is damaging the productivity. Catches are unlikely to increase with more fishing effort. Some potential increase may be gained from improvements in efficiency and/or value-added in the small pelagic fishery and from coastal aquaculture.

To give credence to any measures that attempt to manage and even restrict the fishing effort, there is first the need to better understand the main fisheries taking place along the Tanzania mainland coast, especially within and outside of the many marine conservation areas. For mainland Tanzania, fisheries management plans to address the principle four fishery types: octopus, tuna and tuna-like species, small pelagic species (sardine and anchovies), mixed reef fisheries and seaweed farming now exist, having been recently compiled (2012-2013).

The use of destructive fishing gears, causing a decline in catches, was ranked as the most severe threat, level 5, for the fisheries sector as a whole. Poor fisheries resource management was ranked at level 4 for the sector as a whole.

At district levels, the threat from destructive fishing and decline catches was the most highly ranked of all threats to coastal livelihoods and ecosystems. The significance of the threats posed by fishers and by the decline in fisheries production per unit effort cannot be overstated.

The importance of developing fisheries management plans and implementing the results was stressed recently by a SWIOfish consultancy (Groeneveld et al, 2014) who also supported the need to strengthening existing data collection methods as stressed by de Graaf (2013). It was also felt that such a review should include the harmonisation and revision of fisheries legislation in a number of respects, including best practices, consistency with other national legislation and implementation of international obligations, across the various fisheries sub-sectors, including artisanal and semi-industrial fisheries, and regarding vessels that have been fishing in the EEZ but pass through the territorial seas of Tanzania mainland, as highlighted by the recent SWIOfish study of Swan (2013).

Tan-L41: Small pelagic fisheries support on mainland Tanzania

The artisanal/small-scale fishery sector in mainland Tanzania supports a significant proportion of local livelihoods. In 2009, the Joint Frame Survey estimated that the activity provided full time employment for over 36,321 people with thousands more part time fishermen, yet the increased effort in fishing has not resulted in increases in fish catches per unit.

Small pelagics (Clupeids, Scombrids, Engraulids) made up 68% of the marine catch in recent years (Groeneveld et al 2014). Off mainland Tanzania they are caught off the shores of Tanga, Dar es Salaam and Kilwa, with smaller fishing effort off Mafia, and Mtwara. Open water seine nets, purse seine, gill nets, ring / lift nets and migrant fishers are involved that follow fish schools. There is high demand for anchovies as local source of protein, for poultry farming, aquaculture, and also dried and exported. The management effectiveness of the small pelagic fishery is hindered by limited finances available for enforcement, remote areas, large (and growing) numbers of fishers, easy access, and entrenched fishing rights. Post-harvest loss is highest (20% of catch) during the wet season (SE Monsoon), when small pelagic fishes are abundant, but cannot be dried as rapidly or efficiently. Roads are then difficult to navigate, and therefore catches cannot be distributed efficiently during this period, leading to their loss.

The pragmatic outlook on the fisheries sector on mainland Tanzania is that there is little room for expansion and the current and increasing pressure is damaging the productivity. Catches are unlikely to increase with more fishing effort. Some potential increase may be gained from improvements in efficiency and/or value-added in the small pelagic fishery and from coastal aquaculture.

Although the small pelagic fishery has potential for expansion, and could partly absorb fishers displaced from other fisheries, such as the reef fishery, with declining productivity, or from enforcement of bans of illegal gears, there is an inherent risk associated with promoting a fishery that is not fully understood. Reef fisheries are threatened by over-fishing and environmental disturbance, principally from bleaching episodes (possibly related to anthropogenic climate change). Supporting the small pelagic fishery by better understanding the fishery, by adding value, improving yields, providing a feasibility study for the development of a cannery (for private sector investment) will contribute to its long-term sustainability and contribute towards food security and potentially foreign exchange earnings from export.

The use of destructive fishing gears, causing a decline in catches, was ranked as the most severe threat, level 5, for the fisheries sector as a whole. Poor fisheries resource management was ranked at level 4 for the sector as a whole.

At district levels, the threat from destructive fishing and decline catches was the most highly ranked of all threats to coastal livelihoods and ecosystems. The significance of the threats posed by fishers and by the decline in fisheries production per unit effort cannot be overstated.

It is widely accepted that there is inadequate knowledge on both the fishery and the biology of the pelagic resources (e.g. URT 2013). The productivity of this fisheries is threatened both by over-fishing and by environmental disturbance, principally from bleaching episodes (which may or may not be directly related to anthropogenic climate change). Given the high complexity and natural variability of small pelagic species ecosystems, the lack of data on the fishery and the difficulties in identifying clear potential responses of these fish species to anthropogenic climate change, caution is required by decision-makers who may be tempted to look at this fishery as a go-to fishery that can absorb excess capacity from other fisheries (Anderson, 2014).

Tan-L42: Support for mainland Tanzania fisheries MCS programme

The artisanal/small-scale fishery sector in mainland Tanzania supports a significant proportion of local livelihoods. In 2009, the Joint Frame Survey estimated that the activity provided full time employment for over 36,321 people with thousands more part time fishermen, yet the increased effort in fishing has not resulted in increases in fish catches per unit.

The pragmatic outlook on the fisheries sector on Tanzania's mainland coast is that there is little room for expansion and the current and increasing pressure is damaging the productivity. Catches are unlikely to increase with more fishing effort. Some potential increase may be gained from

improvements in efficiency and/or value-added in the small pelagic fishery and from coastal aquaculture.

There is a very weak history of enforcement of fisheries regulations in mainland Tanzania. In the past, recommendations have been made to ban destructive fishing practices from marine protected areas, something that has partial success, or the complete elimination of illegal practices. Part of the problem has been confusing and contradictory legislation. Under SWIOfish, recent reviews have been made with recommendations for implementation.

The need to firmly address fisheries control and surveillance on coastal mainland Tanzania has been re-iterated recently by Malan (2014) while working on the SWIOfish study on MCS.

The mainland coast of Tanzania does not have strong traditional local governance of fisheries arrangements, though these have strengthened recently by community-based approaches in fisheries through Community Fishermen Committees or CFCs (similar to Beach Management Units, or BMUs, as seen on the mainland) in all fishing villages. Whereas the sea is publicly owned and every individual has a user right, marine environments adjacent to any village are gradually and increasingly under the use, interest and monitoring of that village, through the development and strengthening of the BMUs. Such a structure bodes well for MCS at village level.

The use of destructive fishing gears, causing a decline in catches, was ranked as the most severe threat, level 5, for the fisheries sector as a whole. Poor fisheries resource management was ranked at level 4 for the sector as a whole.

At district levels, the threat from destructive fishing and declining catches was the most highly ranked of all threats to coastal livelihoods and ecosystems. The significance of the threats posed by fishers and by the decline in fisheries production per unit effort cannot be overstated.

It is widely accepted that there is insufficient monitoring, control and surveillance of the inshore waters of Tanzania and that destructive and illegal fishing takes place on a large scale. In order to fill that gap, a series of investigations and interventions are needed. The important first step is to ensure that the legislation is clear and non-contradictory and that it is well-known and clearly understood by the fishing community. A second starting point is to register all vessels, gears and fishers, thereby addressing the widely known underestimate of these elements. Malan (2014) quotes interviews with fisheries officials and fishers who suggested that as many as 50% of boats and fishermen may be unlicensed (see Mkenda and Folmer, 2001). Damage to habitats causes loss of spawning and nursery grounds, loss of biodiversity and diminished habitat resilience. Reduction in fisheries productivity due to habitat destruction, can take years, even centuries to recover.

Tan-L43: Support MCS to end blast fishing in Tanzania

The artisanal/small-scale fishery sector in mainland Tanzania supports a significant proportion of local livelihoods. In 2009, the Joint Frame Survey estimated that the activity provided full time employment for over 36,321 people with thousands more part time fishermen, yet the increased effort in fishing has not resulted in increases in fish catches per unit.

The pragmatic outlook on the fisheries sector on Tanzania's mainland coast is that there is little room for expansion and the current and increasing pressure is damaging the productivity. Catches are unlikely to increase with more fishing effort. Some potential increase may be gained from improvements in efficiency and/or value-added in the small pelagic fishery and from coastal aquaculture.

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The need to firmly address fisheries control and surveillance on coastal mainland Tanzania has been re-iterated recently by Malan (2014) while working on the SWIOfish study on MCS.

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At district levels, the threat from destructive fishing and decline catches was the most highly ranked of all threats to coastal livelihoods and ecosystems. The significance of the threats posed by fishers and by the decline in fisheries production per unit effort cannot be overstated.

It is widely accepted that there is insufficient monitoring, control and surveillance of the inshore waters of Tanzania and that destructive and illegal fishing takes place on a large scale. The important first step is to focus on ending the use of explosives for fishing, a practice that is commonplace from Tanga to Mtwara at selected locations, on specific tides and requiring specific water conditions to be effective. Damage to habitats cause loss of spawning and nursery grounds, loss of biodiversity and diminished habitat resilience, and the destruction is particularly relevant given the climate change threats to inshore marine habitats.

Tan-L44: Strengthening management of octopus fisheries on mainland Tanzania

The artisanal/small-scale fishery sector in mainland Tanzania supports a significant proportion of local livelihoods. In 2009, the Joint Frame Survey estimated that the activity provided full time employment for over 36,321 people with thousands more part time fishermen, yet the increased effort in fishing has not resulted in increases in fish catches per unit.

The pragmatic outlook on the fisheries sector on Tanzania's mainland coast is that there is little room for expansion and the current and increasing pressure is damaging the productivity. Catches are unlikely to increase with more fishing effort. Some potential increase may be gained from improvements in efficiency and/or value-added in the small pelagic fishery and from coastal aquaculture.

There are several studies on octopus fisheries in Tanzania (Guard 2002; Guard and Mgaya 2002), including stock status assessments that demonstrate growth in the fishery, with export of catches. Octopus is a fast growing marine organism that appears to be a resilient with good fisheries prospects, despite its present status of being overfished in many Tanzania locations. Research to support and/or improve the management of octopus fisheries, on spatial and temporal scales, is required and strongly recommended under recent SWIOfish studies (e.g. Groeneveld 2014).

The use of destructive fishing gears, causing a decline in catches, was ranked as the most severe threat, level 5, for the fisheries sector as a whole. Poor fisheries resource management was ranked at level 4 for the sector as a whole.

At district levels, the threat from destructive fishing and decline catches was the most highly ranked of all threats to coastal livelihoods and ecosystems. The significance of the threats posed by fishers and by the decline in fisheries production per unit effort cannot be overstated.

It is widely accepted that there is inadequate knowledge on both the fishery and the biology of the octopus fishery of Zanzibar and mainland Tanzania. In order to fill that gap, a series of investigations and interventions are needed.

Tan-L45: Strengthening the seaweed farming industry on mainland Tanzania

The artisanal/small-scale fishery sector in mainland Tanzania supports a significant proportion of local livelihoods. In 2009, the Joint Frame Survey estimated that the activity provided full time employment for over 36,321 people with thousands more part time fishermen, yet the increased effort in fishing has not resulted in increases in fish catches per unit.

The pragmatic outlook on the fisheries sector on Tanzania's mainland coast is that there is little room for expansion and the current and increasing pressure is damaging the productivity. Catches are unlikely to increase with more fishing effort. Some potential increase may be gained from improvements in efficiency and/or value-added in the small pelagic fishery and from coastal aquaculture.

There are several studies seaweed farming on Zanzibar and parts of mainland Tanzania (e.g. Tanga), which have made recommendations on means to improve the income and benefits from the farming of seaweed. The formation of the farmer groups has significantly improved the diversity and subsequent income associated with the production of seaweed and derivative products like soaps, oils, foodstuffs etc.

The use of destructive fishing gears, causing a decline in catches, was ranked as the most severe threat, level 5, for the fisheries sector as a whole. Poor fisheries resource management was ranked at level 4 for the sector as a whole.

At district levels, the threat from destructive fishing and decline catches was the most highly ranked of all threats to coastal livelihoods and ecosystems. The significance of the threats posed by fishers and by the decline in fisheries production per unit effort cannot be overstated.

It is widely accepted that there is incomplete knowledge on the seaweed farming industry on mainland Tanzania (and Zanzibar) and that in order to fill that gap, a series of investigations and interventions are needed. The sector has good potential for growth, but there is a need to investigate value-adding at local level to increase the value of the sector and break buyer monopoly (i.e. low prices fetched for dried unprocessed product), to understand the decline in production in some places with increased in other, whether there are changes in coastal water conditions that favour or hinder growth, and to address health complications associated tending to the seaweed lines.

Tan-L46: Tuna fisheries support programme for Mtwara and Lindi regions

The artisanal/small-scale fishery sector in mainland Tanzania supports a significant proportion of local livelihoods. In 2009, the Joint Frame Survey estimated that the activity provided full time employment for over 36,321 people with thousands more part time fishermen, yet the increased effort in fishing has not resulted in increases in fish catches per unit.

The pragmatic outlook on the fisheries sector on Tanzania's mainland coast is that there is little room for expansion and the current and increasing pressure is damaging the productivity. Catches are unlikely to increase with more fishing effort. Some potential increase may be gained from improvements in efficiency and/or value-added in the small pelagic fishery and from coastal aquaculture.

Most medium and large pelagics are migratory species, undertaking seasonal movements within the Indian Ocean basin. There are few studies on tuna fisheries in Tanzania (Richmond & Mganwa, 1995), though they demonstrate significant growth in the fishery, based on 1-km long gill-nets set on darker moon nights, largely operating from Nungwi in northern Unguja, Zanzibar. Estimates of stock are not available and stock status indicators available from the IOTC are not specific to Tanzania. Some species may comprise resident populations over the continental shelf of Tanzania (neritic species, accessible to small scale fishers, such as those from Mtwara and Lindi).

However, the IOTC estimates that medium-sized pelagics (kawakawa, skipjack, kingfish) are moderately exploited; albacore is underexploited and bigeye and yellowfin tunas are not overfished. Most estimates are uncertain, but there appears to be considerable scope for fisheries development.

Tuna is a fast growing fish species with movements of schools throughout the western and northwestern Indian Ocean. Fish caught off Tanzania by local fishers tend to be small to moderate sized (5-10 kg), caught mostly from surface trolling or surface-set gillnets. Large individuals, from 20-40 kg are reportedly deeper in the water column, close to the thermocline at 70-100 m depths.

Research to support and/or improve the management of the fishery for tuna and tune-like species, on spatial and temporal scales, is required and strongly recommended under recent SWIOfish studies (e.g. Groeneveld 2014). Representing both governments, the Deep Sea Fishing Authority (DSFA) has jurisdiction over fisheries issues in the EEZ (between 12 and 200 nm from the shore; mainly tunas and billfishes), whereas small scale (artisanal) fisheries for large /medium pelagics are managed by relevant ministries. These small-scale fisheries take place in territorial waters, up to 12 nm from the shore, and focus on neritic species.

The use of destructive fishing gears, causing a decline in catches, was ranked as the most severe threat, level 5, for the fisheries sector as a whole. Poor fisheries resource management was ranked at level 4 for the sector as a whole.

At district levels, the threat from destructive fishing and decline catches was the most highly ranked of all threats to coastal livelihoods and ecosystems. The significance of the threats posed by fishers and by the decline in fisheries production per unit effort cannot be overstated.

It is widely accepted that there is inadequate knowledge on both the fishery and the biology of the tuna fishery of Zanzibar and mainland Tanzania. In order to fill that gap, a series of investigations and interventions are needed. Similarly, the establishment of the DSFA is regarded as a major step forward in terms of management effectiveness of tuna and tuna-like species (e.g. Groeneveld 2014). They argue that though it is still in its infancy, it needs to be further empowered and full implementation supported.

Tan-L47: Support for prawn fishery in Rufiji Delta

The artisanal/small-scale fishery sector in mainland Tanzania supports a significant proportion of local livelihoods. In 2009, the Joint Frame Survey estimated that the activity provided full time employment for over 36,321 people with thousands more part time fishermen, yet the increased effort in fishing has not resulted in increases in fish catches per unit.

The pragmatic outlook on the fisheries sector on Tanzania's mainland coast is that there is little room for expansion and the current and increasing pressure is damaging the productivity. Catches are unlikely to increase with more fishing effort. Some potential increase may be gained from improvements in efficiency and/or value-added in the small pelagic fishery and from coastal aquaculture.

Research to support and/or improve the management of the fishery for prawns, on spatial and temporal scales, is required and strongly recommended under recent SWIOfish studies (e.g. Groeneveld 2014).

These small-scale fisheries for prawns utilised gillnets, traps and fences, in creeks and shallow grounds around the Rufiji delta, from where the bulk of Tanzania catches originate. Lack of accurate fishing effort and understanding of the impacts of the artisanal fishery threatens its management and long-term sustainability. The industrial fishery collapsed several years ago and has not re-emerged, due to poor yields.

Tan-L48: Fish farming research and cage trials in Tanga and Kilwa

The artisanal/small-scale fishery sector in mainland Tanzania supports a significant proportion of local livelihoods. In 2009, the Joint Frame Survey estimated that the activity provided full time employment for over 36,321 people with thousands more part time fishermen, yet the increased effort in fishing has not resulted in increases in fish catches per unit.

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According to de Graff (2014)'s SWIOfish study, mariculture in Tanzania is limited and other than seaweed farming, encompasses only milk fish farming (ca. 5 ponds, 12 ha total area), with total production of about 8 tons/year. Indeed, while there have been several trials of different pond (and cage) culture attempts over the last thirty years, most remain in the experimental or pilot stage (see Mmochi et 2001).

The locally-based Institute of Marine Sciences (IMS) has over twenty years of experience with various small-scale pond and seaweed farming trials and demonstration projects, including those involving local communities. Experimenting with more commercial species and greater investment has not been attempted. Mbegani and TAFIRI with some technical assistance are well-qualified to conduct the necessary studies.

Mauritius has experimented with cage culture and produce 175 tonnes of high value from circular cages in 2008 (Lesperance, 2011). Other countries bordering the Indian Ocean have greater experience and production. For example, in Singapore there are 106 licensed coastal floating netcage fish farms. In 2013, the marine aquaculture industry produced 3,235 tonnes of food fish at a value of USD 11.4 million. The main species are grouper, seabass and snapper, as well as crabs, shrimp and mussels. The Barramundi Asia Farm and Nursery has a 2-hectare USD 3 million fish farm using European and Japanese sea cage fish farming technology.

Torell et al (2011) warn that aquaculture development in the WIO give due consideration to each of the three pillars of sustainability: a balanced understanding of the social, economic and environmental components of aquaculture, within an enabling governance framework.

The use of destructive fishing gears, causing a decline in catches, was ranked as the most severe threat, level 5, for the fisheries sector as a whole. Poor fisheries resource management was ranked at level 4 for the sector as a whole.

At district levels, the threat from destructive fishing and decline catches was the most highly ranked of all threats to coastal livelihoods and ecosystems. The significance of the threats posed by fishers and by the decline in fisheries production per unit effort cannot be overstated.

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At district levels, the threat from destructive fishing and decline catches was the most highly ranked of all threats to coastal livelihoods and ecosystems. The significance of the threats posed by fishers and by the decline in fisheries production per unit effort cannot be overstated.

It is widely accepted that there is inadequate development of fish farming in Zanzibar and on mainland Tanzania. In order to fill that gap, a series of investigations and interventions are needed. Pond culture trials have been the main focus to date, yet more recent initiative in the WIO region include cage culture of high value fish such as cobia and grouper in Mauritius. A characteristic of marine production in Africa has been production of high value species destined for international markets, or on species generating large biomass from low provide vital protein for local consumption but does generate livelihoods and needed incomes (Torell et al 2011).

Such high value species if cultured on at Tanga and Kilwa would be ideal for the tourism industry that demands quality fish for restaurants and supplying Dar es Salaam markets. These authors recommend, among others, that trials be considered for mangrove snappers and octopus, that the acceptability of freshwater pond farming of tilapia be tested, that cost-effective feeds for small-scale mariculture operations be developed.

The inshore waters around Tanga and Kilwa are potentially deep waters that are sheltered from wave action with good water circulation due to the 4 m tidal range. These conditions are ideal for cage culture of high value finfish. The small pelagic fishery in the areas offer the opportunity for feed provision and labour is available. The main elements that are lacking are a hatchery/laboratory, technology and expertise.

Tan-L49: Beach erosion study for coastal Tanzania

The coastal zone of mainland Tanzania is under development pressure from population growth and economic activities, but also from oceanic and weather influences that are thought to be contributing to coastal erosion. The population of coastal districts has reached its highest ever and development pressures on the coastline have reached unprecedented levels.

Many locations along the coasts, especially at the districts of Pangani, Muheza, Bagamoyo, Kinondoni, Kilwa and Mtwara, suffer from coastal erosion, which may be further worsened by sand mining conducted by local villagers, the tourism sector and building material suppliers, as well as by some of the measures taken by beach hotels to mitigate the impacts of erosion, namely inappropriate sea defences. The costs to the tourism sector is increasing.

Various studies have documented the changing beach levels and the loss of sand, which are particularly visibly along the beach fronts of Kinondoni where hotels and private residences have constructed a series of groynes to attempt to combat the problem of the northern drift of beach sand. Such attempts may exacerbate the problem. What is needed is a full understanding of the processes involved before measures can be taken.

Coastal erosion was ranked with severity value 5 for Bagamoyo, 4 for Temeke, Tanga, Pangani, Muheza, Mtwara Urban and Kinondoni, and level 3 for Ilala district. The remaining districts mostly scored a lesser threat values for erosion, between 1 and 2.

With the potential sea level rise for the coastline, if left unattended, the erosion problem affecting these eight mainland districts will worsen with more severe costs, negative visual impact on the tourism sector, greater probability of sea water intrusion into agricultural and other land uses and the water table.

Tan-L50: Kilwa Kisiwani World Heritage Site erosion study

Many locations along the coasts, especially at the districts of Pangani, Muheza, Bagamoyo, Kinondoni, Kilwa and Mtwara, suffer from coastal erosion, which may be further worsened by sand mining conducted by local villagers, the tourism sector and building material suppliers, as well as by some of the measures taken by beach hotels to mitigate the impacts of erosion, namely inappropriate sea defences. The World Heritage Site of Kilwa Kisiwani has a well-documented erosion problem that has resulted in partial loss of the Portuguese Fort, one of the main features of the monument.

At Kilwa Kisiwani a full understanding of the processes involved is needed before mitigation measures can be designed and implemented.

Coastal erosion was ranked with severity value 5 for many coastal districts, though the relatively small area of Kilwa Kisiwani monument has not had an impact on the district threat, ranked at level 2. With the potential sea level rise for the coastline, if left unattended, the erosion problem affecting this site will worsen with more severe costs, negative visual impact on the tourism sector.

In 2004, the UNESCO (see note below) evaluation of factors affecting the site were:

- Erosion and siltation/ deposition
- Financial resources
- Identity, social cohesion, changes in local population and community
- Legal framework
- Management systems/ management plan
- Other Threats:
- Collapsing monuments due to lack of maintenance

One of the recommendations of a recent study (Joint World Heritage Centre / ICOMOS 2013) was "Commissioning of a report on the longer-term interventions required to permanently safeguard the Gereza, Mukutani beachfront mosque and Malindi Mosque".

Tan-L51: Waste oil treatment facility for Tanga, Dar es Salaam and Mtwara harbours

The largest marine ports in the country are, in order of traffic, Dar es Salaam, Tanga and Mtwara. Other smaller ports include Lindi, Kilwa and Mafia. None of these ports have adequate waste oil handling facilities. With the advent of oil and gas exploration in the coastal zone has raised the issue of oil waste handling, resulting in waste oil being transported by barge to neighbouring Mombasa in Kenya. The environmental risks associated with inadequate handling of waste oil and the added costs of transportation to Kenya are high and opportunities are lost to Tanzania.

All three harbours are presently witnessing increased vessel traffic with the increased risk of oil contamination to the marine and coastal environment due to lack of handling facilities. The traffic at these harbours is seen as likely to continue to increase in the future.

Marine pollution were both identified as severity level 4, for Tanga Urban District, pollution sources including uncontrolled dumping (particularly in creeks), as well as from lack of toilets and sewage systems.

Decline in fisheries, regarded as a threat of level 5, are also attributed to loss of fish nurseries like mangrove forests, themselves affected by pollution from the various sources.

Tan-L52: Turtle and nesting beach protection at Pangani District

Many locations along the coasts, at Pangani, suffer from coastal erosion, which may be further worsened by sand mining conducted by local villagers, the tourism sector and building material suppliers, as well as by some of the measures taken by beach hotels to mitigate the impacts of erosion, namely inappropriate sea defences. In Pangani District marine turtle nesting has been on the decline from loss of nesting beaches, from harvest of eggs and slaughter of females, and from loss of foraging grounds due to sedimentation and other causes.

Maziwe Island was known for green, hawksbill and Olive Ridley turtle nesting in the 1970s. Although it is covered by water during high tide it is still a natural nesting site and turtles still frequent the area (see USAID, 2012). Madete beach, within Saadani NP, is a second very important turtle nesting site in Pangani (Wells et al., 2004). Tagging of a female green turtle from a Pangani beach revealed, during the first 78 days, important data on inter-nesting movement patterns and the home range of a gravid female who remained within 15 km of her nesting beach, suggesting it is likely that she went on to lay several more nests around the Pangani area after she was tagged (Seasense, 2014).

With United States Agency for International Development (USAID) funding, the Pwani Project, led by the Coastal Resources Center at the University of Rhode Island and its local partner, Sea Sense, changed attitudes and behaviors of villagers living and working along the coastline of Pangani. Since 2009, local communities have recorded a progressively increasing number of sea turtle nests and hatchings. This effort has faltered through lack of funding and needs to be continued.

Along Ushongo beaches in Pangani and other sandy beaches and dune areas, the loss of turtle nesting and scale of slaughter was ranked at severity level 4. Other threats to turtles in this area include erosion, also ranked with severity value 4, with causes listed as due to mangrove cutting, dynamite fishing, beach sand mining and climate change.

With the potential sea level rise for the coastline, if left unattended, the erosion problem affecting Pangani's coast will worsen, and without a concerted effort at protecting the nesting sites and sensitising local communities on the legal issues of turtle harvest and potential tourism losses, sea turtle populations in this areas a certain to continue to decline. This will also have a negative impact on the tourism sector.

Tan-L53: Bagamoyo town planning

Agriculture is the main economic activity in Bagamoyo District. Other economic activities in the area include fisheries, livestock keeping, tourism, trade, and small-scale industries. In 2011, Bagamoyo's Economic Processing Zone (EPZ) operators exported products worth more than USD 380 million, compared with USD 130 million-worth of exports in 2010. Processing activities are grouped in three main categories. These are agro products (fruits, textiles, cotton lint); precious minerals (lapidary), and leather industry products.

Over recent years, Bagamoyo has served as the expansion area, which is absorbing the rapid growth of neighbouring Dar es Salaam city. This has led to numerous conflicts of land use with the main feature being the loss of agricultural land for human settlements. The growth has been so fast and continuous that the local authorities have been unable to direct development efficiently.

The solution to unplanned development and land use is to first conduct a land use plan for the town of Bagamoyo, mindful of the likely continued need for settlement areas as the population will most likely continue to grow. New access roads and the planned new harbour at Bagamoyo will accelerate the process.

For Bagamoyo District, the loss of habitat and agricultural area was a threat ranked at the highest severity level 5. Causes include rapid urbanization, high increase of people immigration in the city. This action addresses the problem of land management in Bagamoyo, particularly the town and coastal areas. It will make recommendations that the district authorities can use to mitigate the problems they currently face.

Tan-L54: Mangrove rehabilitation at Bagamoyo District

Agriculture is the main economic activity in Bagamoyo District. Other economic activities in the area include fisheries, livestock keeping, tourism, trade, and small-scale industries. In 2011, Bagamoyo's Economic Processing Zone (EPZ) operators exported products worth more than USD 380 million, compared with USD 130 million-worth of exports in 2010. Processing activities are grouped in three main categories. These are agro products (fruits, textiles, cotton lint); precious minerals (lapidary), and leather industry products.

Over recent years, Bagamoyo has served as the expansion areas, which is absorbing the rapid growth of neighbouring Dar es Salaam city. This has led to numerous conflicts of land use with the main feature being the loss of agricultural land for human settlements. Loss and degradation of mangrove forests in Bagamoyo has accompanied the expansion of the town. The growth has been so fast and continuous that the local authorities have been unable to direct development efficiently.

The solution to unplanned development and land use is to first conduct a land use plan for the town of Bagamoyo, mindful of the likely continued need for settlement areas as the population will most likely continue to grow. New access roads and the planned new harbour at Bagamoyo will accelerate the process. This issue of land use planning is addressed under proposed action Tan-L52 (above). The present action addresses the need to reinstate lost or degraded mangrove forests.

Loss of mangrove forest in Bagamoyo was ranked with severity value 3, with sites including Utondwe creek, Wami and Ruvu River mouth, Bagamoyo Town to Mpiji River mouth. Causes included illegal and uncontrolled cutting of mangroves and salt production.

Furthermore, a threat associated with coastal erosion at Bagamoyo was ranked at severity level 5, the highest, due to mangrove cutting, dynamite fishing, beach sand mining and unplanned construction along the coast. Meanwhile the decline in fisheries, ranked at severity level 4, is also attributed, among other things, to mangrove habitat loss.

With the constant increasing population of Bagamoyo, and the potential sea level rise for the coastline, if left unattended, mangrove forest loss will contribute to more coastal erosion, continued reduction in fisheries productivity, and a negative visual impact on the tourism sector.

Zanzibar

Overall Action Area Weighing by Theme

Table 6 above aggregates the assessments made in each of this report's thematic sections for Zanzibar

Altogether 106 threats have been considered in these sections with the greatest numbers identified in themes linked to natural resources and agriculture. Concern appeared at slightly lower level linked to fisheries, tourism, forestry, industry and urbanisation and related to management framework. Fewer threats were identified linked to ports and harbours, infrastructure and hydrocarbons. The is even more accentuated when taking the threat ranking into account as illustrated in Figure 9 above.

The working group in Stone Town identified a number of main intervention dimensions within which mitigation measures were required to address the ranked threats to coastal communities and ecosystems. Table 6 provides an overview of the importance of these intervention dimensions in addressing threats within each sector and overall. In Table 7 the relative importance of the intervention dimensions have been calculated for threats within each sector and overall and Figure 10 offers a simple graphical indication on how important each intervention dimension is considered to be to mitigate the threats identified within each sector.

Table 6: Overall Action Area Weighing by Theme for Zanzibar and Pemba

Intervention Dimension	Fisheries	Tourism	Agriculture	Forestry	Industry	Ports & Harbours	Infrastructure	Urbanisation	Hydrocarbons	Sand & Rock	Salt	Natural Resources	Freshwater Resources	Management Framework	# Threats	Total
Number of Threats	8	10	14	8	7	4	2	7	3	9	6	14	8	6	106	
Weighted Threats	32	37	50	27	27	15	8	24	7	16	16	46	12	22	339	
Integrated Coastal Zone Management (ICZM)	16	28	22	17	11	7	8	4	0	12	10	26	11	18	53	190
Integrated Water Resources Management (IWRM)	0	12	15	5	0	0	0	8	0	6	0	10	21	8	26	85
Land Use Management	16	25	36	27	27	5	8	17	0	10	10	27	16	14	69	238
Shoreline Management Planning	16	24	13	14	0	7	0	4	4	14	10	31	3	18	47	158
Solid and Liquid Waste Management	0	6	0	0	16	1	0	12	0	2	8	14	5	6	19	70
Sanitation	0	6	0	0	0	0	0	12	0	0	0	9	5	0	10	32
Capacity Building	28	37	53	27	20	11	8	25	6	16	8	29	27	22	94	317
Technology	28	33	53	23	20	11	4	19	7	12	11	40	27	14	88	302
Law Enforcement	16	32	33	27	12	5	4	25	5	16	9	39	13	11	77	247
Legal Review	16	15	23	18	0	3	0	0	6	5	9	27	13	11	45	146
Alternative/ Improved Livelihood	16	12	14	19	0	0	0	0	0	12	8	15	3	12	31	111
Awareness Raising	28	33	42	27	12	5	4	25	5	16	9	41	27	18	85	292
Education	28	33	42	27	12	2	0	21	5	16	9	28	27	18	76	268
Totals for Zanzibar	208	296	346	231	130	57	36	172	38	137	101	336	198	170	106	2456

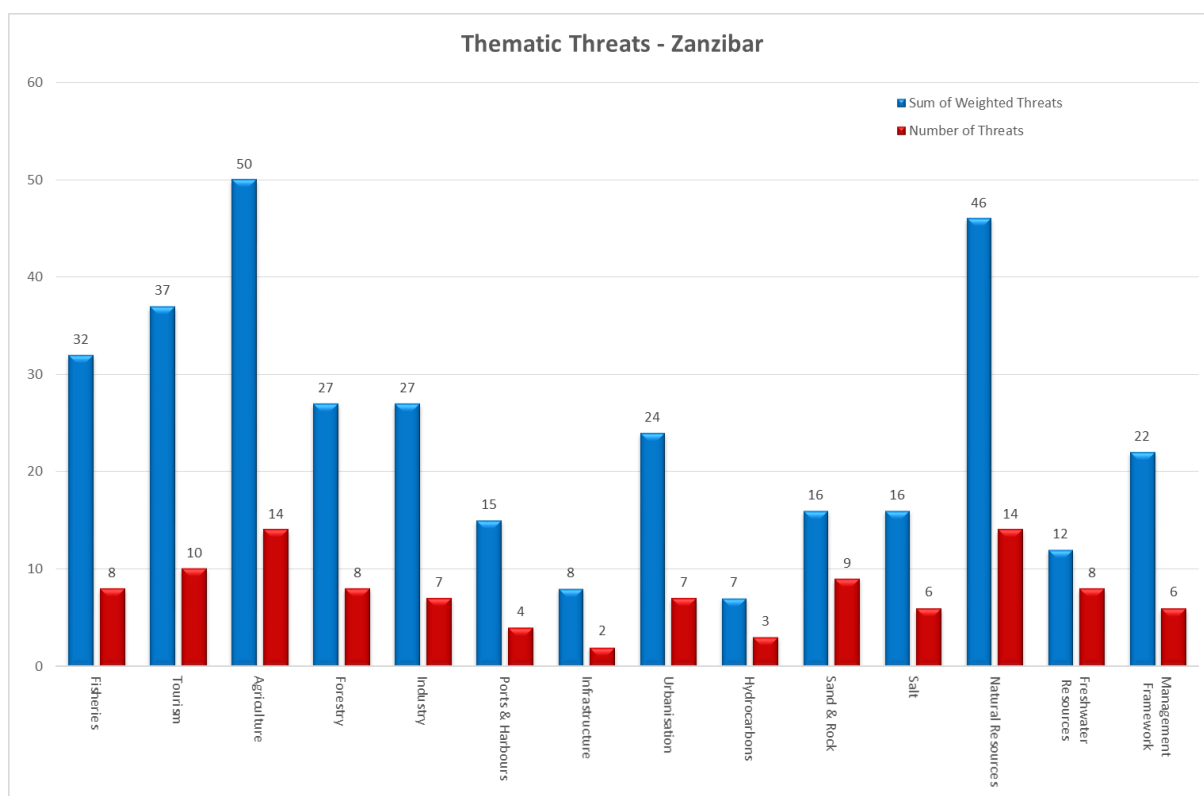


Figure 9: Numbers of threats and weighted threat distribution by theme for Zanzibar. The weighing of threats is based on the severity ranking undertaken with stakeholders and presented in volume 2 of the coastal profile.

Table 7: Overview of relative importance of intervention dimensions in mitigating identified threats within each theme for Zanzibar.

Intervention Dimension	Fisheries	Tourism	Agriculture	Forestry	Industry	Ports & Harbours	Infrastructure	Urbanisation	Hydrocarbons	Sand & Rock	Salt	Natural Resources	Freshwater Resources	Management Framework	# Threats	Total
Integrated Coastal Zone Management (ICZM)	8%	9%	6%	7%	8%	12%	22%	2%	0%	9%	10%	8%	6%	11%	50%	8%
Integrated Water Resources Management (IWRM)	0%	4%	4%	2%	0%	0%	0%	5%	0%	4%	0%	3%	11%	5%	25%	3%
Land Use Management	8%	8%	10%	12%	21%	9%	22%	10%	0%	7%	10%	8%	8%	8%	65%	10%
Shoreline Management Planning	8%	8%	4%	6%	0%	12%	0%	2%	11%	10%	10%	9%	2%	11%	44%	6%
Solid and Liquid Waste Management	0%	2%	0%	0%	12%	2%	0%	7%	0%	1%	8%	4%	3%	4%	18%	3%
Sanitation	0%	2%	0%	0%	0%	0%	0%	7%	0%	0%	0%	3%	3%	0%	9%	1%
Capacity Building	13%	13%	15%	12%	15%	19%	22%	15%	16%	12%	8%	9%	14%	13%	89%	13%
Technology	13%	11%	15%	10%	15%	19%	11%	11%	18%	9%	11%	12%	14%	8%	83%	12%
Law Enforcement	8%	11%	10%	12%	9%	9%	11%	15%	13%	12%	9%	12%	7%	6%	73%	10%
Legal Review	8%	5%	7%	8%	0%	5%	0%	0%	16%	4%	9%	8%	7%	6%	42%	6%
Alternative/ Improved Livelihood	8%	4%	4%	8%	0%	0%	0%	0%	0%	9%	8%	4%	2%	7%	29%	5%
Awareness Raising	13%	11%	12%	12%	9%	9%	11%	15%	13%	12%	9%	12%	14%	11%	80%	12%
Education	13%	11%	12%	12%	9%	4%	0%	12%	13%	12%	9%	8%	14%	11%	72%	11%
Totals for Zanzibar	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

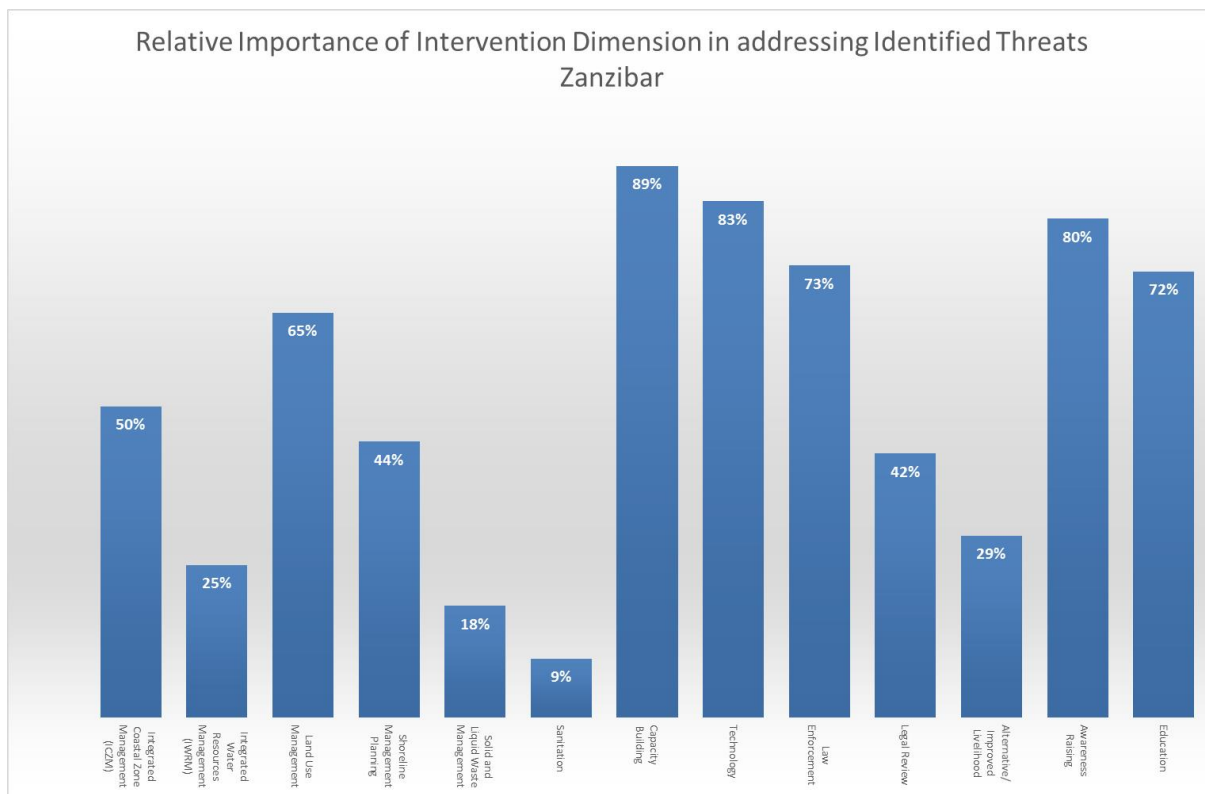


Figure 10: Relative importance of broad mitigation measures in addressing identified thematic threats in Zanzibar. The percentages in the graph show the proportion of the 106 identified threats that call for interventions in each of the broad mitigation measure categories suggested by the working groups.

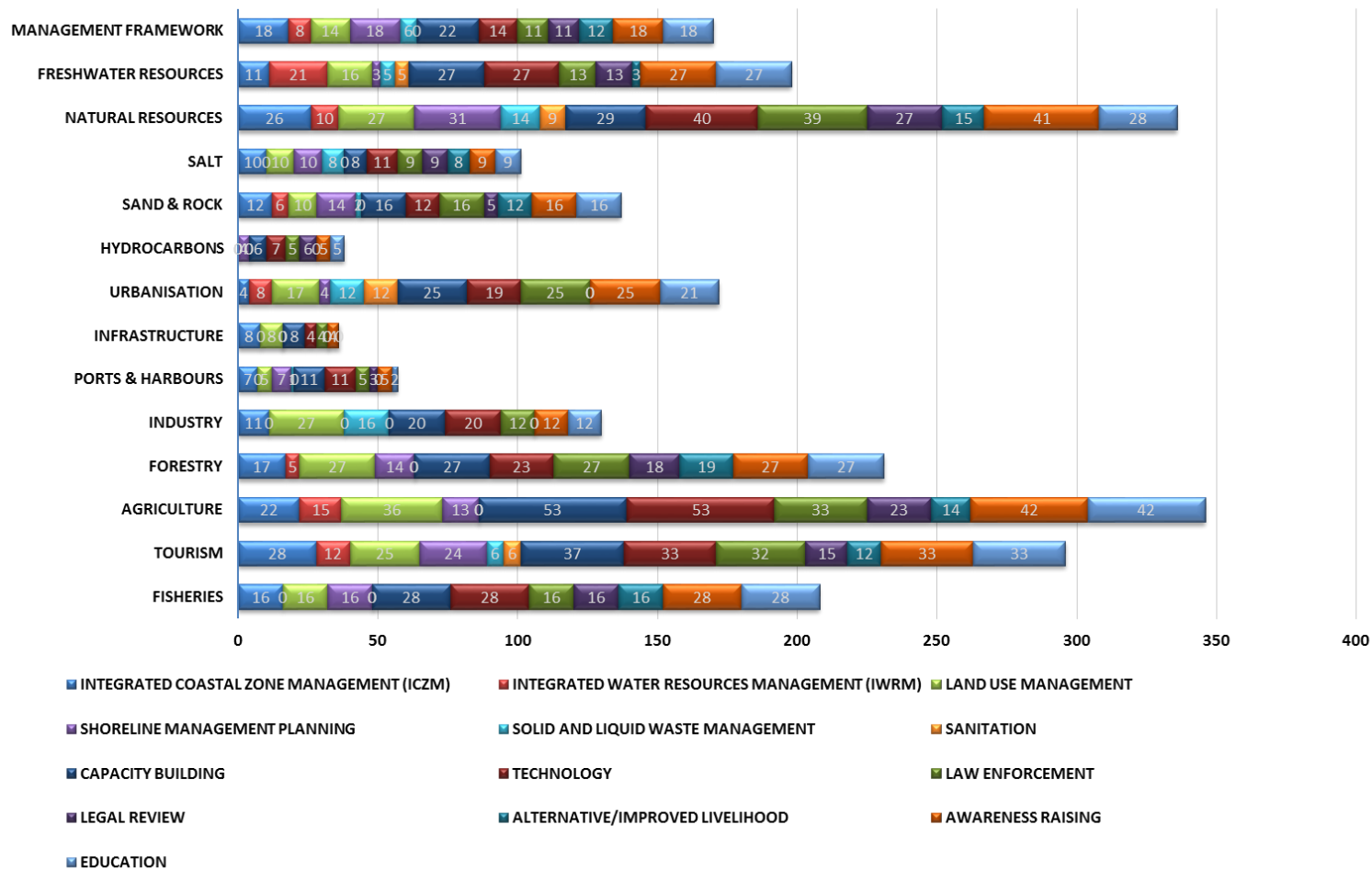


Figure 11: An overview of broad intervention measures required by theme to address identified threats. The importance or weight attributed to each intervention dimension is calculated as the sum of ranked threats requesting effort within the dimension as suggested by the working group in Stone Town. These sum values are given in white with each bar.

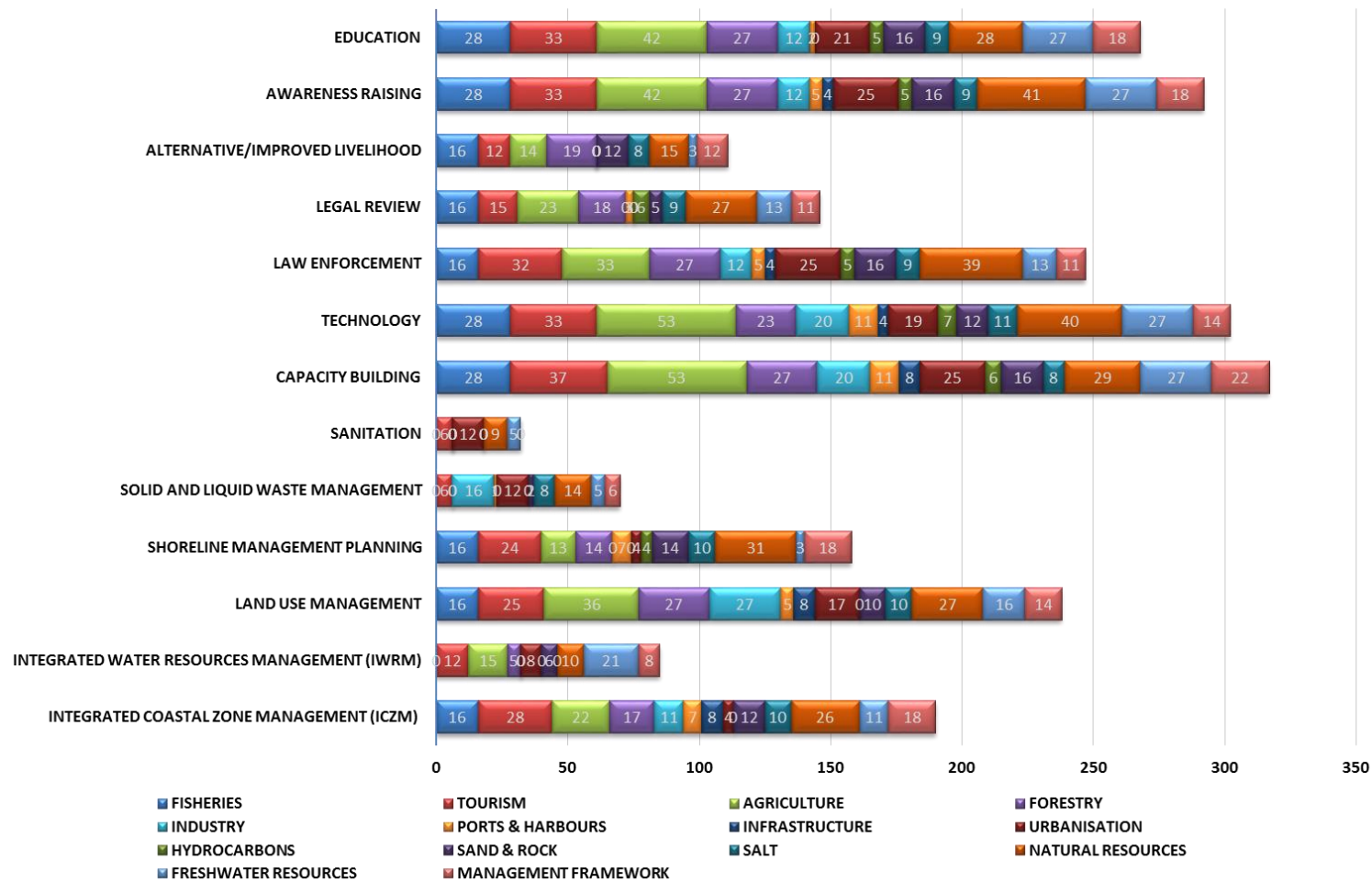


Figure 12: An overview of sector threat levels calling for measures within each intervention dimension suggested by the working group in Stone Town. The importance or weight attributed by each sector to each intervention dimension is calculated as the sum of ranked threats within the sector requesting effort within the dimension.

Overall Action Area Weighing by Region

Table 8 aggregates the assessments made in each of this report's region sections for Zanzibar.

Altogether 36 threats have been considered in these sections with the greatest numbers identified in the three Unguja Regions and with slightly less in the two Pemba Regions. When taking the threat ranking into account Unguja North and Unguja West Regions are most threatened, with Pemba South and Unguja South emerging slightly less threatened. Pemba North Region is the least threatened (Figure 13, below).

The working group in Stone Town identified a number of main intervention dimensions within which mitigation measures were required to address the ranked threats to coastal communities and ecosystems. Table 8 provides an overview of the importance of these intervention dimensions in addressing threats within each region and overall. In Table 9 the relative importance of the intervention dimensions have been calculated for threats within each region and overall and Figure 14 offers a simple graphical indication on how important each intervention dimension is considered to be to mitigate the threats identified within the regions.

Table 8: Overall Action Area Weighing by Region for Zanzibar and Pemba

Intervention Dimension	Pemba North Region	Pemba South Region	Unguja North Region	Unguja West and Urban Region	Unguja South Region	# Threats	Total
Number of Threats	6	6	8	8	8	36	
Weighted Threats	13	18	28	28	18	105	
Integrated Coastal Zone Management (ICZM)	11	15	22	23	16	28	87
Integrated Water Resources Management (IWRM)	3	10	13	15	9	17	50
Land Use Management	13	18	28	28	18	36	105
Shoreline Management Planning	11	15	22	23	16	28	87
Solid and Liquid Waste Management	5	10	8	10	4	15	37
Sanitation	5	10	8	10	4	15	37
Capacity Building	13	14	28	28	18	36	101
Technology	13	14	28	28	12	36	95
Law Enforcement	13	14	24	25	17	33	93
Legal Review	1	3	9	8	7	8	28
Alternative/ Improved Livelihood	8	8	12	11	11	15	50
Awareness Raising	13	18	28	28	18	36	105
Education	13	18	28	28	18	36	105
Totals for Zanzibar	122	167	258	265	168	36	980

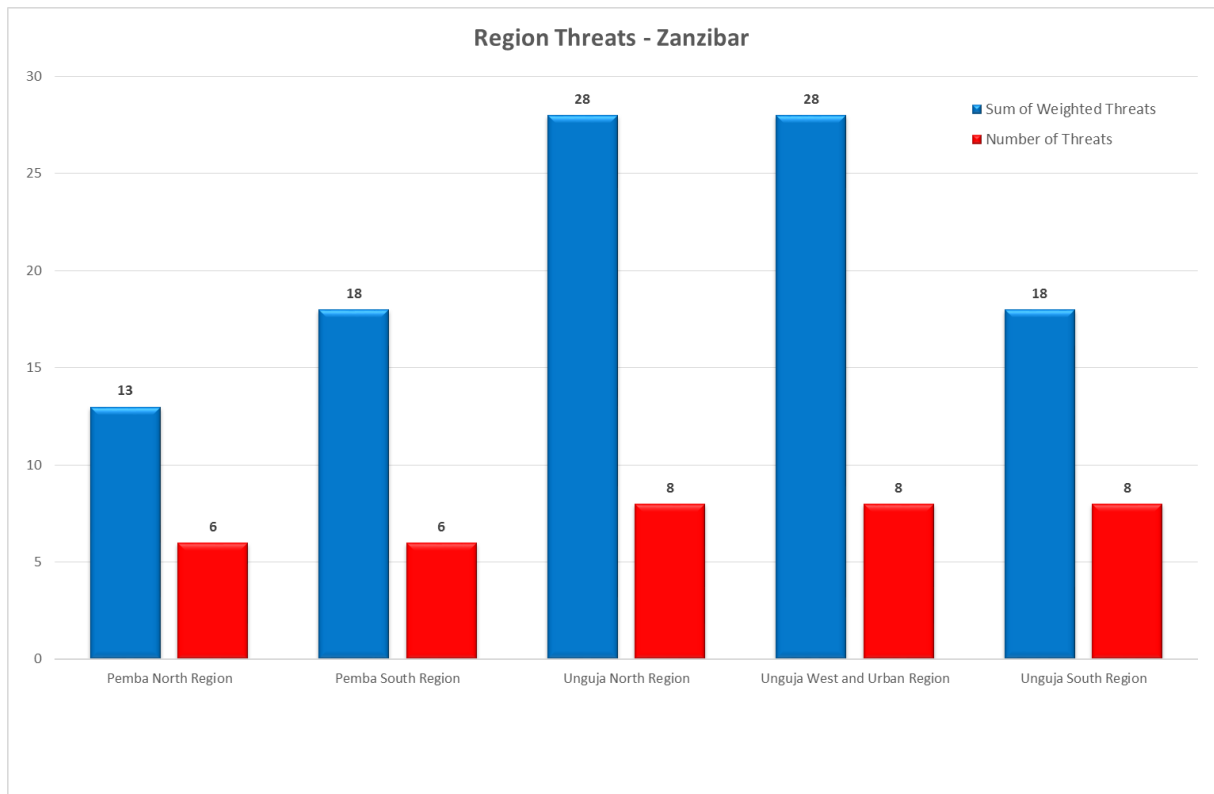


Figure 13: Numbers of threats and weighted threat distribution by region for Zanzibar. The weighing of threats is based on the severity ranking undertaken with stakeholders and presented in volume 2 of the coastal profile.

Table 9: Overview of relative importance of intervention dimensions in mitigating identified threats within each region in Zanzibar.

Intervention Dimension	Pemba North Region	Pemba South Region	Unguja North Region	Unguja West and Urban Region	Unguja South Region	# Threats	Total
Integrated Coastal Zone Management (ICZM)	9%	9%	9%	9%	10%	78%	9%
Integrated Water Resources Management (IWRM)	2%	6%	5%	6%	5%	47%	5%
Land Use Management	11%	11%	11%	11%	11%	100%	11%
Shoreline Management Planning	9%	9%	9%	9%	10%	78%	9%
Solid and Liquid Waste Management	4%	6%	3%	4%	2%	42%	4%
Sanitation	4%	6%	3%	4%	2%	42%	4%
Capacity Building	11%	8%	11%	11%	11%	100%	10%
Technology	11%	8%	11%	11%	7%	100%	10%
Law Enforcement	11%	8%	9%	9%	10%	92%	9%
Legal Review	1%	2%	3%	3%	4%	22%	3%
Alternative/ Improved Livelihood	7%	5%	5%	4%	7%	42%	5%
Awareness Raising	11%	11%	11%	11%	11%	100%	11%
Education	11%	11%	11%	11%	11%	100%	11%
Totals for Zanzibar	100%	100%	100%	100%	100%	100%	100%

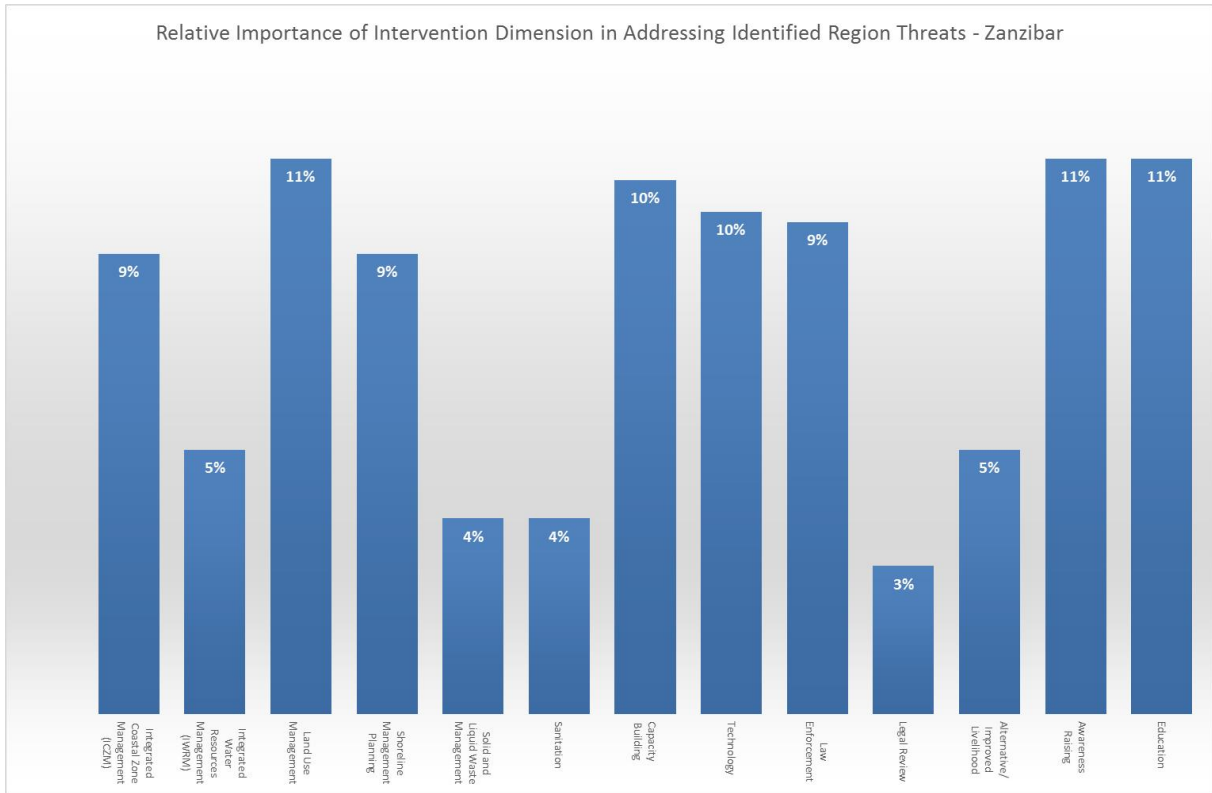


Figure 14: Relative importance of broad mitigation measures in addressing identified region threats in Zanzibar. The percentages in the graph show the proportion of the 36 identified threats that call for interventions in each of the broad mitigation measure categories suggested by the working groups.

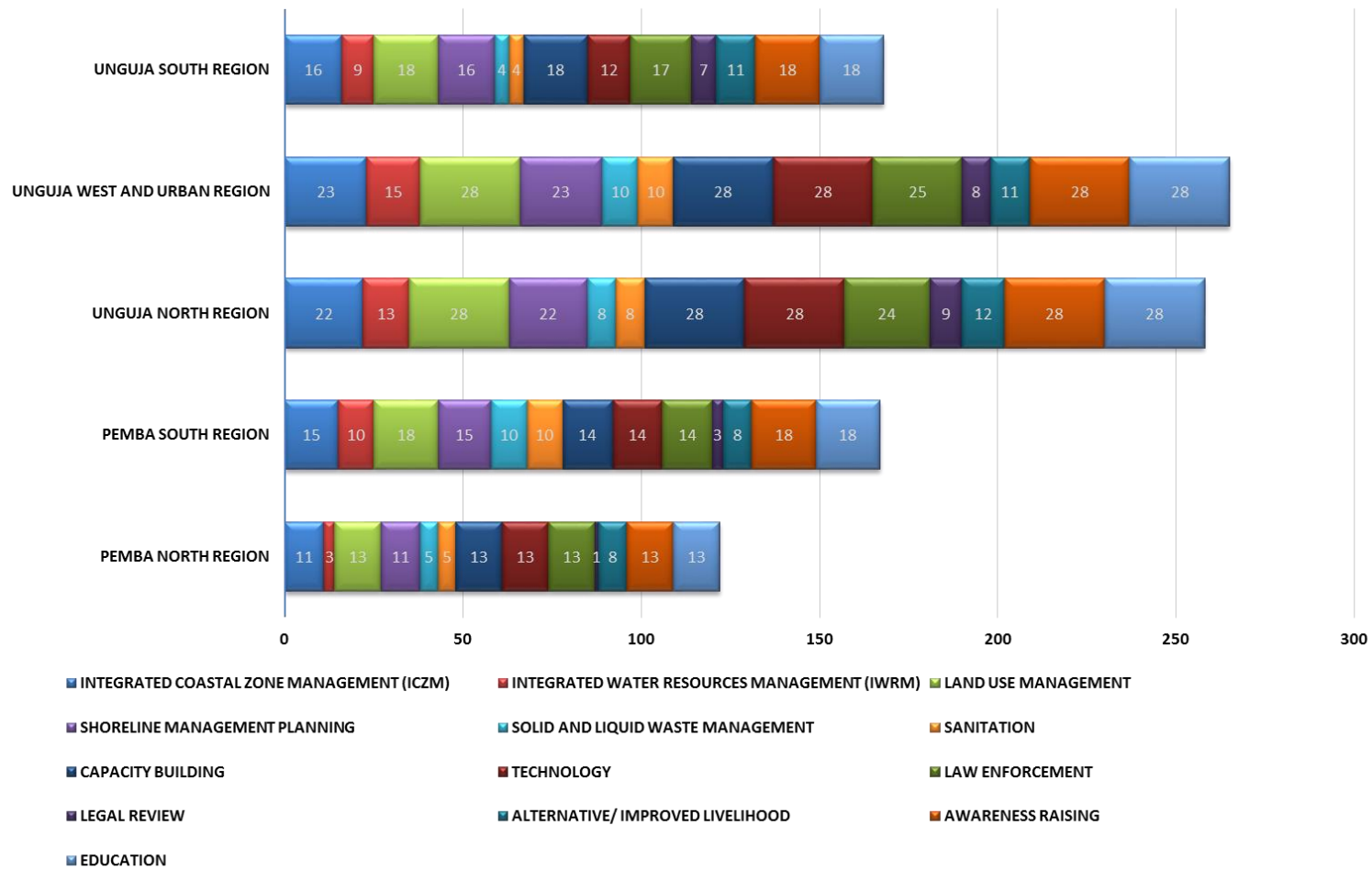


Figure 15: An overview of broad intervention measures required by region to address identified threats. The importance or weight attributed to each intervention dimension is calculated as the sum of ranked threats requesting effort within the dimension as suggested by the working group in Stone Town. These sum values are given in white with each bar.

Systemic Action Areas

Zan-S01 Integrated Coastal Zone Management Framework

The working group in Stone Town found that in Zanzibar the mitigation of

- 53 out of the 106 identified thematic threats to local coastal communities and ecosystems in Zanzibar corresponding to 50%, and
- 36 out of the 36 identified district level threats to local coastal communities corresponding to 100%,

would benefit from an Integrated Coastal Management Framework providing for better coordination within government and between government and non-government organisations.

Traditional sector planning falls short in coping with the complex development situation in the coastal areas, which has contributed to unsustainable land uses, and it is recognised that more integrated approaches are required for development management. Such approaches have matured internationally over the past decades and are increasingly embraced by the international community and considered particularly suited to address the challenges of addressing climate change. It is important that integrated management appreciates the need for linking upstream catchment management arrangements with coastal zone management arrangements to address impacts from inland activities on coastal conditions.

Zan-S02 Spatial Planning

Physical planning targets the optimization of land uses in support of socio-economic and economic development. It is institutionally embedded with statutory status used for forward land use planning (zoning) and in development control. Physical planning ideally operates in a nested or hierarchical manner at different administrative management levels. Structural planning provides a planning framework spatially expressing policies for overall infrastructure and other sector priorities, regional plans translate these into more detailed infrastructure and land use zoning plans and local area plans provide details for development control.

An overall spatial development strategy and plan for Zanzibar are important entry points for mainstreaming climate change adaptation measures into planning. In the context of sea level rise, vulnerability and risk mapping vis-à-vis erosion and inundation become significant themes in spatial analyses. Mainstreamed spatial plans needs to be accompanied by directions and or guidelines for environmental impact assessments for development in vulnerable areas ensuring that climate change mitigation measures are incorporated in plan and project design and implementation.

The working group in Stone Town found that in Zanzibar the mitigation of

- 69 out of 106 identified thematic threats to local coastal communities and ecosystems in Zanzibar corresponding to 65%, and
- 36 out of 36 identified region threats to local coastal communities and ecosystems corresponding to 100%

would benefit from strengthened spatial planning providing for sustainable land use and development control.

Support to land use planning has been provided to Zanzibar through the Sustainable Management of Land and Environment programme over several periods. The programme has recently completed its second phase (SMOLE II). Support has also been provided from the World Bank financed MACEMP to the development of District Land Use Frame Work Plans. These efforts provide an opportunity and foundation to further capacitating the spatial planning system and it is imperative to thoroughly align this action to these activities

Zan-S03 Shoreline Management

Shoreline erosion and accretion are natural processes shaping coastlines where land meets the sea. Influencing factors include winds, waves, currents, tides, storm and surge conditions, sea level rise, land subsidence and sediment supply from rivers. Anthropogenic interference with underlying processes may significantly alter the rates of accretion or sedimentation. This can be through land use changes in catchments, which may impact on sedimentation processes that play a role in shoreline morphology. It may also alter the hydrological regime which can impact on erosion/accretion patterns along the sea adjacent to estuaries. Interference with the shoreline itself by infrastructure and other development can also influence erosion and accretion long distances along the coast.

The dynamic interface between land and sea will move landwards with sea level rise emphasising the demand for specialised studies and planning to develop policies and strategies for land uses along the shoreline to feed into spatial planning.

To determine appropriate management responses to erosion requires an analysis of actual and potential shoreline erosion against planned and existing development activities at the coast. It is recommended to undertake a systematic shoreline management planning process in Zanzibar to produce appropriate policies and strategies for adaptation to coastal erosion.

The working group in Stone Town found that in Zanzibar the mitigation of

- 47 out of the 106 identified thematic threats to local coastal communities and ecosystems in Zanzibar corresponding to 44%, and
- 28 out of the 36 identified district level threats to local coastal communities corresponding to 78%,

would benefit from shoreline management interventions.

A systematic assessment of the shorelines of Zanzibar and Pemba to determine vulnerabilities related to erosion and inundation is a matter of urgency to develop local policies that can be incorporated/mainstreamed into development planning and at the same time consider impacts of climate variability and change.

Zan-S04 Information Management

Spatial data from various sources have been compiled and used to build the Geographical Information System (GIS) supporting the prioritisation study. In this process it has become apparent that although many GIS providers and consumers exist in Tanzania and Zanzibar, a shared and structured directory for accessing geographical information is lacking both in Zanzibar and Tanzania. The lack of such a system leads to inefficient use of data and resources, causes ambiguous use of information sources in management and clouds for a thorough understanding of the current information baseline.

At the moment there are no clear responsibilities on marine and coastal data collection. Each institution collects and uses spatial data that is useful for a particular activity, after which the data is summarised in thematic reports and the raw data is kept by the principal investigator or lost when he/she is moved to another department. A systematic archive of spatial data is required to make available historical and recent data on one side and to minimise duplication of efforts in the collection of new information. GIS for the marine environment is now expanding and there are national plans to harmonise institutions in the collection and sharing of data.

Development management decisions in complex settings such as is the case in Tanzania's coastal zone need to be based on a solid information base that enables analyses across many dimensions, including socioeconomic, economic, natural resources, land uses, and climate. Measures to mitigate threats to local communities and ecosystems must be defined based on analyses spanning these dimensions. An overarching and crucial mitigation measure is therefore to ensure that a solid information base is continually available as decision support for planning, that systematic monitoring is carried out to maintain the information base updated and that mechanisms are in place that ensures shared access to information and systematic dissemination of information on the management situation through state reporting.

Whereas considerable information may be available from numerous government as well as non-government sources, some is not up-to-date, is incomplete in geographical coverage and is not readily interchanged between information suppliers. Much information is produced as part of studies thus representing one-off focused data acquisition efforts, where data may escape integration into government information management systems.

Considerable efforts have been provided through the Sustainable Management of Land and Environment Programme (SMOLE) on assessing the current status of spatial data generation, storage and application and recommendations given on the requirements for consolidating the emerging Zanzibar Land Use Information System. This action should thoroughly consider and build on these and other initiative.

Zan-S05 Education in Primary and Secondary Schools

For the long term sustainable management and use of coastal areas it is important that the coming generations have an adequate understanding of the issues arising when development imposes pressure on these complex and highly dynamic ecosystems. Hence curricula for primary and secondary education should be reviewed and consolidated to ensure that the development of such an understanding is supported among students.

The working group in Stone Town found that in Zanzibar the mitigation of

- 76 out of the 106 identified thematic threats to local coastal communities and ecosystems in Zanzibar corresponding to 72%, and
- 36 out of the 36 identified region level threats to local coastal communities corresponding to 100%,

would benefit from interaction with education in primary and secondary schools.

The working group in these discussion highlighted issues related to

- Sustainable fisheries and fisheries ecology.
- Importance of environmentally sound industrial production
- Sustainable development in areas under high demographic and economic development pressure (coastal areas, urban areas).
- Importance of coasts and coastal habitats and resources.
- Importance of beaches.
- Pollution, environment, health.
- Waste minimisation and recycling.
- Coastal forest ecology
- Coastal forest management;
- Hydrologic cycle
- Importance of disease vector control.
- Complex requirements in coastal areas (high population and economic pressure).
- Sustainable development.
- Spatial planning to service Population requirements
- Importance of environmentally sound agriculture production

Zan-S06 Awareness Raising

An important factor in unsustainable practises among stakeholders in complex and rapidly developing environments is a lack of understanding of the long term consequences of such practises on communities, environment and ecosystems. A key element in development management is therefore to ensure that all stakeholders groups are continuously informed.

The working group in Stone Town found that in Zanzibar the mitigation of

- 85 out of the 106 identified thematic threats to local coastal communities and ecosystems in Mainland Tanzania corresponding to 80%, and
- 36 out of the 36 identified district level threats to local coastal communities corresponding to 100%,

calls for increased awareness concerning coastal issues, in particular vulnerability and complexity of coastal systems facing development pressure

The working group in these discussion for each threat assessed and outlined target for awareness raising activities and subject areas as comprehensively tabulated in this Volume IV of the coastal profile. A comprehensive and very diverse list of targets for awareness raising emerges from these tables while also identifying a wide range of areas where awareness needs to be raised. There is a requirement to develop and implement a comprehensive awareness raising effort.

Zan-S07 Integrated Legal Review

The working group in Stone Town found that in Zanzibar the mitigation of

- 45 out of the 106 identified thematic threats to local coastal communities and ecosystems in Zanzibar corresponding to 42%, and
- 8 out of the 36 identified district level threats to local coastal communities corresponding to 22 %,

called for review of legal provisions. The work group further found that the mitigation of

- 77 out of the 106 identified thematic threats to local coastal communities and ecosystems in Zanzibar corresponding to 73%, and
- 33 out of the 36 identified district level threats to local coastal communities corresponding to 92 %,

required intervention related to enforcement.

Local Action Areas

Zan-L01: Rehabilitation and clean-up of five west-flowing streams in Unguja Urban and West Region

Not much literature exists that documents nutrient and chemical pollution discharged through Zanzibar's small rivers and streams into the coastal environment on the Zanzibar Channel, however, after rains the amount of solid wastes and sediments that discharge are visibly indicative of degraded and polluted watersheds.

The five small stream basins, either perennial or semi-seasonal, from the northern border of the Stone Town northwards [from the 1:50,000 topographic maps] are:

- MtoMpepo, extending from Welezo area, for almost 3 km, passing Saateni Bridge before emptying at Funguni mangrove creek; the largest and most constantly flowing in the Region.
- MtoUpepo, with sources in Masingini, runs for approximately 3 km, emptying at Mtoni Marine hotel;
- MtoChumbuni and MtoMtoni that converge into a single flow, extending from source for about 3 km, passing under Mtoni Bridge (close to the Mtoni mosque) and discharging north of the fuel depot;
- MtoMtoni (second of same name as previous branch), but only ca. 2 km long, discharging at MtoniKigomeni.
- MtoBububu, extending inland over 4 km with several tributaries, with sources at Kidichi and Ndunduke, discharging at Bububu.

Beach pollution and marine pollution were both identified as severity level 4 threats in Unguja West and Urban Region, with sources including uncontrolled dumping and sewage seepage into river basins and the sea.

The west flowing streams north of the Stone Town are some of the largest conduits for liquid and solid waste, chemicals and sediment to the Zanzibar coastline, causing beach and sea pollution which affects health (e.g. of fishermen, bathers, tourists) and marine life (e.g. turtles, fish and habitats), extending many kilometres along the west coast of Zanzibar (likely affecting nearby small islands and coral reefs, and resulting in negative publicity of the historic Stone Town.

Zan-L02: Rehabilitation and clean-up of three northwest-flowing streams in Unguja Urban and West Region

Not much literature exists that documents nutrient and chemical pollution discharged through Zanzibar's small rivers and streams into the coastal environment on the Zanzibar Channel, however, after rains the amount of solid wastes and sediments that discharge are visibly indicative of degraded and polluted watersheds.

The three small streams, either perennial or semi-seasonal, in the Mahonda area [from the 1:50,000 topographic maps], and that are likely to affect the Unguja North region due to coastal current transport northwards past Mkokotoni, are:

- MtoZingweZingwe, extending from Mkanyageni area, past ZingweZingwe, then along the western border of the Mahonda sugar estate, for an overall length of almost 15 km to empty at Kiwanimangrove creek close to Bumbuwini; one of the largest and most constantly flowing in the Region and Unguja Island.
- MtoMwanakombo, with sources in Mgambo, that runs for approximately 6 km, feeding the marshland and rice growing areas of Chelechele, before draining into the Kiwanimangrove creek;
- MtoKipange, with sources in Kitunguja, extending for some 8 km, through the marshland and rice growing areas of Mwanda, before draining into the Kiwani mangrove creek.

Not much literature exists that documents nutrient and chemical pollution discharged through these rivers into the coastal environment on the Zanzibar Channel, however, after rains the amount of solid wastes and sediments that discharge are indicative of a degraded and polluted watershed.

Beach pollution and marine pollution were both identified as severity level 4 threats in Unguja West and Urban Region, with sources including uncontrolled dumping and sewage seepage into river basins and the sea.

The northwest flowing streams north of Stone Town and surrounding the large agricultural land of Mahonda are some of the largest conduits for liquid and solid waste, chemicals and sediment to the Zanzibar coastline, causing beach and sea pollution which affects health (e.g. of fishermen, bathers, tourists) and marine life (e.g. turtles, fish and habitats), extending many kilometres along the west coast of Zanzibar (likely affecting nearby small islands and coral reefs, and the Unguja North region as well, where beach pollution was also ranked at severity level 4. Inshore ocean current are likely to transport wastes, pollution and sediments from the Kiwani mangrove swamps and Mkokotoni area northwards to the important tourism shores of Kiwengwa and Nungwi, resulting in negative publicity of these tourist destinations.

Zan-L03: Beach erosion study for Zanzibar (Pemba and Unguja)

Many locations along the coasts, especially on Unguja Island, suffer from coastal erosion, which may be further worsened by sand mining conducted by local villagers, the tourism sector and building material suppliers, as well as by some of the measures taken by beach hotels to mitigate the impacts of erosion, namely inappropriate sea defences. The costs to the tourism sector is increasing.

Various studies have documented the changing beach levels and the loss of sand, which are particularly visibly along the beach fronts on northern Unguja and the southern parts of that island, as well as in south Pemba.

Coastal erosion was ranked with severity value 5 for both Unguja North and Unguja South, value 4 for Unguja West and Urban, 3 for Pemba South and 1 for Pemba North. Furthermore, a threat associated with the entire tourism sector due to unchecked sand mining was ranked at severity level 4; and under non-extractive resource uses, that include sand mining, also included a threat due to lack of understanding of the causative factors resulting in beach erosion, ranked at severity level 4.

With the potential sea level rise for the coastline, if left unattended, the erosion problem affecting Zanzibar will worsen with more severe costs, negative visual impact on the tourism sector, greater probability of sea water intrusion into agricultural and other land uses and the water table.

Zan-L04: Sewage collection and treatment facilities for the Stone Town, Unguja Urban and West Region

A body of literature documents high nutrient and faecal coliform bacteria levels in waters off the Stone Town, discharged through Zanzibar's small rivers and streams and the sewerage system with only primary screening, directly into the coastal environment on the Zanzibar Channel.

Beach pollution and marine pollution were identified as severity level 4 threats in Unguja West and Urban Region. Sewage from over 7,000 households in Stone Town (half a million people) have only primary sewage treatment systems and sewage pollution to the marine environment is continuous; causing beach and sea pollution which affects health (e.g. of fishermen, bathers, tourists) and marine life (e.g. fish and habitats), extending many kilometres along the west coast of Zanzibar (likely affecting nearby small islands and coral reefs, and resulting in negative publicity to the city. Further, inadequate urban sanitation, also causing health problems from contaminated ground and surface water as well as from water-borne diseases, was ranked at severity level 4.

Zan-L05: Sewage collection and treatment facilities for Zanzibar Town periphery neighbourhoods, Unguja Urban and West

A body of literature documents high nutrient and faecal coliform bacteria levels in waters off the Stone Town, discharged through Zanzibar's small rivers and streams and the sewerage system with only primary screening, directly into the coastal environment on the Zanzibar Channel.

The periphery urban area of Zanzibar Town includes a large neighbourhood called N'gambo, plus numerous others that together cover an area of 6-7 square kilometres, all without a formal sewage system.

The urban problems associated with the periphery of the Zanzibar Stone Town are well-documented, particularly under the SMOLE programme. Inadequate sanitation, causing health problems from contaminated water as well as from water-borne diseases, was ranked at severity level 4. In addition, coastal areas close to the periphery urban neighbourhoods are likely to be suffering from leaching of nutrients from septic tanks and soak-aways as well as raw sewage pollution from storm drain that act as conduits of sewage directly into the marine environment. Beach pollution and marine pollution were identified as severity level 4 threats in Unguja Urban and West.

Zan-L06: Sewage collection and treatment facilities for Nungwi Village and hotel areas, Unguja North Region

Not much literature exists on nutrient and faecal coliform bacteria levels in waters around the northern end of Unguja, yet villagers and hotel use sewage soak-aways, with nutrients directly entering into the coastal environment and in some cases faeces from villagers who defecate on the beaches through lack of alternatives.

Beach pollution was identified as severity level 4 threats in Unguja North, notably at Nungwi village area. Similarly, inadequate sewage infrastructure and waste management resulting in pollution was ranked as a major problem, level 5, affecting the entire industry on Zanzibar. There are no sewage treatment systems in the Nungwi area and sewage pollution to the marine environment is continuous – whether nutrients only, or with faecal material. Inadequate sanitation, causing health problems from contaminated water as well as from water-borne diseases, was ranked at severity level 4, causing beach and sea pollution which affects health (e.g. of fishermen, bathers, tourists). Marine life (e.g. fish and habitats), extending many kilometres around the northern portion of Unguja, is also likely affected by Nungwi nutrients and sewage pollution, as are nearby small islands and coral reefs, resulting in negative publicity of the tourist destination.

Zan-L07: Sewage collection and treatment facilities for the Mkoani, Pemba South Region

Not much literature exists on nutrient and faecal coliform bacteria levels in waters around the western and southern shores of Pemba, yet with Mkoani town inhabitants using sewage soak-aways /or defecating on the beaches, nutrients and/or bacteria are directly entering the coastal environment.

Marine pollution were identified as severity level 4 in Pemba South Region, especially at Mkoani and Chake Chake areas. Untreated sewage-related disease from several thousand households in Mkoani

do not have sewage treatment systems and sewage pollution to the marine environment is continuous. Inadequate sanitation, causing health problems from contaminated water as well as from water-borne diseases, was ranked at severity level 3, affecting health of fishermen, bathers, tourists and urban residents. Marine life (e.g. fish and habitats) are similarly affected from resulting seepage and marine pollution, and a negative publicity to the city if portrayed to visitors and tourists.

The projected population and development growth (also associated with the port) in the coming years will further aggravate the pollution and health problems associated with the lack of a municipal sewage system at Mkoani.

Zan-L08: Sewage collection and treatment facilities for the Chake Chake, Pemba South Region

Not much literature exists on nutrient and faecal coliform bacteria levels in waters around the western and southern shores of Pemba, yet with Chake Chake town inhabitants using sewage soak-aways or defecating on the beaches, nutrients and/or bacteria are directly entering the coastal environment.

Marine pollution were identified as severity level 4 in Pemba South Region, especially at Mkoani and Chake Chake areas. Untreated sewage-related disease from several thousand households in Chake Chake do not have sewage treatment systems and sewage pollution to the marine environment is continuous. Inadequate sanitation, causing health problems from contaminated water as well as from water-borne diseases, was ranked at severity level 3, affecting health of fishermen, bathers, tourists and urban residents. Marine life (e.g. fish and habitats) are similarly affected from resulting seepage and marine pollution, and a negative publicity to the city if portrayed to visitors and tourists.

The projected population and development growth (also associated with the port) in the coming years will further aggravate the pollution and health problems associated with the lack of a municipal sewage system at Chake Chake.

Zan-L09: Professional Tourism Training Centre for Zanzibar

The most significant threat affecting local livelihoods associated with the tourism sector is the loss of employment opportunities due to inadequate levels of training among local job-seekers and competition for those job opportunities from more qualified personnel from mainland Tanzania and Kenya. Though exact figures were not found, as to the numbers of staff that are not from Zanzibar, the general perception among those in the industry is that more locals could and should be employed but only if they were better qualified.

Loss of employment opportunities was ranked at severity level 3. However, given the expansion of the sector at 10% per annum, and the population growth of the island at around 3%, the potential for local business and staff employed in foreign hotels will continue to increase, yet it is estimated that only 20% of the earning from the sector benefits the local population, including the purchase of local food stuffs. Consequently, unless the local population are able to participate more in the tourism sector, the significance of the lost employment/business opportunities will similarly increase. Better educated candidates for employment as well as to start and run their own tourism businesses will contribute to a greater share of the tourism profits reaching Zanzibar people.

Furthermore, social problem associated with unemployment, such as crime and vice are threats that rank at severity level 4, and desperation among communities leading to deterioration of the marine environment through destructive fishing practices and of the terrestrial conservation areas through encroachment, especially of forest, were both threats ranked at level 4. By involving more local youths in the tourism sector, through better and dedicated training in a facility run by professions in the sector, tourism-related job opportunities will become more realistic.

Zan-L10: Regional Solid Waste Collection and Processing facility for Pemba North

Not much literature documents the amounts of solid wastes that enter coastal waters around the north and western shores of Pemba, yet with Wete and Micheweni town inhabitants reliant on informal and inadequate solid waste collection and processing services, large amounts of waste directly enter the natural environment including coastal waters. This affects productivity and tourism potential.

Marine pollution were identified as severity level 2 in Pemba North Region, especially at Wete and Micheweni areas. The several thousand households in Wete and Micheweni lack access to solid waste

treatment systems and pollution to the marine environment is continuous. Inadequate waste control also contributes health problems from contaminated water as well as from water-borne diseases, ranked severity level 2 for Pemba North, affecting health of fishermen, bathers, tourists and urban residents. Beach pollution was ranked severity level 1, though with projected population and development growth (associated with Wete and Mcheweni and the village areas) in the coming years, all forms of pollution (and health problems) associated with the lack of an effective municipal collection and solid waste system at Pemba North are bound to deteriorate further.

Marine life (e.g. fish and habitats) are similarly affected from resulting pollution - with fisheries decline ranked severity level 4 in Pemba North. The negative publicity aspect of visible solid waste affects visitors and tourists.

Zan-L11: Regional Solid Waste Collection and Processing facility for Pemba South

Not much literature documents the amounts of solid wastes that enter coastal waters around the north and western shores of Pemba, yet with Chake Chake and Mkoani town inhabitants reliant on informal and inadequate solid waste collection and processing services, large amounts of waste directly enter the natural environment including coastal waters. This affects productivity and tourism potential.

Marine pollution were identified as severity level 4 in Pemba South Region, especially at Weshu, Chake Chake and Mkoani areas. The several thousand households in these three urban centres lack access to solid waste treatment systems and pollution to the marine environment is continuous. Inadequate waste control also contributes health problems from contaminated water as well as from water-borne diseases, ranked severity level 3 for Pemba South, affecting health of fishermen, bathers, tourists and urban residents. Beach pollution was ranked severity level 3, though with projected population and development growth (associated with the three urban areas and the village areas) in the coming years, all forms of pollution (and health problems) associated with the lack of an effective municipal collection and solid waste system at Pemba South are bound to deteriorate further.

Marine life (e.g. fish and habitats) are similarly affected from resulting pollution - with fisheries decline ranked severity level 4 in Pemba South. The negative publicity aspect of visible solid waste affects visitors and tourists.

Zan-L12: Regional Solid Waste Collection and Processing facility for Unguja North

Not much literature documents the amounts of solid wastes that enter coastal waters around the north and western shores of Unguja North, yet within large villages like Nungwi, Mkokotoni and northeast centres like Pwani Mchangani and Kiwengwa (among others) the inhabitants are reliant on informal and inadequate solid waste collection and processing services, large amounts of waste directly enter the natural environment including coastal waters. This affects coastal productivity, fishing activities and tourism potential.

Beach pollution was ranked at severity level 4 for the main northern villages in Unguja North Region; while marine pollution were identified as severity level 2, especially at Pwani Mchangani and Kiwengwa, Matemwe, Nungwi, Mkokotoni and Mangapwani areas. The several tens of thousands of households in these large village centres lack access to solid waste treatment systems and pollution to the marine environment is continuous. Inadequate solid waste control also contributes health problems from contaminated water as well as from water-borne diseases, ranked severity level 2 for Unguja North, affecting health of fishermen, bathers, tourists and urban residents. With projected population and development growth (associated with these large villages and their associated hotels) in the coming years, all forms of pollution (and health problems) associated with the lack of an effective municipal collection and solid waste system at Unguja North are bound to deteriorate further.

Marine life (e.g. fish and habitats) are similarly affected from resulting pollution - with fisheries decline ranked severity level 4 in Unguja North. The negative publicity aspect of visible solid waste affects visitors and tourists.

Zan-L13: Regional Solid Waste Collection and Processing facility for Unguja Urban and West

Not much literature documents the amounts of solid wastes that enter coastal waters around the north and western shores of Unguja North, yet within large villages like Nungwi, Mkokotoni and northeast centres like Pwani Mchangani and Kiwengwa (among others) the inhabitants are reliant on informal and inadequate solid waste collection and processing services, large amounts of waste directly enter the natural environment including coastal waters. This affects coastal productivity, fishing activities and tourism potential.

Beach pollution was ranked at severity level 4 for the main northern villages in Unguja West and Urban Region, with marine pollution also identified as severity level 4. The several hundreds of thousands of households in the Stone Town area lack access to solid waste treatment systems and pollution to the marine environment is continuous. Inadequate solid waste control also contributes health problems from contaminated water as well as from water-borne diseases, ranked severity level 2 for Unguja Urban and West, affecting health of fishermen, bathers, tourists and urban residents. With projected population and development growth (associated with the Stone Town and their associated hotels) in the coming years, all forms of pollution (and health problems) associated with the lack of an effective municipal collection and solid waste system at Unguja Urban and West are bound to deteriorate further.

Marine life (e.g. fish and habitats) are similarly affected from resulting pollution - with fisheries decline ranked severity level 4 in Unguja Urban and West. The negative publicity aspect of visible solid waste affects visitors and tourists.

Zan-L14: Regional Solid Waste Collection and Processing facility for Unguja South

Not much literature documents the amounts of solid wastes that enter coastal waters around the north and western shores of Unguja North, yet within large villages like Nungwi, Mkokotoni and northeast centres like Pwani Mchangani and Kiwengwa (among others) the inhabitants are reliant on informal and inadequate solid waste collection and processing services, large amounts of waste directly enter the natural environment including coastal waters. This affects coastal productivity, fishing activities and tourism potential.

Beach pollution was ranked only at severity level 1 for the main southern villages in Unguja South Region, with marine pollution also identified as severity level 2. Despite these relatively low threat severity levels, the several hundreds of thousands of households in the large villages extending from Menai Bay to Michamvi (Kizimkazi, Makunduchi and north along the East coast to Jambiani, Paje and Bwejuu), lack of access to solid waste treatment systems means solid waste pollution to the marine environment is continuous. Furthermore, with projected population and development growth (associated with coastal villages and tourism development) in the coming years, all forms of pollution (and health problems) associated with the lack of an effective municipal collection and solid waste system at Unguja South are bound to deteriorate further. Inadequate solid waste control also contributes health problems from contaminated water as well as from water-borne diseases, ranked severity level 1 for Unguja South, affecting health of fishermen, bathers, tourists and urban residents.

Marine life (e.g. fish and habitats) are similarly affected from resulting pollution - with fisheries decline ranked severity level 4 in Unguja South. The negative publicity aspect of visible solid waste affects visitors and tourists.

Zan-L15: Study, review, design and trial freshwater supply options for Pemba Island

Water supply problems are well-documented and threaten livelihoods in future if the supplies and options are not well-understood. This uncertainty affects coastal communities and their productivity, agriculture (especially on Pemba where this is a vital economic activity) and the tourism industry.

On Pemba Island, inefficient management of piped water supply leading to leaks and loss of water, and inefficient management of water bodies has led to removal of riverine vegetation, erosion of riverbanks, degradation of water bodies or abstraction for water for agriculture (or livestock), were both threats ranked with a threat severity level 3. Lack of updated data on rivers sources is considered a threat ranked at level 4, made more pertinent by the uncertainties of climate change impacts.

Meanwhile the increased demand from population and economic growth, as well as the degradation of catchments from changes in land use and/or livestock are threats also ranked at level 4.

Zan-L16: Study, review and design of freshwater supply options for Unguja

Water supply problems are well-documented and threaten livelihoods in future if the supplies and options are not well-understood. Studies in the 1990s documented large aquifers that have since then been heavily utilised. The continued uncertainty affects coastal communities and their productivity, as well as agriculture and tourism (the latter especially on Unguja where this is a vital economic activity).

On Unguja Island, inefficient management of piped water supply leading to leaks and loss of water (e.g. 35-40% on Unguja) was a threat ranked with a severity level 3, while lack of updated data on aquifer sources leading to failure to comprehensively control water supplies was considered a threat ranked at level 4, made more pertinent by the uncertainties of climate change impacts. Meanwhile, the increased demand from population and economic growth (a level 4 threat) is accompanied by the threat from demands by the tourism sector that was ranked a level 3 threat.

Zan-L17: Zanzibar fisheries sector review by fishery type and management areas

The artisanal/small-scale fishery sector in Zanzibar supports a significant proportion of local livelihoods. In 2007, the Joint Frame Survey estimated that the activity provided full time employment for over 34,268 people with thousands more part time fishermen, yet the increased effort in fishing has not resulted in increases in fish catches per unit.

The pragmatic outlook on the fisheries sector on Zanzibar is that there is little room for expansion and the current and increasing pressure is damaging the productivity. Catches are unlikely to increase with more fishing effort. Some potential increase may be gained from improvements in efficiency and/or value-added in the small pelagic fishery and from coastal aquaculture.

To give credence to any measures that attempt to manage and even restrict the fishing effort, there is first the need to better understand the main fisheries taking place in Zanzibar, especially within and outside of the many marine conservation areas. On mainland Tanzania there are now fisheries management plans to address the principle four fishery types: octopus, tuna and tuna-like species, small pelagic species (sardine and anchovies), mixed reef fisheries and seaweed farming. The equivalent for Zanzibar has not been undertaken and is an important gap in the management of the fisheries in the present day.

The use of destructive fishing gears was ranked as the most severe threat, level 5, for Zanzibar as a whole, with fisheries decline ranked at level 4 for all five regions. The inadequate understanding of fisheries resources was similarly ranked at level 4 for Zanzibar as a whole, with conflicts arising from between local fishers and migrant fishers and between two neighbouring fishing communities over disagreements over gears ranked 4 and 3 respectively. The significance of the threats posed by fishers and by the decline in fisheries production per unit effort cannot be overstated.

The importance of developing fisheries management plans and implementing the results was stressed recently by a SWIOfish consultancy (Groeneveld et al, 2014) who also supported the need to strengthening existing data collection methods as stressed by de Graaf (2013). It was also felt that such a review should include the harmonisation and revision of the Fisheries Act (2010) in a number of respects, including best practices, consistency with other national legislation and implementation of international obligations, across the various fisheries sub-sectors, including artisanal and semi-industrial fisheries, and regarding vessels that have been fishing in the EEZ but pass through the territorial sea around Zanzibar and enter into its port, as highlighted by the recent SWIOfish study of Swan (2013).

Zan-L18: Small pelagic fisheries support on Zanzibar

The artisanal/small-scale fishery sector in Zanzibar supports a significant proportion of local livelihoods. In 2007, the Joint Frame Survey estimated that the activity provided full time employment for over 34,268 people with thousands more part time fishermen, yet the increased effort in fishing has not resulted in increases in fish catches per unit.

Small pelagics (Clupeids, Scombrids, Engraulids) made up 68% of the marine catch in recent years (Groeneveld et al 2014). Off Zanzibar they are caught off the western shores, with concentrations at Zanzibar Town and Chake Chake and Mkoani, Pemba. Open water seine nets, purse seine, gill nets, ring / lift nets and migrant fishers are involved that follow fish schools. There is high demand for anchovies as local source of protein, for poultry farming, aquaculture, and also dried and exported. The management effectiveness of the small pelagic fishery is hindered by limited finances available for enforcement, remote areas, large (and growing) numbers of fishers, easy access, and entrenched fishing rights. Post-harvest loss is highest (20% of catch) during the wet season (SE Monsoon), when small pelagic fishes are abundant, but cannot be dried as rapidly or efficiently. Roads are then difficult to navigate, and therefore catches cannot be distributed efficiently during this period, leading to their loss.

The pragmatic outlook on the fisheries sector on Zanzibar is that there is little room for expansion and the current and increasing pressure is damaging the productivity. Catches are unlikely to increase with more fishing effort. Some potential increase may be gained from improvements in efficiency and/or value-added in the small pelagic fishery and from coastal aquaculture.

Although the small pelagic fishery has potential for expansion, and could partly absorb fishers displaced from other fisheries, such as the reef fishery, with declining productivity, or from enforcement of bans of illegal gears, there is an inherent risk associated with promoting a fishery that is not fully understood. Reef fisheries are threatened by over-fishing and environmental disturbance, principally from bleaching episodes (possibly related to anthropogenic climate change). Supporting the small pelagic fishery by better understanding the fishery, by adding value, improving yields, providing a feasibility study for the development of a cannery (for private sector investment) will contribute to its long-term sustainability and contribute towards food security and potentially foreign exchange earnings from export.

The use of destructive fishing gears was ranked as the most severe threat, level 5, for Zanzibar as a whole, with fisheries decline ranked at level 4 for all five regions. The inadequate understanding of fisheries resources was similarly ranked at level 4 for Zanzibar as a whole, with conflicts arising from between local fishers and migrant fishers and between two neighbouring fishing communities over disagreements over gears ranked 4 and 3 respectively. The significance of the threats posed by fishers and by the decline in fisheries production per unit effort cannot be overstated.

It is widely accepted that there is inadequate knowledge on both the fishery and the biology of the pelagic resources (e.g. URT 2013). The productivity of this fisheries is threatened both by over-fishing and by environmental disturbance, principally from bleaching episodes (which may or may not be directly related to anthropogenic climate change). Given the high complexity and natural variability of small pelagic species ecosystems, the lack of data on the fishery and the difficulties in identifying clear potential responses of these fish species to anthropogenic climate change, caution is required by decision-makers who may be tempted to look at this fishery as a go-to fishery that can absorb excess capacity from other fisheries (Anderson, in prep).

Zan-L19: Support for Zanzibar fisheries MCS programme

The artisanal/small-scale fishery sector in Zanzibar supports a significant proportion of local livelihoods. In 2007, the Joint Frame Survey estimated that the activity provided full time employment for over 34,268 people with thousands more part time fishermen, yet the increased effort in fishing has not resulted in increases in fish catches per unit.

The pragmatic outlook on the fisheries sector on Zanzibar is that there is little room for expansion and the current and increasing pressure is damaging the productivity. Catches are unlikely to increase with more fishing effort. Some potential increase may be gained from improvements in efficiency and/or value-added in the small pelagic fishery and from coastal aquaculture. Other than attempt to generate or harvest greater amounts of fish from the natural environment, one other alternative is to reduce the degradation of the fish habitats from destructive and illegal fishing activities. Two well-known such activities are the use of beach seine nets and the use of small-meshed purse seine nets around coral reefs, a practice known as “kigumi” fishery. Reducing destructive fishery practices will over time result in increased production.

There is a very weak history of enforcement of fisheries regulations in Zanzibar and worse on mainland Tanzania. In the past, recommendations have been made to ban destructive fishing practices from marine protected areas, something that has partial success, or the complete elimination of illegal practices. Part of the problem has been the confusing and at times contradictory legislation. In the case of the “kigumi” practice whereby the nets used are not illegal but the way they are used (involving smashing corals to force fish out) is destructive and illegal – though this is not clear. The need to firmly address fisheries control and surveillance on Zanzibar has been re-iterated recently by Malan (2014) while working on the SWIOfish study on MCS.

Zanzibar has relatively strong traditional local governance of fisheries, strengthened recently by community-based approaches in fisheries through Community Fishermen Committees or CFCs (similar to Beach management Units, or BMUs, as seen on the mainland) in all fishing villages. Whereas the sea is publicly owned and every individual has a user right, marine environments adjacent to any village are traditionally under the use interest and monitoring of that village. Such a structure bodes well for MCS at village level.

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It is widely accepted that there is insufficient monitoring, control and surveillance of the inshore waters of Zanzibar and that destructive and illegal fishing takes place on a large scale. In order to fill that gap, a series of investigations and interventions are needed. The important first step is to ensure that the legislation is clear and non-contradictory and that it is well-known and clearly understood by the fishing community. A second starting point is to register all vessels, gears and fishers, thereby addressing the widely known underestimate of these elements. Malan (2014) quotes interviews with fisheries officials and fishers who suggested that as many as 50% of boats and fishermen may be unlicensed (see Mkenda and Folmer, 2001). Damage to habitats cause loss of spawning and nursery grounds, loss of biodiversity and diminished habitat resilience. Reduction in fisheries productivity due to habitat destruction, can takes years, even centuries to recover.

Zan-L20: Strengthening management of octopus fisheries on Zanzibar

The artisanal/small-scale fishery sector in Zanzibar supports a significant proportion of local livelihoods. In 2007, the Joint Frame Survey estimated that the activity provided full time employment for over 34,268 people with thousands more part time fishermen, yet the increased effort in fishing has not resulted in increases in fish catches per unit.

While the pragmatic outlook on the fisheries sector on Zanzibar is that there is little room for expansion and the current and increasing pressure is damaging the productivity, with catches unlikely to increase with more fishing effort, and some potential increase from improvements in efficiency and/or value-added in the small pelagic fishery and from coastal aquaculture, the octopus fishery deserves attention.

There are several studies on octopus fisheries in Tanzania (Guard 2002; Guard and Mgaya 2002), including stock status assessments that demonstrate growth in the fishery, with export of catches. Octopus is a fast growing marine organism that appears to be a resilient with good fisheries prospects, despite its present status of being overfished in many Tanzania locations. Research to support and/or improve the management of octopus fisheries, on spatial and temporal scales, is required and strongly recommended under recent SWIOfish studies (e.g. Groeneveld 2014).

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It is widely accepted that there is inadequate knowledge on both the fishery and the biology of the octopus fishery of Zanzibar and mainland Tanzania. In order to fill that gap, a series of investigations and interventions are needed.

Zan-L21: Strengthening the seaweed farming industry on Zanzibar

The artisanal/small-scale seaweed farming sector in Zanzibar supports a significant proportion of local livelihoods, in an activity that started in 1989. Some 23,000 people at 80 villages in Zanzibar participate in seaweed farming, of which 90% are women. Seaweed of the genus *Euchema* is cultured in the shallow subtidal along the coast of Zanzibar, using lines strung above the sea bottom. The product is harvested in 6 weeks, dried, and sold to six companies that export it.

Problems associated with the industry include massive decline in productivity in Unguja seaweed farms, with failure of some varieties to grow; inability or difficulty of culture of deeper water species in Unguja compared to Pemba; conflicts with buyers over pricing and health complications associated with the time spent in the shallow water while tending to the seaweed lines.

While the pragmatic outlook on the fisheries sector on Zanzibar is that there is little room for expansion and the current and increasing pressure is damaging the productivity, with catches unlikely to increase with more fishing effort, and some potential increase from improvements in efficiency and/or value-added in the small pelagic fishery and from coastal aquaculture. Enhancing seaweed production is one activity that has been recommended by various sources including the recent SWIOfish study by Groeneveld et al (2014).

There are several studies seaweed farming on Zanzibar, e.g. SMOLE supported study by Frocklin et al . (2012) which have made recommendations on means to improve the income and benefits from the farming of seaweed. The formation of the Zanzibar Seaweed Cluster has significantly improved the diversity and subsequent income associated with the production of seaweed and derivative products like soaps, oils, foodstuffs etc.

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It is widely accepted that there is incomplete knowledge on the seaweed farming industry on Zanzibar (and mainland Tanzania) and that in order to fill that gap, a series of investigations and interventions are needed. The sector has good potential for growth, but there is a need to investigate value-adding at local level to increase the value of the sector and break buyer monopoly (i.e. low prices fetched for dried unprocessed product), to understand the decline in production in Unguja and the increased production from Pemba, whether there are changes in coastal water conditions that favour or hinder growth, and to address health complications associated tending to the seaweed lines.

Zan-L22: Tuna fisheries support programme for Zanzibar

The artisanal/small-scale fishery sector in Zanzibar supports a significant proportion of local livelihoods. In 2007, the Joint Frame Survey estimated that the activity provided full time employment for over 34,268 people with thousands more part time fishermen, yet the increased effort in fishing has not resulted in increases in fish catches per unit.

While the pragmatic outlook on the fisheries sector on Zanzibar is that there is little room for expansion and the current and increasing pressure is damaging the productivity, with catches unlikely to increase with more fishing effort, and some potential increase from improvements in efficiency and/or value-added in the small pelagic fishery, from coastal aquaculture, and from offshore resources such as the tuna fishery.

Most medium and large pelagics are migratory species, undertaking seasonal movements within the Indian Ocean basin. There are few studies on tuna fisheries in Tanzania (Richmond & Mganwa, 1995), though they demonstrate significant growth in the fishery, based on 1-km long gill-nets set on darker

moon nights, largely operating from Nungwi in northern Unguja, Zanzibar. Estimates of stock are not available and stock status indicators available from the IOTC are not specific to Tanzania. Some species may comprise resident populations over the continental shelf of Tanzania (neritic species, accessible to small scale fishers, such as those from Nungwi).

However, the IOTC estimates that medium-sized pelagics (kawakawa, skipjack, kingfish) are moderately exploited; albacore is underexploited and bigeye and yellowfin tunas are not overfished. Most estimates are uncertain, but there appears to be considerable scope for fisheries development.

Tuna is a fast growing fish species with movements of schools throughout the western and northwestern Indian Ocean. Fish caught off Zanzibar tend to be small to moderate sized (5-10 kg), caught mostly from surface trolling or surface-set gillnets. Large individuals, from 20-40 kg are reportedly deeper in the water column, close to the thermocline at 70-100 m depths.

Research to support and/or improve the management of the fishery for tuna and tuna-like species, on spatial and temporal scales, is required and strongly recommended under recent SWIOfish studies (e.g. Groeneveld 2014). Representing both governments, the Deep Sea Fishing Authority (DSFA) has jurisdiction over fisheries issues in the EEZ (between 12 and 200 nm from the shore; mainly tunas and billfishes), whereas small scale (artisanal) fisheries for large /medium pelagics are managed by relevant ministries. These small-scale fisheries take place in territorial waters, up to 12 nm from the shore, and focus on neritic species.

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It is widely accepted that there is inadequate knowledge on both the fishery and the biology of the tuna fishery of Zanzibar and mainland Tanzania. In order to fill that gap, a series of investigations and interventions are needed. Similarly, the establishment of the DSFA is regarded as a major step forward in terms of management effectiveness of tuna and tuna-like species (e.g. Groeneveld 2014). They argue that though it is still in its infancy, it needs to be further empowered and full implementation supported.

Zan-L23: Fish farming research and cage trials on Pemba Island

The artisanal/small-scale fishery sector in Zanzibar supports a significant proportion of local livelihoods. In 2007, the Joint Frame Survey estimated that the activity provided full time employment for over 34,268 people with thousands more part time fishermen, yet the increased effort in fishing has not resulted in increases in fish catches per unit.

The pragmatic outlook on the fisheries sector on Zanzibar is that there is little room for expansion and the current and increasing pressure is damaging the productivity. Catches are unlikely to increase with more fishing effort. Some potential increase may be gained from improvements in efficiency and/or value-added in the small pelagic fishery and from coastal aquaculture.

According to de Graff (2014)'s SWIOfish study, mariculture in Zanzibar is limited and other than seaweed farming, encompasses only milk fish farming (ca. 5 ponds, 12 ha total area), with total production of about 8 tons/year. Indeed, while there have been several trials of different pond (and cage) culture attempts over the last thirty years, most remain in the experimental or pilot stage (see Mmochi et 2001).

The fisheries department of Zanzibar now has a dedicated mariculture unit, tasked with supporting expansion of this important yet under developed sector (other than for seaweed farming). The locally-based Institute of Marine Sciences (IMS) has over twenty years of experience with various small-scale pond and seaweed farming trials and demonstration projects, including those involving local communities. Experimenting with more commercial species and greater investment has not been attempted.

Mauritius has experimented with cage culture and produce 175 tonnes of high value from circular cages in 2008 (Lesperance, 2011). Other countries bordering the Indian Ocean have greater experience and production. For example, in Singapore there are 106 licensed coastal floating netcage fish farms. In 2013, the marine aquaculture industry produced 3,235 tonnes of food fish at a value of USD 11.4 million. The main species are grouper, seabass and snapper, as well as crabs, shrimp and mussels. The Barramundi Asia Farm and Nursery has a 2-hectare USD 3 million fish farm using European and Japanese sea cage fish farming technology.

Troell et al (2011) warn that aquaculture development in the WIO give due consideration to each of the three pillars of sustainability: a balanced understanding of the social, economic and environmental components of aquaculture, within an enabling governance framework.

The use of destructive fishing gears was ranked as the most severe threat, level 5, for Zanzibar as a whole, with fisheries decline ranked at level 4 for all five regions. The inadequate understanding of fisheries resources was similarly ranked at level 4 for Zanzibar as a whole, with conflicts arising from between local fishers and migrant fishers and between two neighbouring fishing communities over disagreements over gears ranked 4 and 3 respectively. The significance of the threats posed by fishers and by the decline in fisheries production per unit effort cannot be overstated.

It is widely accepted that there is inadequate development of fish farming in Zanzibar and on mainland Tanzania. In order to fill that gap, a series of investigations and interventions are needed. Pond culture trials have been the main focus to date, yet more recent initiative in the WIO region include cage culture of high value fish such as cobia and grouper in Mauritius. A characteristic of marine production in Africa has been production of high value species destined for international markets, or on species generating large biomass from low provide vital protein for local consumption but does generate livelihoods and needed incomes (Troell et al 2011). Such high value species if cultured on Zanzibar would be ideal for the tourism industry that demands quality fish for restaurants. These authors recommend, among others, that trials be considered for mangrove snappers and octopus, that the acceptability of freshwater pond farming of tilapia be tested, that cost-effective feeds for small-scale mariculture operations be developed.

The western shores of Pemba have deep waters that are sheltered from wave action with good water circulation due to the 4 m tidal range. These conditions are ideal for cage culture of high value finfish. The small pelagic fishery in the area offers the opportunity for feed provision and labour is available. The main elements that are lacking are a hatchery/laboratory, technology and expertise.

Screening

Mainland Tanzania Mitigation Matrix

ID	Mitigation Measure	Win/Win	Regret/No Regret	Flexible	Resilience	Urgency	Political Acceptability	Costs	Score
	Do Nothing	--- No wins. Sea levels will rise and cause losses if not addressed.	--- Adaptation measures take time - speeding up or alternatives are costly.	--- Not addressing planning requirements will render later solutions less flexible.	--- No resilience vis-à-vis sea level rise. No action will increase vulnerability.	0	--- Climate change adaptation is already on the political agenda including adaptation to sea level rise.	--- Not addressing potential impact of sea level rise on land uses will increase costs for adaptation at a later date.	
Tan-S01	Integrated Coastal Zone Management (ICZM) Institutional reform targeting sustainable management of coastal areas through improved coordination and integration	+++ ICZM is an important approach to addressing development pressure in coastal areas.	+++ No regret as ICZM addresses other development challenges than those imposed by climate change.	+++ ICZM is targeting better coordination between decision makers and integration of stakeholders lowering rigidity from traditional sector management.	+++ Coordinated management will enhance resilience.	+++ Urgent as institutional reforms take time.	++/- ICZM Committee has been established to develop policies. May meet some institutional resistance.	++/-	19+/05-
Tan-S02	Integrated Spatial Planning Updated structure, regional and local plans addressing vulnerability to climate change and sea level rise. Apply inclusive approach in the planning process.	+++ A prerequisite for development planning and control	+++ No regret as it is urgently required in complex management challenges in the coastal areas.	+ Flexibility incorporated if cyclic planning is adhered to.	+ Systematic and cyclic spatial planning can have resilient measures built in.	+++ Urgent to control the comprehensive development along the coast and to minimise sea level impacts on high life time investments.	+++/- Government has initiated the reviewing of the National Physical Development Plan of 1984. Adaptation measures (resettlement, relocation) may meet resistance.	+/-	15+/05-
Tan-S03	Shoreline Management Planning Land use policies at the shore based on systematic assessment of shoreline and near shore vulnerabilities.	+++ Shoreline management planning is required to address effects from the sea on shorelines and near shore coastal land.	+++ Shoreline management planning is required to address effects from the sea on shorelines and near shore coastal land.	+ Some flexibility in its provision of strategic options.	++ Shoreline management will enhance resilience by providing strategic options to spatial planning.	+++ Urgent to inform planning in general and land use planning in particular.	++/- Political awareness about requirements for shoreline planning. May meet institutional and private sector resistance.	+/-	15+/04-

ID	Mitigation Measure	Win/Win	Regret/No Regret	Flexible	Resilience	Urgency	Political Acceptability	Costs	Score
Tan-S04	Information Management National coordinated and shared information management system (IMS) using GIS for geo-referenced data. Enables analysis across different themes indispensable for coordinated mitigation responses.	+++ Access to updated and shared information system establishes common reference in all decision making.	+++ All management will benefit from structured updated information with or without climate change.	++ Structured and shared information management accommodates revisions/expansions more expediently.	++ Updated, expanded information base widens response.	+++ Urgent to inform a wide range of decision makers / planners in a situation with increasing development pressure.	++ / - - - There is an acknowledgement that information should be coordinated and shared. There may be opposition against rearranging information management. Clear policies for data exchange need to be established including cost recovery.	++ The information management system in itself not very costly. Its maintenance and continuous updating is costly, but not necessarily beyond existing information acquisition costs.	17+/03-
Tan-S05	Education in Primary and Secondary Schools Key to long term management of the complex challenges in coastal development. Vehicle for alleviating current pressure on vulnerable ecosystems and for sustainable environmental management.	+++ Strengthened education related to sustainable development and management will benefit across the board.	+++ Skills in holistic and integrated management beneficial important to address a wide variety of challenges associated with future development and management	++ Holistic appreciation of challenges in complex development management support flexible responses in management.	+++ A holistic understanding of complex management environments enhances response resilience.	++ Urgent to prepare future generations for the challenges emerging from current unsustainable management.	++ Political awareness about the importance of preparing future generations through education system exists.	+++/- Curriculum development, teacher training and production of training material is part of existing systems and processes within the education system. A rapid focused and particular effort is costly.	18+/01-
Tan-S06	Awareness Raising Key to engaging stakeholders in decision support and for conflict resolution	+++ Enhances access to stakeholder experience and concern in all decision making and facilitates decision implementation	++ All management will benefit from aware stakeholders	++ Informed stakeholders lowers rigidity thus enhancing flexibility	++ Informed and aware stakeholders provide more response resilience.	++ Urgent to involve stakeholders in identifying and addressing challenges in complex coastal areas under significant development pressure	++/- - - There is an acknowledgement of the importance of informed stakeholder participation in management decisions. May meet some political and institutional resistance.	++/- Comprehensive awareness raising programs costly. Effective awareness raising better achieved addressing concrete issues.	15+/04-

ID	Mitigation Measure	Win/Win	Regret/No Regret	Flexible	Resilience	Urgency	Political Acceptability	Costs	Score
Tan-S07	Integrated Legal Review Key to identifying gaps and overlaps and to make enforcement more cost-efficient	+++ Benefits other management requirements	++ No regret	+ Enhances flexibility	+ Enhances resilience	++ Urgent to streamline legal framework to catering for regulations and enforcement requirements in ares under considerable development pressure.	++/--- May meet some institutional and private sector resistance.	++/-- Review not costly. Implementation of reforms may be costly.	13+/-05
Tan-S08	Support for NEMC Key to improve coastal development options and enforcement	+++ Benefits other management requirements	++ No regret	+ Enhances flexibility	+ Enhances resilience	++ Urgent to control the comprehensive development in coastal zone and streamline enforcement requirements in ares under considerable development pressure.	++/--- May meet some institutional and private sector resistance.	++/-- Review not costly. Implementation of reforms may be costly.	13+/-05
Tan-S09	Support for Tourism Management Planning Key to guide development in sensitive coastal aeras such as Mafia, Kilwa and Pangani	+++ Benefits other management requirements	++ No regret	+ Enhances flexibility	+ Enhances resilience	++ Urgent to control tourism development in coastal districts and enforcement requirements in ares under considerable development pressure.	++/--- May meet some institutional and private sector resistance.	++/-- Review not costly. Implementation of reforms may be costly.	13+/-05
Tan-L01	Rehabilitation and clean-up of four east-flowing rivers, Mkinga District	+++ River basin management also addresses coastal pollution.	+++ No regret as IWRM addresses other development challenges than those imposed by climate change.	+++ IWRM is targeting better coordination between decision makers and integration of stakeholders lowering rigidity from traditional sector management	+++ Coordinated river basin management will enhance resilience.	+++ Urgent to control the comprehensive development along coastal district river basins.	+ +/ - - Political awareness about requirements for river basin management exists. May meet institutional and private sector resistance.	+ +/ - - Implementation of river rehabilitation over time may involve costly measures (protection, relocation). Delayed planning will increase costs.	19+/-04-

ID	Mitigation Measure	Win/Win	Regret/No Regret	Flexible	Resilience	Urgency	Political Acceptability	Costs	Score
Tan-L02	Rehabilitation and clean-up of Sigi and Mkulumzi rivers, Tanga and Muheza	+++ River basin management also addresses coastal pollution.	+++ No regret as IWRM addresses other development challenges than those imposed by climate change.	+++ IWRM is targeting better coordination between decision makers and integration of stakeholders lowering rigidity from traditional sector management	+++ Coordinated river basin management will enhance resilience.	+++ Urgent to control the comprehensive development along coastal district river basins.	+ +/ - - Political awareness about requirements for river basin management exists. May meet institutional and private sector resistance.	+ +/ - - Implementation of river rehabilitation over time may involve costly measures (protection, relocation). Delayed planning will increase costs.	19+/04-
Tan-L03	Rehabilitation and clean-up of lower Pangani River, Pangani and Muheza	+++ River basin management also addresses coastal pollution.	+++ No regret as IWRM addresses other development challenges than those imposed by climate change.	+++ IWRM is targeting better coordination between decision makers and integration of stakeholders lowering rigidity from traditional sector management	+++ Coordinated river basin management will enhance resilience.	+++ Urgent to control the comprehensive development along coastal district river basins.	+ +/ - - Political awareness about requirements for river basin management exists. May meet institutional and private sector resistance.	+ +/ - - Implementation of river rehabilitation over time may involve costly measures (protection, relocation). Delayed planning will increase costs.	19+/04-
Tan-L04	Safeguarding of the Wami River, Bagamoyo	+++ River basin management also addresses coastal pollution.	+++ No regret as IWRM addresses other development challenges than those imposed by climate change.	+++ IWRM is targeting better coordination between decision makers and integration of stakeholders lowering rigidity from traditional sector management	+++ Coordinated river basin management will enhance resilience.	+++ Urgent to control the comprehensive development along coastal district river basins.	+ +/ - - Political awareness about requirements for river basin management exists. May meet institutional and private sector resistance.	+ +/ - - Implementation of safeguarding plan over time likely not to involve costly measures (protection, relocation). Delayed planning will increase costs.	19+/03-
Tan-L05	Rehabilitation and clean-up of Ruvu River Basin, Bagamoyo	+++ River basin management also addresses coastal pollution.	+++ No regret as IWRM addresses other development challenges than those imposed by climate change.	+++ IWRM is targeting better coordination between decision makers and integration of stakeholders lowering rigidity from traditional sector management	+++ Coordinated river basin management will enhance resilience.	+++ Urgent to control the comprehensive development along coastal district river basins.	+ +/ - - Political awareness about requirements for river basin management exists. May meet institutional and private sector resistance.	+ +/ - - Implementation of river rehabilitation over time may involve costly measures (protection, relocation). Delayed planning will increase costs.	19+/04-

ID	Mitigation Measure	Win/Win	Regret/No Regret	Flexible	Resilience	Urgency	Political Acceptability	Costs	Score
Tan-L06	Rehabilitation and clean-up of Mkuza and Mpiji rivers, Kinondoni	+++ River basin management also addresses coastal pollution.	+++ No regret as IWRM addresses other development challenges than those imposed by climate change.	+++ IWRM is targeting better coordination between decision makers and integration of stakeholders lowering rigidity from traditional sector management	+++ Coordinated river basin management will enhance resilience.	+++ Urgent to control the comprehensive development along coastal district river basins.	+ +/ - - Political awareness about requirements for river basin management exists. May meet institutional and private sector resistance.	+ + / - - Implementation of river rehabilitation over time may involve costly measures (protection, relocation). Delayed planning will increase costs.	19+/04-
Tan-L07	Rehabilitation and clean-up of seven east-flowing rivers, Kinondoni	+++ River basin management also addresses coastal pollution.	+++ No regret as IWRM addresses other development challenges than those imposed by climate change.	+++ IWRM is targeting better coordination between decision makers and integration of stakeholders lowering rigidity from traditional sector management	+++ Coordinated river basin management will enhance resilience.	+++ Urgent to control the comprehensive development along coastal district river basins.	+ +/ - - Political awareness about requirements for river basin management exists. May meet institutional and private sector resistance.	+ + / - - Implementation of river rehabilitation over time may involve costly measures (protection, relocation). Delayed planning will increase costs.	19+/04-
Tan-L08	Rehabilitation and clean-up of Msimbazi River Basin, Ilala-Kinondoni	+++ River basin management also addresses coastal pollution.	+++ No regret as IWRM addresses other development challenges than those imposed by climate change.	+++ IWRM is targeting better coordination between decision makers and integration of stakeholders lowering rigidity from traditional sector management	+++ Coordinated river basin management will enhance resilience.	+++ Urgent to control the comprehensive development along coastal district river basins.	+ +/ - - Political awareness about requirements for river basin management exists. May meet institutional and private sector resistance.	+ + + / - - - Implementation of river rehabilitation over time may involve costly measures (protection, relocation). Delayed planning will increase costs.	20+/05-
Tan-L09	Rehabilitation and clean-up of Kizinga and Mzingira river basins, Ilala and Temeke districts	+++ River basin management also addresses coastal pollution.	+++ No regret as IWRM addresses other development challenges than those imposed by climate change.	+++ IWRM is targeting better coordination between decision makers and integration of stakeholders lowering rigidity from traditional sector management	+++ Coordinated river basin management will enhance resilience.	+++ Urgent to control the comprehensive development along coastal district river basins.	+ +/ - - Political awareness about requirements for river basin management exists. May meet institutional and private sector resistance.	+ + / - - Implementation of river rehabilitation over time may involve costly measures (protection, relocation). Delayed planning will increase costs.	19+/04-

ID	Mitigation Measure	Win/Win	Regret/No Regret	Flexible	Resilience	Urgency	Political Acceptability	Costs	Score
Tan-L10	Safeguarding Nguva River and other rivers in Temeke District	+++ River basin management also addresses coastal pollution.	+++ No regret as IWRM addresses other development challenges than those imposed by climate change.	+++ IWRM is targeting better coordination between decision makers and integration of stakeholders lowering rigidity from traditional sector management	+++ Coordinated river basin management will enhance resilience.	+++ Urgent to control the comprehensive development along coastal district river basins.	+ +/ - - Political awareness about requirements for river basin management exists. May meet institutional and private sector resistance.	+++ / - - Implementation of safeguarding plan over time likely not to involve costly measures (protection, relocation). Delayed planning will increase costs.	20+/03-
Tan-L11	Rehabilitation, clean-up and safeguarding the lower Rufiji and Mohoro rivers, Rufiji	+++ River basin management also addresses coastal pollution.	+++ No regret as IWRM addresses other development challenges than those imposed by climate change.	+++ IWRM is targeting better coordination between decision makers and integration of stakeholders lowering rigidity from traditional sector management	+++ Coordinated river basin management will enhance resilience.	+++ Urgent to control the comprehensive development along coastal district river basins.	+ +/ - - Political awareness about requirements for river basin management exists. May meet institutional and private sector resistance.	+++ / - - Implementation of safeguarding plan over time may involve costly measures (protection, relocation). Delayed planning will increase costs.	20+/04-
Tan-L12	Sewage treatment facility Tanga City	+++ Sewage management directly addresses coastal pollution, health and fisheries decline.	+++ No regret as addresses population growth and development challenges other than those imposed by climate change.	0 The need for sewage treatment will increase with time. New technology may improve performance.	+++ Integrated sewage system will enhance resilience.	+++ Urgent to reduce and manage all forms of coastal pollution.	+ +/ - - Political awareness about sewage and health exists. May meet institutional and private sector resistance.	+++ / - - - Implementation of sewage systems involve high costs (infrastructure, relocation). Delayed planning will increase costs.	17+/04-
Tan-L13	Sewage treatment facility Pangani Town	+++ Sewage management directly addresses coastal pollution, health and fisheries decline.	+++ No regret as addresses population growth and development challenges other than those imposed by climate change.	0 The need for sewage treatment will increase with time. New technology may improve performance.	+++ Integrated sewage system will enhance resilience.	+++ Urgent to reduce and manage all forms of coastal pollution.	+ +/ - - Political awareness about sewage and health exists. May meet institutional and private sector resistance.	+++ / - - - Implementation of sewage systems involve high costs (infrastructure, relocation). Delayed planning will increase costs.	17+/04-

ID	Mitigation Measure	Win/Win	Regret/No Regret	Flexible	Resilience	Urgency	Political Acceptability	Costs	Score
Tan-L14	Sewage treatment facility Bagamoyo Town	+++ Sewage management directly addresses coastal pollution, health and fisheries decline.	+++ No regret as addresses population growth and development challenges other than those imposed by climate change.	0 The need for sewage treatment will increase with time. New technology may improve performance.	+++ Integrated sewage system will enhance resilience.	+++ Urgent to reduce and manage all forms of coastal pollution.	++/- Political awareness about sewage and health exists. May meet institutional and private sector resistance.	+++/- - - Implementation of sewage systems involve high costs (infrastructure, relocation). Delayed planning will increase costs.	17+/04-
Tan-L15	Sewage treatment facility Kinondoni Municipality	+++ Sewage management directly addresses coastal pollution, health and fisheries decline.	+++ No regret as addresses population growth and development challenges other than those imposed by climate change.	0 The need for sewage treatment will increase with time. New technology may improve performance.	+++ Integrated sewage system will enhance resilience.	+++ Urgent to reduce and manage all forms of coastal pollution.	++/- Political awareness about sewage and health exists. May meet institutional and private sector resistance.	+++/- - - Implementation of sewage systems involve high costs (infrastructure, relocation). Delayed planning will increase costs.	17+/04-
Tan-L16	Sewage treatment facility Ilala Municipality	+++ Sewage management directly addresses coastal pollution, health and fisheries decline.	+++ No regret as addresses population growth and development challenges other than those imposed by climate change.	0 The need for sewage treatment will increase with time. New technology may improve performance.	+++ Integrated sewage system will enhance resilience.	+++ Urgent to reduce and manage all forms of coastal pollution.	++/- Political awareness about sewage and health exists. May meet institutional and private sector resistance.	+++/- - - Implementation of sewage systems involve high costs (infrastructure, relocation). Delayed planning will increase costs.	17+/04-
Tan-L17	Sewage treatment facility Temeke Municipality	+++ Sewage management directly addresses coastal pollution, health and fisheries decline.	+++ No regret as addresses population growth and development challenges other than those imposed by climate change.	0 The need for sewage treatment will increase with time. New technology may improve performance.	+++ Integrated sewage system will enhance resilience.	+++ Urgent to reduce and manage all forms of coastal pollution.	++/- Political awareness about sewage and health exists. May meet institutional and private sector resistance.	+++/- - - Implementation of sewage systems involve high costs (infrastructure, relocation). Delayed planning will increase costs.	17+/04-

ID	Mitigation Measure	Win/Win	Regret/No Regret	Flexible	Resilience	Urgency	Political Acceptability	Costs	Score
Tan-L18	Sewage treatment facility Kilindoni Town, Mafia	+++ Sewage management directly addresses coastal pollution, health and fisheries decline.	+++ No regret as addresses population growth and development challenges other than those imposed by climate change.	0 The need for sewage treatment will increase with time. New technology may improve performance.	+++ Integrated sewage system will enhance resilience.	+++ Urgent to reduce and manage all forms of coastal pollution.	++/- Political awareness about sewage and health exists. May meet institutional and private sector resistance.	+++/- Implementation of sewage systems involve moderate costs (infrastructure, relocation). Delayed planning will increase costs.	17+/02-
Tan-L19	Sewage treatment facility Kilwa Kivinje Town	+++ Sewage management directly addresses coastal pollution, health and fisheries decline.	+++ No regret as addresses population growth and development challenges other than those imposed by climate change.	0 The need for sewage treatment will increase with time. New technology may improve performance.	+++ Integrated sewage system will enhance resilience.	+++ Urgent to reduce and manage all forms of coastal pollution.	++/- Political awareness about sewage and health exists. May meet institutional and private sector resistance.	+++/- Implementation of sewage systems involve moderate costs (infrastructure, relocation). Delayed planning will increase costs.	17+/02-
Tan-L20	Sewage treatment facility Kilwa Masoko Town, Kilwa	+++ Sewage management directly addresses coastal pollution, health and fisheries decline.	+++ No regret as addresses population growth and development challenges other than those imposed by climate change.	0 The need for sewage treatment will increase with time. New technology may improve performance.	+++ Integrated sewage system will enhance resilience.	+++ Urgent to reduce and manage all forms of coastal pollution.	++/- Political awareness about sewage and health exists. May meet institutional and private sector resistance.	+++/- Implementation of sewage systems involve moderate costs (infrastructure, relocation). Delayed planning will increase costs.	17+/02-
Tan-L21	Sewage treatment facility Lindi Town, Lindi Urban	+++ Sewage management directly addresses coastal pollution, health and fisheries decline.	+++ No regret as addresses population growth and development challenges other than those imposed by climate change.	0 The need for sewage treatment will increase with time. New technology may improve performance.	+++ Integrated sewage system will enhance resilience.	+++ Urgent to reduce and manage all forms of coastal pollution.	++/- Political awareness about sewage and health exists. May meet institutional and private sector resistance.	+++/- Implementation of sewage systems involve high costs (infrastructure, relocation). Delayed planning will increase costs.	17+/03-

ID	Mitigation Measure	Win/Win	Regret/No Regret	Flexible	Resilience	Urgency	Political Acceptability	Costs	Score
Tan-L22	Sewage treatment facility Mikindani Town, Mtwara Urban	+++ Sewage management directly addresses coastal pollution, health and fisheries decline.	+++ No regret as addresses population growth and development challenges other than those imposed by climate change.	0 The need for sewage treatment will increase with time. New technology may improve performance.	+++ Integrated sewage system will enhance resilience.	+++ Urgent to reduce and manage all forms of coastal pollution.	++/- Political awareness about sewage and health exists. May meet institutional and private sector resistance.	+++/- Implementation of sewage systems involve high costs (infrastructure, relocation). Delayed planning will increase costs.	17+/03-
Tan-L23	Sewage treatment facility Mtwara Town, Mtwara Urban	+++ Sewage management directly addresses coastal pollution, health and fisheries decline.	+++ No regret as addresses population growth and development challenges other than those imposed by climate change.	0 The need for sewage treatment will increase with time. New technology may improve performance.	+++ Integrated sewage system will enhance resilience.	+++ Urgent to reduce and manage all forms of coastal pollution.	++/- Political awareness about sewage and health exists. May meet institutional and private sector resistance.	+++/- Implementation of sewage systems involve high costs (infrastructure, relocation). Delayed planning will increase costs.	17+/04-
Tan-L24	Safe toilet facilities for Bwejuu and Jibondo islands, Mafia District	+++ Sewage management directly addresses coastal pollution, health and fisheries decline.	+++ No regret as addresses population growth and development challenges other than those imposed by climate change.	0 The need for sewage treatment will increase with time. New technology may improve performance.	+++ Integrated sewage system will enhance resilience.	+++ Urgent to reduce and manage all forms of coastal pollution.	++/- Political awareness about sewage and health exists. May meet institutional and private sector resistance.	+++/- Implementation of sewage systems to scale involve low costs. Delayed planning will increase costs.	17+/02-
Tan-L25	Urban solid waste collection and processing facility Tanga City	+++ Solid waste management directly addresses coastal pollution and health.	+++ No regret as addresses population growth and development challenges other than those imposed by climate change.	0 The need for solid waste treatment will increase with time. New technology may improve performance.	+++ Integrated solid waste system will enhance resilience.	+++ Urgent to reduce and manage all forms of coastal pollution.	++/- Political awareness about solid waste and health exists. May meet institutional and private sector resistance.	+++/- Implementation of solid waste systems involve low costs. Delayed planning will increase costs.	17+/02-
Tan-L26	Urban solid waste collection and processing facility Pangani town	+++ Solid waste management directly addresses coastal pollution and health.	+++ No regret as addresses population growth and development challenges other than those imposed by climate change.	0 The need for solid waste treatment will increase with time. New technology may improve performance.	+++ Integrated solid waste system will enhance resilience.	+++ Urgent to reduce and manage all forms of coastal pollution.	++/- Political awareness about solid waste and health exists. May meet institutional and private sector resistance.	+++/- Implementation of solid waste systems involve low costs. Delayed planning will increase costs.	17+/02-

ID	Mitigation Measure	Win/Win	Regret/No Regret	Flexible	Resilience	Urgency	Political Acceptability	Costs	Score
Tan-L27	Urban solid waste collection and processing facility Bagamoyo town	+++ Solid waste management directly addresses coastal pollution and health.	+++ No regret as addresses population growth and development challenges other than those imposed by climate change.	0 The need for solid waste treatment will increase with time. New technology may improve performance.	+++ Integrated solid waste system will enhance resilience.	+++ Urgent to reduce and manage all forms of coastal pollution.	++/- Political awareness about solid waste and health exists. May meet institutional and private sector resistance.	+++/- Implementation of solid waste systems involve low/moderate costs (infrastructure, relocation). Delayed planning will increase costs.	17+/02-
Tan-L28	Urban solid waste collection and processing facility Kinondoni	+++ Solid waste management directly addresses coastal pollution and health.	+++ No regret as addresses population growth and development challenges other than those imposed by climate change.	0 The need for solid waste treatment will increase with time. New technology may improve performance.	+++ Integrated solid waste system will enhance resilience.	+++ Urgent to reduce and manage all forms of coastal pollution.	++/- Political awareness about solid waste and health exists. May meet institutional and private sector resistance.	+++/- Implementation of solid low systems involve low/moderate costs (infrastructure, relocation). Delayed planning will increase costs.	17+/02-
Tan-L29	Urban solid waste collection and processing facility Ilala	+++ Solid waste management directly addresses coastal pollution and health.	+++ No regret as addresses population growth and development challenges other than those imposed by climate change.	0 The need for solid waste treatment will increase with time. New technology may improve performance.	+++ Integrated solid waste system will enhance resilience.	+++ Urgent to reduce and manage all forms of coastal pollution.	++/- Political awareness about solid waste and health exists. May meet institutional and private sector resistance.	+++/- Implementation of solid waste systems involve low/moderate costs (infrastructure, relocation). Delayed planning will increase costs.	17+/02-
Tan-L30	Urban solid waste collection and processing facility Temeke	+++ Solid waste management directly addresses coastal pollution and health.	+++ No regret as addresses population growth and development challenges other than those imposed by climate change.	0 The need for solid waste treatment will increase with time. New technology may improve performance.	+++ Integrated solid waste system will enhance resilience.	+++ Urgent to reduce and manage all forms of coastal pollution.	++/- Political awareness about solid waste and health exists. May meet institutional and private sector resistance.	+++/- Implementation of solid waste systems involve low/moderate costs (infrastructure, relocation). Delayed planning will increase costs.	17+/02-

ID	Mitigation Measure	Win/Win	Regret/No Regret	Flexible	Resilience	Urgency	Political Acceptability	Costs	Score
Tan-L31	Urban solid waste collection and processing facility Kilindoni, Mafia	+++ Solid waste management directly addresses coastal pollution and health.	+++ No regret as addresses population growth and development challenges other than those imposed by climate change.	0 The need for solid waste treatment will increase with time. New technology may improve performance.	+++ Integrated solid waste system will enhance resilience.	+++ Urgent to reduce and manage all forms of coastal pollution.	++/- Political awareness about solid waste and health exists. May meet institutional and private sector resistance.	+++/- Implementation of solid waste systems involve low costs. Delayed planning will increase costs.	17+/02-
Tan-L32	Urban solid waste collection and processing facility Kilwa Kivinje, Kilwa	+++ Solid waste management directly addresses coastal pollution and health.	+++ No regret as addresses population growth and development challenges other than those imposed by climate change.	0 The need for solid waste treatment will increase with time. New technology may improve performance.	+++ Integrated solid waste system will enhance resilience.	+++ Urgent to reduce and manage all forms of coastal pollution.	++/- Political awareness about solid waste and health exists. May meet institutional and private sector resistance.	+++/- Implementation of solid waste systems involve low costs. Delayed planning will increase costs.	17+/02-
Tan-L33	Urban solid waste collection and processing facility Kilwa Masoko, Kilwa	+++ Solid waste management directly addresses coastal pollution and health.	+++ No regret as addresses population growth and development challenges other than those imposed by climate change.	0 The need for solid waste treatment will increase with time. New technology may improve performance.	+++ Integrated solid waste system will enhance resilience.	+++ Urgent to reduce and manage all forms of coastal pollution.	++/- Political awareness about solid waste and health exists. May meet institutional and private sector resistance.	+++/- Implementation of solid waste systems involve low costs. Delayed planning will increase costs.	17+/02-
Tan-L34	Urban solid waste collection and processing facility Lindi town, Lindi urban	+++ Solid waste management directly addresses coastal pollution and health.	+++ No regret as addresses population growth and development challenges other than those imposed by climate change.	0 The need for solid waste treatment will increase with time. New technology may improve performance.	+++ Integrated solid waste system will enhance resilience.	+++ Urgent to reduce and manage all forms of coastal pollution.	++/- Political awareness about solid waste and health exists. May meet institutional and private sector resistance.	+++/- Implementation of solid waste systems involve low/moderate costs (infrastructure, relocation). Delayed planning will increase costs.	17+/02-
Tan-L35	Urban solid waste collection and processing facility Mikindani/Mtwara, Mtwara Urban	+++ Solid waste management directly addresses coastal pollution and health.	+++ No regret as addresses population growth and development challenges other than those imposed by climate change.	0 The need for solid waste treatment will increase with time. New technology may improve performance.	+++ Integrated solid waste system will enhance resilience.	+++ Urgent to reduce and manage all forms of coastal pollution.	++/- Political awareness about solid waste and health exists. May meet institutional and private sector resistance.	+++/- Implementation of solid waste systems involve low/moderate costs (infrastructure, relocation). Delayed planning will increase costs.	17+/02-

ID	Mitigation Measure	Win/Win	Regret/No Regret	Flexible	Resilience	Urgency	Political Acceptability	Costs	Score
Tan-L36	Study, review, design and trial freshwater supply options for Tanga City	+++ Freshwater supply directly addresses coastal livelihoods, environment and economy.	+++ No regret as addresses population growth and development challenges other than those imposed by climate change.	0 The need for freshwater will increase with time. New technology will improve supply.	+++ Reliable freshwater supply will enhance resilience.	+++ Urgent to sustain development.	+++/- Strong political awareness about freshwater needs. May meet institutional and private sector resistance.	+++/- Study and design involve low costs. Implementation may be costly. Delayed planning may increase costs.	18+/02-
Tan-L37	Study, review, design and trial freshwater supply Lindi Town, Lindi Urban and Rural	+++ Freshwater supply directly addresses coastal livelihoods, environment and economy.	+++ No regret as addresses population growth and development challenges other than those imposed by climate change.	0 The need for freshwater will increase with time. New technology will improve supply.	+++ Reliable freshwater supply will enhance resilience.	+++ Urgent to sustain development.	+++/- Strong political awareness about freshwater needs. May meet institutional and private sector resistance.	+++/- Study and design involve low costs. Implementation may be costly. Delayed planning may increase costs.	18+/02-
Tan-L38	Study, review, design and trial freshwater supply options for outlying small islands in the Mafia Island Marine Park, Mafia	+++ Freshwater supply directly addresses coastal livelihoods, environment and economy.	+++ No regret as addresses population growth and development challenges other than those imposed by climate change.	0 The need for freshwater will increase with time. New technology will improve supply.	+++ Reliable freshwater supply will enhance resilience.	+++ Urgent to sustain development.	+++/- Strong political awareness about freshwater needs. May meet institutional and private sector resistance.	+++/- Study and design involve low costs. Implementation may be costly. Delayed planning may increase costs.	18+/02-
Tan-L39	Study, review, design and trial freshwater supply options for outlying villages in Mnazi Bay Ruvuma Estuary Marine Park, Mtwara Rural	+++ Freshwater supply directly addresses coastal livelihoods, environment and economy.	+++ No regret as addresses population growth and development challenges other than those imposed by climate change.	0 The need for freshwater will increase with time. New technology will improve supply.	+++ Reliable freshwater supply will enhance resilience.	+++ Urgent to sustain development.	+++/- Strong political awareness about freshwater needs. May meet institutional and private sector resistance.	+++/- Study and design involve low costs. Implementation may be costly. Delayed planning may increase costs.	18+/02-
Tan-L40	Fisheries sector review by fishery types and management areas	+++ Improved fisheries management directly addresses coastal livelihoods and environment.	+++ No regret as addresses population growth and development challenges other than those imposed by climate change.	0 The need for seafood will increase with time. New technology will improve supply.	+++ Managed fisheries will enhance resilience.	+++ Urgent to sustain development and reduce degradation.	+/- Some political awareness about marine fisheries needs. May meet institutional resistance.	+++/- Review and changes involve low costs.	16+/02-

ID	Mitigation Measure	Win/Win	Regret/No Regret	Flexible	Resilience	Urgency	Political Acceptability	Costs	Score
Tan-L41	Small pelagic fisheries support programme for mainland Tanzania	+++ Improved fisheries management directly addresses coastal livelihoods and environment.	+++ No regret as addresses population growth and development challenges other than those imposed by climate change.	0 The need for seafood will increase with time. New technology will improve supply.	+++ Managed fisheries will enhance resilience.	+++ Urgent to sustain development and reduce degradation.	+ / - Some political awareness about marine fisheries needs. May meet institutional resistance.	+++ / - Research and trials involve low costs.	16+/02-
Tan-L42	Support for mainland fisheries monitoring, control and surveillance programme	+++ Improved fisheries management directly addresses coastal livelihoods and environment.	+++ No regret as addresses population growth and development challenges other than those imposed by climate change.	0 The need for seafood will increase with time. New technology will improve supply.	+++ Managed fisheries will enhance resilience.	+++ Urgent to sustain development and reduce degradation.	+ / - Some political awareness about marine fisheries needs. May meet institutional resistance.	+++ / - Review and changes involve low costs.	16+/02-
Tan-L43	Support MCS to end blast fishing in Tanzania	+++ Improved fisheries management directly addresses coastal livelihoods and environment.	+++ No regret as addresses population growth and development challenges other than those imposed by climate change.	0 The need for seafood will increase with time.	+++ Managed fisheries will enhance resilience.	+++ Urgent to reduce degradation.	+ / - Some political awareness about marine fisheries needs. May meet institutional and private sector resistance.	+++ / - Review and changes involve low costs.	16+/02-
Tan-L44	Strengthening the management of octopus fisheries on mainland Tanzania	+++ Improved fisheries management directly addresses coastal livelihoods and environment.	+++ No regret as addresses population growth and development challenges other than those imposed by climate change.	0 The need for seafood will increase with time. New technology will improve supply.	+++ Managed fisheries will enhance resilience.	+++ Urgent to sustain development and reduce degradation.	+ / - Some political awareness about marine fisheries needs. May meet institutional resistance.	+++ / - Research and trials involve low costs.	16+/02-
Tan-L45	Strengthening the seaweed farming industry on mainland Tanzania	+++ Improved seaweed farming directly addresses coastal livelihoods and environment.	+++ No regret as addresses population growth and development challenges other than those imposed by climate change.	0 The need for coastal incomes will increase with time. New technology will improve supply.	+++ Managed seaweed farming will enhance resilience.	+++ Urgent to sustain development.	+ / - Political awareness about seaweed farming. May meet institutional resistance.	+++ / - Research and trials involve low costs.	16+/02-

ID	Mitigation Measure	Win/Win	Regret/No Regret	Flexible	Resilience	Urgency	Political Acceptability	Costs	Score
Tan-L46	Tuna fisheries support programme for Mtwara and Lindi Regions	+++ Improved fisheries management directly addresses coastal livelihoods and environment.	+++ No regret as addresses population growth and development challenges other than those imposed by climate change.	0 The need for seafood will increase with time. New technology will improve supply.	+++ Managed fisheries will enhance resilience.	+++ Urgent to sustain development and reduce degradation.	+ / - Some political awareness about marine fisheries needs. May meet institutional resistance.	+++ / - Research and trials involve low costs.	16+/02-
Tan-L47	Prawn fisheries support programme for Rufiji District	+++ Improved fisheries management directly addresses coastal livelihoods and environment.	+++ No regret as addresses population growth and development challenges other than those imposed by climate change.	0 The need for seafood will increase with time. New technology will improve supply.	+++ Managed fisheries will enhance resilience.	+++ Urgent to sustain development and reduce degradation.	+ / - Some political awareness about marine fisheries needs. May meet institutional resistance.	+++ / - Research and trials involve low costs.	16+/02-
Tan-L48	Fish farming research and cage trials in Tanga and Kilwa	+++ Improved fisheries management directly addresses coastal livelihoods and environment.	+++ No regret as addresses population growth and development challenges other than those imposed by climate change.	0 The need for seafood will increase with time. New technology will improve supply.	+++ Managed fisheries will enhance resilience.	+++ Urgent to sustain development and reduce degradation.	+ / - Some political awareness about marine fisheries needs. May meet institutional resistance.	+++ / - Research and trials involve low costs.	16+/02-
Tan-L49	Beach erosion study for coastal Tanzania mainland	+++ Coastal erosion fundamentally supports coastal development.	+++ No regret as condition currently needs attention, likely worsened by climate change.	++ Present conditions require attention. New information may improve management.	+++ Informed and coordinate shoreline management will enhance resilience.	++ Urgent in many locations. Likely to worsen.	+ + / - - Political awareness about coastal erosion exists. May meet institutional and private sector resistance.	+++ / - Research involves low costs. Implementation likely to involve costly measures (protection, relocation). Delayed action will increase costs.	18+/03-
Tan-L50	Kilwa Kisiwani WH Site, Kilwa	+++ Coastal erosion fundamentally supports coastal development.	+++ No regret as condition currently needs attention, likely worsened by climate change.	++ Present conditions require attention. New information may improve management.	+++ Informed and coordinate shoreline management will enhance resilience.	++ Urgent at location.	++ Political awareness about coastal erosion exists.	+++ / - Research involves low costs. Implementation likely to involve costly measures (protection, relocation). Delayed action will increase costs.	18+/01-

ID	Mitigation Measure	Win/Win	Regret/No Regret	Flexible	Resilience	Urgency	Political Acceptability	Costs	Score
Tan-L51	Waste oil treatment facility, DSM Harbour, Tanga Harbour, Kilindoni Harbour (Mafia), Mtwara harbour	+++ Waste oil management directly addresses coastal pollution and environment.	+++ No regret as addresses development challenges other than those imposed by climate change.	0 The need for waste oil treatment will increase with time. New technology may improve performance.	0 Waste oil system has little bearing on resilience.	+++ Urgent to reduce and manage all forms of coastal pollution.	+ / - Political awareness about waste exists.	+ + / - Implementation of waste oil systems involve moderate costs. Delayed planning will increase costs.	13+/02-
Tan-L52	Turtle and nesting beach protection, Pangani	+ Secured turtle populations and nesting contributes to awareness and ecosystem	+++ No regret as condition currently needs attention, likely worsened by climate change.	++ Present conditions require attention. New information may improve management.	+++ Informed and coordinate turtle management will enhance resilience.	++ Urgent in certain locations. Likely to worsen.	+ / - Some political awareness of turtles exists.	+++ Research, monitoring and awareness involve low costs. Implementation also low cost. Delayed action will increase costs.	15+/01-
Tan-L53	Bagamoyo town planning, Bagamoyo	+++ Town planning is required to address effects from the sea on shorelines and near shore coastal land.	+++ Town planning is required to address effects from the sea on shorelines and near shore coastal land.	+ Some flexibility in its provision of strategic options.	++ Town planning will enhance resilience.	+++ Urgent to address rapid growth.	+ + / - - Political awareness about requirements for town planning. May meet institutional and private sector resistance.	+ / - - Costly to systematically assess vulnerability throughout the coast (studies and modelling). The plan itself not so costly.	15+/04-
Tan-L54	Mangrove rehabilitation around Bagamoyo Town, Bagamoyo	+++ Mangrove health fundamentally supports coastal resources and health.	+++ No regret as condition currently needs attention, likely worsened by climate change.	++ Present conditions require attention. New information may improve management.	+++ Safeguarded mangrove management will enhance resilience.	+++ Urgent to address rapid growth. Likely to worsen.	+ + / - - Low political awareness about coastal habitats exists.	+++ / - Research involves low costs and implementation likely to involve low cost. Delayed action will increase costs.	19+/03-

Zanzibar Mitigation Matrix

ID	Mitigation Measure	Win/Win	Regret/No Regret	Flexible	Resilience	Urgency	Political Acceptability	Costs	Score
	Do Nothing	--- No wins. Sea levels will rise and cause losses if not addressed.	--- Adaptation measures take time - speeding up or alternatives are costly.	--- Not addressing planning requirements will render later solutions less flexible.	--- No resilience vis-à-vis sea level rise. No action will increase vulnerability.	0	--- Climate change adaptation is already on the political agenda including adaptation to sea level rise.	--- Not addressing potential impact of sea level rise on land uses will increase costs for adaptation at a later date.	
Zan-S01	Integrated Coastal Zone Management (ICZM) Institutional reform targeting sustainable management of coastal areas through improved coordination and integration	+++ ICZM is an important approach to addressing development pressure in coastal areas.	+++ No regret as ICZM addresses other development challenges than those imposed by climate change.	+++ ICZM is targeting better coordination between decision makers and integration of stakeholders lowering rigidity from traditional sector management.	+++ Coordinated management will enhance resilience.	+++ Urgent as institutional reforms take time.	++/- - - ICZM Committee has been established to develop policies. May meet some institutional resistance.	++/- - - Low costs to plan for institutional reforms. Reform processes may be costly.	19+/05-
Zan-S02	Integrated Spatial Planning Updated structure, regional and local plans addressing vulnerability to climate change and sea level rise. Apply inclusive approach in the planning process.	+++ A prerequisite for development planning and control	+++ No regret as it is urgently required in complex management challenges in the coastal areas.	+ Flexibility incorporated if cyclic planning is adhered to.	+ Systematic and cyclic spatial planning can have resilient measures built in.	+++ Urgent to control the comprehensive development along the coast and to minimise sea level impacts on high life time investments.	+++/- - - Government has initiated the reviewing of the National Physical Development Plan of 1984. Adaptation measures (resettlement, relocation) may meet resistance.	+/- - - Implementation of updated plan over time may involve costly measures (protection, relocation). Delayed planning will increase costs.	15+/05-
Zan-S03	Shoreline Management Planning Land use policies at the shore based on systematic assessment of shoreline and near shore vulnerabilities.	+++ Shoreline management planning is required to address effects from the sea on shorelines and near shore coastal land.	+++ Shoreline management planning is required to address effects from the sea on shorelines and near shore coastal land.	+ Some flexibility in its provision of strategic options.	++ Shoreline management will enhance resilience by providing strategic options to spatial planning.	+++ Urgent to inform planning in general and land use planning in particular.	++/- - - Political awareness about requirements for shoreline planning. May meet institutional and private sector resistance.	+/- - - Costly to systematically assess vulnerability throughout the coast (studies and modelling). The plan itself not so costly.	15+/04-

ID	Mitigation Measure	Win/Win	Regret/No Regret	Flexible	Resilience	Urgency	Political Acceptability	Costs	Score
Zan-S04	Information Management National coordinated and shared information management system (IMS) using GIS for geo-referenced data. Enables analysis across different themes indispensable for coordinated adaptation responses.	+++ Access to updated and shared information system establishes common reference in all decision making.	+++ All management will benefit from structured updated information with or without climate change.	++ Structured and shared information management accommodates revisions/expansions more expediently.	++ Updated, expanded information base widens response.	+++ Urgent to inform a wide range of decision makers / planners.	++ / --- There is an acknowledgement that information should be coordinated and shared. There may be opposition against rearranging information management. Clear policies for data exchange need to be established including cost recovery.	++ The information management system in itself not very costly. Its maintenance and continuous updating is costly, but not necessarily beyond existing information acquisition costs.	17+/03-
Zan-S05	Education in Primary and Secondary Schools Key to long term management of the complex challenges in coastal development. Vehicle for alleviating current pressure on vulnerable ecosystems and for sustainable environmental management.	+++ Strengthened education related to sustainable development and management will benefit across the board.	+++ Skills in holistic and integrated management beneficial important to address a wide variety of challenges associated with future development and management	++ Holistic appreciation of challenges in complex development management support flexible responses in management.	+++ A holistic understanding of complex management environments enhances response resilience.	++ Urgent to prepare future generations for the challenges emerging from current unsustainable management.	++ Political awareness about the importance of preparing future generations through education system exists.	+++ / -- Curriculum development, teacher training and production of training material is part of existing systems and processes within the education system. A rapid focused and particular effort is costly.	18+/01-
Zan-S06	Awareness Raising Key to engaging stakeholders in decision support and for conflict resolution	+++ Enhances access to stakeholder experience and concern in all decision making and facilitates decision implementation	++ All management will benefit from aware stakeholders	++ Informed stakeholders lowers rigidity thus enhancing flexibility	++ Informed and aware stakeholders provide more response resilience.	++ Urgent to involve stakeholders in identifying and addressing challenges in complex coastal areas under significant development pressure	++ / --- There is an acknowledgement of the importance of informed stakeholder participation in management decisions. May meet some political and institutional resistance.	++ / - Comprehensive awareness raising programs costly. Effective awareness raising better achieved addressing concrete issues.	15+/04-

ID	Mitigation Measure	Win/Win	Regret/No Regret	Flexible	Resilience	Urgency	Political Acceptability	Costs	Score
Zan-S07	Integrated Legal Review Key to identifying gaps and overlaps and to make enforcement more cost-efficient	+++ Benefits other management requirements	++ No regret	+ Enhances flexibility	+ Enhances resilience	++ Urgent to streamline legal framework to catering 91for regulations and enforcement requirements in ares under considerable development pressure.	++/-- May meet some institutional and private sector resistance.	++/-- Review not costly. Implementation of reforms may be costly.	
Zan-L01	Rehabilitation and clean-up of five west-flowing streams in Unguja Urban and West Region (North of Stone Town)	+++ River basin management also addresses coastal pollution.	+++ No regret as IWRM addresses other development challenges than those imposed by climate change.	+++ IWRM is targeting better coordination between decision makers and integration of stakeholders lowering rigidity from traditional sector management	+++ Coordinated river basin management will enhance resilience.	+++ Urgent to control the comprehensive development along coastal district river basins.	++/- - Political awareness about requirements for river basin management exists. May meet institutional and private sector resistance.	++ / - - Implementation of river rehabilitation over time may involve costly measures (protection, relocation). Delayed planning will increase costs.	19+/04-
Zan-L02	Rehabilitation and clean-up of three northwest-flowing streams in Unguja Urban and West Region (close to Mohanda)	+++ River basin management also addresses coastal pollution.	+++ No regret as IWRM addresses other development challenges than those imposed by climate change.	+++ IWRM is targeting better coordination between decision makers and integration of stakeholders lowering rigidity from traditional sector management	+++ Coordinated river basin management will enhance resilience.	+++ Urgent to control the comprehensive development along coastal district river basins.	++/- - Political awareness about requirements for river basin management exists. May meet institutional and private sector resistance.	++ / - - Implementation of river rehabilitation over time may involve costly measures (protection, relocation). Delayed planning will increase costs.	19+/04-
Zan-L03	Beach erosion study for Zanzibar (Pemba and Unguja)	+++ Coastal erosion fundamentally supports coastal development.	+++ No regret as condition currently needs attention, likely worsened by climate change.	++ Present conditions require attention. New information may improve management.	+++ Informed and coordinate shoreline management will enhance resilience.	++ Urgent in many locations.	++/- - Political awareness about coastal erosion exists. May meet institutional and private sector resistance.	+++ / - Research involves low costs. Implementation likely to involve costly measures (protection, relocation). Delayed action will increase costs.	18+/03-

ID	Mitigation Measure	Win/Win	Regret/No Regret	Flexible	Resilience	Urgency	Political Acceptability	Costs	Score
Zan-L04	Sewage collection and treatment facilities for Stone Town, Unguja West and Urban	+++ Sewage management directly addresses coastal pollution, health and fisheries decline.	+++ No regret as addresses population growth and development challenges other than those imposed by climate change.	0 The need for sewage treatment will increase with time. New technology may improve performance.	+++ Integrated sewage system will enhance resilience.	+++ Urgent to reduce and manage all forms of coastal pollution.	++/- Political awareness about sewage and health exists. May meet institutional and private sector resistance.	+++/- - - Implementation of sewage systems involve high costs (infrastructure, relocation). Delayed planning will increase costs.	17+/04-
Zan-L05	Sewage collection and treatment facilities for the Zanzibar Town periphery	+++ Sewage management directly addresses coastal pollution, health and fisheries decline.	+++ No regret as addresses population growth and development challenges other than those imposed by climate change.	0 The need for sewage treatment will increase with time. New technology may improve performance.	+++ Integrated sewage system will enhance resilience.	+++ Urgent to reduce and manage all forms of coastal pollution.	++/- Political awareness about sewage and health exists. May meet institutional and private sector resistance.	+++/- - - Implementation of sewage systems involve high costs (infrastructure, relocation). Delayed planning will increase costs.	17+/04-
Zan-L06	Sewage collection and treatment facility at Nungwi Village and hotel areas, Unguja	+++ Sewage management directly addresses coastal pollution, health and fisheries decline.	+++ No regret as addresses population growth and development challenges other than those imposed by climate change.	0 The need for sewage treatment will increase with time. New technology may improve performance.	+++ Integrated sewage system will enhance resilience.	+++ Urgent to reduce and manage all forms of coastal pollution.	++/- Political awareness about sewage and health exists. May meet institutional and private sector resistance.	+++/- - - Implementation of sewage systems involve high costs (infrastructure, relocation). Delayed planning will increase costs.	17+/04-
Zan-L07	Sewage collection and treatment facility at Mkoani	+++ Sewage management directly addresses coastal pollution, health and fisheries decline.	+++ No regret as addresses population growth and development challenges other than those imposed by climate change.	0 The need for sewage treatment will increase with time. New technology may improve performance.	+++ Integrated sewage system will enhance resilience.	+++ Urgent to reduce and manage all forms of coastal pollution.	++/- Political awareness about sewage and health exists. May meet institutional and private sector resistance.	+++/- - - Implementation of sewage systems involve high costs (infrastructure, relocation). Delayed planning will increase costs.	17+/04-

ID	Mitigation Measure	Win/Win	Regret/No Regret	Flexible	Resilience	Urgency	Political Acceptability	Costs	Score
Zan-L08	Sewage collection and treatment facility at Chake Chake	+++ Sewage management directly addresses coastal pollution, health and fisheries decline.	+++ No regret as addresses population growth and development challenges other than those imposed by climate change.	0 The need for sewage treatment will increase with time. New technology may improve performance.	+++ Integrated sewage system will enhance resilience.	+++ Urgent to reduce and manage all forms of coastal pollution.	++/- Political awareness about sewage and health exists. May meet institutional and private sector resistance.	+++/- - - Implementation of sewage systems involve high costs (infrastructure, relocation). Delayed planning will increase costs.	17+/04-
Zan-L09	Professional Tourism Training Centre for Zanzibar	+++ Professional training/ capacity building directly addresses coastal livelihoods.	+++ No regret as addresses development challenges other than those imposed by climate change.	0 The need for qualified personnel in tourism sector exists and will increase with time.	++ Qualified locals improves livelihood resilience.	+++ Urgent to improve lost opportunities to locals in the sector.	++/- Political awareness about shortcomings of local stakeholders exists.	++ Training facilities involve moderate costs.	15+/01-
Zan-L10	Regional solid waste collection and processing facility, Pemba North	+++ Solid waste management directly addresses coastal pollution and health.	+++ No regret as addresses population growth and development challenges other than those imposed by climate change.	0 The need for solid waste treatment will increase with time. New technology may improve performance.	+++ Integrated solid waste system will enhance resilience.	+++ Urgent to reduce and manage all forms of coastal pollution.	++/- Political awareness about solid waste and health exists. May meet institutional and private sector resistance.	+++/- Implementation of solid waste systems involve low costs. Delayed planning will increase costs.	17+/02-
Zan-L11	Regional solid waste collection and processing facility, Pemba South	+++ Solid waste management directly addresses coastal pollution and health.	+++ No regret as addresses population growth and development challenges other than those imposed by climate change.	0 The need for solid waste treatment will increase with time. New technology may improve performance.	+++ Integrated solid waste system will enhance resilience.	+++ Urgent to reduce and manage all forms of coastal pollution.	++/- Political awareness about solid waste and health exists. May meet institutional and private sector resistance.	+++/- Implementation of solid waste systems involve low costs. Delayed planning will increase costs.	17+/02-
Zan-L12	Regional solid waste collection and processing facility, Unguja North	+++ Solid waste management directly addresses coastal pollution and health.	+++ No regret as addresses population growth and development challenges other than those imposed by climate change.	0 The need for solid waste treatment will increase with time. New technology may improve performance.	+++ Integrated solid waste system will enhance resilience.	+++ Urgent to reduce and manage all forms of coastal pollution.	++/- Political awareness about solid waste and health exists. May meet institutional and private sector resistance.	+++/- Implementation of solid waste systems involve low costs. Delayed planning will increase costs.	17+/02-

ID	Mitigation Measure	Win/Win	Regret/No Regret	Flexible	Resilience	Urgency	Political Acceptability	Costs	Score
Zan-L13	Regional solid waste collection and processing facility, Unguja West & Urban	+++ Solid waste management directly addresses coastal pollution and health.	+++ No regret as addresses population growth and development challenges other than those imposed by climate change.	0 The need for solid waste treatment will increase with time. New technology may improve performance.	+++ Integrated solid waste system will enhance resilience.	+++ Urgent to reduce and manage all forms of coastal pollution.	++/- Political awareness about solid waste and health exists. May meet institutional and private sector resistance.	+++/- Implementation of solid waste systems involve low costs. Delayed planning will increase costs.	17+/02-
Zan-L14	Regional solid waste collection and processing facility, Unguja South	+++ Solid waste management directly addresses coastal pollution and health.	+++ No regret as addresses population growth and development challenges other than those imposed by climate change.	0 The need for solid waste treatment will increase with time. New technology may improve performance.	+++ Integrated solid waste system will enhance resilience.	+++ Urgent to reduce and manage all forms of coastal pollution.	++/- Political awareness about solid waste and health exists. May meet institutional and private sector resistance.	+++/- Implementation of solid waste systems involve low costs. Delayed planning will increase costs.	17+/02-
Zan-L15	Study, review and design of freshwater supply options for Pemba	+++ Freshwater supply directly addresses coastal livelihoods, environment and economy.	+++ No regret as addresses population growth and development challenges other than those imposed by climate change.	0 The need for freshwater will increase with time. New technology will improve supply.	+++ Reliable freshwater supply will enhance resilience.	+++ Urgent to sustain development.	+++/- Strong political awareness about freshwater needs. May meet institutional and private sector resistance.	+++/- Study and design involve low costs. Implementation may be costly. Delayed planning may increase costs.	18+/02-
Zan-L16	Study, review and design of freshwater supply options for Unguja	+++ Freshwater supply directly addresses coastal livelihoods, environment and economy.	+++ No regret as addresses population growth and development challenges other than those imposed by climate change.	0 The need for freshwater will increase with time. New technology will improve supply.	+++ Reliable freshwater supply will enhance resilience.	+++ Urgent to sustain development.	+++/- Strong political awareness about freshwater needs. May meet institutional and private sector resistance.	+++/- Study and design involve low costs. Implementation may be costly. Delayed planning may increase costs.	18+/02-
Zan-L17	Zanzibar fisheries sector review by fishery types and management areas	+++ Improved fisheries management directly addresses coastal livelihoods and environment.	+++ No regret as addresses population growth and development challenges other than those imposed by climate change.	0 The need for seafood will increase with time. New technology will improve supply.	+++ Managed fisheries will enhance resilience.	+++ Urgent to sustain development and reduce degradation.	+/- Some political awareness about marine fisheries needs. May meet institutional resistance.	+++/- Review and changes involve low costs.	16+/02-

ID	Mitigation Measure	Win/Win	Regret/No Regret	Flexible	Resilience	Urgency	Political Acceptability	Costs	Score
Zan-L18	Zanzibar small pelagic fisheries support on Zanzibar	+++ Improved fisheries management directly addresses coastal livelihoods and environment.	+++ No regret as addresses population growth and development challenges other than those imposed by climate change.	0 The need for seafood will increase with time. New technology will improve supply.	+++ Managed fisheries will enhance resilience.	+++ Urgent to sustain development and reduce degradation.	+ / - Some political awareness about marine fisheries needs. May meet institutional resistance.	+++ / - Research and trials involve low costs.	16+/02-
Zan-L19	Zanzibar fisheries MCS programme	+++ Improved fisheries management directly addresses coastal livelihoods and environment.	+++ No regret as addresses population growth and development challenges other than those imposed by climate change.	0 The need for seafood will increase with time. New technology will improve supply.	+++ Managed fisheries will enhance resilience.	+++ Urgent to sustain development and reduce degradation.	+ / - Some political awareness about marine fisheries needs. May meet institutional resistance.	+++ / - Review and changes involve low costs.	16+/02-
Zan-L20	Strengthening management of octopus fisheries on Zanzibar	+++ Improved fisheries management directly addresses coastal livelihoods and environment.	+++ No regret as addresses population growth and development challenges other than those imposed by climate change.	0 The need for seafood will increase with time. New technology will improve supply.	+++ Managed fisheries will enhance resilience.	+++ Urgent to sustain development and reduce degradation.	+ / - Some political awareness about marine fisheries needs. May meet institutional resistance.	+++ / - Research and trials involve low costs.	16+/02-
Zan-L21	Strengthening seaweed farming in Zanzibar	+++ Improved seaweed farming management directly addresses coastal livelihoods and environment.	+++ No regret as addresses population growth and development challenges other than those imposed by climate change.	0 The need for coastal incomes will increase with time. New technology will improve supply.	+++ Managed seaweed farming will enhance resilience.	+++ Urgent to sustain development and reduce degradation.	+ / - Some political awareness about seaweed farming needs. May meet institutional resistance.	+++ / - Research and trials involve low costs.	16+/02-
Zan-L22	Semi-industrial offshore tuna fisheries support programme	+++ Improved fisheries management directly addresses coastal livelihoods and environment.	+++ No regret as addresses population growth and development challenges other than those imposed by climate change.	0 The need for seafood will increase with time. New technology will improve supply.	+++ Managed fisheries will enhance resilience.	+++ Urgent to sustain development and reduce degradation.	+ / - Some political awareness about marine fisheries needs. May meet institutional resistance.	+++ / - Research and trials involve low costs.	16+/02-

ID	Mitigation Measure	Win/Win	Regret/No Regret	Flexible	Resilience	Urgency	Political Acceptability	Costs	Score
Zan-L23	Strengthening fish mariculture in Zanzibar	+++ Improved fisheries management directly addresses coastal livelihoods and environment.	+++ No regret as addresses population growth and development challenges other than those imposed by climate change.	0 The need for seafood will increase with time. New technology will improve supply.	+++ Managed fisheries will enhance resilience.	+++ Urgent to sustain development and reduce degradation.	+ / - Some political awareness about marine fisheries needs. May meet institutional resistance.	+++ / - Research and trials involve low costs.	16+/02-

Mainland Tanzania Themes

Coastal Fisheries

The fisheries sub-sector contributes between 1-3 % to GDP, based on direct fish value generation as well as exports, though much of this comes from Lake Victor Nile Perch fishery, with the coastal marine fisheries contributing only a small percentage.

Tanzania's marine resources are however critical to economic and social development in coastal communities, and underpin the households that rely on the sea for food and income. In addition to the 40,000 individuals who derive their living from fishing, to coastal communities, fishing is the primary source of protein and a crucial source of revenue in allied industries.



The main shallow demersal fishing grounds along the 1,340 km coastline of mainland Tanzania and associated islands lie within the 20 meter contour, an area of around 3,500 km² that includes mangroves, rocky tidal zones, coral reefs, sea grass beds, estuaries and intermediate habitats. Some deeper waters up to the 100 meter contour are also fished.

Multiple fishing gears are used in the demersal fishery, both traditional and modern.



The principal small pelagic fishing grounds are fished by large semi-industrial scale purse seine netting vessels, involving light attraction at night. The large pelagic species are fished within 5-10 km of the coast by a local fleet of 9-12 m boats, with large meshed gill nets. Prawns are trawled in shallow waters.

Catches have been static around 50,000 tons per year valued as of the order of 70 million USD. Despite an estimated potential as high as 100,000 tons per year, increased efforts has not lead to increased catches.

Pressure from over-fishing and use of destructive fishing methods have greatly undermined the marine ecology and caused changes in species compositions. There is little room for expanding fisheries and catches are unlikely to increase with more fishing effort. Some potential increase may be gained from deeper water operations and from improvements in efficiencies in the smaller pelagic fisheries. Aquaculture holds potential for further development.

Prioritized Threats

In Table 10 below the threats identified related to coastal fisheries have been listed and ranked according to their severity as established using the CRIAM method discussed extensively in Volumes I and II of the Coastal Profile. A rapid assessment has been made on the susceptibility of each threat to impacts of climate change more specifically, changes in whether patterns, extreme events, sea level rise, temperature rise and acidification.

Table 10: Prioritised threats related to coastal fisheries and a rapid assessment of threat susceptibility to climate change.

#	Threat as identified in Coastal Profile	Threat Level	Influence from Climate Change					
			Change in Patterns	Extreme events	Sea Level Rise	Temperature rise	Acidification	
M-Fish-03	Destructive and illegal fishing - causing decline in productivity due to habitat destruction through beach seine, spear guns and dragnets, and dynamite, adversely affecting the fisher community livelihoods.	Major Problem	0	-	0	0	0	Changes in climate are not expected to impact per se on the practise of destructive and illegal fisheries. Extreme weather events may in periods have a preventive effect.
M-Fish-10	Poor mangrove resource management - allowing over harvesting of mangrove and wetland or riverine trees leading to erosion and estuarine siltation.	Major Problem	++	++	+	0	0	Impact from unsuitable resource use practises will be exacerbated notable from extreme events (storms and surges), stress from changed weather patterns and from sea level rise.
M-Fish-11	Catchment deforestation in major basins - causing changes in river flows, leading to excessive run-off, flooding, erosion and siltation.	Major Problem	+++	++	0	0	0	The effects of deforestation in upstream catchments will be aggravated with higher frequency and intensity of extreme events.
M-Fish-04	Poor fishery resource management - allowing open access fishery, thus increasing fishing pressure and stock depletion is difficult to manage; leading to conflicts with tourists over coral reefs to dive and to snorkel, fish landing sites and tourist hotels; to seaweed farming conflict with boat users and tourists;	Very Important Problem	0	0	0	+	0	Climate change does not aggravate poor fishery resource management per se. Increase in temperatures may reduce productivity from coral reefs.
M-Fish-05	Poverty and lack of education - combine with absence of alternatives or investment, are all attributed as the causes for the current behaviour of fishers.	Very Important Problem	0	0	0	+	0	Climate change aggravate poverty to the extent fisheries stocks and thereby livelihood basis is reduced.
M-Fish-01	Social conflicts over fishing gears - where local fishers use gears or methods (some of which are illegal) that are not acceptable by neighbouring villages.	Very Important Problem	0	0	0	0	0	Climate change does impact on use of fishing gear. Reduced stocks may increase the impetus towards usage of illegal fishing gear to secure livelihood in the short term.
M-Fish-06	Pollution into catchments and the coastal zone - by dumping or leaching of domestic, urban, mining and industrial wastes, sewage, solids, agricultural pesticides into catchments or direct disposal in wetlands, draining to estuaries and coastal zone, affecting marine productivity.	Important Problem	++	++	0	0	0	More frequent and severe weather events may increase the leaching of pollutants into water resources and thereby exacerbate the levels reaching local ecosystems.
M-Fish-09	River damming - for reservoirs for domestic water, irrigation and/or hydro-electric power (HEP) changing sediment loads, affecting estuaries.	Problem	++	++	0	0	0	Changes in weather patterns will impact on river flows and sediment loads adding to the implications of management interference with such flows (damming).
M-Fish-07	Drainage changes - re-claiming areas for agriculture, to build roads, houses and cities or mosquito control, or diversion or inefficient use of water for irrigation, mining, industry, livestock or domestic and urban needs alters flows, changes estuarine sediment loads.	Problem	++	++	+	0	0	Changes in weather patterns will impact on river flows and drainage adding to the implications of land use changes.
M-Fish-08	Unsustainable mining - salt, sand, coral lime, fossil coral limestone, etc. mined with damage to physical properties of shorelines and river basins.	Problem		+	+	0	0	Increased sea levels and more frequent and severe weather events will exacerbate the impact on weakened shorelines from mining
M-Fish-02	Social conflicts over access to resource - where cultural and historical rivalry over "traditional" fishing grounds increases as pressure on the resource increases; also includes increasing resentment of migratory fishing groups of "dago" fishers during seasonal visits, using gears considered destructive or conflict with local traditions.	Light Problem	0	0	0	+	0	Climate change may exacerbate social conflicts to the extent that the capability of ecosystems to maintain fisheries stocks is weakened.
+++	Threat is severely aggravated from climate change dimension							
++	Threat is aggravated from climate change dimension							
+	Threat is slightly aggravated from climate change dimension							
0	No influence of threat from climate change dimension							
-	Remediating effect on threat from climate change dimension							

Recommendations for threat mitigation measures

Overall measures to mitigate each if the identified fisheries related threats to coastal local communities and ecosystems have been tabulated in Table 176 (page 333) arranged under broad management dimension headings. Table 11 below provides an overview of the requirements/opportunities expressed within each of these management or intervention dimensions.

Table 11: Broad management intervention dimensions to address identified and prioritised threats to coastal communities and ecosystems associated with fisheries in Mainland Tanzania

Intervention Dimension	Statement	Threat pertinence at each RV				
		Major Problem (RV 5)	Very important problem (RV 4)	Important Problem (RV 3)	Problem (RV 2)	Light Problem (RV 1)
Integrated Coastal Zone Management (ICZM)	<p>Ensure coordination and participation in management of coastal land, water and resources use currently under complex pressures.</p> <p>Facilitate dialogues required to alleviate social conflicts over resources use.</p> <p>Link with hinterland management to address catchment and riverbank deforestation, river flow changes and river pollution, all of which affect the coast in many ways (ICARM).</p>	<p>M-Fish-03: Destructive fisheries.</p> <p>M-Fish-10: Poor mangrove management.</p> <p>M-Fish-11: Catchment deforestation.</p>	<p>M-Fish-01: Social conflicts over use of fishing gear</p> <p>M-Fish-04: Poor fisheries resources management</p> <p>M-Fish-05: Destructive fishing practises.</p>	<p>M-Fish-06: Pollution in catchments and the coastal zone</p>	<p>M-Fish-07: Drainage changes</p> <p>M-Fish-08: Physical damage from unsustainable mining.</p> <p>M-Fish-09: River damming</p>	<p>M-Fish-02: Social conflicts over resources</p>
Integrated Water Resources Management (IWRM)	<p>Link IWRM to coastal integrated planning ensuring upstream/downstream considerations (ICARM).</p> <p>Land use in catchments and its impacts on water resources included in IWRM planning.</p>	<p>M-Fish-10: Poor mangrove management.</p> <p>M-Fish-11: Catchment deforestation.</p>	<p>M-Fish-04: Poor fisheries resources management</p> <p>M-Fish-05: Destructive fishing practises.</p>	<p>M-Fish-06: Pollution in catchments and the coastal zone</p>	<p>M-Fish-07: Drainage changes</p> <p>M-Fish-08: Physical damage from unsustainable mining.</p> <p>M-Fish-09: River damming</p>	
Land Use Management	<p>Land use information management systems to include ecosystems, habitats and water resources.</p> <p>Incorporate ecosystems, habitats and water resources considerations in spatial planning.</p> <p>Inform hinterland spatial planning to direct zoning to prevent downstream impacts on fisheries habitats.</p>	<p>M-Fish-03: Destructive fisheries.</p> <p>M-Fish-10: Poor mangrove management.</p> <p>M-Fish-11: Catchment deforestation.</p>	<p>M-Fish-01: Social conflicts over use of fishing gear</p> <p>M-Fish-04: Poor fisheries resources management</p> <p>M-Fish-05: Destructive fishing practises.</p>	<p>M-Fish-06: Pollution in catchments and the coastal zone</p>	<p>M-Fish-07: Drainage changes</p> <p>M-Fish-08: Physical damage from unsustainable mining.</p> <p>M-Fish-09: River damming</p>	<p>M-Fish-02: Social conflicts over resources</p>
Shoreline Management Planning	<p>Establish a systematic overview of coastal processes through a shoreline management investigation, considering the entire coast, and inform spatial planning accordingly.</p> <p>Sediment cell resolution national effort, management unit resolution regional/district effort.</p>	<p>M-Fish-03: Destructive fisheries.</p> <p>M-Fish-10: Poor mangrove management.</p> <p>M-Fish-11: Catchment deforestation.</p>	<p>M-Fish-01: Social conflicts over use of fishing gear</p> <p>M-Fish-04: Poor fisheries resources management</p> <p>M-Fish-05: Destructive fishing practises.</p>	<p>M-Fish-06: Pollution in catchments and the coastal zone</p>	<p>M-Fish-08: Physical damage from unsustainable mining.</p> <p>M-Fish-09: River damming</p>	<p>M-Fish-02: Social conflicts over resources</p>
Solid and Liquid Waste Management	<p>Review agrochemical management and inform land use accordingly.</p> <p>Pursue integrated solid and liquid waste management solutions considering:</p> <p>Waste water treatment systems:</p> <ul style="list-style-type: none"> - collection - treatment technology - discharge <p>Liquid Waste Management Systems:</p> <ul style="list-style-type: none"> - collection - storage - processing - financing - minimisation - reuse? <p>Green Infrastructure</p> <p>Storm Water Systems</p>			<p>M-Fish-06: Pollution in catchments and the coastal zone</p>	<p>M-Fish-07: Drainage changes</p>	
Sanitation	<p>Pursue integrated solid and liquid waste management considering:</p> <p>Waste water treatment systems:</p> <ul style="list-style-type: none"> - collection - treatment technology - discharge <p>Liquid Waste Management Systems:</p> <ul style="list-style-type: none"> - collection - storage - processing - financing - minimisation - reuse? <p>Green Infrastructure</p> <p>Storm Water Systems</p>			<p>M-Fish-06: Pollution in catchments and the coastal zone</p>	<p>M-Fish-07: Drainage changes</p>	

Intervention Dimension	Statement	Threat pertinence at each RV				
		Major Problem (RV 5)	Very important problem (RV 4)	Important Problem (RV 3)	Problem (RV 2)	Light Problem (RV 1)
Capacity Building	<p>Accompany management interventions with appropriate capacity building components. Particular focus on spatial planning, shoreline management, conflict resolution, monitoring, law enforcement.</p> <p>Enhance information management systems to provide for better and systematically informed management decisions.</p>	<p>M-Fish-03: Destructive fisheries.</p> <p>M-Fish-10: Poor mangrove management.</p> <p>M-Fish-11: Catchment deforestation.</p>	<p>M-Fish-01: Social conflicts over use of fishing gear</p> <p>M-Fish-04: Poor fisheries resources management</p> <p>M-Fish-05: Destructive fishing practises.</p>	<p>M-Fish-06: Pollution in catchments and the coastal zone</p>	<p>M-Fish-07: Drainage changes</p> <p>M-Fish-08: Physical damage from unsustainable mining.</p> <p>M-Fish-09: River damming</p>	<p>M-Fish-02: Social conflicts over resources</p>
Technology	<p>Pursue opportunities through further technology development within:</p> <ul style="list-style-type: none"> Offshore fisheries Aquaculture Value addition Integrated solid and liquid waste management Shoreline management 	<p>M-Fish-03: Destructive fisheries.</p> <p>M-Fish-10: Poor mangrove management.</p> <p>M-Fish-11: Catchment deforestation.</p>	<p>M-Fish-01: Social conflicts over use of fishing gear</p> <p>M-Fish-04: Poor fisheries resources management</p> <p>M-Fish-05: Destructive fishing practises.</p>	<p>M-Fish-06: Pollution in catchments and the coastal zone</p>	<p>M-Fish-07: Drainage changes</p> <p>M-Fish-08: Physical damage from unsustainable mining.</p> <p>M-Fish-09: River damming</p>	<p>M-Fish-02: Social conflicts over resources</p>
Law Enforcement	<p>1) Integrated review of laws, regulations and their enforcement within amongst others:</p> <ul style="list-style-type: none"> Fisheries, Mangrove exploitation Coral mining Agrochemicals Industrial and domestic waste Land use <p>2) Optimise enforcement through capacity building and coordination following recommendations from review.</p>	<p>M-Fish-03: Destructive fisheries.</p> <p>M-Fish-10: Poor mangrove management.</p> <p>M-Fish-11: Catchment deforestation.</p>	<p>M-Fish-01: Social conflicts over use of fishing gear</p> <p>M-Fish-04: Poor fisheries resources management</p> <p>M-Fish-05: Destructive fishing practises.</p>	<p>M-Fish-06: Pollution in catchments and the coastal zone</p>	<p>M-Fish-07: Drainage changes</p> <p>M-Fish-08: Physical damage from unsustainable mining.</p> <p>M-Fish-09: River damming</p>	<p>M-Fish-02: Social conflicts over resources</p>
Legal Review	<p>1) Integrated review of laws, regulations and their enforcement within amongst others:</p> <ul style="list-style-type: none"> Fisheries, Mangrove exploitation Coral mining Agrochemicals Industrial and domestic waste Land use <p>2) Initiate revision of existing and develop new laws, regulations according to recommendations from review</p>	<p>M-Fish-03: Destructive fisheries.</p>	<p>M-Fish-01: Social conflicts over use of fishing gear</p> <p>M-Fish-04: Poor fisheries resources management</p> <p>M-Fish-05: Destructive fishing practises.</p>		<p>M-Fish-08: Physical damage from unsustainable mining.</p> <p>M-Fish-09: River damming</p>	<p>M-Fish-02: Social conflicts over resources</p>
Alternative/Improved Livelihood	<p>Develop and offer alternative livelihoods for households currently engaged in destructive resource exploitation practises. Particular efforts to provide alternatives for young generation.</p> <p>Improve current sustainable resource use livelihoods using technology advances and insights.</p>	<p>M-Fish-03: Destructive fisheries.</p> <p>M-Fish-10: Poor mangrove management.</p> <p>M-Fish-11: Catchment deforestation.</p>	<p>M-Fish-01: Social conflicts over use of fishing gear</p> <p>M-Fish-04: Poor fisheries resources management</p> <p>M-Fish-05: Destructive fishing practises.</p>	<p>M-Fish-06: Pollution in catchments and the coastal zone</p>	<p>M-Fish-08: Physical damage from unsustainable mining.</p> <p>M-Fish-09: River damming</p>	<p>M-Fish-02: Social conflicts over resources</p>
Awareness Raising	<p>Develop and launch awareness raising campaigns related to coastal management challenges directed to the public at large and to schools.</p> <p>Develop and launch issue specific awareness raising campaigns targeting stakeholders affected by or affecting the issue.</p>	<p>M-Fish-03: Destructive fisheries.</p> <p>M-Fish-10: Poor mangrove management.</p> <p>M-Fish-11: Catchment deforestation.</p>	<p>M-Fish-01: Social conflicts over use of fishing gear</p> <p>M-Fish-04: Poor fisheries resources management</p> <p>M-Fish-05: Destructive fishing practises.</p>	<p>M-Fish-06: Pollution in catchments and the coastal zone</p>	<p>M-Fish-07: Drainage changes</p> <p>M-Fish-08: Physical damage from unsustainable mining.</p> <p>M-Fish-09: River damming</p>	<p>M-Fish-02: Social conflicts over resources</p>
Education	<p>Engage in curricula review and development for primary and secondary schools to enhance the knowledge and understanding about coastal management issues- Issue of particular relevance from a fisheries perspective include:</p> <ul style="list-style-type: none"> Fisheries ecology and sustainable fisheries Impact from catchment management on coastal fisheries Environmental management Coastal ecology Importance of beaches 	<p>M-Fish-03: Destructive fisheries.</p> <p>M-Fish-10: Poor mangrove management.</p> <p>M-Fish-11: Catchment deforestation.</p>	<p>M-Fish-01: Social conflicts over use of fishing gear</p> <p>M-Fish-04: Poor fisheries resources management</p> <p>M-Fish-05: Destructive fishing practises.</p>	<p>M-Fish-06: Pollution in catchments and the coastal zone</p>	<p>M-Fish-07: Drainage changes</p> <p>M-Fish-08: Physical damage from unsustainable mining.</p> <p>M-Fish-09: River damming</p>	<p>M-Fish-02: Social conflicts over resources</p>

Action areas

In Table 12 below an overview has been established on how strongly each intervention dimension responds to threats to local communities and ecosystems as perceived by local stakeholders.

Table 12: Assessment of the importance of broad management dimension in addressing threats to local communities and ecosystems associated with fisheries.

Intervention Dimension	Major Problem Weight	Very important problem weight	Important Problem weight	Problem weight	Light Problem weight	# of threats	Total Score
Integrated Coastal Zone Management (ICZM)	15	12	3	6	1	11	37
Integrated Water Resources Management (IWRM)	10	8	3	6	0	8	27
Land Use Management	15	12	3	6	1	11	37
Shoreline Management Planning	15	12	3	4	1	10	35
Solid and Liquid Waste Management	0	0	3	2	0	2	5
Sanitation	0	0	3	2	0	2	5
Capacity Building	15	12	3	6	1	11	37
Technology	15	12	3	6	1	11	37
Law Enforcement	15	12	3	6	1	11	37
Legal Review	5	12	0	4	1	7	22
Alternative/ Improved Livelihood	15	12	3	4	1	10	35
Awareness Raising	15	12	3	6	1	11	37
Education	1	12	3	6	1	9	23
Mainland Tanzania				Fisheries	Total	11	374

For each intervention dimension and for each problem class the number of threats considered to benefit from the intervention have been multiplied by the range value (RV) for the given problem class. The total score for each management dimension has then been calculated by adding the values achieved. The table thus provides an indication of the importance of each intervention dimension in addressing identified and ranked threats. In the same manner Figure 16 gives a graphical presentation of the relevance of intervention dimensions in addressing the identified threats related to coastal fisheries.

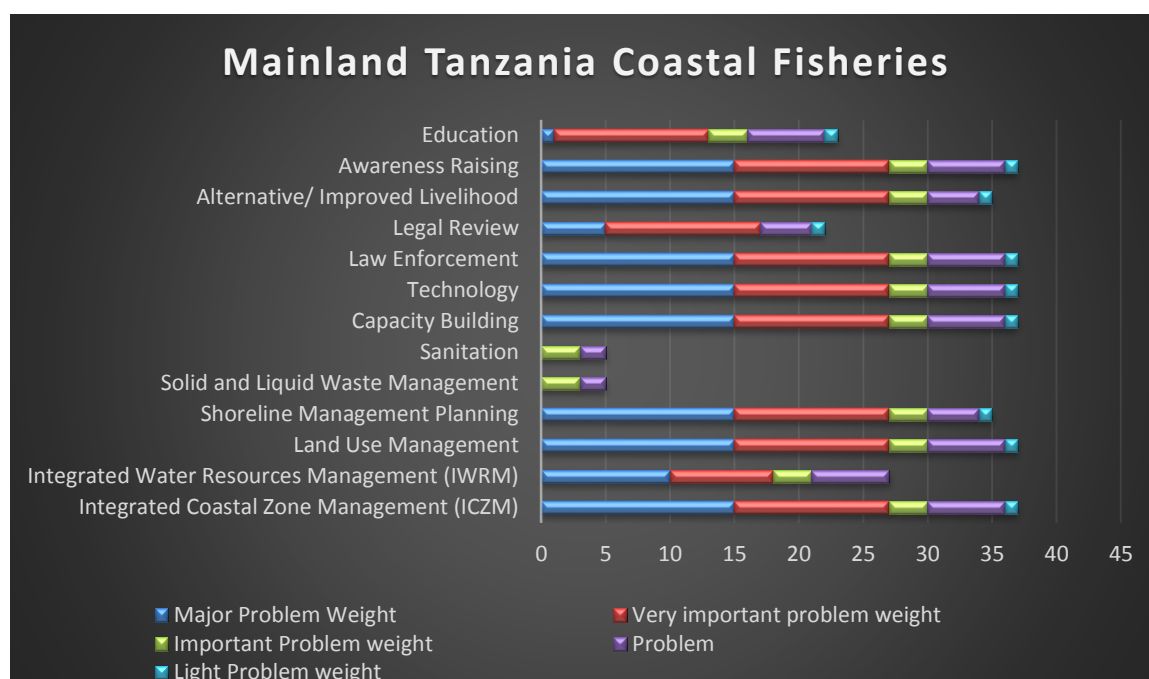


Figure 16: The importance of broad intervention dimension in responding to threats to local communities and ecosystems associated with coastal fisheries.

Threats to local communities and ecosystems related to fisheries emerge as significant with three posing major and three posing very important problems. The situation in fisheries management is complex with resources and livelihoods being impacted by activities in other sectors and in inland areas. Poverty and lack of alternatives result in the use of destructive exploitation practises often exacerbated by lack of awareness and skills.

This situation is well reflected in Table 12 which suggests that mitigation measures amongst others are required through efforts at more systemic levels, involving stronger coordination in management, dialogues concerning inland activities, land use management and shoreline management.

While efforts are required directly at local levels to address threats as they are experienced at present a longer term effort requires interventions directed towards securing an enabling environment to handle the problems and pursue opportunities related to fisheries in Mainland Tanzania. Such systemic efforts include:

- Integrated Coastal Zone Management to provide a framework for coordination between sectors, between management levels, between government and non-government stakeholders and between up and downstream catchment management. The targeted framework includes institutional arrangements for regular meetings at central and district levels, oversight of updated baseline information, policy development, strategy formulation and action planning. Important functions for the framework include resolution of existing conflicts between stakeholders and proactively address potential future conflicts.
- Shoreline management plans to develop policies for sustainable shoreline development and activities incorporating fisheries options and concerns and assuring access to the sea.
- Spatial planning to provide sustainable control of land use development and incorporating shoreline management policies. Of particular importance are protection through zoning of important fisheries habitats
- Better information management for decision making concerning the effects of development management. A shared structured information system is required in support of planning and monitoring while at the same time providing for awareness raising and education.
- Integrated review of legal arrangements examining existing laws and regulatory instruments as a basis for mainstreaming legal system and strengthening enforcement. From a fisheries position alignment of regulation related to fisheries, mangroves, corals, land uses at the coast and upstream and pollution are of particular importance.
- Enhance awareness among all stakeholders including the public at large about coastal issues arising due to demographic and economic pressure on the highly dynamic and sensitive coastal ecosystems many of which are important habitats for fisheries resources.
- Review education at primary and secondary level with the view of incorporating a holistic understanding of the complex natural resources, environment, economic and socio-economic situation at the coast. Efforts at primary and secondary education level is key to address the threats in a longer term perspective. From a fisheries perspective issues of particular relevance include fisheries ecology and sustainable fisheries, impact from up-stream land and water uses on coastal fisheries, environmental management, coastal ecology, importance of beaches and climate change.

These expectations have been converted into recommendations for systemic investments in the main Section on Prioritized Action Areas (page 8).

More specific actions are called for to alleviate the current pressure on fisheries habitats and resources from encroachment and unsustainable exploitation. Of particular concern here for longer term impact would be to:

- Provide improved or alternative livelihoods for people currently engaged in destructive fisheries practises
- Develop new fishing technologies/practises
- Strengthen enforcement against illegal activities

Investments actions to that effect are also discussed in the main section on Prioritized Action Areas.

Tourism

Tourism is one of the fast growing sectors of Tanzania's economy, ranking top in foreign exchange earnings, overtaking agriculture in GDP terms, generating significant amounts of hard currency and providing a range of employment, service and product opportunities for other sectors of the economy. The attraction of mainland Tanzania to international tourists is very strong, being based on the well-established and in places exceptional wildlife reserves and parks, the landscapes, history cultural identity and generally peaceful status.



Four interest groups among those visiting the coastal districts can be identified: wildlife tourism (focused on Saadani National Park and water birds); marine-based tourism (focused on marine parks, for diving, snorkelling, deep sea fishing, etc.); cultural tourism (historical, heritage and cultural sites); and beach tourism (beaches, hotels, restaurants, shops, handicrafts, etc.). There is considerable overlap within these interest groups, but the bulk of present interest is the coastal beach experience.

Coastal tourism on the mainland is however growing rapidly (e.g. in 2011, Mafia Island received 4,500 tourists, while Dar es Salaam Marine Reserves catered for 20,000 visitors, and visitors to Tanga and Mtwara region are growing annually). Beach hotels are scattered along the entire coastline, and is a more recent development than the traditional, land based nature tourism, for which Tanzania is internationally known.

Coastal tourism shows a promising future as evidenced by the number, variety and diversity of accommodation facilities that have been constructed or are planned. They range from ecologically friendly lodges, stylish to classic type of hotels, a diverse range of accommodation to target different market segments of eco-tourists, local and international holiday makers.

Recommendations in the Tourism Master Plan (CHL, 2002) that look at factors that will enhance coastal tourism, include diversification from Northern Circuit, and extension of the north coast arc of Tanga/Pangani, development of a strong Southern Circuit comprising the coastal areas beach resort tourism including Mafia, offshore islands, Bagamoyo, Saadani Game Reserve and Kilwa, and enhancement of Dar es Salaam and environs with emphasis on the urban waterfront.

Prioritized Threats

In Table 13 below the threats identified related to tourism have been listed and ranked according to their severity as established using the CRIAM method discussed extensively in Volumes I and II of the Coastal Profile. A rapid assessment has been made on the susceptibility of each threat to impacts of climate change more specifically, changes in whether patterns, extreme events, sea level rise, temperature rise and acidification.

Table 13: Prioritised threats related to tourism and a rapid assessment of threat susceptibility to climate change.

#	Threat as identified in Coastal Profile	Threat Level	Influence from Climate Change				
			Change in Patterns	Extreme events	Sea Level Rise	Temperature rise	Acidification
M-Tour-06	Uncertainty of tourism jobs with most being ad-hoc, or as needed' basis and does not offer steady employment, or seasonal in nature.	Very Important Problem	++	++	0	+	+
			More frequent extreme events and changes in weather patterns will influence tourism flow and thus render jobs less secure.				
M-Tour-08	Erosion of local traditions and culture due to influences from tourists and non-locals in the industry ⁴	Very Important Problem	0	0	0	0	0
			Climate change may weaken tourism opportunities and thus lead to a decrease in numbers of non-locals.				
M-Tour-12	Inadequate sewage infrastructure and waste management resulting in pollution of the coastal zone, from some developments illegally dumping waste and litter.	Very Important Problem	++	++	++	0	0
			Climate change will aggravate the effects of inadequate sewage infrastructure and waste management.				
M-Tour-04	Increased cost of living due to tourism industry where prices of fish and agricultural foodstuff have gone up, to the detriment of the local consumers who risk loss of valuable protein inputs to their diets.	Very Important Problem	0	0	0	0	0
			Climate change may weaken tourism opportunities and thus lead to a normalisation of prices at a level in conformance with local consumers.				
M-Tour-03	Profits not captured locally, thus not benefitting the local population (e.g. package tours sold overseas).	Very Important Problem	+	+	0	0	0
			Climate change may weaken tourism opportunities and thus lessen benefits for the local population.				
M-Tour-05	Increasing cost of land in high tourism potential areas are targeted by speculators or developers and competition for land can drive prices high, so that local population cannot afford land.	Important Problem	0	0	0	0	0
			Climate change may weaken tourism opportunities and thus lead to a normalisation of land prices at a level in conformance with local population.				
M-Tour-10	Reduction in iconic marine life with illegal killing of whale sharks, dolphins, dugongs, turtles and other exotic marine animals that are tourist attractions degrading the value of the experience and creating a poor image of Tanzania as an eco-friendly destination.	Important Problem	0	0	+	0	0
			Sea level rise may impact on nesting sites for turtles.				
M-Tour-11	Ecosystem fragmentation due to encroachment of corridors and protected areas, is affecting migratory species, exacerbated by over utilization of forest resources and conflicts between agriculture and wildlife, due to failure of management to address encroachment and resource over-utilisation, especially forests.	Important Problem	++	+	+	+	+
			Changes in weather patterns may disrupt ecosystem coherence and sea level rise.				
M-Tour-02	Lack of trained personnel for conservation and management of cultural heritage (ICMP 2001).	Important Problem	0	0	0	0	0
			No impact from climate change on this threat				
M-Tour-13	Increased beach erosion due to tourism alteration of the shoreline, with obstruction of sediment supply by modification of the beach hydrodynamics due to the construction of inappropriate engineering structures like sea walls, jetties and salt pans and removal of beach material for road or hotel or beach construction, and of protective mangroves enhancing aggressive wave action on the beach, leading to sand loss (e.g. northern Bagamoyo Beach Hotels have cleared their mangrove frontage, resulting in erosion rates of up to 3m/year.). Poor planning by beach hotels and residential houses built directly on or very close to the beach are threatened by erosion (e.g. in Dar es Salaam area Hotel Africana built on a dune lost more than 50% of its residential huts by the late 1980s).	Problem	++	++	++	0	0
			Changes in weather patterns, increased frequency and strengths of extreme events and sea level rise may significantly alter erosion, accretion patterns along the coast.				
M-Tour-01	Anarchistic tourist development destroying cultural heritage sites (TCMP 2001) where urban development planning and control fail to intervene.	Problem	0	0	0	0	0
			No impact from climate change on this threat				
M-Tour-07	Loss of employment opportunities by locals to more qualified and better trained staff from other parts of mainland Tanzania and Kenya.	Problem	0	0	0	0	0
			No impact from climate change on this threat				
M-Tour-09	Deterioration of marine environment resulting in loss of biodiversity and other marine tourist attractions from destructive fishing practices (e.g. dynamite fishing) due to failures in marine resource management to cope with the increased pressure on marine resources due to the demand for seafood from the tourism sector and urban centres, also threatening the sport fishing industry.	Problem	0	0	0	0	0
			No impact from climate change on this threat				
+++	Threat is severely aggravated from climate change dimension						
++	Threat is aggravated from climate change dimension						
+	Threat is slightly aggravated from climate change dimension						
0	No influence of threat from climate change dimension						
-	Remediating effect on threat from climate change dimension						

Recommendations for threat mitigation measures

Overall measures to mitigate each if the identified tourism related threats to coastal local communities and ecosystems have been tabulated in Table 177 (page 335) arranged under broad management dimensions headings. Table 14 below provides an overview of the requirements/opportunities expressed within each of these management or intervention dimensions.

⁴e.g. from language, dress code, manners and habits; loss of village elder authority to preside over disputes; increases in prostitution, robbery and alcohol abuse; goods and services offered freely in the past (e.g. land, thatch (roofing materials) and assistance to the elderly or during times of hardship), are eroded by the 'money economy' of wage employment.

Table 14: Broad management intervention dimensions to address identified and prioritised threats to coastal communities and ecosystems associated with tourism in Mainland Tanzania

Intervention Dimension	Statement	Threat pertinence at each RV				
		Major Problem (RV 5)	Very important problem (RV 4)	Important Problem (RV 3)	Problem (RV 2)	Light Problem (RV 1)
Integrated Coastal Zone Management (ICZM)	Ensure coordination and participation in management of coastal land, water and resources use currently under complex pressures. Link with hinterland management to address catchment and riverbank deforestation, river flow changes and river pollution, all of which affect the coast in many ways (ICARM).		M-Tour-12: Inadequate sewage infrastructure and waste management (pollution)	M-Tour-10: Reduction in iconic marine life by illegal practices M-Tour-11: Ecosystem fragmentation	M-Tour-09: Deterioration of marine environment... from destructive fishing practices M-Tour-13: Increased beach erosion (from tourism)	
Integrated Water Resources Management (IWRM)	Link IWRM to coastal integrated planning to address impacts from upstream pollution (ICARM).		M-Tour-12: Inadequate sewage infrastructure and waste management (pollution)		M-Tour-13: Increased beach erosion (from tourism)	
Land Use Management	Land use information management systems to include ecosystems, habitats and water resources. Incorporate ecosystems, habitats, shoreline processes and water resources considerations in spatial planning. Optimise land use through zoning to minimise conflicts and prevent anarchistic development.		M-Tour-12: Inadequate sewage infrastructure and waste management (pollution) M-Tour-05: Increasing cost of land	M-Tour-11: Ecosystem fragmentation	M-Tour-01: Anarchistic tourist development destroying cultural heritage M-Tour-09: Deterioration of marine environment... from destructive fishing practices M-Tour-13: Increased beach erosion (from tourism)	
Shoreline Management Planning	Establish a systematic overview of coastal processes through a shoreline management investigation, considering the entire coast, and inform spatial planning accordingly. Sediment cell resolution national effort, management unit resolution regional/district effort.		M-Tour-12: Inadequate sewage infrastructure and waste management (pollution)	M-Tour-10: Reduction in iconic marine life by illegal practices M-Tour-11: Ecosystem fragmentation	M-Tour-09: Deterioration of marine environment... from destructive fishing practices M-Tour-13: Increased beach erosion (from tourism)	
Solid and Liquid Waste Management	Pursue integrated solid and liquid waste management solutions considering: Waste water treatment systems: - collection - treatment technology - discharge Liquid Waste Management Systems: - collection - storage - processing - financing - minimisation - reuse? Green Infrastructure Storm Water Systems		M-Tour-12: Inadequate sewage infrastructure and waste management (pollution)	M-Tour-10: Reduction in iconic marine life by illegal practices		
Sanitation	Pursue integrated solid and liquid waste management considering: Waste water treatment systems: - collection - treatment technology - discharge Liquid Waste Management Systems: - collection - storage - processing - financing - minimisation - reuse? Green Infrastructure Storm Water Systems		M-Tour-12: Inadequate sewage infrastructure and waste management (pollution)			

Intervention Dimension	Statement	Threat pertinence at each RV				
		Major Problem (RV 5)	Very important problem (RV 4)	Important Problem (RV 3)	Problem (RV 2)	Light Problem (RV 1)
Capacity Building	<p>Emphasise local tradition and culture as a tourism attraction.</p> <p>Accompany management interventions with appropriate capacity building components. Particular focus on spatial planning, shoreline management, ecosystems and species management, cultural heritage management, conflict resolution, monitoring, law enforcement.</p> <p>Enhance information management systems to provide for better and systematically informed management decisions.</p> <p>Develop and diversify local skills at all levels to enhance local participation in tourism sector and encourage local client sector.</p>		<p>M-Tour-03: Profits not captured locally</p> <p>M-Tour-04: Increased cost of living due to tourism</p> <p>M-Tour-06: Uncertainty of tourism jobs</p> <p>M-Tour-08: Erosion of local traditions</p> <p>M-Tour-12: Inadequate sewage infrastructure and waste management (pollution)</p>	<p>M-Tour-02: Lack of trained personnel for conservation and management of cultural heritage</p> <p>M-Tour-11: Ecosystem fragmentation</p>	<p>M-Tour-07: Loss of employment opportunities by locals</p> <p>M-Tour-09: Deterioration of marine environment... from destructive fishing practices</p> <p>M-Tour-13: Increased beach erosion (from tourism)</p>	
Technology	<p>Pursue opportunities through further technology development within:</p> <p>Integrated solid and liquid waste management</p> <p>Shoreline management</p> <p>Coastal forest management</p> <p>Offshore fisheries</p> <p>Aquaculture</p>		<p>M-Tour-12: Inadequate sewage infrastructure and waste management (pollution)</p>	<p>M-Tour-11: Ecosystem fragmentation</p>	<p>M-Tour-13: Increased beach erosion (from tourism)</p> <p>M-Tour-09: Deterioration of marine environment... from destructive fishing practices</p>	
Law Enforcement	<p>Integrated review of laws, regulations and their enforcement within amongst others:</p> <p>Fisheries,</p> <p>Mangrove and coastal forest exploitation</p> <p>Ecosystems and species</p> <p>Coral (and sand) mining</p> <p>Agrochemicals</p> <p>Industrial and domestic waste</p> <p>Land use (especially shoreline and set-back uses) and speculation.</p> <p>Tourism revenues</p> <p>Anti-social behaviour</p> <p>Construction around monuments.</p> <p>Optimise enforcement through capacity building and coordination following recommendations from review.</p>		<p>M-Tour-03: Profits not captured locally</p> <p>M-Tour-08: Erosion of local traditions</p> <p>M-Tour-12: Inadequate sewage infrastructure and waste management (pollution)</p> <p>M-Tour-05: Increasing cost of land</p>	<p>M-Tour-10: Reduction in iconic marine life by illegal practices</p> <p>M-Tour-11: Ecosystem fragmentation</p>	<p>M-Tour-01: Anarchistic tourist development destroying cultural heritage</p> <p>M-Tour-09: Deterioration of marine environment... from destructive fishing practices</p> <p>M-Tour-13: Increased beach erosion (from tourism)</p>	
Legal Review	<p>Integrated review of laws, regulations and their enforcement within amongst others:</p> <p>Fisheries,</p> <p>Mangrove exploitation</p> <p>Ecosystems and species</p> <p>Coral mining</p> <p>Agrochemicals</p> <p>Industrial and domestic waste</p> <p>Land use (especially shoreline and set-back uses) and speculation.</p> <p>Tourism revenues</p> <p>Local content employment of staff in the sector.</p> <p>Initiate revision of existing and develop new laws, regulations according to recommendations from review</p>		<p>M-Tour-03: Profits not captured locally</p> <p>M-Tour-08: Erosion of local traditions</p>	<p>M-Tour-10: Reduction in iconic marine life by illegal practices</p>	<p>M-Tour-07: Loss of employment opportunities by locals</p> <p>M-Tour-09: Deterioration of marine environment... from destructive fishing practices</p> <p>M-Tour-13: Increased beach erosion (from tourism)</p>	
Alternative/Improved Livelihood	<p>Develop and offer alternative livelihoods for households currently engaged in destructive resource exploitation practises and those displaced and disadvantaged. Particular efforts to provide alternatives for young generation.</p> <p>Improve current sustainable resource use livelihoods using technology advances and insights.</p>		<p>M-Tour-05: Increasing cost of land</p> <p>M-Tour-06: Uncertainty of tourism jobs</p> <p>M-Tour-08: Erosion of local traditions</p>	<p>M-Tour-02: Lack of trained personnel for conservation and management of cultural heritage</p> <p>M-Tour-11: Ecosystem fragmentation</p>	<p>M-Tour-09: Deterioration of marine environment... from destructive fishing practices</p> <p>M-Tour-13: Increased beach erosion (from tourism)</p>	

Intervention Dimension	Statement	Threat pertinence at each RV				
		Major Problem (RV 5)	Very important problem (RV 4)	Important Problem (RV 3)	Problem (RV 2)	Light Problem (RV 1)
Awareness Raising	Develop and launch awareness raising campaigns related to coastal management challenges directed to the public at large and to schools. Develop and launch issue specific awareness raising campaigns targeting stakeholders affected by or affecting the issue.		M-Tour-12: Inadequate sewage infrastructure and waste management	M-Tour-10: Reduction in iconic marine life by illegal practices M-Tour-11: Ecosystem fragmentation	M-Tour-09: Deterioration of marine environment... from destructive fishing practices M-Tour-13: Increased beach erosion (from tourism)	
Education	Engage in curricula review and development for primary and secondary schools to enhance the knowledge and understanding about coastal management issues- Issue of particular relevance from a tourism perspective include: <ul style="list-style-type: none"> • Fisheries ecology and sustainable fisheries • Environmental management • Coastal ecology • Importance of beaches • Sustainable tourism 		M-Tour-12: Inadequate sewage infrastructure and waste management	M-Tour-11: Ecosystem fragmentation	M-Tour-09: Deterioration of marine environment... from destructive fishing practices M-Tour-13: Increased beach erosion (from tourism)	

Action areas

In Table 15 below an overview has been established on how strongly each intervention dimension responds to threats to local communities and ecosystems as perceived by local stakeholders.

Table 15: Assessment of the importance of broad management dimension in addressing threats to local communities and ecosystems associated with tourism.

	Major Problem Weight	Very important problem weight	Important Problem weight	Problem weight	Light Problem weight	# of threats	Total Score
Integrated Coastal Zone Management (ICZM)	0	4	6	4	0	5	19
Integrated Water Resources Management (IWRM)	0	4	0	2	0	2	8
Land Use Management	0	8	3	6	0	6	23
Shoreline Management Planning	0	4	6	4	0	5	19
Solid and Liquid Waste Management	0	4	3	0	0	2	9
Sanitation	0	4	0	0	0	1	5
Capacity Building	0	20	6	6	0	9	41
Technology	0	4	3	4	0	4	15
Law Enforcement	0	16	6	6	0	9	37
Legal Review	0	8	3	6	0	6	23
Alternative/ Improved Livelihood	0	12	6	4	0	7	29
Awareness Raising	0	4	6	4	0	5	19
Education	0	4	3	4	0	4	15
Mainland Tanzania				Tourism		Total	262

For each intervention dimension and for each problem class the number of threats considered to benefit from the intervention have been multiplied by the range value (RV) for the given problem class. The total score for each management dimension has then been calculated by adding the values achieved. The table thus provides an indication of the importance of each intervention dimension in addressing identified and ranked threats. In the same manner Figure 17 gives a graphical presentation of the relevance of intervention dimensions in addressing the identified threats related to tourism.

Threats to local communities and ecosystems related to tourism emerge as significant with five posing very important problems, four posing important problems and four problems.

The situation in tourism management is complex with resources and livelihoods being impacted by activities in other sectors and in inland areas. Poverty and lack of alternatives result in the use of destructive exploitation practises often exacerbated by lack of awareness and skills.

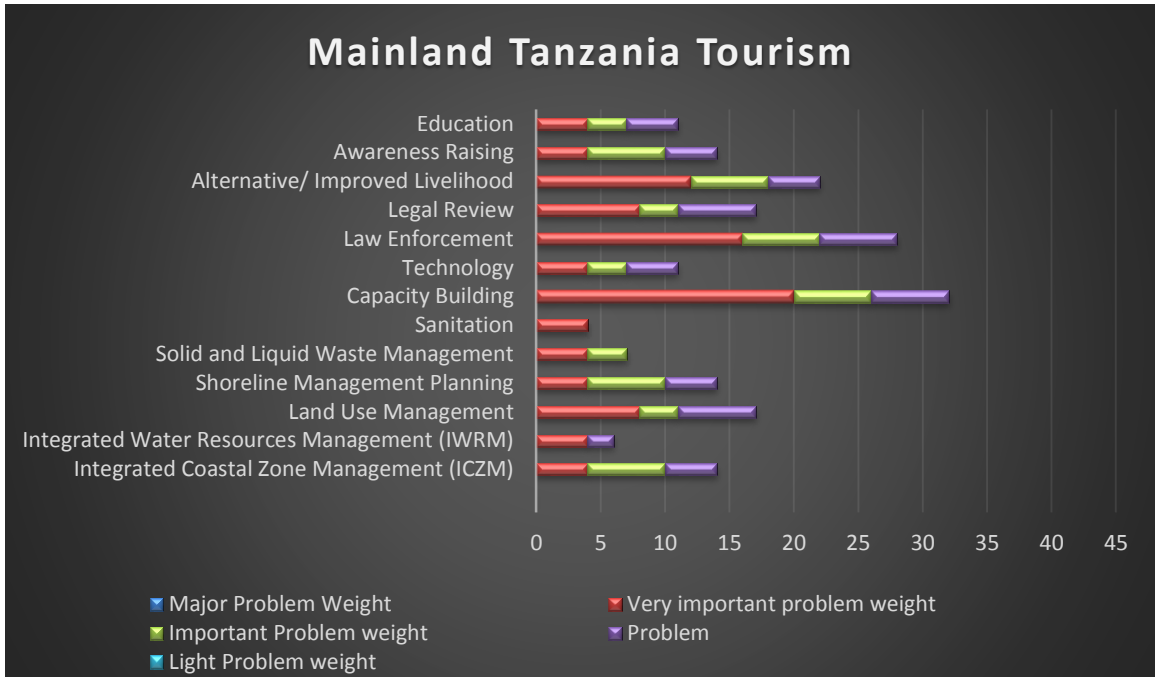


Figure 17: The importance of broad intervention dimension in responding to threats to local communities and ecosystems associated with tourism.

Livestock and Agriculture

Agriculture is the main stay of the livelihoods of the majority of the coastal population and urban and rural agriculture and livestock keeping are practiced at both small and large scale. Most of the land in the coastal area is of low agricultural potential, with an over-reliance on rain-fed agriculture and investment in the sector, in coastal districts, has remained low.

Nevertheless 80-90% of people's livelihood at the coast depends on agriculture, largely subsistence, but with some surplus cash crops. More recently, several large bio-fuel projects have targeted the coast where there is available land and agro-climatic conditions and soils suitable for these crops.



Compared to other parts of the country coastal livestock is not very developed. This may be due to access to inexpensive dietary proteins from coastal fisheries.

Prioritized Threats

In Table 16 below the threats identified related to livestock and agriculture have been listed and ranked according to their severity as established using the CRIAM method discussed extensively in Volumes I and II of the Coastal Profile. A rapid assessment has been made on the susceptibility of each threat to impacts of climate change more specifically, changes in whether patterns, extreme events, sea level rise, temperature rise and acidification.

Table 16: Prioritised threats related to livestock and agriculture and a rapid assessment of threat susceptibility to climate change.

#	Threat as identified in Coastal Profile	Threat Level	Influence from Climate Change					
			Change in Patterns	Extreme events	Sea Level Rise	Temperature rise	Acidification	
M-Agr-01	Poor land management leading to social conflicts over land between agriculture and livestock grazing.	Very Important Problem	0	0	0	0	0	No impact from climate change on this threat
M-Agr-02	Poor land tenure. Leading to inadequate and/or poor land development/use.	Very Important Problem	0	0	0	0	0	No impact from climate change on this threat
M-Agr-03	Inadequate Government support for continued or expanded production, e.g. with new seeds to resist new pest.	Very Important Problem	++	++	++	++	0	This situation likely to become more pronounced with climate change as demand for changes in practices will increase
M-Agr-05	Reduction in soil fertility and structure.	Very Important Problem	++	++	++	0	0	Soil fertility and structure in coastal areas rely on sediment and water flow patterns in rivers and catchments. With changes in weather patterns these conditions will be influenced. Extreme events will exacerbate erosion.
M-Agr-07	Scarcity and irregular supply.	Very Important Problem	0	0	0	0	0	No impact from climate change on this threat
M-Agr-09	Dependence on rain-fed agriculture and insufficient freshwater for irrigation	Very Important Problem	++	++	++	0	0	Change in precipitation will alter conditions for agriculture and impact on irrigation potential
M-Agr-12	Lack of early warning systems strengthening climate information and agro-meteorological services and seasonal forecasting, and strengthened early warning systems (including communication) and enhanced disaster risk management (VPO 2012).	Very Important Problem	++	++	0	0	0	Greater variability and changes in weather require early management responses to sustain productivity.
M-Agr-06	Drying up and contamination of ground and surface waters, with periodic outbreak water borne diseases.	Important Problem	++	+	+	+	0	Increased frequencies of drought will exacerbate this situation. Sea level rise will through salinization impact on ground and surface waters, particularly during extreme events.

#	Threat as identified in Coastal Profile	Threat Level	Influence from Climate Change				
			Change in Patterns	Extreme events	Sea Level Rise	Temperature rise	Acidification
M-Agr-10	Limited success of timely product distribution.	Important Problem	0	0	0	0	0
M-Agr-04	Harvest quality deterioration and huge post-harvest losses.	Problem	No impact from climate change on this threat				
M-Agr-11	Salt water intrusion seen in many of the coastal areas with good soils for agriculture (Rufiji, Mkuranga, Bagamoyo, Pangani, Lindi) which are now frequently flooded by sea water during spring tides.	Problem	No impact from climate change on this threat				
1M-Agr-08	Coral rag bush fallow system has been progressively reduced in extremes, to 1-2 years instead of the customary 10-15. Also, availability, timing, price, variety and quality of essential seed varieties and chemicals hinder optimal production, thus limiting output and returns. Also, loss of topsoil, erosion, structural deterioration and declining fertility.	Light Problem	0	0	0	0	0
+++	Threat is severely aggravated from climate change dimension						
++	Threat is aggravated from climate change dimension						
+	Threat is slightly aggravated from climate change dimension						
0	No influence of threat from climate change dimension						
-	Remediating effect on threat from climate change dimension						

Recommendations for threat mitigation measures

Overall measures to mitigate each if the identified livestock and agriculture related threats to coastal local communities and ecosystems have been tabulated in Table 178 (page 337) arranged under broad management dimensions headings. Table 17 below provides an overview of the requirements/opportunities expressed within each of these management or intervention dimensions.

Table 17: Broad management intervention dimensions to address identified and prioritised threats to coastal communities and ecosystems associated with livestock and agriculture in Mainland Tanzania

Intervention Dimension	Statement	Threat pertinence at each RV				
		Major Problem (RV 5)	Very important problem (RV 4)	Important Problem (RV 3)	Problem (RV 2)	Light Problem (RV 1)
Integrated Coastal Zone Management (ICZM)	Ensure coordination and participation in management of coastal land, water and resources use currently under complex pressures. Facilitate dialogues required to alleviate social conflicts over land use Coordinated response system to climate challenges. Link with hinterland management to address catchment and riverbank deforestation, river flow changes and river pollution, all of which affect the coast in many ways (ICARM).		M-Agr-01: Poor land management M-Agr-07: Scarcity of supplies M-Agr-09: Dependence on rain fed agriculture M-Agr-12: Lack of access to early warning and forecasting	M-Agr-06: Drying and contamination of water resources		
Integrated Water Resources Management (IWRM)	Link IWRM to coastal integrated planning ensuring upstream/downstream considerations (ICARM). Land use in catchments and its impacts on water resources included in IWRM planning. Upstream water management incorporating impacts on coastal ecosystems and livelihoods in IWRM plans (ICARM)		M-Agr-01: Poor land management M-Agr-07: Scarcity of supplies M-Agr-09: Dependence on rain fed agriculture M-Agr-12: Lack of access to early warning and forecasting	M-Agr-06: Drying and contamination of water resources	M-Agr-11: Salinization of soils	
Land Use Management	Land use information management systems to duly include agriculture potential, uses and use sustainability. Incorporate agriculture land uses in spatial planning. Inform hinterland spatial planning to direct zoning to address downstream impacts agriculture potential and practises.		M-Agr-01: Poor land management M-Agr-02: Poor land tenure M-Agr-07: Scarcity of supplies M-Agr-09: Dependence on rain fed agriculture	M-Agr-06: Drying and contamination of water resources	M-Agr-11: Salinization of soils	M-Agr-08: Disrupted coral rag bush fallow system

Intervention Dimension	Statement	Threat pertinence at each RV				
		Major Problem (RV 5)	Very important problem (RV 4)	Important Problem (RV 3)	Problem (RV 2)	Light Problem (RV 1)
Shoreline Management Planning	Establish a systematic overview of coastal processes through a shoreline management investigation, considering the entire coast, and inform spatial planning accordingly. Sediment cell resolution national effort, management unit resolution regional/district effort.		M-Agr-01: Poor land management			
Solid and Liquid Waste Management	Review agrochemical management and inform land use accordingly. Pursue integrated solid and liquid waste management solutions considering: Waste water treatment systems: - collection - treatment technology - discharge Liquid Waste Management Systems: - collection - storage - processing - financing - minimisation - reuse? Green Infrastructure Storm Water Systems			M-Agr-06: Drying and contamination of water resources		
Sanitation	Pursue integrated solid and liquid waste management considering: Waste water treatment systems: - collection - treatment technology - discharge Liquid Waste Management Systems: - collection - storage - processing - financing - minimisation - reuse? Green Infrastructure Storm Water Systems			M-Agr-06: Drying and contamination of water resources		
Capacity Building	Accompany management interventions with appropriate capacity building components. Particular focus on <ul style="list-style-type: none"> • spatial planning, • sustainable land and water use, • catchment management, • agriculture extension, • conflict resolution, • monitoring, • law enforcement. Enhance information management systems to provide for better and systematically informed management decisions.		M-Agr-01: Poor land management M-Agr-03: Inadequate government extension M-Agr-05: Deteriorating soil fertility and structure M-Agr-07: Scarcity of supplies M-Agr-09: Dependence on rain fed agriculture M-Agr-12: Lack of access to early warning and forecasting	M-Agr-06: Drying and contamination of water resources M-Agr-10: Untimely product distribution	M-Agr-04: Decrease in harvest quality and high post-harvest losses. M-Agr-11: Salinization of soils	M-Agr-08: Disrupted coral rag bush fallow system

Intervention Dimension	Statement	Threat pertinence at each RV				
		Major Problem (RV 5)	Very important problem (RV 4)	Important Problem (RV 3)	Problem (RV 2)	Light Problem (RV 1)
Technology	<p>Pursue opportunities through further technology development within:</p> <ul style="list-style-type: none"> • Agriculture soil improvement • Green infrastructure • Farming • Monitoring, remote imageries • GIS • Agriculture postharvest and marketing • Rainwater harvesting • Aquifer recharging 		<p>M-Agr-01: Poor land management</p> <p>M-Agr-03: Inadequate government extension</p> <p>M-Agr-05: Deteriorating soil fertility and structure</p> <p>M-Agr-07: Scarcity of supplies</p> <p>M-Agr-09: Dependence on rain fed agriculture</p> <p>M-Agr-12: Lack of access to early warning and forecasting</p>	<p>M-Agr-06: Drying and contamination of water resources</p> <p>M-Agr-10: Untimely product distribution</p>	<p>M-Agr-04: Decrease in harvest quality and high post-harvest losses.</p> <p>M-Agr-11: Salinization of soils</p>	<p>M-Agr-08: Disrupted coral rag bush fallow system</p>
Law Enforcement	<p>1) Integrated review of laws, regulations and their enforcement within amongst others:</p> <ul style="list-style-type: none"> • Resource exploration • Sand mining • Shoreline construction • Spatial planning • Water abstraction <p>2) Optimise enforcement through capacity building and coordination following recommendations from review.</p>		<p>M-Agr-01: Poor land management</p> <p>M-Agr-02: Poor land tenure</p> <p>M-Agr-07: Scarcity of supplies</p> <p>M-Agr-09: Dependence on rain fed agriculture</p>	<p>M-Agr-06: Drying and contamination of water resources</p>		
Legal Review	<p>1) Integrated review of laws, regulations and their enforcement within amongst others:</p> <ul style="list-style-type: none"> • Resource exploration • Sand mining • Shoreline construction • Spatial planning • Water abstraction <p>2) Initiate revision of existing and develop new laws, regulations according to recommendations from review</p>		<p>M-Agr-01: Poor land management</p> <p>M-Agr-07: Scarcity of supplies</p>	<p>M-Agr-06: Drying and contamination of water resources</p>		<p>M-Agr-08: Disrupted coral rag bush fallow system</p>
Alternative/ Improved Livelihood	<p>Develop and offer alternative livelihoods for households currently engaged in destructive resource exploitation practises. Particular efforts to provide alternatives for young generation.</p> <p>Improve current sustainable resource use livelihoods using technology advances and insights.</p>		<p>M-Agr-09: Dependence on rain fed agriculture</p>		<p>M-Agr-11: Salinization of soils</p>	
Awareness Raising	<p>Develop and launch awareness raising campaigns related to coastal management challenges directed to the public at large and to schools.</p> <p>Develop and launch issue specific awareness raising campaigns targeting stakeholders affected by or affecting the issue.</p> <p>These may address:</p> <ul style="list-style-type: none"> • Sustainable development planning and development control • Impact of pollution on environment and health • Pollution pathways including upstream downstream <p>And Target:</p> <ul style="list-style-type: none"> • Farmers • District authorities • Land-users • Stakeholders benefitting from beaches • Stakeholders benefitting from mangrove services and products • Tourists 		<p>M-Agr-01: Poor land management</p> <p>M-Agr-02: Poor land tenure</p> <p>M-Agr-03: Inadequate government extension</p> <p>M-Agr-05: Deteriorating soil fertility and structure</p> <p>M-Agr-07: Scarcity of supplies</p> <p>M-Agr-09: Dependence on rain fed agriculture</p> <p>M-Agr-12: Lack of access to early warning and forecasting</p>	<p>M-Agr-06: Drying and contamination of water resources</p>	<p>M-Agr-11: Salinization of soils</p>	<p>M-Agr-08: Disrupted coral rag bush fallow system</p>

Intervention Dimension	Statement	Threat pertinence at each RV				
		Major Problem (RV 5)	Very important problem (RV 4)	Important Problem (RV 3)	Problem (RV 2)	Light Problem (RV 1)
Education	<p>Engage in curricula review and development for primary and secondary schools to enhance the knowledge and understanding about coastal management issues- Issue of particular relevance from an agriculture perspective include:</p> <ul style="list-style-type: none"> • Sustainable development in areas under high development pressure (coastal, urban) • Importance of coasts and coastal habitats and resources • Importance of environmentally sound agriculture production. • Importance of integrated management (upstream / downstream). • Importance of marine environment. • Pollution, environment, health. • Waste minimisation and recycling. • Hydrological cycle 		<p>M-Agr-01: Poor land management</p> <p>M-Agr-07: Scarcity of supplies</p> <p>M-Agr-09: Dependence on rain fed agriculture</p>	<p>M-Agr-06: Drying and contamination of water resources</p>	<p>M-Agr-11: Salinization of soils</p>	<p>M-Agr-08: Disrupted coral rag bush fallow system</p>

Action areas

In Table 18 below an overview has been established on how strongly each intervention dimension responds to threats to local communities and ecosystems as perceived by local stakeholders.

For each intervention dimension and for each problem class the number of threats considered to benefit from the intervention have been multiplied by the range value (RV) for the given problem class. The total score for each management dimension has then been calculated by adding the values achieved. The table thus provides an indication of the importance of each intervention dimension in addressing identified and ranked threats. In the same manner Figure 18 gives a graphical presentation of the relevance of intervention dimensions in addressing the identified threats related to livestock and agriculture.

Table 18: Assessment of the importance of broad management dimension in addressing threats to local communities and ecosystems associated with livestock and agriculture.

Intervention Dimension	Major Problem weight	Very important problem weight	Important Problem weight	Problem weight	Light Problem weight	Total Score
Integrated Coastal Zone Management (ICZM)	0	16	3	0	0	19
Integrated Water Resources Management (IWRM)	0	16	3	2	0	21
Land Use Management	0	16	3	2	1	22
Shoreline Management Planning	0	4	0	0	0	4
Solid and Liquid Waste Management	0	0	3	0	0	3
Sanitation	0	0	3	0	0	3
Capacity Building	0	24	6	4	1	35
Technology	0	24	6	4	1	35
Law Enforcement	0	16	3	0	0	19
Legal Review	0	8	3	0	1	12
Alternative/ Improved Livelihood	0	4	0	2	0	6
Awareness Raising	0	28	3	2	1	34
Education	0	12	3	2	1	18
Mainland Tanzania			Agriculture		Total	231

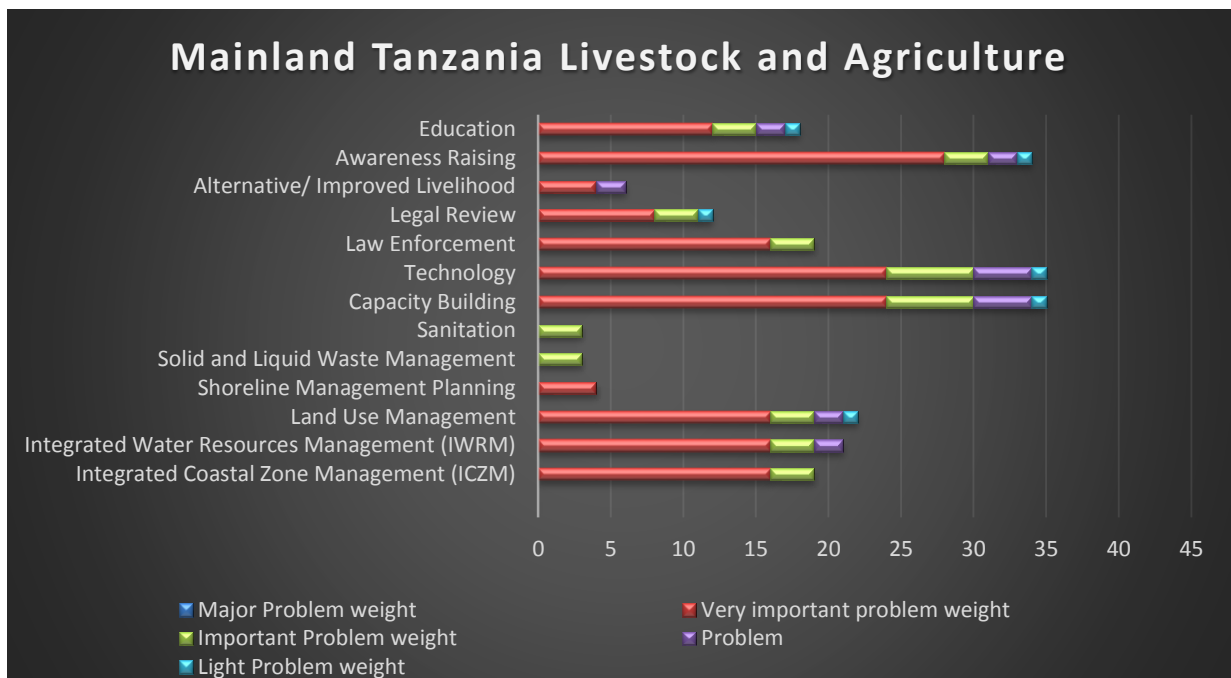


Figure 18: The importance of broad intervention dimension in responding to threats to local communities and ecosystems associated with livestock and agriculture.

Forestry

Forests and woodlands are key elements in the livelihoods of hundreds of thousands of households across Tanzania and cover an estimated 35 million hectares or 33% of the total land coverage.

Forests resources on Tanzania's mainland coastal districts are of three sorts: coastal forest reserves (high biodiversity, some as protected sites), coastal forest and thickets on general land (used for timber, charcoal), and mangrove forest (protected under law, but used amongst others for timber, poles, charcoal).



Forests provide a wide range of benefits both directly in the form of timber, forage, fruits, fuel wood and charcoal (providing 95% of Tanzania's energy supply), traditional medicines, and gums and resins, and indirectly through their ecosystem functions including regulating water-catchment, erosion control, nutrient cycling, maintaining local climates, and in supporting a rich biodiversity

The largest continuous mangrove areas are to be found on the coast of Tanga district in the north, in the delta of the Rufiji River (40%), in Kilwa and Lindi districts, Muheza, Bagamoyo, Kisarawe and in Mtwara, where the Ruvuma River forms an estuary close to the Mozambique border.

Coastal (and other) forests and mangroves in Tanzania are subject to increasing overexploitation, and varying degrees of degradation, whether they are protected forests, village forests or open access woodland. The deforestation rate was estimated in 2005 to be 1.2%/year, ranking Tanzania 6th globally for forest loss (GCAP, 2011). This is likely to increase as demand for forest products grow in the absence of alternatives. Meanwhile, the ability of the management institutions to contain or reduce the degradation is questionable, despite the large number of initiatives, NGOs and donors that support forest conservation programs.

The REDD Strategy 2012, addresses the current use of forest resources, proposing strategies to halt forest deforestation and degradation.

Prioritized Threats

In Table 19 below the threats identified related to forestry have been listed and ranked according to their severity as established using the CRIAM method discussed extensively in Volumes I and II of the Coastal Profile. A rapid assessment has been made on the susceptibility of each threat to impacts of climate change more specifically, changes in whether patterns, extreme events, sea level rise, temperature rise and acidification.

Table 19: Prioritised threats related to forestry and a rapid assessment of threat susceptibility to climate change.

#	Threat as identified in Coastal Profile	Threat Level	Influence from Climate Change					
			Change in Patterns	Extreme events	Sea Level Rise	Temperature rise	Acidification	
M-Forest-06	Encroachment of expanding agriculture and settlements into coastal forest reserves e.g. South Ruvu forest reserve and widespread in Msubugwe and Gendagenda FRs in Tanga region, Vikindu FR near Dar es salaam and near major centres e.g. Bagamoyo.	Major Problem	0	0	0	0	0	No impact from climate change on this threat
M-Forest-10	Inefficient use of biomass fuel production (e.g. forest charcoal) and consumption is extremely inefficient, exacerbating the demand.	Major Problem	0	0	0	0	0	No impact from climate change on this threat
M-Forest-01	Invasion of water catchments areas and upstream changes in river courses (springs, small seasonal streams, ponds and wetlands) by farmers (agriculture), leads to decreases in freshwater flows affecting coastal and mangrove forests (e.g. Pangani River estuary).	Very Important Problem	++	+	0	0	0	Effect will be exacerbated with weather pattern changes and extreme events
M-Forest-02	Inadequate enforcement of forest management regulations resulting in illegal clearing and over-harvesting of mangrove forests and coastal forests for various reasons: charcoal (Bagamoyo and close to large urban areas) and domestic firewood (most districts), for lime burning (in Rufiji, Mafia and Lindi), conversion to agricultural land (Rufiji for rice), tourist developments (e.g. Bagamoyo) and salt farms. Lack of effective enforcement, low penalties, and a long and cumbersome procedure to pass by-laws, dilutes the process.	Very Important Problem	0	0	0	0	0	No impact from climate change on this threat
M-Forest-07	Uncontrolled fires escaping from plot clearing destroys forests, killing wildlife and other living organisms and are a long term threat to coastal forests, exacerbated by long dry seasons experienced over recent years have caused the coastal forests to dry up and prone to forest fires.	Very Important Problem	++	+				Risk for such fires will rise with more frequent and severe drought situations
M-Forest-08	Ineffective implementation of land use planning resulting in destructive mining practices such as of limestone is widespread along coastal areas of Wazo Hill in Dar es Salaam and Amboni in Tanga, clearing forests while the Songo Songo gas project pipeline extending from Lindi to Dar es Salaam, with extensive damage to coastal forests, or over exploitation of coast forests for salt works or tourism.	Very Important Problem	0	0	0	0	0	No impact from climate change on this threat
M-Forest-11	Unreserved status in more than 60% of forest and woodlands leaving these areas with insufficient management instruments.	Very Important Problem	0	0	0	0	0	No impact from climate change on this threat
M-Forest-09	Land tenure uncertainty discourages long-term investment in village land and protection of sensitive areas as water catchment areas and forests.	Important Problem	0	0	0	0	0	No impact from climate change on this threat
M-Forest-03	Pollution from fertilizers, pesticides, and other toxic agrochemicals and solid wastes including from up-stream sources. DDT and Thiodan are widely used to control crabs in the rice farms in the Rufiji delta, can poison mangroves.	Problem	++++	+	0	0	0	Extreme events and changed weather patterns impact on effect ts of unsustainably use of agrochemicals upstream
M-Forest-04	Erosion of mangrove stands from sea level changes and storms.	Problem	++	++	++			Pressure on mangrove stands will increase with sea level rise and more frequent and severe extreme storms. Mangrove helath may also be impacted from changes in sedimentation and flows from catchments resulting from changed weather patterns.
M-Forest-05	Inadequate enforcement of hunting regulations resulting in loss of wildlife from many coastal forests (the demand for bush meat is ever increasing in coastal forest communities, notably Gendagenda forest reserve in Handeni district and Noto/ Chitoo Plateau forests in Lindi region).	Problem	0	0	0	0	0	No impact from climate change on this threat
+++	Threat is severely aggravated from climate change dimension							
++	Threat is aggravated from climate change dimension							
+	Threat is slightly aggravated from climate change dimension							
0	No influence of threat from climate change dimension							
-	Remediating effect on threat from climate change dimension							

Recommendations for threat mitigation measures

Overall measures to mitigate each if the identified forestry related threats to coastal local communities and ecosystems have been tabulated in Table 179(page339) arranged under broad management dimensions headings. Table 20below provides an overview of the requirements/opportunities expressed within each of these management or intervention dimensions.

Table 20: Broad management intervention dimensions to address identified and prioritised threats to coastal communities and ecosystems associated with forestry in Mainland Tanzania

Intervention Dimension	Statement	Threat pertinence at each RV				
		Major Problem (RV 5)	Very important problem (RV 4)	Important Problem (RV 3)	Problem (RV 2)	Light Problem (RV 1)
Integrated Coastal Zone Management (ICZM)	<p>Ensure coordination and participation in management of coastal land, water and resources use currently under complex pressures.</p> <p>Ensures coordinated and integrated management of forestry resources considering linkages to other sectors.</p> <p>Facilitate dialogues required to alleviate social conflicts over land use</p> <p>Link with hinterland management to address catchment and riverbank deforestation, river flow changes and river pollution, all of which affect the coast in many ways (ICARM).</p>	<p>M-Forest-06: Encroachment into coastal forests</p> <p>M-Forest-10: Inefficient use of biomass fuel.</p>	<p>M-Forest-01: Decreasing flows due to invasion in wetlands</p> <p>M-Forest-02: Inadequate enforcement of forest regulations</p> <p>M-Forest-07: Uncontrolled fires</p> <p>M-Forest-08: Ineffective land use planning</p> <p>M-Forest-11: Lack of protection status</p>	M-Forest-09: Land tenure uncertainty	M-Forest-03: Pollution from agrochemicals and solid waste	M-Forest-04: Erosion of mangrove stands
Integrated Water Resources Management (IWRM)	<p>Link IWRM to coastal integrated planning ensuring upstream/ downstream considerations (ICARM).</p> <p>Land use in catchments and its impacts on water resources included in IWRM planning.</p> <p>Upstream water management incorporating impacts on coastal forests in IWRM plans (ICARM).</p>		M-Forest-01: Decreasing flows due to invasion in wetlands	M-Forest-09: Land tenure uncertainty	M-Forest-03: Pollution from agrochemicals and solid waste	M-Forest-04: Erosion of mangrove stands
Land Use Management	<p>Land use information management systems to duly include forests and forest reserves.</p> <p>Incorporate forest reserves and forest uses in spatial planning.</p> <p>Inform hinterland spatial planning to direct zoning to address downstream impacts on coastal forests.</p>	<p>M-Forest-06: Encroachment into coastal forests</p> <p>M-Forest-10: Inefficient use of biomass fuel.</p>	<p>M-Forest-01: Decreasing flows due to invasion in wetlands</p> <p>M-Forest-02: Inadequate enforcement of forest regulations</p> <p>M-Forest-07: Uncontrolled fires</p> <p>M-Forest-08: Ineffective land use planning</p> <p>M-Forest-11: Lack of protection status</p>	M-Forest-09: Land tenure uncertainty	M-Forest-03: Pollution from agrochemicals and solid waste	M-Forest-04: Erosion of mangrove stands
Shoreline Management Planning	<p>Establish a systematic overview of coastal processes through a shoreline management investigation, considering the entire coast, and inform spatial planning accordingly. Sediment cell resolution national effort, management unit resolution regional/ district effort.</p> <p>Identifying management units to incorporate coastal forest concerns.</p>	<p>M-Forest-06: Encroachment into coastal forests</p> <p>M-Forest-10: Inefficient use of biomass fuel.</p>	<p>M-Forest-02: Inadequate enforcement of forest regulations</p> <p>M-Forest-08: Ineffective land use planning</p> <p>M-Forest-11: Lack of protection status</p>	M-Forest-09: Land tenure uncertainty	M-Forest-04: Erosion of mangrove stands	
Solid and Liquid Waste Management	<p>Review agrochemical management and inform land use accordingly.</p> <p>Pursue integrated solid and liquid waste management solutions considering:</p> <p>Waste water treatment systems:</p> <ul style="list-style-type: none"> - collection - treatment technology - discharge <p>Liquid Waste Management Systems:</p> <ul style="list-style-type: none"> - collection - storage - processing - financing - minimisation - reuse? <p>Green Infrastructure</p> <p>Storm Water Systems</p>				M-Forest-03: Pollution from agrochemicals and solid waste	
Sanitation						

Intervention Dimension	Statement	Threat pertinence at each RV				
		Major Problem (RV 5)	Very important problem (RV 4)	Important Problem (RV 3)	Problem (RV 2)	Light Problem (RV 1)
Capacity Building	<p>Accompany management interventions with appropriate capacity building components. Particular focus on</p> <ul style="list-style-type: none"> Monitoring forest reserves and their exploitation Monitoring wildlife reserve Catchment management Conflict resolution <p>Enhance information management systems to provide for better and systematically informed management decisions.</p> <p>Targeting relevant government departments at national and local levels, BMUs</p>	<p>M-Forest-06: Encroachment into coastal forests</p> <p>M-Forest-10: Inefficient use of biomass fuel.</p>	<p>M-Forest-01: Decreasing flows due to invasion in wetlands</p> <p>M-Forest-02: Inadequate enforcement of forest regulations</p> <p>M-Forest-07: Uncontrolled fires</p> <p>M-Forest-08: Ineffective land use planning</p> <p>M-Forest-11: Lack of protection status</p>	M-Forest-09: Land tenure uncertainty	<p>M-Forest-03: Pollution from agrochemicals and solid waste</p> <p>M-Forest-04: Erosion of mangrove stands</p> <p>M-Forest-05: Inadequate enforcement of hunting regulations</p>	
Technology	<p>Pursue opportunities through further technology development within:</p> <ul style="list-style-type: none"> Best forest management practises Alternative livelihoods remove pressure on forestry reserves and wildlife Alternative energy resources for households Monitoring, remote imageries GIS 	<p>M-Forest-06: Encroachment into coastal forests</p> <p>M-Forest-10: Inefficient use of biomass fuel.</p>	<p>M-Forest-01: Decreasing flows due to invasion in wetlands</p> <p>M-Forest-02: Inadequate enforcement of forest regulations</p> <p>M-Forest-07: Uncontrolled fires</p> <p>M-Forest-08: Ineffective land use planning</p> <p>M-Forest-11: Lack of protection status</p>	M-Forest-09: Land tenure uncertainty	<p>M-Forest-03: Pollution from agrochemicals and solid waste</p> <p>M-Forest-04: Erosion of mangrove stands</p> <p>M-Forest-05: Inadequate enforcement of hunting regulations</p>	
Law Enforcement	<p>1) Integrated review of laws, regulations and their enforcement within amongst others:</p> <ul style="list-style-type: none"> Coastal forest exploitation Use of fire to clear areas Coastal mining Wildlife Agrochemicals Mangrove <p>2) Optimise enforcement through capacity building and coordination following recommendations from review.</p>	<p>M-Forest-06: Encroachment into coastal forests</p> <p>M-Forest-10: Inefficient use of biomass fuel.</p>	<p>M-Forest-01: Decreasing flows due to invasion in wetlands</p> <p>M-Forest-02: Inadequate enforcement of forest regulations</p> <p>M-Forest-07: Uncontrolled fires</p> <p>M-Forest-08: Ineffective land use planning</p> <p>M-Forest-11: Lack of protection status</p>	M-Forest-09: Land tenure uncertainty	<p>M-Forest-03: Pollution from agrochemicals and solid waste</p> <p>M-Forest-04: Erosion of mangrove stands</p> <p>M-Forest-05: Inadequate enforcement of hunting regulations</p>	
Legal Review	<p>1) Integrated review of laws, regulations and their enforcement within amongst others:</p> <ul style="list-style-type: none"> Coastal forest exploitation Use of fire to clear areas Coastal mining Wildlife Agrochemicals Mangrove <p>2) Initiate revision of existing and develop new laws, regulations according to recommendations from review</p>		<p>M-Forest-01: Decreasing flows due to invasion in wetlands</p> <p>M-Forest-02: Inadequate enforcement of forest regulations</p> <p>M-Forest-07: Uncontrolled fires</p>	M-Forest-09: Land tenure uncertainty		
Alternative/ Improved Livelihood	<p>Develop and offer alternative livelihoods for households currently engaged in destructive exploitation of coastal forests. Particular efforts to provide alternatives for young generation.</p> <p>Explore in particular alternatives to fuel wood extraction.</p> <p>Improve current sustainable resource use livelihoods using technology advances and insights.</p>	<p>M-Forest-06: Encroachment into coastal forests</p> <p>M-Forest-10: Inefficient use of biomass fuel.</p>	<p>M-Forest-02: Inadequate enforcement of forest regulations</p> <p>M-Forest-07: Uncontrolled fires</p> <p>M-Forest-08: Ineffective land use planning</p> <p>M-Forest-11: Lack of protection status</p>		<p>M-Forest-04: Erosion of mangrove stands</p> <p>M-Forest-05: Inadequate enforcement of hunting regulations</p>	

Intervention Dimension	Statement	Threat pertinence at each RV				
		Major Problem (RV 5)	Very important problem (RV 4)	Important Problem (RV 3)	Problem (RV 2)	Light Problem (RV 1)
Awareness Raising	<p>Develop and launch awareness raising campaigns related to coastal management challenges directed to the public at large and to schools.</p> <p>Develop and launch issue specific awareness raising campaigns targeting stakeholders affected by or affecting the issue.</p> <p>And Target:</p> <ul style="list-style-type: none"> Stakeholders benefitting from coastal forest services and products Stakeholders benefitting from mangrove services and products Tourists 	<p>M-Forest-06: Encroachment into coastal forests</p> <p>M-Forest-10: Inefficient use of biomass fuel.</p>	<p>M-Forest-01: Decreasing flows due to invasion in wetlands</p> <p>M-Forest-02: Inadequate enforcement of forest regulations</p> <p>M-Forest-07: Uncontrolled fires</p> <p>M-Forest-08: Ineffective land use planning</p> <p>M-Forest-11: Lack of protection status</p>	M-Forest-09: Land tenure uncertainty	<p>M-Forest-03: Pollution from agrochemicals and solid waste</p> <p>M-Forest-04: Erosion of mangrove stands</p> <p>M-Forest-05: Inadequate enforcement of hunting regulations</p>	
Education	<p>Engage in curricula review and development for primary and secondary schools to enhance the knowledge and understanding about coastal management issues- Issue of particular relevance from a forestry perspective include:</p> <ul style="list-style-type: none"> Coastal forest and wildlife ecology Coastal forest management 	<p>M-Forest-06: Encroachment into coastal forests</p> <p>M-Forest-10: Inefficient use of biomass fuel.</p>	<p>M-Forest-01: Decreasing flows due to invasion in wetlands</p> <p>M-Forest-02: Inadequate enforcement of forest regulations</p> <p>M-Forest-07: Uncontrolled fires</p> <p>M-Forest-08: Ineffective land use planning</p> <p>M-Forest-11: Lack of protection status</p>	M-Forest-09: Land tenure uncertainty	<p>M-Forest-03: Pollution from agrochemicals and solid waste</p> <p>M-Forest-04: Erosion of mangrove stands</p> <p>M-Forest-05: Inadequate enforcement of hunting regulations</p>	

Action areas

In Table 21 below an overview has been established on how strongly each intervention dimension responds to threats to local communities and ecosystems as perceived by local stakeholders.

For each intervention dimension and for each problem class the number of threats considered to benefit from the intervention have been multiplied by the range value (RV) for the given problem class. The total score for each management dimension has then been calculated by adding the values achieved. The table thus provides an indication of the importance of each intervention dimension in addressing identified and ranked threats. In the same manner Figure 19 gives a graphical presentation of the relevance of intervention dimensions in addressing the identified threats related to with forestry.

Table 21: Assessment of the importance of broad management dimension in addressing threats to local communities and ecosystems associated with forestry.

Intervention Dimension	Major Problem weight	Very important problem weight	Important Problem weight	Problem weight	Light Problem weight	Total Score
Integrated Coastal Zone Management (ICZM)	10	20	3	4	0	37
Integrated Water Resources Management (IWRM)	0	4	3	4	0	11
Land Use Management	10	20	3	6	0	39
Shoreline Management Planning	10	12	3	2	0	27
Solid and Liquid Waste Management	0	0	0	2	0	2
Sanitation	0	0	0	0	0	0
Capacity Building	10	20	3	6	0	39
Technology	10	20	3	6	0	39
Law Enforcement	10	20	3	6	0	39
Legal Review	0	12	3	0	0	15
Alternative/ Improved Livelihood	10	16	0	4	0	30
Awareness Raising	10	20	3	6	0	39
Education	10	20	3	6	0	39
Mainland Tanzania				Forestry	Total	356

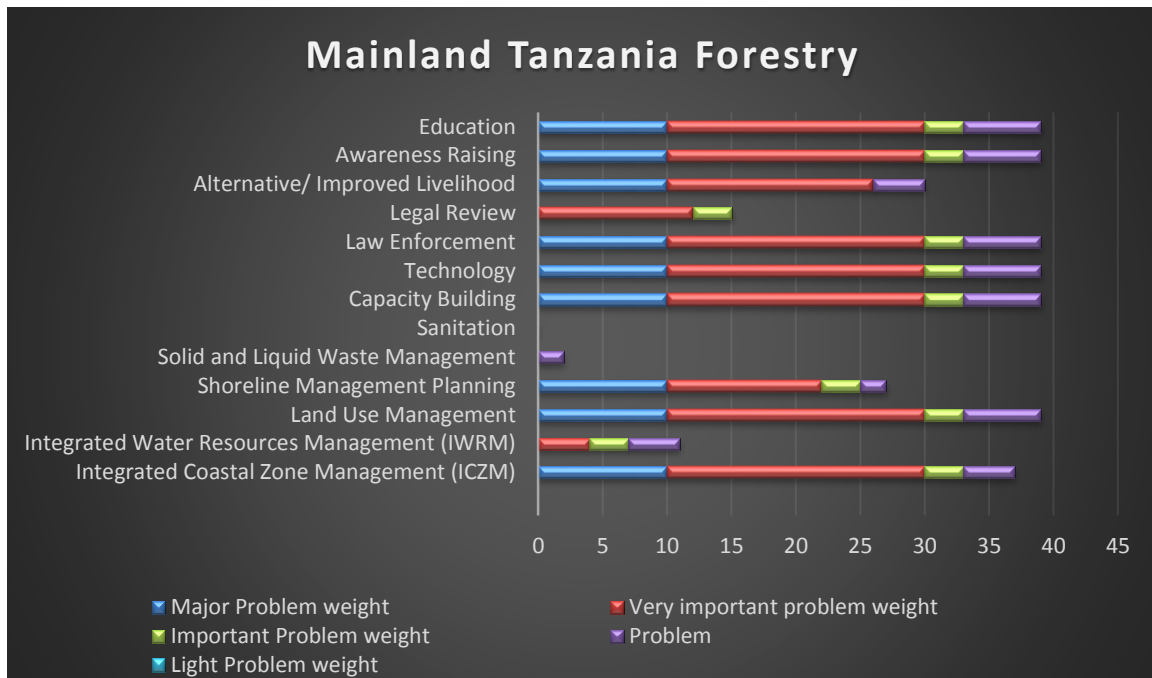


Figure 19: The importance of broad intervention dimension in responding to threats to local communities and ecosystems associated with forestry.

Industry

The majority of coastal industrial establishment are located in Dar es Salaam. Reasons for this include the long-established port and railways, the history of the city as the only site with sufficient infrastructure in the country, and the available workforce. Dar es Salaam has more than 575 major industrial establishments, with small and large scale industries a common feature in the City and including pharmaceutical, chemical, plastics and rubber, glass, metal works, soaps and detergents.

Outside Dar es Salaam, Tanga enjoys the fastest growth speed in regional GDP (18%), with impressive accumulation of factories such as textile mills, food processing, leather goods, handcrafts, cosmetics and construction materials. Mtwara and Lindi reflect an 8% and 12% GDP contribution growth and the Coast (Pwani) 12%. The major industrial and manufacturing sub-sectors present within the coastal regions are associated with limestone and cement, textiles and agro-processing.

The coastal zone will witness considerable industrial development in the coming 5-10 years. Oil and gas development is accelerating in Mtwara, Lindi and Kilwa and has the potential to benefit livelihoods by creating opportunities for business (e.g. fertilizer plants, cement factories, processing plants) that require large amounts of power and employment opportunities will expand. Industries in these traditionally poor regions has a better chance of accompanying economic development if some of profits from the activities are retained in the regions.



A major coastal development instrument promoted by the National Development Corporation includes the accumulation and concentration of industrial firms through cluster development, supported by Special Economic Zones (SEZ).

Three waterfront SEZs are planned: one for Dar es Salaam linked with the Central Railway Line to constitute the “Logistics Corridor” and TAZARA to constitute the “Agricultural Corridor”; Mtwara SEZ which is being developed as the “Minerals Corridor” and the

Tanga corridor to serve the areas of northern and north-western Tanzania up to and including Rwanda.

Prioritized Threats

In Table 22 below the threats identified related to industry have been listed and ranked according to their severity as established using the CRIAM method discussed extensively in Volumes I and II of the Coastal Profile. A rapid assessment has been made on the susceptibility of each threat to impacts of climate change more specifically, changes in weather patterns, extreme events, sea level rise, temperature rise and acidification.

Table 22: Prioritised threats related to industry and a rapid assessment of threat susceptibility to climate change.

#	Threat as identified in Coastal Profile	Threat Level	Influence from Climate Change				
			Change in Patterns	Extreme events	Sea Level Rise	Temperature Rise	Acidification
M-Industry-01	Inadequate infrastructure management unable to maintain supply of services (electricity, transport, water supply) to coastal regions, resulting in a disincentive for industry to be attracted to the coast and develop.	Very Important Problem	+	++	+++	0	0
			Demands for infrastructure increases to respond to sea level rise and impacts during extreme events.				
M-Industry-03	Industrial pollution of waterways and ground water.	Very Important Problem	+	+	+	0	0
			Flooding and inundations due to changed weather patterns and extreme events exacerbates impacts of industrial pollution				
M-Industry-04	Industrial pollution of waterways and open ground.	Very Important Problem	+	+	+	0	0
			Flooding and inundations due to changed weather patterns and extreme events exacerbates impacts of industrial pollution				
M-Industry-02	Lack of coordination of the choice of location of new industries (underlines the need for integrated planning).	Problem	++	++	++		
			The consequences of uncoordinated planning of industrial development will be aggravated from sea level rise and more frequent extreme events.				
M-Industry-05	Air emission leading to air pollution.	Light Problem	0	0	0	0	0
			No impact from climate change on this threat				
+++	Threat is severely aggravated from climate change dimension						
++	Threat is aggravated from climate change dimension						
+	Threat is slightly aggravated from climate change dimension						
0	No influence of threat from climate change dimension						
-	Remediating effect on threat from climate change dimension						

Recommendations for threat mitigation measures

Overall measures to mitigate each of the identified industry related threats to coastal local communities and ecosystems have been tabulated in Table 180 (page 341) arranged under broad management dimensions headings. Table 23 below provides an overview of the requirements/opportunities expressed within each of these management or intervention dimensions.

Table 23: Broad management intervention dimensions to address identified and prioritised threats to coastal communities and ecosystems associated with industry in Mainland Tanzania

Intervention Dimension	Statement	Threat pertinence at each RV				
		Major Problem (RV 5)	Very important problem (RV 4)	Important Problem (RV 3)	Problem (RV 2)	Light Problem (RV 1)
Integrated Coastal Zone Management (ICZM)	<p>Ensure coordination and participation in management of coastal land, water and resources use currently under complex pressures.</p> <p>Ensures coordinated and integrated management of industries considering linkages to other sectors.</p> <p>Facilitate dialogues required to alleviate social conflicts over land use</p> <p>Link with hinterland management to address catchment and riverbank deforestation, river flow changes and river pollution, all of which affect the coast in many ways (ICARM).</p>		<p>M-Industry-03: Pollution of water ways and ground water</p> <p>M-Industry-04: Pollution of water ways and open ground</p>			
Integrated Water Resources Management (IWRM)	<p>Link IWRM to coastal integrated planning ensuring upstream/ downstream considerations (ICARM).</p> <p>Land use in catchments and its impacts on water resources included in IWRM planning.</p> <p>Upstream water management incorporating industry impacts on coastal ecosystems in IWRM plans (ICARM).</p>		<p>M-Industry-03: Pollution of water ways and ground water</p> <p>M-Industry-04: Pollution of water ways and open ground</p>			
Land Use Management	<p>Land use information management systems to duly include industry locations.</p> <p>Incorporate industries in spatial planning.</p> <p>Inform hinterland spatial planning to direct zoning to address downstream impacts from industries.</p>		<p>M-Industry-03: Pollution of water ways and ground water</p> <p>M-Industry-04: Pollution of water ways and open ground</p>		M-Industry-02: Lack of coordination of industry site selection	M-Industry-05: Air pollution from industry emissions

Intervention Dimension	Statement	Threat pertinence at each RV				
		Major Problem (RV 5)	Very important problem (RV 4)	Important Problem (RV 3)	Problem (RV 2)	Light Problem (RV 1)
Shoreline Management Planning						
Solid and Liquid Waste Management	<p>Review of management of industrial wastes.</p> <p>Pursue integrated solid and liquid waste management solutions considering:</p> <p>Industrial waste water treatment systems:</p> <ul style="list-style-type: none"> - collection - treatment technology - discharge <p>Industrial solid waste management systems:</p> <ul style="list-style-type: none"> - collection - storage - processing - financing - minimisation - reuse? <p>Green Infrastructure</p> <p>Storm Water Systems</p>		<p>M-Industry-03: Pollution of water ways and ground water</p> <p>M-Industry-04: Pollution of water ways and open ground</p>			M-Industry-05: Air pollution from industry emissions
Sanitation						
Capacity Building	<p>Accompany management interventions with appropriate capacity building components. Particular focus on</p> <ul style="list-style-type: none"> • Spatial planning • Industrial waste <p>Enhance information management systems to provide for better and systematically informed management decisions. Include:</p> <ul style="list-style-type: none"> • Industrial waste streams • Industrial pollution streams <p>Targeting relevant government departments at national and local levels.</p>		<p>M-Industry-01: Inadequate infrastructure to service industries</p> <p>M-Industry-03: Pollution of water ways and ground water</p> <p>M-Industry-04: Pollution of water ways and open ground</p>		M-Industry-02: Lack of coordination of industry site selection	M-Industry-05: Air pollution from industry emissions
Technology	<p>Pursue opportunities through further technology development within:</p> <ul style="list-style-type: none"> • Clean industrial technologies • Waste solid and liquid industrial waste treatment • Air emission treatment • Monitoring, remote imageries • GIS 		<p>M-Industry-01: Inadequate infrastructure to service industries</p> <p>M-Industry-03: Pollution of water ways and ground water</p> <p>M-Industry-04: Pollution of water ways and open ground</p>		M-Industry-02: Lack of coordination of industry site selection	M-Industry-05: Air pollution from industry emissions
Law Enforcement	<p>1) Integrated review of laws, regulations and their enforcement within amongst others:</p> <ul style="list-style-type: none"> • Industrial waste treatment and disposal • Air pollution <p>2) Optimise enforcement through capacity building and coordination following recommendations from review.</p>		<p>M-Industry-03: Pollution of water ways and ground water</p> <p>M-Industry-04: Pollution of water ways and open ground</p>			M-Industry-05: Air pollution from industry emissions
Legal Review						
Alternative/ Improved Livelihood						
Awareness Raising	<p>Develop and launch awareness raising campaigns related to coastal management challenges directed to the public at large and to schools.</p> <p>Develop and launch issue specific awareness raising campaigns targeting stakeholders affected by or affecting the issue.</p> <p>And Target:</p> <ul style="list-style-type: none"> • Relevant industria/ activities 		<p>M-Industry-03: Pollution of water ways and ground water</p> <p>M-Industry-04: Pollution of water ways and open ground</p>		M-Industry-02: Lack of coordination of industry site selection	M-Industry-05: Air pollution from industry emissions

Intervention Dimension	Statement	Threat pertinence at each RV				
		Major Problem (RV 5)	Very important problem (RV 4)	Important Problem (RV 3)	Problem (RV 2)	Light Problem (RV 1)
Education	Engage in curricula review and development for primary and secondary schools to enhance the knowledge and understanding about coastal management issues. Issue of particular relevance from an industry perspective include: <ul style="list-style-type: none"> • Environmentally sound industries • Integrated management (cross sector, upstream/downstream, ICARM) 		M-Industry-03: Pollution of water ways and ground water M-Industry-04: Pollution of water ways and open ground			M-Industry-05: Air pollution from industry emissions

Action areas

In Table 24 below an overview has been established on how strongly each intervention dimension responds to threats to local communities and ecosystems as perceived by local stakeholders.

For each intervention dimension and for each problem class the number of threats considered to benefit from the intervention have been multiplied by the range value (RV) for the given problem class. The total score for each management dimension has then been calculated by adding the values achieved. The table thus provides an indication of the importance of each intervention dimension in addressing identified and ranked threats. In the same manner Figure 20 gives a graphical presentation of the relevance of intervention dimensions in addressing the identified threats related to with industry.

Table 24: Assessment of the importance of broad management dimension in addressing threats to local communities and ecosystems associated with industry.

Intervention Dimension	Major Problem weight	Very important problem weight	Important Problem weight	Problem weight	Light Problem weight	Total Score
Integrated Coastal Zone Management (ICZM)	0	8	0	0	0	8
Integrated Water Resources Management (IWRM)	0	8	0	0	0	8
Land Use Management	0	8	0	2	1	11
Shoreline Management Planning	0	0	0	0	0	0
Solid and Liquid Waste Management	0	8	0	0	1	9
Sanitation	0	0	0	0	0	0
Capacity Building	0	12	0	2	1	15
Technology	0	12	0	2	1	15
Law Enforcement	0	8	0	0	1	9
Legal Review	0	0	0	0	0	0
Alternative/ Improved Livelihood	0	0	0	0	0	0
Awareness Raising	0	8	0	2	1	11
Education	0	8	0	0	1	9
Mainland Tanzania				Industry	Total	95

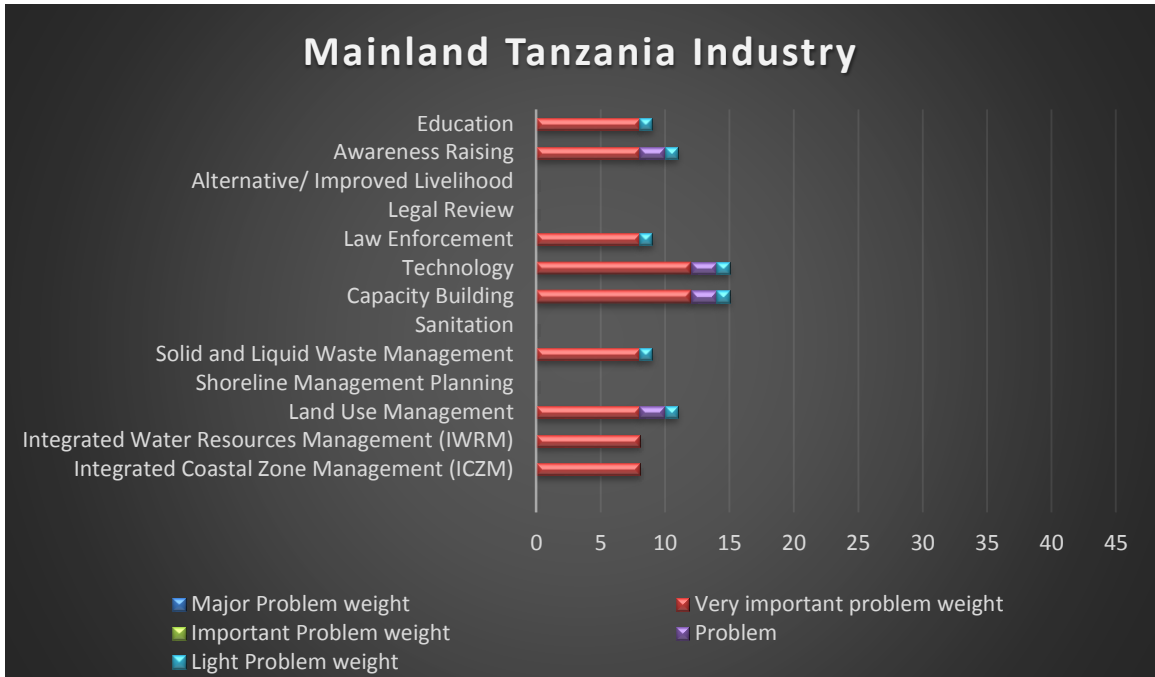


Figure 20: The importance of broad intervention dimension in responding to threats to local communities and ecosystems associated with industry.

Ports and Harbours

The Tanzanian mainland ports system comprises one large international port, Dar es Salaam, with a throughput of 13.5 million tonnes for the period 2012-13; two medium sized coastal ports, Tanga and Mtwara, with throughputs of 380,000 and 295,000 tonnes respectively for the period 2012-13; and the secondary coastal ports with current throughputs of less than 50,000 tonnes per annum (2007), namely Pangani, Kilindoni (Mafia), Kilwa Masoko and Kilwa Kivinje, Rushungi, Lindi and Mikindani (Mtwara).



Between 2001 and 2007 the average growth rate for coastal ports was 9.2% per annum (8.5% per annum for imports and 9.1% per annum for exports) (TPA 2009). Container traffic has been growing even faster, at around 13.5% per annum, and there has also been strong growth in dry bulk cargoes such as wheat, fertilisers and cement. Liquid bulk traffic (mainly oil) has been growing at an average rate of 5.4% per annum, but break-bulk traffic has been static. Transit traffic to the land-locked countries (Burundi, Rwanda, Uganda, Malawi and Zambia) makes up a growing proportion of Dar es Salaam's traffic, increasing from 10% to 41% of liquid bulks, and from 25% to 39% of containers between 2001 and 2007.



All Tanzania's coastal ports are located close to their city centres, where their operation contributes to traffic congestion and other adverse environmental effects, especially in the largest port of Dar es Salaam. Difficulties in acquiring land have led to cramped and inefficient port layouts, and imposed serious constraints on port expansion plans.

Since approximately 90% of Tanzania's international transactions transit through the port of Dar es Salaam, improvements to this facility (especially efficiency) should be prioritised.

For example, it is estimated that it takes on average seven days to transport goods from Dar es Salaam to the Zambian border (counting for the poor infrastructure and administrative delays). By comparison, the waiting time, including anchorage and dwell time, at the port of Dar es Salaam was generally higher than 20 days (as of mid- 2012).

Prioritized Threats

In Table 25 below the threats identified related to ports and harbours have been listed and ranked according to their severity as established using the CRIAM method discussed extensively in Volumes I and II of the Coastal Profile. A rapid assessment has been made on the susceptibility of each threat to impacts of climate change more specifically, changes in whether patterns, extreme events, sea level rise, temperature rise and acidification.

Table 25: Prioritised threats related to Ports and Harbours and a rapid assessment of threat susceptibility to climate change.

#	Threat as identified in Coastal Profile	Threat Level	Influence from Climate Change				
			Change in Patterns	Extreme events	Sea Level Rise	Temperature rise	Acidification
M-P&H-01	Inefficient operation at Dar es Salaam port leading to loss of economic competitiveness (compared to other ports e.g. Mombasa) by increasing the costs of import/export to/from global markets.	Problem	0	0	0	0	0
			No impact from climate change on this threat				
M-P&H-02	Inadequate compensation for land for port expansion at Dar es Salaam, Mtwara, Mwamabni (Tanga) and Bagamoyo.	Problem	0	0	0	0	0
			No impact from climate change on this threat				
M-P&H-03	Inadequate environmental mitigation during port expansion at Mtwara, Mwamabni (Tanga) and Bagamoyo, leading to environmental degradation e.g. siltation of reefs.	Problem	+	+	+	0	0
			Extreme events, sea level rise and changed weather patterns may aggravate environmental degradation caused by port expansion.				
M-P&H-04	Erosion of shorelines adjacent to some secondary ports: Kilindoni (Mafia), Lindi, Rushungi, Kilwa Kivinje and Kilwa Masoko ports.	Light Problem	++	++	++	0	0
			Changed weather patterns may interfere with sediment balances. Extreme events and sea level rise aggravate erosion.				
M-P&H-05	Pollution arising from port activities and traffic.	Light Problem	+	+	+	0	0
			Flooding and inondations due to changed weather patterns and extreme events exacerbates impacts of pollution				
+++	Threat is severely aggravated from climate change dimension						
++	Threat is aggravated from climate change dimension						
+	Threat is slightly aggravated from climate change dimension						
0	No influence of threat from climate change dimension						
-	Remediating effect on threat from climate change dimension						

Recommendations for threat mitigation measures

Overall measures to mitigate each of the identified ports and harbours related threats to coastal local communities and ecosystems have been tabulated in Table 181 (page 342) arranged under broad management dimensions headings. Table 26 below provides an overview of the requirements/opportunities expressed within each of these management or intervention dimensions.

Table 26: Broad management intervention dimensions to address identified and prioritised threats to coastal communities and ecosystems associated with ports and harbours in Mainland Tanzania

Intervention Dimension	Statement	Threat pertinence at each RV				
		Major Problem (RV 5)	Very important problem (RV 4)	Important Problem (RV 3)	Problem (RV 2)	Light Problem (RV 1)
Integrated Coastal Zone Management (ICZM)	<p>Ensure coordination and participation in management of coastal land, water and resources use currently under complex pressures.</p> <p>Facilitate dialogues required to alleviate social conflicts over resources use.</p> <p>Link with hinterland management to address catchment and riverbank deforestation, river flow changes and river sedimentation loads, all of which affect the coastlines in many ways (ICARM).</p>					<p>M-P&H-04: Erosion of shorelines around some secondary ports.</p> <p>M-P&H-05: Pollution from port activities and traffic.</p>
Integrated Water Resources Management (IWRM)	<p>Link IWRM to coastal integrated planning ensuring upstream/downstream considerations (ICARM).</p> <p>Land use in catchments and its impacts on coastlines included in IWRM planning.</p>					M-P&H-04: Erosion of shorelines around some secondary ports.
Land Use Management	<p>Land use information management systems to shoreline management parameters.</p> <p>Incorporate shoreline management concerns in spatial planning.</p> <p>Inform hinterland spatial planning to direct zoning to mitigate downstream impacts on coastlines.</p>					<p>M-P&H-04: Erosion of shorelines around some secondary ports.</p> <p>M-P&H-05: Pollution from port activities and traffic.</p>

Intervention Dimension	Statement	Threat pertinence at each RV				
		Major Problem (RV 5)	Very important problem (RV 4)	Important Problem (RV 3)	Problem (RV 2)	Light Problem (RV 1)
Shoreline Management Planning	Establish a systematic overview of coastal processes through a shoreline management investigation, considering the entire coast, and inform spatial planning accordingly. Sediment cell resolution national effort, management unit resolution regional/district effort.					M-P&H-04: Erosion of shorelines around some secondary ports. M-P&H-05: Pollution from port activities and traffic.
Solid and Liquid Waste Management	Pursue integrated solid and liquid waste management solutions considering: Waste water management system in ports and on ships: - collection - treatment technology - discharge Liquid Waste Management Systems in ports and on ships: - collection - storage - processing - financing - minimisation - reuse?					M-P&H-05: Pollution from port activities and traffic.
Sanitation						
Capacity Building	Accompany management interventions with appropriate capacity building components. Particular focus on spatial planning, shoreline management, pollution control. Enhance information management systems to provide for better and systematically informed management decisions.				M-P&H-01: Inefficient operation of DAR port. M-P&H-03: Inadequate environmental mitigation during port expansion	M-P&H-04: Erosion of shorelines around some secondary ports. M-P&H-05: Pollution from port activities and traffic.
Technology	Pursue opportunities through further technology development within: <ul style="list-style-type: none"> Port management Shoreline management Pollution management in ports and on ships 				M-P&H-01: Inefficient operation of DAR port.	M-P&H-04: Erosion of shorelines around some secondary ports. M-P&H-05: Pollution from port activities and traffic.
Law Enforcement	1) Integrated review of laws, regulations and their enforcement within amongst others: <ul style="list-style-type: none"> Land appropriation Environmental and Social Impact Assessments (ESIA) Waste management in ports and on ships Shoreline management 2) Optimise enforcement through capacity building and coordination following recommendations from review.				M-P&H-02: Inadequate land compensation related to port expansion. M-P&H-03: Inadequate environmental mitigation during port expansion	M-P&H-04: Erosion of shorelines around some secondary ports. M-P&H-05: Pollution from port activities and traffic.
Legal Review	1) Integrated review of laws, regulations and their enforcement within amongst others: <ul style="list-style-type: none"> Land appropriation Environmental and Social Impact Assessments (ESIA) Waste management in ports and on ships Shoreline management 2) Initiate revision of existing and develop new laws, regulations according to recommendations from review				M-P&H-02: Inadequate land compensation related to port expansion.	M-P&H-04: Erosion of shorelines around some secondary ports.
Alternative/ Improved Livelihood	Develop and offer alternative livelihoods for households currently engaged in destructive practises impacting on shorelines. Improve current sustainable resource use livelihoods using technology advances and insights.					M-P&H-04: Erosion of shorelines around some secondary ports.

Intervention Dimension	Statement	Threat pertinence at each RV				
		Major Problem (RV 5)	Very important problem (RV 4)	Important Problem (RV 3)	Problem (RV 2)	Light Problem (RV 1)
Awareness Raising	Develop and launch awareness raising campaigns related to coastal management challenges directed to the public at large and to schools. Develop and launch issue specific awareness raising campaigns targeting stakeholders affected by or affecting the issue. Particular emphasis on shoreline processes and impacts on shorelines and environment from ports and marine traffic and on contingency planning.					M-P&H-04: Erosion of shorelines around some secondary ports. M-P&H-05: Pollution from port activities and traffic.
Education	Engage in curricula review and development for primary and secondary schools to enhance the knowledge and understanding about coastal management issues- Issue of particular relevance from a fisheries perspective include: <ul style="list-style-type: none"> • Importance of beaches • Pollution, environment health • Waste minimisation and recycling • Contingency planning 					M-P&H-04: Erosion of shorelines around some secondary ports. M-P&H-05: Pollution from port activities and traffic.

Action areas

In Table 27 below an overview has been established on how strongly each intervention dimension responds to threats to local communities and ecosystems as perceived by local stakeholders.

For each intervention dimension and for each problem class the number of threats considered to benefit from the intervention have been multiplied by the range value (RV) for the given problem class. The total score for each management dimension has then been calculated by adding the values achieved. The table thus provides an indication of the importance of each intervention dimension in addressing identified and ranked threats. In the same manner Figure 21 gives a graphical presentation of the relevance of intervention dimensions in addressing the identified threats related to with ports and harbours.

Table 27: Assessment of the importance of broad management dimension in addressing threats to local communities and ecosystems associated with ports and harbours.

Intervention Dimension	Major Problem weight	Very important problem weight	Important Problem weight	Problem weight	Light Problem weight	Total Score
Integrated Coastal Zone Management (ICZM)	0	0	0	0	2	2
Integrated Water Resources Management (IWRM)	0	0	0	0	1	1
Land Use Management	0	0	0	0	2	2
Shoreline Management Planning	0	0	0	0	2	2
Solid and Liquid Waste Management	0	0	0	0	1	1
Sanitation	0	0	0	0	0	0
Capacity Building	0	0	0	4	2	6
Technology	0	0	0	2	2	4
Law Enforcement	0	0	0	4	2	6
Legal Review	0	0	0	2	1	3
Alternative/ Improved Livelihood	0	0	0	0	1	1
Awareness Raising	0	0	0	0	2	2
Education	0	0	0	0	2	2
Mainland Tanzania				Ports & Harbours	Total	32

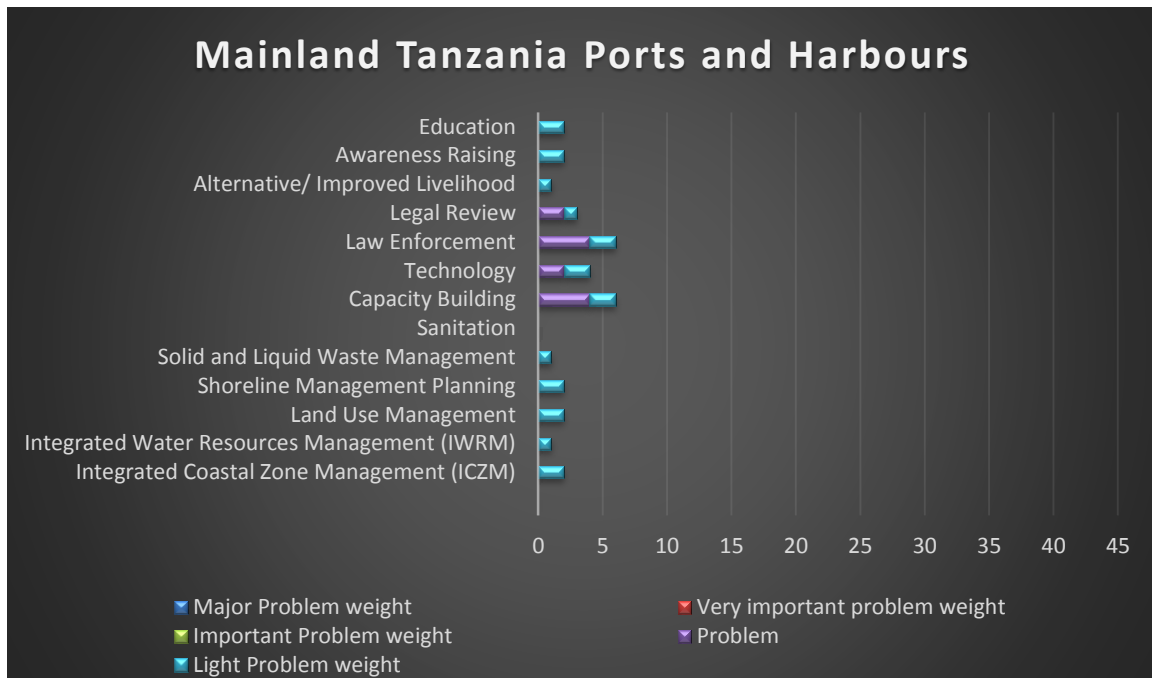


Figure 21: The importance of broad intervention dimension in responding to threats to local communities and ecosystems associated with ports and harbours.

Infrastructure

The speed of population growth, urbanisation and the need for infrastructure is taking place in many parts of the coast place enormous pressure on the local authorities to match the provision of basic services (clean water supply, power and energy, transportation, health, education, etc.). Some of the sub-sector fare better than others, for example the ICT developments over recent years are far more impressive than the development in provision of safe drinking water.



Enterprise surveys suggest that infrastructure constraints are responsible for about 34% of the productivity handicap faced by the private sector in Tanzania over the period 2002-2006, with the remainder being due to governance, red tape, and financing constraints. Transportation is reportedly the infrastructure constraint that weighs most heavily on businesses followed closely by water supply.

The coastal zone will witness considerable development in business and trade in the coming 5-10 years. Oil and gas development is accelerating in Mtwara, Lindi and Kilwa and has the potential to benefit livelihoods through employment, while companies in the sector are likely to further engage in the community and support local development.



Infrastructure in these traditionally poor regions has a better chance of accompanying economic development if some of profits from the activities are retained in the regions. Agricultural output, tourism development and general trade are likely to witness accelerated growth in the near future, especially in the southern coastal region, but also to the north. Tanga and Pangani are already witnessing growth in the tourism sector, largely due to

better roads and infrastructure, and the trend is likely to continue. The challenge will be for the responsible ministries and local authorities to implement and maintain the infrastructure sub-sectors that need developing.

Tanzania has recently embarked on the concept of “development corridors” with the National Development Corporation charged with their implementation, whereby large public investments in energy and transport will support and boost private sector investment in mining and agriculture along four corridors, thus ensuring balanced regional growth, running from the coast inland. The corridors are the “Tanga Corridor”, the “Central Corridor”, the “Southern Agricultural Growth Corridor” and the “Mtwara (or Ruwuma) Corridor”.

Prioritized Threats

In Table 28 below the threats identified related to infrastructure have been listed and ranked according to their severity as established using the CRIAM method discussed extensively in Volumes I and II of the Coastal Profile. A rapid assessment has been made on the susceptibility of each threat to impacts of climate change more specifically, changes in whether patterns, extreme events, sea level rise, temperature rise and acidification.

Table 28: Prioritised threats related to infrastructure and a rapid assessment of threat susceptibility to climate change.

#	Threat as identified in Coastal Profile	Threat Level	Influence from Climate Change				
			Change in Patterns	Extreme events	Sea Level Rise	Temperature rise	Acidification
M-Infra-01	Poor infrastructure management leading to poor or biased choices for development, for example, promoting road transport at the expenses of developing railways.	Very Important Problem	+	++	++	0	0
			Infrastructure needs to be carefully planned and managed with due considerations to climate change to avoid or mitigate impacts from sea level rise and extreme events				
M-Infra-02	Inadequate infrastructure management unable to maintain supply of services (electricity, transport, water supply, health and education services and ICT) to coastal regions, resulting in a deterioration of living standards, business development and prosperity.	Very Important Problem	+	++	++	0	0
			Infrastructure needs to be carefully planned and managed with due considerations to climate change to avoid or mitigate impacts from sea level rise and extreme events and to optimise infrastructure services delivery.				
M-Infra-03	Weak Implementation of Environmental Legislation (Inception Meeting Addition)	Very Important Problem	++	++	++		
			Environmental impact assessments incorporating climate change considerations are imperative to avoid or mitigate impacts.				
+++	Threat is severely aggravated from climate change dimension						
++	Threat is aggravated from climate change dimension						
+	Threat is slightly aggravated from climate change dimension						
0	No influence of threat from climate change dimension						
-	Remediating effect on threat from climate change dimension						

Recommendations for threat mitigation measures

Overall measures to mitigate each if the identified infrastructure related threats to coastal local communities and ecosystems have been tabulated in Table 182(page343) arranged under broad management dimensions headings. Table 29 below provides an overview of the requirements/opportunities expressed within each of these management or intervention dimensions.

Table 29: Broad management intervention dimensions to address identified and prioritised threats to coastal communities and ecosystems associated with infrastructure in Mainland Tanzania

Intervention Dimension	Statement	Threat pertinence at each RV				
		Major Problem (RV 5)	Very important problem (RV 4)	Important Problem (RV 3)	Problem (RV 2)	Light Problem (RV 1)
Integrated Coastal Zone Management (ICZM)	Ensure coordination and participation in management of coastal land, water and resources use currently under complex pressures. Develop infrastructure accommodating sector coordination and delivering to local levels. Link with hinterland management to facilitate infrastructure coherence in sustainably delivering services and products satisfying requirements at the coast (ICARM).		M-Infra-01: Poor infrastructure planning			
Integrated Water Resources Management (IWRM)	Link IWRM to coastal integrated planning ensuring upstream/ downstream considerations (ICARM). Infrastructure in catchments and its importance for coastal connection consider in IWRM planning.		M-Infra-01: Poor infrastructure planning			
Land Use Management	Land use information management systems to include infrastructure. Incorporate infrastructure required to satisfy development objectives in spatial planning. Inform hinterland spatial planning to enable infrastructure linkages.		M-Infra-01: Poor infrastructure planning			
Shoreline Management Planning	Establish a systematic overview of coastal processes through a shoreline management investigation, considering the entire coast, and inform spatial planning accordingly. Sediment cell resolution national effort, management unit resolution regional/district effort.		M-Infra-01: Poor infrastructure planning			
Solid and Liquid Waste Management	Extend solid and liquid waste management infrastructure to satisfy current and planned population and economic activities.		M-Infra-01: Poor infrastructure planning			

Intervention Dimension	Statement	Threat pertinence at each RV				
		Major Problem (RV 5)	Very important problem (RV 4)	Important Problem (RV 3)	Problem (RV 2)	Light Problem (RV 1)
Sanitation	Extend sanitation management infrastructure to satisfy current and planned population and economic activities.		M-Infra-01: Poor infrastructure planning			
Capacity Building	Accompany management interventions with appropriate capacity building components. Particular focus on spatial planning. Enhance information management systems to provide for better and systematically informed management decisions.		M-Infra-01: Poor infrastructure planning M-Infra-02: Poor infrastructure maintenance M-Infra-03: Weak implementation of environment legislation			
Technology	Apply new infrastructure technologies to minimize impacts and increase cost-effectiveness		M-Infra-01: Poor infrastructure planning M-Infra-02: Poor infrastructure maintenance			
Law Enforcement	Integrated review of laws, regulations and their enforcement within amongst others: <ul style="list-style-type: none"> Development planning and control Optimise enforcement through capacity building and coordination following recommendations from review.		M-Infra-01: Poor infrastructure planning M-Infra-02: Poor infrastructure maintenance M-Infra-03: Weak implementation of environment legislation			
Legal Review	Integrated review of laws, regulations and their enforcement within amongst others: <ul style="list-style-type: none"> Development planning and control Initiate revision of existing and develop new laws, regulations according to recommendations from review		M-Infra-01: Poor infrastructure planning M-Infra-02: Poor infrastructure maintenance M-Infra-03: Weak implementation of environment legislation			
Alternative/ Improved Livelihood						
Awareness Raising	Develop and launch awareness raising campaigns related to coastal management challenges directed to the public at large and to schools. Develop and launch issue specific awareness raising campaigns targeting stakeholders affected by or affecting the issue.		M-Infra-03: Weak implementation of environment legislation			
Education	Engage in curricula review and development for primary and secondary schools to enhance the knowledge and understanding about coastal management issues- Issue of particular relevance from a fisheries perspective include: Importance of spatial planning in sustainably securing services through infrastructure to people and economic development.		M-Infra-01: Poor infrastructure planning M-Infra-02: Poor infrastructure maintenance			

Action areas

In Table 30 below an overview has been established on how strongly each intervention dimension responds to threats to local communities and ecosystems as perceived by local stakeholders.

For each intervention dimension and for each problem class the number of threats considered to benefit from the intervention have been multiplied by the range value (RV) for the given problem class. The total score for each management dimension has then been calculated by adding the values achieved. The table thus provides an indication of the importance of each intervention dimension in addressing identified and ranked threats. In the same manner Figure 22 gives a graphical presentation of the relevance of intervention dimensions in addressing the identified threats related to with infrastructure.

Table 30: Assessment of the importance of broad management dimension in addressing threats to local communities and ecosystems associated with infrastructure.

Intervention Dimension	Major Problem weight	Very important problem weight	Important Problem weight	Problem weight	Light Problem weight	Total Score
Integrated Coastal Zone Management (ICZM)	0	4	0	0	0	4
Integrated Water Resources Management (IWRM)	0	4	0	0	0	4
Land Use Management	0	4	0	0	0	4
Shoreline Management Planning	0	4	0	0	0	4
Solid and Liquid Waste Management	0	4	0	0	0	4
Sanitation	0	4	0	0	0	4
Capacity Building	0	12	0	0	0	12
Technology	0	8	0	0	0	8
Law Enforcement	0	12	0	0	0	12
Legal Review	0	12	0	0	0	12
Alternative/ Improved Livelihood	0	0	0	0	0	0
Awareness Raising	0	4	0	0	0	4
Education	0	8	0	0	0	8
Mainland Tanzania				Infrastructure	Total	80

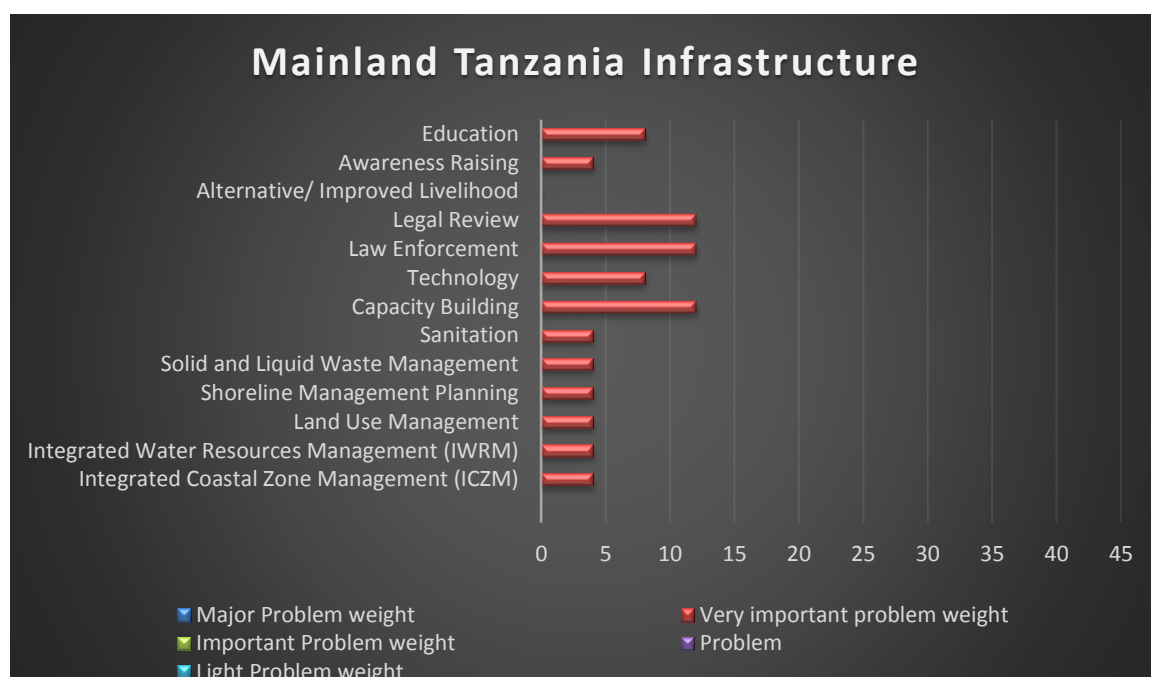


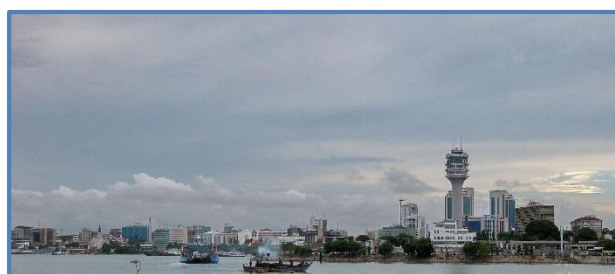
Figure 22: The importance of broad intervention dimension in responding to threats to local communities and ecosystems associated with infrastructure.

Urbanisation

The proportion of people living in urban areas in Tanzania has increased from less than 10% in 1975 to 33% in 2003. The annual urban growth rate is estimated at 2.8 %, indicating that it is among one of the most rapidly urbanising countries in the region. This growth rate is typical of most of principle coastal urban centres.

Among the fifteen coastal districts there are seven centres that are considered urban, Tanga city, Muheza, Bagamoyo, Dar es Salaam, Utete (Rufiji), Lindi and Mtwara. Of these, Dar es Salaam is by far the largest.

Dar es Salaam had a population of about 150,969 in 1963 which increased to 2.5 million by 2001 and to 4.4 million by 2012. The city now hosts 8% of the national population and generates over 70% of the national GDP. It has a land area of 565 km² from 30 km² in 1963. Much of the urban growth of Dar es Salaam has been unguided characterised by informal settlements and un-serviced housing areas and a growing informal sector. In Bagamoyo, 65% of the urban population live in unplanned and un-serviced settlements.



The speed at which urbanisation is taking place in Dar es Salaam and in other major coastal cities places enormous pressure on the city authorities to match the provision of basic services (clean water supply, sewage and waste management, transportation, health, education, etc.).

Urban growth in Tanzania is projected to continue in the coming decades. If the current predicaments faced in urban centres are not addressed soon, conditions will deteriorate.

As density increases and unplanned settlements become more congested, investments in facilities, services and infrastructure are will become costlier, both financially and socially.

Already Dar es Salaam has one of the highest proportions of urban residents living in unplanned settlements in all of sub-Saharan Africa

Prioritized Threats

In Table 31 below the threats identified related to urbanisation have been listed and ranked according to their severity as established using the CRIAM method discussed extensively in Volumes I and II of the Coastal Profile. A rapid assessment has been made on the susceptibility of each threat to impacts of climate change more specifically, changes in whether patterns, extreme events, sea level rise, temperature rise and acidification.

Table 31: Prioritised threats related tourbanisation and a rapid assessment of threat susceptibility to climate change.

#	Threat as identified in Coastal Profile	Threat Level	Influence from Climate Change				
			Change in Patterns	Extreme events	Sea Level Rise	Temperature rise	Acidification
M-Urban-02	Inadequate solid waste management causing pollution of the landscape, watersheds and the coast.	Very Important Problem	+	++	++	0	0
M-Urban-06	Youth Unemployment (Inception Meeting Addition)	Very Important Problem	0	0	0	0	0
M-Urban-01	Poor urban management leading to overcrowding informal settlements that lack clean water and adequate sanitation, leading to increase health and well-being problems from contaminated water and from mosquitos and other pests that thrive in unsanitary environments.	Important Problem	++	++	++	0	0
M-Urban-04	Encroachment into coastal habitats from urban expansion	Important Problem	0	0	0	0	0
M-Urban-05	Increasing vehicular/ pedestrian congestion, conflicts and air pollution.	Important Problem	0	0	0	0	0
M-Urban-03	Failure of housing for the youth and children exposing them to human predators, violence, abuse and sexual assault that increase their risk of HIV infection.	Problem	0	0	0	0	0
+++	Threat is severely aggravated from climate change dimension						
++	Threat is aggravated from climate change dimension						
+	Threat is slightly aggravated from climate change dimension						
0	No influence of threat from climate change dimension						
-	Remediating effect on threat from climate change dimension						

Recommendations for threat mitigation measures

Overall measures to mitigate each if the identified urbanisation related threats to coastal local communities and ecosystems have been tabulated in Table 197(page366) arranged under broad management dimensions headings. Table 32below provides an overview of the requirements/opportunities expressed within each of these management or intervention dimensions.

Table 32: Broad management intervention dimensions to address identified and prioritised threats to coastal communities and ecosystems associated with urbanisation in Mainland Tanzania

Intervention Dimension	Statement	Threat pertinence at each RV				
		Major Problem (RV 5)	Very important problem (RV 4)	Important Problem (RV 3)	Problem (RV 2)	Light Problem (RV 1)
Integrated Coastal Zone Management (ICZM)	Ensure coordination and participation in management of coastal land, water and resources use currently under complex pressures particularly in urban areas.		M-Urban-02: Inadequate solid waste management	M-Urban-01: Urban sprawl and lack of services provision M-Urban-04: Urban encroachment into coastal habitats		
Integrated Water Resources Management (IWRM)						
Land Use Management	Land use information management systems include urban areas, urban services and available zoning within. Consider urbanisation in spatial planning.		M-Urban-02: Inadequate solid waste management	M-Urban-01: Urban sprawl and lack of services provision M-Urban-04: Urban encroachment into coastal habitats M-Urban-05: Traffic congestion		

Intervention Dimension	Statement	Threat pertinence at each RV				
		Major Problem (RV 5)	Very important problem (RV 4)	Important Problem (RV 3)	Problem (RV 2)	Light Problem (RV 1)
Shoreline Management Planning	Establish a systematic overview of coastal processes through a shoreline management investigation, considering the entire coast, and inform spatial planning accordingly. Sediment cell resolution national effort, management unit resolution regional/district effort. Develop policies for development control in management units directing spatial planning.		M-Urban-02: Inadequate solid waste management	M-Urban-01: Urban sprawl and lack of services provision M-Urban-04: Urban encroachment into coastal habitats		
Solid and Liquid Waste Management	Pursue integrated solid and liquid waste management solutions considering: Waste water treatment systems: - collection - treatment technology - discharge Liquid Waste Management Systems: - collection - storage - processing - financing - minimisation - reuse? Green Infrastructure Storm Water Systems		M-Urban-02: Inadequate solid waste management	M-Urban-01: Urban sprawl and lack of services provision		
Sanitation	Pursue integrated solid and liquid waste management considering: Waste water treatment systems: - collection - treatment technology - discharge Liquid Waste Management Systems: - collection - storage - processing - financing - minimisation - reuse? Green Infrastructure Storm Water Systems		M-Urban-02: Inadequate solid waste management	M-Urban-01: Urban sprawl and lack of services provision		
Capacity Building	Accompany management interventions with appropriate capacity building components. Particular focus on spatial planning, urbanisation, shoreline management, conflict resolution, monitoring, law enforcement. Enhance information management systems to provide for better and systematically informed management decisions.		M-Urban-02: Inadequate solid waste management M-Urban-06: Youth unemployment	M-Urban-01: Urban sprawl and lack of services provision M-Urban-04: Urban encroachment into coastal habitats M-Urban-05: Traffic congestion	M-Urban-02: Lack of housing for youth and children	
Technology	Pursue opportunities through further technology development within: <ul style="list-style-type: none"> Integrated solid and liquid waste management Traffic planning Shoreline management 		M-Urban-02: Inadequate solid waste management M-Urban-06: Youth unemployment	M-Urban-01: Urban sprawl and lack of services provision M-Urban-05: Traffic congestion		
Law Enforcement	1) Integrated review of laws, regulations and their enforcement within amongst others: <ul style="list-style-type: none"> Resource exploitation Sand mining Near shore construction Traffic Child welfare Urban land use Spatial planning 2) Optimise enforcement through capacity building and coordination following recommendations from review.		M-Urban-02: Inadequate solid waste management	M-Urban-01: Urban sprawl and lack of services provision M-Urban-04: Urban encroachment into coastal habitats M-Urban-05: Traffic congestion	M-Urban-02: Lack of housing for youth and children	
Legal Review						

Intervention Dimension	Statement	Threat pertinence at each RV				
		Major Problem (RV 5)	Very important problem (RV 4)	Important Problem (RV 3)	Problem (RV 2)	Light Problem (RV 1)
Alternative/ Improved Livelihood	Develop and offer alternative livelihoods for households currently engaged in destructive resource exploitation practises. Particular efforts to provide alternatives for young generation. Promote private sector investments to create jobs. Promote vocational training of youth aligned to sector demands. Improve current sustainable resource use livelihoods using technology advances and insights.		M-Urban-06: Youth unemployment			
Awareness Raising	Develop and launch awareness raising campaigns related to coastal management challenges directed to the public at large and to schools. Develop and launch issue specific awareness raising campaigns targeting stakeholders affected by or affecting the issue.		M-Urban-02: Inadequate solid waste management	M-Urban-01: Urban sprawl and lack of services provision M-Urban-05: Traffic congestion	M-Urban-02: Lack of housing for youth and children	
Education	Engage in curricula review and development for primary and secondary schools to enhance the knowledge and understanding about coastal management issues- Issue of particular relevance from a fisheries perspective include: <ul style="list-style-type: none"> Sustainable development in areas under high demographic and economic development pressure (coastal areas, urban areas). Importance of coasts and coastal habitats and resources. 		M-Urban-06: Youth unemployment	M-Urban-05: Traffic congestion		

Action areas

In Table 33 below an overview has been established on how strongly each intervention dimension responds to threats to local communities and ecosystems as perceived by local stakeholders.

For each intervention dimension and for each problem class the number of threats considered to benefit from the intervention have been multiplied by the range value (RV) for the given problem class. The total score for each management dimension has then been calculated by adding the values achieved. The table thus provides an indication of the importance of each intervention dimension in addressing identified and ranked threats. In the same manner Figure 23 gives a graphical presentation of the relevance of intervention dimensions in addressing the identified threats related to with urbanisation.

Table 33: Assessment of the importance of broad management dimension in addressing threats to local communities and ecosystems associated with urbanisation.

	Major Problem weight	Very important problem weight	Important Problem weight	Problem weight	Light Problem weight	Total Score
Integrated Coastal Zone Management (ICZM)	0	4	6	0	0	10
Integrated Water Resources Management (IWRM)	0	0	0	0	0	0
Land Use Management	0	4	9	0	0	13
Shoreline Management Planning	0	4	6	0	0	10
Solid and Liquid Waste Management	0	4	3	0	0	7
Sanitation	0	4	3	0	0	7
Capacity Building	0	8	9	0	0	17
Technology	0	8	6	0	0	14
Law Enforcement	0	4	9	2	0	15
Legal Review	0	0	0	0	0	0
Alternative/ Improved Livelihood	0	4	0	0	0	4
Awareness Raising	0	4	6	2	0	12
Education	0	4	3	0	0	7
Mainland Tanzania				Urbanisation	Total	116

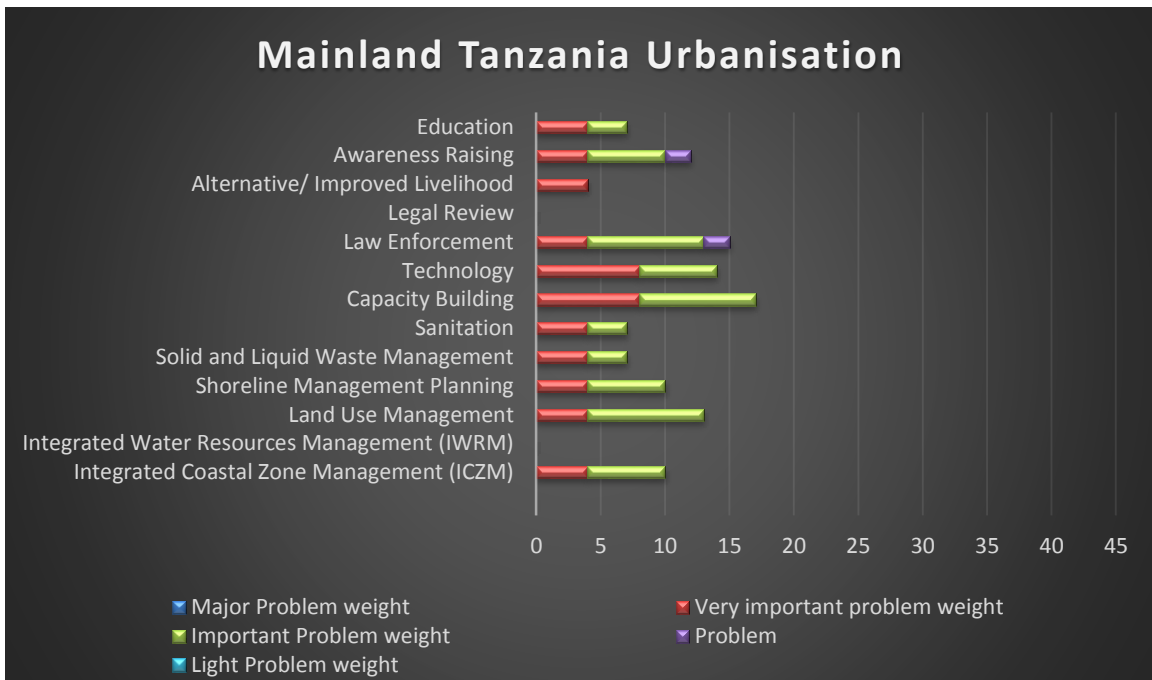
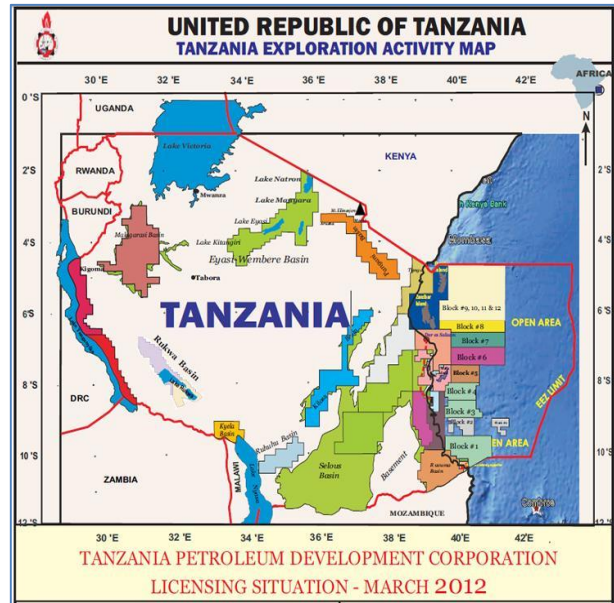


Figure 23: The importance of broad intervention dimension in responding to threats to local communities and ecosystems associated with urbanisation.

Non-Renewable Extractive Industry – Hydrocarbons

Tanzania was not, until recently, known for hydrocarbons, but oil and gas reserves are certainly present, in the coastal zone, beneath the seabed and within the East African rift system.

The exploration for and development of oil and gas resources have been going on for some time, but have only recently begun to contribute towards economic development in the country. One of several recently-discovered East African basins is an area off the coast of southern Tanzania, now referred to as the *Mafia Deep Offshore Basin*, of about 75,000 km² in size with depths of 500 to 3,300 m. This is believed by some experts in the industry to provide one of the few remaining significant offshore exploration opportunities in Africa, with world-class hydrocarbon potential, possibly comparable with those recently made in West Africa



By 2004 the gas from Songo Songo gas field was piped 232 km to generate electricity in Dar es Salaam, and by 2007 Mnazi Bay gas was used to produce electricity in Mtwara and in Lindi by 2009. Offshore exploration drilling continues with now enough proven reserves of methane discovered by BG and Statoil in three general locations (in 2012), of significant size to justify investment in the construction of a Liquefied Natural Gas (LNG) plant at Lindi, with construction expected to begin by 2015. Meanwhile a 500 km gas pipeline is presently being constructed to supply surplus gas from Mnazi Bay (and expected new discoveries) to Dar es Salaam, with completion expected in 2015.



The outlook for the oil and gas industry in Tanzania, from upstream to downstream operations is likely to witness significant increase in volumes extracted and traded, income generated and employment created.

Prioritized Threats

In Table 34 below the threats identified related to hydrocarbons have been listed and ranked according to their severity as established using the CRIAM method discussed extensively in Volumes I and II of the Coastal Profile. A rapid assessment has been made on the susceptibility of each threat to impacts of climate change more specifically, changes in whether patterns, extreme events, sea level rise, temperature rise and acidification.

Table 34: Prioritised threats related to hydrocarbons and a rapid assessment of threat susceptibility to climate change.

#	Threat as identified in Coastal Profile	Threat Level	Influence from Climate Change				
			Change in Patterns	Extreme events	Sea Level Rise	Temperature rise	Acidification
M-HydroC-01	Degradation of the natural marine and coastal environment and thus impact on livelihoods, from failure of exploration companies to adhere to environmental and socio-economic safeguards, partly due to weakness in the oversight provided by the Department of Environment, responsible for issuing licences and monitoring the operations that have been subjected to ELAs.	Very Important Problem	++	++	++	0	0
			Degradation may become more severe in cases of extreme events and due to sea level rise				
M-HydroC-03	Piracy attacks against offshore operations.	Very Important Problem	0	0	0	0	0
			No impact from climate change on this threat				
M-HydroC-04	Social and/or political unrest related to behaviour of the Government and stakeholders.	Important Problem	0	0	0	0	0
			No impact from climate change on this threat				
M-HydroC-05	Damage to infrastructure and environment from engineering design failure.	Problem	++	++	++	0	0
			Damages may become more severe in cases of extreme events and due to sea level rise				
+++	Threat is severely aggravated from climate change dimension						
++	Threat is aggravated from climate change dimension						
+	Threat is slightly aggravated from climate change dimension						
0	No influence of threat from climate change dimension						
-	Remediating effect on threat from climate change dimension						

Recommendations for threat mitigation measures

Overall measures to mitigate each if the identified hydrocarbon related threats to coastal local communities and ecosystems have been tabulated in Table 184(page345) arranged under broad management dimensions headings. Table 20above provides an overview of the requirements/opportunities expressed within each of these management or intervention dimensions.

Table 35: Broad management intervention dimensions to address identified and prioritised threats to coastal communities and ecosystems associated with hydrocarbons in Mainland Tanzania

Intervention Dimension	Statement	Threat pertinence at each RV				
		Major Problem (RV 5)	Very important problem (RV 4)	Important Problem (RV 3)	Problem (RV 2)	Light Problem (RV 1)
Integrated Coastal Zone Management (ICZM)	Ensure coordination and participation in management of coastal land, water and resources use currently under complex pressures. Facilitate dialogues required to alleviate social conflicts over resources use.		M-HydroC-01: Degradation of marine and coastal habitats from failure to adhere to environmental and social safeguards			
Integrated Water Resources Management (IWRM)						
Land Use Management	Land use information management systems to include hydrocarbon infrastructure and exploration sites. Incorporate hydrocarbon exploration in special planning.		M-HydroC-01: Degradation of marine and coastal habitats from failure to adhere to environmental and social safeguards			
Shoreline Management Planning	Establish a systematic overview of coastal processes through a shoreline management investigation, considering the entire coast, and inform spatial planning accordingly. Sediment cell resolution national effort, management unit resolution regional/district effort.		M-HydroC-01: Degradation of marine and coastal habitats from failure to adhere to environmental and social safeguards			
Solid and Liquid Waste Management						
Sanitation						

Intervention Dimension	Statement	Threat pertinence at each RV				
		Major Problem (RV 5)	Very important problem (RV 4)	Important Problem (RV 3)	Problem (RV 2)	Light Problem (RV 1)
Capacity Building	<p>Accompany management interventions with appropriate capacity building components. Particular focus on spatial planning, shoreline management, pollution control and hydropower regulation.</p> <p>Enhance information management systems to provide for better and systematically informed management decisions.</p>		<p>M-HydroC-01: Degradation of marine and coastal habitats from failure to adhere to environmental and social safeguards</p> <p>M-HydroC-03: Piracy threat on offshore operations</p>		M-HydroC-04: Damage to infrastructure and environment from engineering design failure.	
Technology	<p>Pursue opportunities through further technology development within:</p> <ul style="list-style-type: none"> Remote sensing monitoring 		<p>M-HydroC-01: Degradation of marine and coastal habitats from failure to adhere to environmental and social safeguards</p> <p>M-HydroC-03: Piracy threat on offshore operations</p>	M-HydroC-05: Social and/or political unrest related to government and stakeholder behaviour.		
Law Enforcement	<ol style="list-style-type: none"> Integrated review of laws, regulations and their enforcement within amongst others: <ul style="list-style-type: none"> Hydrocarbon exploration International agreements Optimise enforcement through capacity building and coordination following recommendations from review. 		<p>M-HydroC-01: Degradation of marine and coastal habitats from failure to adhere to environmental and social safeguards</p>	M-HydroC-05: Social and/or political unrest related to government and stakeholder behaviour.	M-HydroC-04: Damage to infrastructure and environment from engineering design failure.	
Legal Review	<ol style="list-style-type: none"> Integrated review of laws, regulations and their enforcement within amongst others: <ul style="list-style-type: none"> Acts of piracy Initiate revision of existing and develop new laws, regulations according to recommendations from review 		<p>M-HydroC-01: Degradation of marine and coastal habitats from failure to adhere to environmental and social safeguards</p> <p>M-HydroC-03: Piracy threat on offshore operations</p>			
Alternative/ Improved Livelihood						
Awareness Raising	<p>Develop and launch awareness raising campaigns related to coastal management challenges directed to the public at large and to schools.</p> <p>Develop and launch issue specific awareness raising campaigns targeting stakeholders affected by or affecting the issue. Particular emphasis on shoreline processes and impacts on shorelines and environment from hydrocarbon exploration and development and on contingency planning.</p>		<p>M-HydroC-01: Degradation of marine and coastal habitats from failure to adhere to environmental and social safeguards</p>	M-HydroC-05: Social and/or political unrest related to government and stakeholder behaviour.		
Education						

Action areas

In Table 36 below an overview has been established on how strongly each intervention dimension responds to threats to local communities and ecosystems as perceived by local stakeholders.

For each intervention dimension and for each problem class the number of threats considered to benefit from the intervention have been multiplied by the range value (RV) for the given problem class. The total score for each management dimension has then been calculated by adding the values achieved. The table thus provides an indication of the importance of each intervention dimension in addressing identified and ranked threats. In the same manner Figure 24 gives a graphical presentation of the relevance of intervention dimensions in addressing the identified threats related to with hydrocarbons.

Table 36: Assessment of the importance of broad management dimension in addressing threats to local communities and ecosystems associated with hydrocarbons.

Intervention Dimension	Major Problem weight	Very important problem weight	Important Problem weight	Problem weight	Light Problem weight	Total Score
Integrated Coastal Zone Management (ICZM)	0	4	0	0	0	4
Integrated Water Resources Management (IWRM)	0	0	0	0	0	0
Land Use Management	0	4	0	0	0	4
Shoreline Management Planning	0	4	0	0	0	4
Solid and Liquid Waste Management	0	0	0	0	0	0
Sanitation	0	0	0	0	0	0
Capacity Building	0	8	0	2	0	10
Technology	0	8	3	0	0	11
Law Enforcement	0	4	3	2	0	9
Legal Review	0	8	0	0	0	8
Alternative/ Improved Livelihood	0	0	0	0	0	0
Awareness Raising	0	4	3	0	0	7
Education	0	0	0	0	0	0
Mainland Tanzania	Hydrocarbons			Total		57

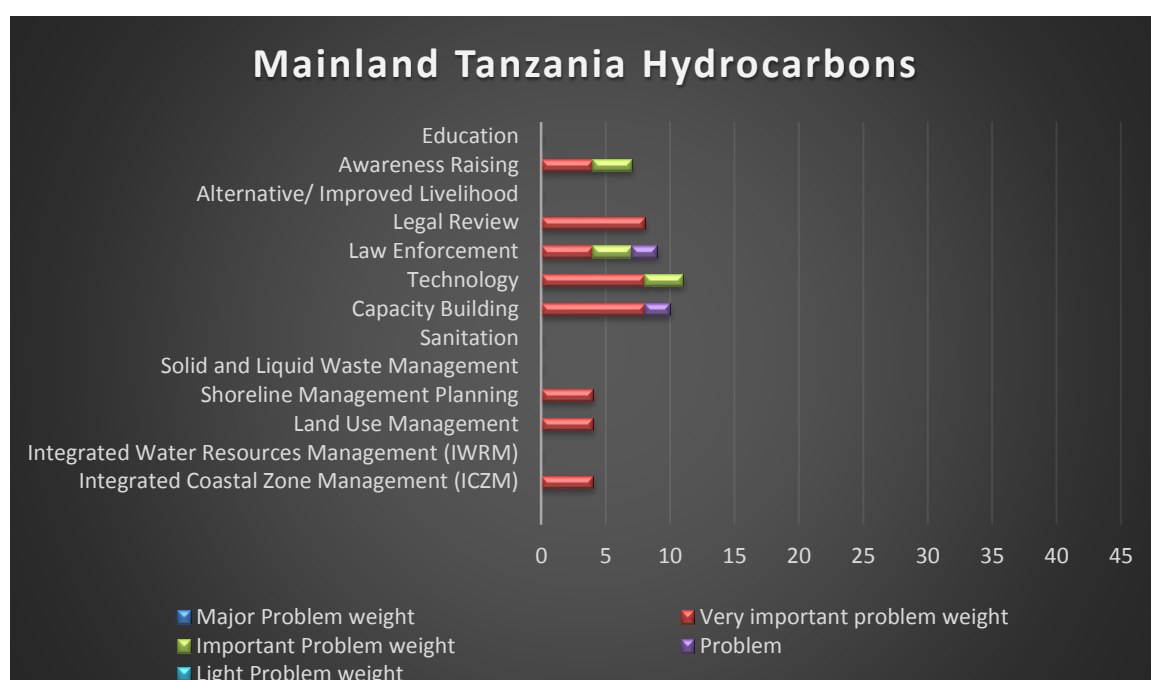


Figure 24: The importance of broad intervention dimension in responding to threats to local communities and ecosystems associated with hydrocarbons.

Non-Renewable Extractive Industry – Coastal Sand and Rock Mining

Being Africa’s third largest gold producer, the world’s sole producer of the gemstone tanzanite, and a producer of cement, diamonds and other gemstones, Tanzania has an extensive and diverse mining sector. However, most of the mining takes place in the interior and west of the county. The coastal zone does however have mining operations focused on cement, coral and lime, with both lime and cement being produced for export throughout East Africa. The coast also provides rock and sand for the construction industry.



From the coastal districts, the sand, rock and coral (as rock or lime) that are mined for the building industry are usually sold by volume, in a trade that is mostly not regulated, with little if any royalties or taxes accrued to the government, other than fees to the quarry owner. Supplies to the cement factories are more regulated.

Illegal sand mining along beaches, in coastal streams/rivers, and at other restricted areas localised causes coastal erosion and environmental degradation and threat to coastal properties.

Removal of live coral results in loss of reef habitat, loss of natural breakwaters with concomitant indirect loss of adjacent coastal habitats, and loss of the aesthetic value of the reefs for tourism. Moreover, since coral mining simplifies the surface topography of reefs, there is also a reduction in microhabitat diversity that, in turn, results in a decrease in biodiversity.



With Tanzania’s GDP growth rate reaching 6-7%, similar rates of growth are expected in the construction industry, thus requiring construction materials, such as bricks, limestone, sand and gravel and the extraction and mining of these materials and resulting impacts could increase substantially.

While financial resources are limited and environmental management remains uncoordinated, NGO involvement in coastal zone management and the development of new cement projects on the coast suggest further growth in the mining sector.

Despite some of the environmental issues surrounding the mining sector on the coast, the incentive to invest in the region remains high.

Prioritized Threats

In Table 37 below the threats identified related to sand and rock mining have been listed and ranked according to their severity as established using the CRIAM method discussed extensively in Volumes I and II of the Coastal Profile. A rapid assessment has been made on the susceptibility of each threat to impacts of climate change more specifically, changes in whether patterns, extreme events, sea level rise, temperature rise and acidification.

Table 37: Prioritised threats related to sand and rock mining and a rapid assessment of threat susceptibility to climate change.

#	Threat as identified in Coastal Profile	Threat Level	Influence from Climate Change				
			Change in Patterns	Extreme events	Sea Level Rise	Temperature rise	Acidification
M-SandR-01	Poor management of shores (e.g. coastal developments) and river basins, lack of understanding of coastal erosion causative factors and sustainable mitigation/adaptation measures leading to loss of shoreline due to coastal erosion.	Very Important Problem	++	+++	+++	0	0
M-SandR-04	Corrupt and uncoordinated institutional enforcement of mining policy to protect the natural environment, particularly rivers and coastline.	Important Problem	++	++	++	0	0
M-SandR-05	Anarchistic sand and rock extraction from coastal zone resulting in increased erosion.	Important Problem	++	++	++	0	0
M-SandR-06	Loss of river basin habitat from un-regulated sand extraction.	Important Problem	++	++	++	0	0
M-SandR-07	Loss of beach habitats for turtle nesting.	Important Problem	+	++	++	0	0
M-SandR-02	Destruction of reef protection services from removal of live coral, threatening coastal infrastructure, farmland, villages and fisheries resources	Problem	0	++	0	0	0
M-SandR-03	Reduced coastal sand recharge from rivers due to over-extraction of river sand.	Problem	+	+	+	0	0
M-SandR-10	Increase in water born diseases from quarries that fill with rainwater.	Problem	+	+	+	0	0
M-SandR-08	Economic losses through tourist abandonment	Light Problem	0	0	0	0	0
M-SandR-09	Loss of coastal aesthetics	Light Problem	0	0	0	0	0
M-SandR-11	Shallow freshwater table contamination from poor citing of rock quarries.	Light Problem	+	+	+	0	0
+++ Threat is severely aggravated from climate change dimension ++ Threat is aggravated from climate change dimension + Threat is slightly aggravated from climate change dimension 0 No influence of threat from climate change dimension - Remediating effect on threat from climate change dimension							

Recommendations for threat mitigation measures

Overall measures to mitigate each if the identified sand and rock mining related threats to coastal local communities and ecosystems have been tabulated in Table 185(page346) arranged under broad management dimensions headings. Table 38 below provides an overview of the requirements/opportunities expressed within each of these management or intervention dimensions.

Table 38: Broad management intervention dimensions to address identified and prioritised threats to coastal communities and ecosystems associated with sand and rock mining in Mainland Tanzania

Intervention Dimension	Statement	Threat pertinence at each RV				
		Major Problem (RV 5)	Very important problem (RV 4)	Important Problem (RV 3)	Problem (RV 2)	Light Problem (RV 1)
Integrated Coastal Zone Management (ICZM)	Ensure coordination and participation in management of coastal land, water and resources use currently under complex pressures. Facilitate dialogues required to alleviate social conflicts over resources use. Link with hinterland management to address catchment and riverbank deforestation, river flow changes and sand extraction upstream, all of which affect the coast in many ways (ICARM).		M-SandR-01: Poor management of shores and catchments	M-SandR-04: Corrupt and uncoordinated enforcement M-SandR-05: Anarchistic extraction M-SandR-06: Unregulated sand extraction in rivers M-SandR-07: Loss of habitats for turtle nesting	M-SandR-02: Reef destruction from mining M-SandR-03: Over extraction of river sand M-SandR-10: Increase in water borne diseases from quarries	M-SandR-09: Loss of coastal aesthetics M-SandR-11: Contamination of shallow aquifers from poor siting of quarries
Integrated Water Resources Management (IWRM)	Link IWRM to coastal integrated planning ensuring upstream/downstream considerations (ICARM). Land use in catchments and its impacts on water resources included in IWRM planning. Sand extraction in in upstream river beds and its impact on shorelines and coastal areas included in IWRM planning.		M-SandR-01: Poor management of shores and catchments	M-SandR-04: Corrupt and uncoordinated enforcement M-SandR-05: Anarchistic extraction M-SandR-06: Unregulated sand extraction in rivers	M-SandR-03: Over extraction of river sand M-SandR-10: Increase in water borne diseases from quarries	M-SandR-11: Contamination of shallow aquifers from poor siting of quarries

Intervention Dimension	Statement	Threat pertinence at each RV				
		Major Problem (RV 5)	Very important problem (RV 4)	Important Problem (RV 3)	Problem (RV 2)	Light Problem (RV 1)
Land Use Management	<p>Land use information management systems to include ecosystems, habitats and water resources.</p> <p>Incorporate ecosystems, habitats and water resources considerations in spatial planning, including sediment flow to nourish shorelines.</p> <p>Inform hinterland spatial planning to direct zoning to prevent downstream impacts on shorelines.</p>		M-SandR-01: Poor management of shores and catchments	M-SandR-04: Corrupt and uncoordinated enforcement M-SandR-05: Anarchistic extraction M-SandR-06: Unregulated sand extraction in rivers	M-SandR-02: Reef destruction from mining M-SandR-03: Over extraction of river sand M-SandR-10: Increase in water borne diseases from quarries	M-SandR-11: Contamination of shallow aquifers from poor siting of quarries
Shoreline Management Planning	<p>Establish a systematic overview of coastal processes through a shoreline management investigation, considering the entire coast, and inform spatial planning accordingly. Sediment cell resolution national effort, management unit resolution regional/district effort.</p> <p>Develop policies at sediment cell level to address erosion and accretion problems along the shores.</p> <p>Direct the development of similar policies for management units at district level.</p>		M-SandR-01: Poor management of shores and catchments	M-SandR-04: Corrupt and uncoordinated enforcement M-SandR-05: Anarchistic extraction M-SandR-06: Unregulated sand extraction in rivers M-SandR-07: Loss of habitats for turtle nesting	M-SandR-02: Reef destruction from mining M-SandR-03: Over extraction of river sand	
Solid and Liquid Waste Management	Develop policies for quarry siting, management and restoration as basis for regulations.				M-SandR-10: Increase in water borne diseases from quarries	
Sanitation	Develop policies for quarry siting, management and restoration as basis for regulations.				M-SandR-10: Increase in water borne diseases from quarries	
Capacity Building	<p>Accompany management interventions with appropriate capacity building components. Particular focus on spatial planning, shoreline management, conflict resolution, monitoring, law enforcement.</p> <p>Enhance information management systems to provide for better and systematically informed management decisions.</p>		M-SandR-01: Poor management of shores and catchments	M-SandR-05: Anarchistic extraction M-SandR-06: Unregulated sand extraction in rivers M-SandR-07: Loss of habitats for turtle nesting	M-SandR-02: Reef destruction from mining M-SandR-03: Over extraction of river sand M-SandR-10: Increase in water borne diseases from quarries	M-SandR-11: Contamination of shallow aquifers from poor siting of quarries
Technology	<p>Pursue opportunities through further technology development within:</p> <ul style="list-style-type: none"> Beach protection (soft) Turtle tracking geographically and seasonally Shoreline management 		M-SandR-01: Poor management of shores and catchments	M-SandR-05: Anarchistic extraction M-SandR-06: Unregulated sand extraction in rivers M-SandR-07: Loss of habitats for turtle nesting	M-SandR-02: Reef destruction from mining M-SandR-03: Over extraction of river sand M-SandR-10: Increase in water borne diseases from quarries	M-SandR-11: Contamination of shallow aquifers from poor siting of quarries
Law Enforcement	<p>1) Integrated review of laws, regulations and their enforcement within amongst others:</p> <ul style="list-style-type: none"> Resources exploitation Sand mining Quarries Turtle protection Coral mining ESIA related to mining and freshwater Marine resources <p>2) Optimise enforcement through capacity building and coordination following recommendations from review.</p>		M-SandR-01: Poor management of shores and catchments	M-SandR-04: Corrupt and uncoordinated enforcement M-SandR-05: Anarchistic extraction M-SandR-06: Unregulated sand extraction in rivers M-SandR-07: Loss of habitats for turtle nesting	M-SandR-02: Reef destruction from mining M-SandR-03: Over extraction of river sand M-SandR-10: Increase in water borne diseases from quarries	M-SandR-08: Economic losses through tourist abandonment M-SandR-09: Loss of coastal aesthetics M-SandR-11: Contamination of shallow aquifers from poor siting of quarries

Intervention Dimension	Statement	Threat pertinence at each RV				
		Major Problem (RV 5)	Very important problem (RV 4)	Important Problem (RV 3)	Problem (RV 2)	Light Problem (RV 1)
Legal Review	<p>1) Integrated review of laws, regulations and their enforcement within amongst others:</p> <ul style="list-style-type: none"> Resources exploitation Sand mining Quarries Turtle protection Coral mining ESIA related to mining and freshwater Marine resources <p>2) Initiate revision of existing and develop new laws, regulations according to recommendations from review</p>		M-SandR-01: Poor management of shores and catchments	M-SandR-04: Corrupt and uncoordinated enforcement M-SandR-05: Anarchistic extraction M-SandR-06: Unregulated sand extraction in rivers	M-SandR-02: Reef destruction from mining M-SandR-03: Over extraction of river sand	
Alternative/ Improved Livelihood	<p>Develop and offer alternative livelihoods for households currently engaged in destructive sand and rock mining practices. Particular efforts to provide alternatives for young generation.</p> <p>Improve current sustainable resource use livelihoods using technology advances and insights.</p>		M-SandR-01: Poor management of shores and catchments	M-SandR-04: Corrupt and uncoordinated enforcement M-SandR-05: Anarchistic extraction M-SandR-06: Unregulated sand extraction in rivers	M-SandR-02: Reef destruction from mining M-SandR-03: Over extraction of river sand	½
Awareness Raising	<p>Develop and launch awareness raising campaigns related to coastal management challenges directed to the public at large and to schools.</p> <p>Develop and launch issue specific awareness raising campaigns targeting stakeholders affected by or affecting the issue.</p>		M-SandR-01: Poor management of shores and catchments	M-SandR-04: Corrupt and uncoordinated enforcement M-SandR-05: Anarchistic extraction M-SandR-06: Unregulated sand extraction in rivers M-SandR-07: Loss of habitats for turtle nesting	M-SandR-02: Reef destruction from mining M-SandR-03: Over extraction of river sand M-SandR-10: Increase in water borne diseases from quarries	M-SandR-08: Economic losses through tourist abandonment M-SandR-09: Loss of coastal aesthetics M-SandR-11: Contamination of shallow aquifers from poor siting of quarries
Education	<p>Engage in curricula review and development for primary and secondary schools to enhance the knowledge and understanding about coastal management issues- Issue of particular relevance from a fisheries perspective include:</p> <ul style="list-style-type: none"> Importance of beaches Importance of shoreline management 		M-SandR-01: Poor management of shores and catchments	M-SandR-04: Corrupt and uncoordinated enforcement M-SandR-05: Anarchistic extraction M-SandR-06: Unregulated sand extraction in rivers M-SandR-07: Loss of habitats for turtle nesting	M-SandR-02: Reef destruction from mining M-SandR-03: Over extraction of river sand M-SandR-10: Increase in water borne diseases from quarries	M-SandR-08: Economic losses through tourist abandonment M-SandR-09: Loss of coastal aesthetics M-SandR-11: Contamination of shallow aquifers from poor siting of quarries

Action areas

In Table 39 below an overview has been established on how strongly each intervention dimension responds to threats to local communities and ecosystems as perceived by local stakeholders.

For each intervention dimension and for each problem class the number of threats considered to benefit from the intervention have been multiplied by the range value (RV) for the given problem class. The total score for each management dimension has then been calculated by adding the values achieved. The table thus provides an indication of the importance of each intervention dimension in addressing identified and ranked threats. In the same manner Figure 25 gives a graphical presentation of the relevance of intervention dimensions in addressing the identified threats related to with coastal rock and sand mining.

Table 39: Assessment of the importance of broad management dimension in addressing threats to local communities and ecosystems associated with coastal rock and sand mining.

Intervention Dimension	Major Problem weight	Very important problem weight	Important Problem weight	Problem weight	Light Problem weight	Total Score
Integrated Coastal Zone Management (ICZM)	0	4	12	6	2	24
Integrated Water Resources Management (IWRM)	0	4	9	4	1	18
Land Use Management	0	4	9	6	1	20
Shoreline Management Planning	0	4	12	4	0	20
Solid and Liquid Waste Management	0	0	0	2	0	2
Sanitation	0	0	0	2	0	2
Capacity Building	0	4	9	6	1	20
Technology	0	4	9	6	1	20
Law Enforcement	0	4	12	6	3	25
Legal Review	0	4	9	4	0	17
Alternative/ Improved Livelihood	0	4	9	4	0	17
Awareness Raising	0	4	12	6	3	25
Education	0	4	12	6	3	25
Mainland Tanzania			Sand and Rock		Total	235

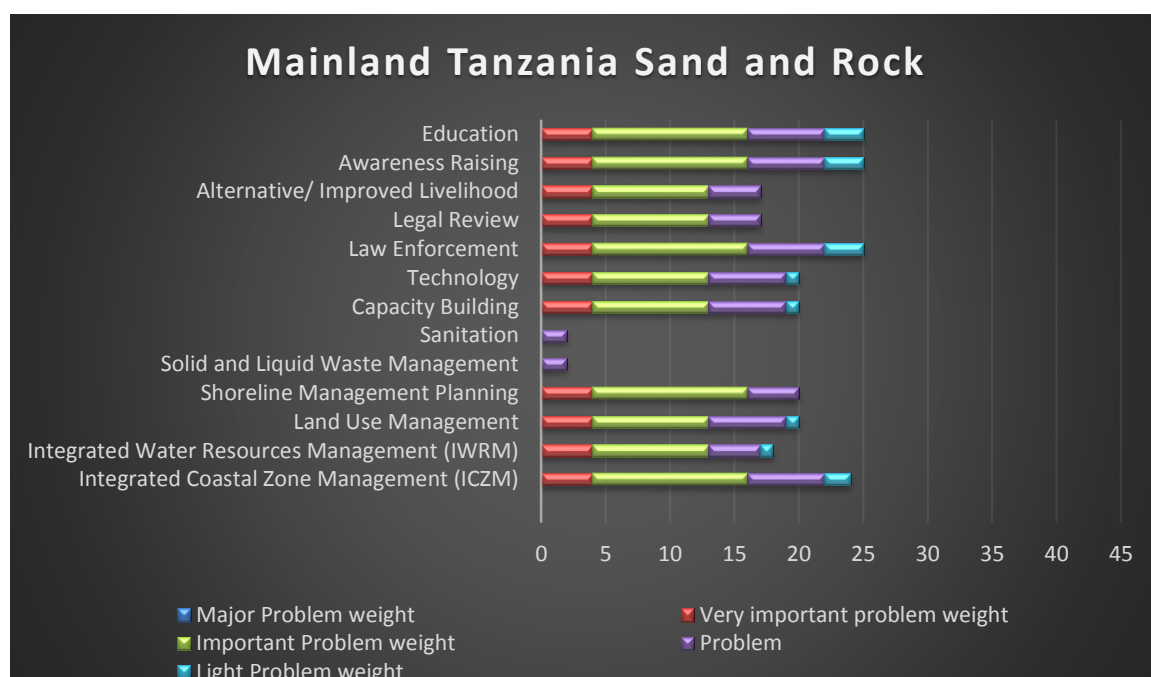


Figure 25: The importance of broad intervention dimension in responding to threats to local communities and ecosystems associated with sand and rock mining.

Non-Renewable Extractive Industry – Salt Production from Evaporation of Sea Water

Based on satellite imagery analysis, along the Tanzania mainland coastline there are an estimated 3,697 hectares (ca. 37 km²) of salt pans. Most of the industry is unregulated and does not contribute to the national GDP, and it is estimated that there are several hundred operators.

Salt works usually consist of a series of evaporation ponds from the seawater intake point to the crystallizing ponds. Pond walls are constructed using impermeable clay soils available on site, hence local availability of clay is critical. The only machinery required for commercial pond systems is water pumps. Ditches and gate structures between ponds and pipes under roads are also needed. Salt is also produced at very small-scales through boiling seawater in pans, whereby two truckloads of wood are needed to produce 1.4 ton of salt.



Mainland Tanzania	Saltpan area (h)
Tanga	286.44
Mkinga (2007)	364.54
Temeke	63.62
Kinondoni	86.89
Rufiji	48.53
Mkuranga	116.52
Bagamoyo	1,106.01
Lindi Rural	199.95
Lindi Urban	269.5
Kilwa	417.03
Mtwara Rural	607.74
Mtwara Urban	130.7
Total	3,697.47

The solar salt industry in Tanzania continues to suffer from inconsistent iodisation, with southern regions of Mtwara and Lindi having the poorest levels of iodised salt consumption. Local producers claim that as a result of high prices for iodine, hardly 18 % of produced salt in Mtwara region is iodised, unlike the past, when government subsidies for salt producers, increased iodisation to over 90%.

It seems that the solar salt industry has room for expansion in coastal Tanzania, to the benefit of the wider economy and population, and the livelihoods of those involved.

There are concerns in the industry on the taxes and levies which salt producers are required to pay, increasing operation costs. In addition, producers are obliged to charge VAT (18%) on the saleable product which makes it more expensive to the consumer. VAT is not charged on other food products. The financial burdens are a disincentive to development of the sector.

Prioritized Threats

In Table 40 below the threats identified related to salt production have been listed and ranked according to their severity as established using the CRIAM method discussed extensively in Volumes I and II of the Coastal Profile. A rapid assessment has been made on the susceptibility of each threat to impacts of climate change more specifically, changes in weather patterns, extreme events, sea level rise, temperature rise and acidification.

Table 40: Prioritised threats related to salt production and a rapid assessment of threat susceptibility to climate change.

#	Threat as identified in Coastal Profile	Threat Level	Influence from Climate Change				
			Change in Patterns	Extreme events	Sea Level Rise	Temperature rise	Acidification
M-Salt-02	Lack of government support with infrastructure (e.g. roads) and land ownership, and corruption.	Important Problem	0	0	0	0	0
			No impact from climate change on this threat				
M-Salt-04	Unsustainable practices resulting in degradation of mangrove forests for ponds and timber (for boiling salt water), causing losses to the wider environment with respect to shelter from wave action (erosion) to fisheries production.	Important Problem	++	++	++	0	0
			Weakened mangroves further threatened from impacts of climate change				
M-Salt-05	Sea level rise threatening infrastructure (dykes and buildings, etc.).	Important Problem	0	++	++	0	0
			Extreme events further exacerbates this impact				

#	Threat as identified in Coastal Profile	Threat Level	Influence from Climate Change				
			Change in Patterns	Extreme events	Sea Level Rise	Temperature rise	Acidification
M-Salt-03	Unplanned urbanization and land availability into which to expand (in some areas).	Problem	0	0	0	0	0
M-Salt-01	Loss of suitable habitat for artisanal (non-pump) and industrial systems into which to expand/adapt, particularly with respect to land and availability of clay to construct dykes.	Light Problem	No impact from climate change on this threat				
			0	+	++	0	0
M-Salt-06	Local population IDD hazard from low iodisation of salt from small-scale producers in Mtwara and Lindi.	Light Problem	Extreme events and sea level rise may reduce areas suitable for salt production				
			0	0	0	0	0
			No impact from climate change on this threat				
			0	0	0	0	0
+++	Threat is severely aggravated from climate change dimension						
++	Threat is aggravated from climate change dimension						
+	Threat is slightly aggravated from climate change dimension						
0	No influence of threat from climate change dimension						
-	Remediating effect on threat from climate change dimension						

Recommendations for threat mitigation measures

Overall measures to mitigate each of the identified salt production related threats to coastal local communities and ecosystems have been tabulated in Table 186 (page 349) arranged under broad management dimensions headings. Table 41 below provides an overview of the requirements/opportunities expressed within each of these management or intervention dimensions.

Table 41: Broad management intervention dimensions to address identified and prioritised threats to coastal communities and ecosystems associated with salt production in Mainland Tanzania

Intervention Dimension	Statement	Threat pertinence at each RV				
		Major Problem (RV 5)	Very important problem (RV 4)	Important Problem (RV 3)	Problem (RV 2)	Light Problem (RV 1)
Integrated Coastal Zone Management (ICZM)	<p>Ensure coordination and participation in management of coastal land, water and resources use currently under complex pressures.</p> <p>Facilitate dialogues required to alleviate social conflicts over resources use.</p> <p>Link with hinterland management to address catchment and riverbank deforestation, river flow changes and sand extraction upstream, all of which affect the coast in many ways (ICARM).</p>			<p>M-Salt-02: Lack of government support</p> <p>M-Salt-04: Degradation of mangroves from unsustainable salt production</p> <p>M-Salt-05: Sea level rise threatening infrastructure</p>	<p>M-Salt-03: Competition for land (urbanisation)</p>	<p>M-Salt-01: Lack of suitable land for artisanal production.</p> <p>M-Salt-06: IDD hazard associated with small-scale producers</p>
Integrated Water Resources Management (IWRM)						
Land Use Management	<p>Land use information management systems to include ecosystems, habitats and water resources.</p> <p>Incorporate ecosystems, habitats and water resources considerations in spatial planning, including sediment flow to nourish shorelines.</p> <p>Inform hinterland spatial planning to direct zoning to prevent downstream impacts on shorelines.</p>			<p>M-Salt-02: Lack of government support</p> <p>M-Salt-04: Degradation of mangroves from unsustainable salt production</p> <p>M-Salt-05: Sea level rise threatening infrastructure</p>	<p>M-Salt-03: Competition for land (urbanisation)</p>	<p>M-Salt-01: Lack of suitable land for artisanal production.</p>
Shoreline Management Planning	<p>Establish a systematic overview of coastal processes through a shoreline management investigation, considering the entire coast, and inform spatial planning accordingly. Sediment cell resolution national effort, management unit resolution regional/district effort.</p> <p>Develop policies at sediment cell level to address erosion and accretion problems along the shores.</p> <p>Direct the development of similar policies for management units at district level.</p>			<p>M-Salt-02: Lack of government support</p> <p>M-Salt-04: Degradation of mangroves from unsustainable salt production</p> <p>M-Salt-05: Sea level rise threatening infrastructure</p>	<p>M-Salt-03: Competition for land (urbanisation)</p>	<p>M-Salt-01: Lack of suitable land for artisanal production.</p>

Intervention Dimension	Statement	Threat pertinence at each RV				
		Major Problem (RV 5)	Very important problem (RV 4)	Important Problem (RV 3)	Problem (RV 2)	Light Problem (RV 1)
Solid and Liquid Waste Management	Develop policies for quarry siting, management and restoration as basis for regulations.					
Sanitation	Develop policies for quarry siting, management and restoration as basis for regulations.					
Capacity Building	Accompany management interventions with appropriate capacity building components. Particular focus on spatial planning, shoreline management, conflict resolution, monitoring, law enforcement. Enhance information management systems to provide for better and systematically informed management decisions.			M-Salt-02: Lack of government support M-Salt-04: Degradation of mangroves from unsustainable salt production	M-Salt-03: Competition for land (urbanisation)	M-Salt-01: Lack of suitable land for artisanal production.
Technology	Pursue opportunities through further technology development within: <ul style="list-style-type: none"> Beach protection (soft) Turtle tracking geographically and seasonally Shoreline management 			M-Salt-04: Degradation of mangroves from unsustainable salt production M-Salt-05: Sea level rise threatening infrastructure	M-Salt-03: Competition for land (urbanisation)	
Law Enforcement	3) Integrated review of laws, regulations and their enforcement within amongst others: <ul style="list-style-type: none"> Resources exploitation Sand mining Quarries Turtle protection Coral mining ESIA related to mining and freshwater Marine resources 4) Optimise enforcement through capacity building and coordination following recommendations from review.			M-Salt-02: Lack of government support M-Salt-04: Degradation of mangroves from unsustainable salt production	M-Salt-03: Competition for land (urbanisation)	M-Salt-06: IDD hazard associated with small-scale producers
Legal Review	3) Integrated review of laws, regulations and their enforcement within amongst others: <ul style="list-style-type: none"> Resources exploitation Sand mining Quarries Turtle protection Coral mining ESIA related to mining and freshwater Marine resources 4) Initiate revision of existing and develop new laws, regulations according to recommendations from review			M-Salt-02: Lack of government support		M-Salt-01: Lack of suitable land for artisanal production. M-Salt-06: IDD hazard associated with small-scale producers
Alternative/ Improved Livelihood	Develop and offer alternative livelihoods for households currently engaged in destructive sand and rock mining practices. Particular efforts to provide alternatives for young generation. Improve current sustainable resource use livelihoods using technology advances and insights.			M-Salt-04: Degradation of mangroves from unsustainable salt production		
Awareness Raising	Develop and launch awareness raising campaigns related to coastal management challenges directed to the public at large and to schools. Develop and launch issue specific awareness raising campaigns targeting stakeholders affected by or affecting the issue.			M-Salt-04: Degradation of mangroves from unsustainable salt production		M-Salt-06: IDD hazard associated with small-scale producers

Intervention Dimension	Statement	Threat pertinence at each RV				
		Major Problem (RV 5)	Very important problem (RV 4)	Important Problem (RV 3)	Problem (RV 2)	Light Problem (RV 1)
Education	Engage in curricula review and development for primary and secondary schools to enhance the knowledge and understanding about coastal management issues- Issue of particular relevance from a fisheries perspective include: <ul style="list-style-type: none"> • Importance of beaches • Importance of shoreline management 			M-Salt-04: Degradation of mangroves from unsustainable salt production		M-Salt-06: IDD hazard associated with small-scale producers

Action areas

In Table 42 below an overview has been established on how strongly each intervention dimension responds to threats to local communities and ecosystems as perceived by local stakeholders.

For each intervention dimension and for each problem class the number of threats considered to benefit from the intervention have been multiplied by the range value (RV) for the given problem class. The total score for each management dimension has then been calculated by adding the values achieved. The table thus provides an indication of the importance of each intervention dimension in addressing identified and ranked threats. In the same manner Figure 26 gives a graphical presentation of the relevance of intervention dimensions in addressing the identified threats related to with coastal salt production.

Table 42: Assessment of the importance of broad management dimension in addressing threats to local communities and ecosystems associated with salt production.

Intervention Dimension	Major Problem weight	Very important problem weight	Important Problem weight	Problem weight	Light Problem weight	Total Score
Integrated Coastal Zone Management (ICZM)	0	0	9	2	2	13
Integrated Water Resources Management (IWRM)	0	0	0	0	0	0
Land Use Management	0	0	9	2	1	12
Shoreline Management Planning	0	0	9	2	1	12
Solid and Liquid Waste Management	0	0	0	0	0	0
Sanitation	0	0	0	0	0	0
Capacity Building	0	0	6	2	1	9
Technology	0	0	6	2	0	8
Law Enforcement	0	0	6	2	1	9
Legal Review	0	0	3	0	2	5
Alternative/ Improved Livelihood	0	0	3	0	0	3
Awareness Raising	0	0	3	0	1	4
Education	0	0	3	0	1	4
Mainland Tanzania				Salt	Total	79

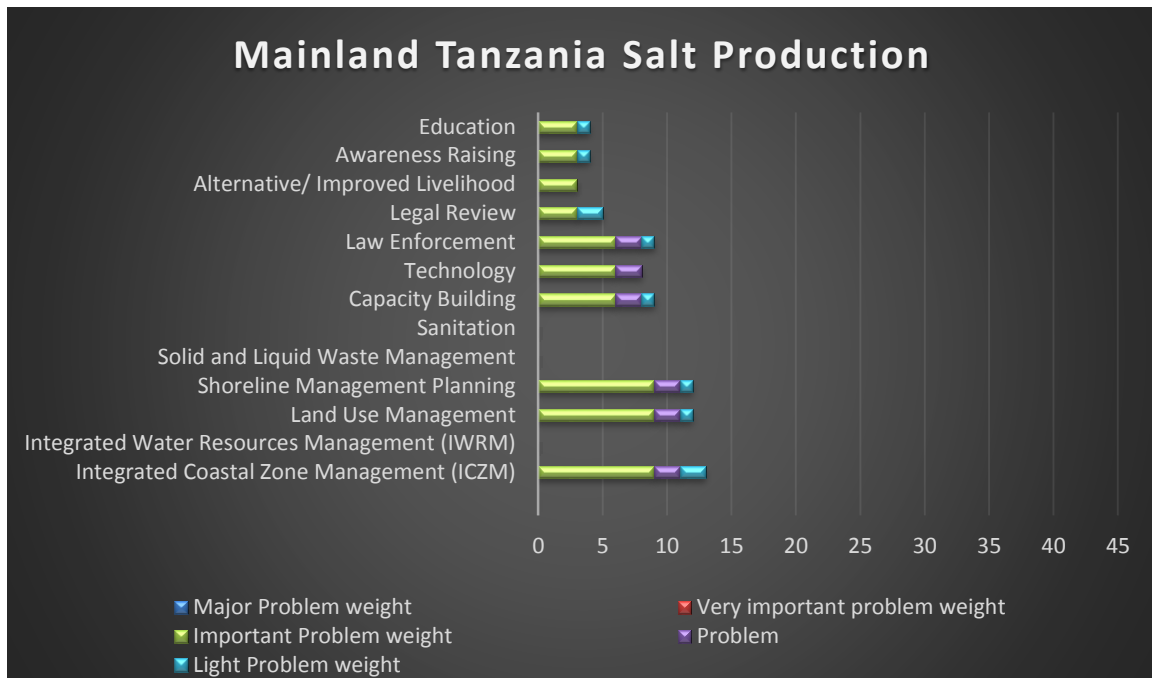


Figure 26: The importance of broad intervention dimension in responding to threats to local communities and ecosystems associated with salt production.

Natural Resources

The coast of Tanzania stretches over a distance of 650 km. There are many islands that shelter the mainland from the waves, some of these are very large (Zanzibar, Pemba and Mafia)

Features of interest within the coastal zone include the coastline, continental shelf, corals, mangroves, and seagrass beds. These are characterized by high marine biodiversity and rich marine and coastal resources.

About two thirds of the coastline has fringing reefs, often close to the shoreline, broken by river outlets such as the Rufiji, Pangani, Ruvuma, Wami and Ruvu. These rivers influence the coastal environment through creation of productive brackish water environments in estuaries, tidal flats and shorelines and nourishment of mangroves and seagrass beds. These coastal ecosystems subsequently interact with each other and together sustain a tremendous diversity of marine life, which supports the livelihood of coastal communities.



A wide range of important and valued species are found along the coast, including an estimated 150 species of corals in 13 families; 8,000 species of invertebrates; 1,000 species of fish; five species of marine turtles, at least 30 species of marine mammals and many seabirds.

The pragmatic outlook on the coastal ecosystems along mainland Tanzania's coast is that the areas close to large urban centres (particularly Tanga, Dar es Salaam, Kilwa, Lindi and Mtwara) are experiencing such a level of degradation from various anthropogenic impacts that the current pressure is damaging their integrity and productivity. Fortunately these areas represent only a relatively small portion of the total coverage of the coastal ecosystems, some 20-30%.

The bulk of the natural coastal environment is not being over-harvested, damaged by destructive fishing gears, or acutely polluted from riverine, urban or agricultural sources, because it is distant from these impacts. Thus there remains considerable opportunity to conserve the productive status of much of the coastline, if measures, education and population pressure are managed.

Prioritized Threats

In Table 43 below the threats identified related to natural resources have been listed and ranked according to their severity as established using the CRIAM method discussed extensively in Volumes I and II of the Coastal Profile. A rapid assessment has been made on the susceptibility of each threat to impacts of climate change more specifically, changes in whether patterns, extreme events, sea level rise, temperature rise and acidification.

Table 43: Prioritised threats related to natural resources and a rapid assessment of threat susceptibility to climate change.

#	Threat as identified in Coastal Profile	Threat Level	Influence from Climate Change					
			Change in Patterns	Extreme events	Sea Level Rise	Temperature Rise	Acidification	
M-NatRes-01	Poor management of the shores (e.g. coastal developments) and lack of understanding of coastal erosion causative factors and sustainable mitigation/adaptation measures leading to loss of shoreline due to coastal erosion.	Very Important Problem	++	+++	+++	0	0	Increased pressures on shoreline management will arise under extreme events and due to sea level rise.
M-NatRes-02	Illegal (destructive) fishing (shallow water prawn trawling, beach seining and dynamite fishing), damaging seaweed, seagrass beds and coral reefs.	Very Important Problem	0	0	0	0	0	No impact from climate change on this threat
M-NatRes-04	Poor upstream agriculture increases sediment loads, increased turbidity and reduced photosynthesis, affecting seaweed and seagrass productivity.	Important Problem	+	++	0	0	0	Changed weather patterns and extreme events will further influence sediment load conditions.
M-NatRes-06	Coral bleaching from El Nino sea surface temperature rise damaging coral reefs	Important Problem	0	0	0	+++	0	Increasing water surface temperatures will further coral bleaching
M-NatRes-05	Waste disposal, in solid and liquid form (pollution) causing harm to seagrass beds and estuaries where marine debris enters from storm sewers, or especially after heavy rains. Debris comes from many sources, including improper disposal of trash on land, storm water runoff and combined sewer overflows to rivers and streams, ships and other vessels.	Problem	+	++	+	0	0	Impacts from pollution will be further enhanced due to flooding and inundation.
M-NatRes-07	Coral mining for the lime industry significantly destructive to reef ecosystems, especially in Kilwa, Lindi and Mtwara districts.	Problem	0	0	0	0	0	No impact from climate change on this threat
M-NatRes-11	Habitat alteration such as the filling of marshes and tidal flats, and reconstruction of shorelines to accommodate the needs of development, transportation, and agriculture, can degrade estuaries.	Problem	0	0	0	0	0	No impact from climate change on this threat
M-NatRes-13	Invasive Indian house crow causing loss of bird diversity through ferocious predation on eggs of local bird species thus threatening indigenous populations.	Problem	0	0	0	0	0	No impact from climate change on this threat
M-NatRes-18	Seismic surveys by oil and gas companies deterring whales, especially migrating Humpback whales with calves.	Problem	0	0	0	0	0	No impact from climate change on this threat
M-NatRes-03	Tourist activities destroying seagrass beds and coral reefs (e.g. trampling when wading, boat anchorage).	Light Problem	0	0	0	0	0	No impact from climate change on this threat
M-NatRes-08	Pollution of coastal watersheds poses a threat to estuaries, entering waterways through storm drains, industrial discharges, runoff from farmlands, discharges from sewage treatment plants, being toxic or harmful to biological systems with long lasting effects, as well as having a negative visual impacts on estuarine environment.	Light Problem	+	++	++	0	0	Flooding and inundation may aggravate impact of pollution
M-NatRes-09	Marine pollution.	Light Problem	0	0	0	0	0	No impact from climate change on this threat
M-NatRes-10	Sedimentation of coral reefs from river discharges, sewage discharges (pollution) and dredging.	Light Problem	+	+	0	0	0	Changes in weather patterns will influence hydrology and sediment loads in rivers as will extreme events.
M-NatRes-12	Intentional or accidental introduction of invasive species can often result in unexpected ecological, economic, and social impacts on the estuarine environment.	Light Problem	0	0	0	0	0	No impact from climate change on this threat
M-NatRes-14	Gillnetting possess the greatest threat to dugongs.	Light Problem	0	0	0	0	0	No impact from climate change on this threat
M-NatRes-15	Shrimp trawling threatening turtles.	Light Problem	0	0	0	0	0	No impact from climate change on this threat
M-NatRes-16	Gillnetting threatening turtles (adults and sub adults).	Light Problem	0	0	0	0	0	No impact from climate change on this threat
M-NatRes-17	Gillnetting threatening whales, especially migrating Humpback whales.	Light Problem	0	0	0	0	0	No impact from climate change on this threat
+++	Threat is severely aggravated from climate change dimension							
++	Threat is aggravated from climate change dimension							
+	Threat is slightly aggravated from climate change dimension							
0	No influence of threat from climate change dimension							
-	Remediating effect on threat from climate change dimension							

Recommendations for threat mitigation measures

Overall measures to mitigate each if the identified natural resources related threats to coastal local communities and ecosystems have been tabulated in Table 179(page339) arranged under broad management dimensions headings. Table 20above provides an overview of the requirements/opportunities expressed within each of these management or intervention dimensions.

Table 44: Broad management intervention dimensions to address identified and prioritised threats to coastal communities and ecosystems associated with natural resources in Mainland Tanzania

Intervention Dimension	Statement	Threat pertinence at each RV				
		Major Problem (RV 5)	Very important problem (RV 4)	Important Problem (RV 3)	Problem (RV 2)	Light Problem (RV 1)
Integrated Coastal Zone Management (ICZM)	<p>Ensure coordination and participation in management of coastal land, water and resources use currently under complex pressures.</p> <p>Facilitate dialogues required to alleviate social conflicts over resources use.</p> <p>Link with hinterland management to address catchment and riverbank deforestation, river flow changes and river pollution, all of which affect the coast in many ways (ICARM).</p>		<p>M-NatRes-01: Poor shoreline management</p> <p>M-NatRes-02: Destructive fishing</p>	M-NatRes-04: Poor upstream agriculture	<p>M-NatRes-05: Waste disposal</p> <p>M-NatRes-07: Coral mining</p> <p>M-NatRes-11: Habitat alteration</p>	<p>M-NatRes-03: Destructive tourist activities</p> <p>M-NatRes-08: Upstream pollution</p> <p>M-NatRes-09: Marine pollution</p> <p>M-NatRes-10: Sedimentation of coral reefs</p>
Integrated Water Resources Management (IWRM)	<p>Link IWRM to coastal integrated planning ensuring upstream/downstream considerations (ICARM).</p> <p>Land use in catchments and its impacts on water resources included in IWRM planning.</p>		M-NatRes-01: Poor shoreline management	M-NatRes-04: Poor upstream agriculture	<p>M-NatRes-05: Waste disposal</p> <p>M-NatRes-11: Habitat alteration</p>	<p>M-NatRes-08: Upstream pollution</p> <p>M-NatRes-09: Marine pollution</p>
Land Use Management	<p>Land use information management systems to include ecosystems, habitats and water resources.</p> <p>Incorporate ecosystems, habitats and water resources considerations in spatial planning.</p> <p>Inform hinterland spatial planning to direct zoning to prevent downstream impacts on fisheries habitats.</p>		<p>M-NatRes-01: Poor shoreline management</p> <p>M-NatRes-02: Destructive fishing</p>	M-NatRes-04: Poor upstream agriculture	<p>M-NatRes-05: Waste disposal</p> <p>M-NatRes-11: Habitat alteration</p>	<p>M-NatRes-03: Destructive tourist activities</p> <p>M-NatRes-08: Upstream pollution</p> <p>M-NatRes-09: Marine pollution</p> <p>M-NatRes-10: Sedimentation of coral reefs</p>
Shoreline Management Planning	<p>Establish a systematic overview of coastal processes through a shoreline management investigation, considering the entire coast, and inform spatial planning accordingly. Sediment cell resolution national effort, management unit resolution regional/district effort.</p>		<p>M-NatRes-01: Poor shoreline management</p> <p>M-NatRes-02: Destructive fishing</p>		<p>M-NatRes-05: Waste disposal</p> <p>M-NatRes-07: Coral mining</p> <p>M-NatRes-11: Habitat alteration</p>	<p>M-NatRes-03: Destructive tourist activities</p> <p>M-NatRes-08: Upstream pollution</p> <p>M-NatRes-09: Marine pollution</p> <p>M-NatRes-10: Sedimentation of coral reefs</p>
Solid and Liquid Waste Management	<p>Review agrochemical management and inform land use accordingly.</p> <p>Pursue integrated solid and liquid waste management solutions considering:</p> <p>Waste water treatment systems:</p> <ul style="list-style-type: none"> - collection - treatment technology - discharge <p>Liquid Waste Management Systems:</p> <ul style="list-style-type: none"> - collection - storage - processing - financing - minimisation - reuse? <p>Green Infrastructure</p> <p>Storm Water Systems</p>				<p>M-NatRes-05: Waste disposal</p> <p>M-NatRes-13: Invasive Indian crow</p>	<p>M-NatRes-08: Upstream pollution</p> <p>M-NatRes-09: Marine pollution</p>
Sanitation	<p>Pursue integrated solid and liquid waste management considering:</p> <p>Waste water treatment systems:</p> <ul style="list-style-type: none"> - collection - treatment technology - discharge <p>Liquid Waste Management Systems:</p> <ul style="list-style-type: none"> - collection - storage - processing - financing - minimisation - reuse? <p>Green Infrastructure</p> <p>Storm Water Systems</p>				M-NatRes-05: Waste disposal	<p>M-NatRes-08: Upstream pollution</p> <p>M-NatRes-09: Marine pollution</p>

Intervention Dimension	Statement	Threat pertinence at each RV				
		Major Problem (RV 5)	Very important problem (RV 4)	Important Problem (RV 3)	Problem (RV 2)	Light Problem (RV 1)
Capacity Building	<p>Accompany management interventions with appropriate capacity building components. Particular focus on spatial planning, shoreline management, conflict resolution, monitoring, law enforcement.</p> <p>Enhance information management systems to provide for better and systematically informed management decisions.</p>		<p>M-NatRes-01: Poor shoreline management</p> <p>M-NatRes-02: Destructive fishing</p>	M-NatRes-04: Poor upstream agriculture	<p>M-NatRes-05: Waste disposal</p> <p>M-NatRes-07: Coral mining</p> <p>M-NatRes-11: Habitat alteration</p> <p>M-NatRes-18: Seismic survey noise</p>	<p>M-NatRes-03: Destructive tourist activities</p> <p>M-NatRes-08: Upstream pollution</p> <p>M-NatRes-09: Marine pollution</p>
Technology	<p>Pursue opportunities through further technology development within:</p> <ul style="list-style-type: none"> Offshore fisheries Aquaculture Value addition Integrated solid and liquid waste management Shoreline management 		<p>M-NatRes-01: Poor shoreline management</p> <p>M-NatRes-02: Destructive fishing</p>	M-NatRes-04: Poor upstream agriculture	<p>M-NatRes-05: Waste disposal</p> <p>M-NatRes-07: Coral mining</p> <p>M-NatRes-11: Habitat alteration</p> <p>M-NatRes-13: Invasive Indian crow</p> <p>M-NatRes-18: Seismic survey noise</p>	<p>M-NatRes-03: Destructive tourist activities</p> <p>M-NatRes-08: Upstream pollution</p> <p>M-NatRes-09: Marine pollution</p> <p>M-NatRes-14: Dugong gillnetting</p> <p>M-NatRes-15 : Turtle shrimp trawling</p> <p>M-NatRes-16 : Turtle gillnetting</p> <p>M-NatRes-17 : Whale gillnetting</p>
Law Enforcement	<p>5) Integrated review of laws, regulations and their enforcement within amongst others:</p> <ul style="list-style-type: none"> Fisheries, Mangrove exploitation Coral mining Agrochemicals Industrial and domestic waste Land use <p>6) Optimise enforcement through capacity building and coordination following recommendations from review.</p>		<p>M-NatRes-01: Poor shoreline management</p> <p>M-NatRes-02: Destructive fishing</p>	M-NatRes-04: Poor upstream agriculture	<p>M-NatRes-05: Waste disposal</p> <p>M-NatRes-07: Coral mining</p> <p>M-NatRes-11: Habitat alteration</p> <p>M-NatRes-18: Seismic survey noise</p>	<p>M-NatRes-08: Upstream pollution</p> <p>M-NatRes-09: Marine pollution</p> <p>M-NatRes-10: Sedimentation of coral reefs</p> <p>M-NatRes-14: Dugong gillnetting</p>
Legal Review	<p>4) Integrated review of laws, regulations and their enforcement within amongst others:</p> <ul style="list-style-type: none"> Fisheries, Mangrove exploitation Coral mining Agrochemicals Industrial and domestic waste Land use <p>5) Initiate revision of existing and develop new laws, regulations according to recommendations from review</p>		<p>M-NatRes-01: Poor shoreline management</p> <p>M-NatRes-02: Destructive fishing</p>	M-NatRes-04: Poor upstream agriculture	<p>M-NatRes-07: Coral mining</p> <p>M-NatRes-11: Habitat alteration</p> <p>M-NatRes-18: Seismic survey noise</p>	<p>M-NatRes-03: Destructive tourist activities</p> <p>M-NatRes-14: Dugong gillnetting</p> <p>M-NatRes-15 : Turtle shrimp trawling</p> <p>M-NatRes-16 : Turtle gillnetting</p>
Alternative/ Improved Livelihood	<p>Develop and offer alternative livelihoods for households currently engaged in destructive resource exploitation practises. Particular efforts to provide alternatives for young generation.</p> <p>Improve current sustainable resource use livelihoods using technology advances and insights.</p>		<p>M-NatRes-01: Poor shoreline management</p> <p>M-NatRes-02: Destructive fishing</p>		M-NatRes-07: Coral mining	M-NatRes-03: Destructive tourist activities

Intervention Dimension	Statement	Threat pertinence at each RV				
		Major Problem (RV 5)	Very important problem (RV 4)	Important Problem (RV 3)	Problem (RV 2)	Light Problem (RV 1)
Awareness Raising	Develop and launch awareness raising campaigns related to coastal management challenges directed to the public at large and to schools. Develop and launch issue specific awareness raising campaigns targeting stakeholders affected by or affecting the issue.		M-NatRes-01: Poor shoreline management M-NatRes-02: Destructive fishing	M-NatRes-04: Poor upstream agriculture	M-NatRes-05: Waste disposal M-NatRes-07: Coral mining M-NatRes-11: Habitat alteration M-NatRes-13: Invasive Indian crow M-NatRes-18: Seismic survey noise	M-NatRes-03: Destructive tourist activities M-NatRes-08: Upstream pollution M-NatRes-09: Marine pollution M-NatRes-10: Sedimentation of coral reefs M-NatRes-12: Impact from other invasive species M-NatRes-14: Dugong gillnetting M-NatRes-15 : Turtle shrimp trawling M-NatRes-16 : Turtle gillnetting M-NatRes-17 : Whale gillnetting
Education	Engage in curricula review and development for primary and secondary schools to enhance the knowledge and understanding about coastal management issues- Issue of particular relevance from a fisheries perspective include: <ul style="list-style-type: none"> • Fisheries ecology and sustainable fisheries • Impact from catchment management on coastal fisheries • Environmental management • Coastal ecology • Importance of beaches 		M-NatRes-01: Poor shoreline management M-NatRes-02: Destructive fishing	M-NatRes-04: Poor upstream agriculture	M-NatRes-05: Waste disposal M-NatRes-07: Coral mining M-NatRes-11: Habitat alteration	M-NatRes-03: Destructive tourist activities M-NatRes-08: Upstream pollution M-NatRes-09: Marine pollution

Action areas

In Table 45 below an overview has been established on how strongly each intervention dimension responds to threats to local communities and ecosystems as perceived by local stakeholders.

For each intervention dimension and for each problem class the number of threats considered to benefit from the intervention have been multiplied by the range value (RV) for the given problem class. The total score for each management dimension has then been calculated by adding the values achieved. The table thus provides an indication of the importance of each intervention dimension in addressing identified and ranked threats. In the same manner Figure 27 gives a graphical presentation of the relevance of intervention dimensions in addressing the identified threats related to with importance of broad management dimension in addressing threats to local communities and ecosystems associated with natural resources.

Table 45: Assessment of the importance of broad management dimension in addressing threats to local communities and ecosystems associated with natural resources.

Intervention Dimension	Major Problem weight	Very important problem weight	Important Problem weight	Problem weight	Light Problem weight	Total Score
Integrated Coastal Zone Management (ICZM)	0	8	3	6	4	21
Integrated Water Resources Management (IWRM)	0	4	3	4	2	13
Land Use Management	0	8	3	4	4	19
Shoreline Management Planning	0	8	0	6	4	18
Solid and Liquid Waste Management	0	0	0	4	2	6
Sanitation	0	0	0	2	2	4
Capacity Building	0	8	4	8	3	23
Technology	0	8	3	10	7	28
Law Enforcement	0	8	3	8	4	23
Legal Review	0	8	3	6	4	21
Alternative/ Improved Livelihood	0	8	0	2	1	11
Awareness Raising	0	8	3	10	9	30
Education	0	8	3	6	3	20
Mainland Tanzania				Natural Resources	Total	237

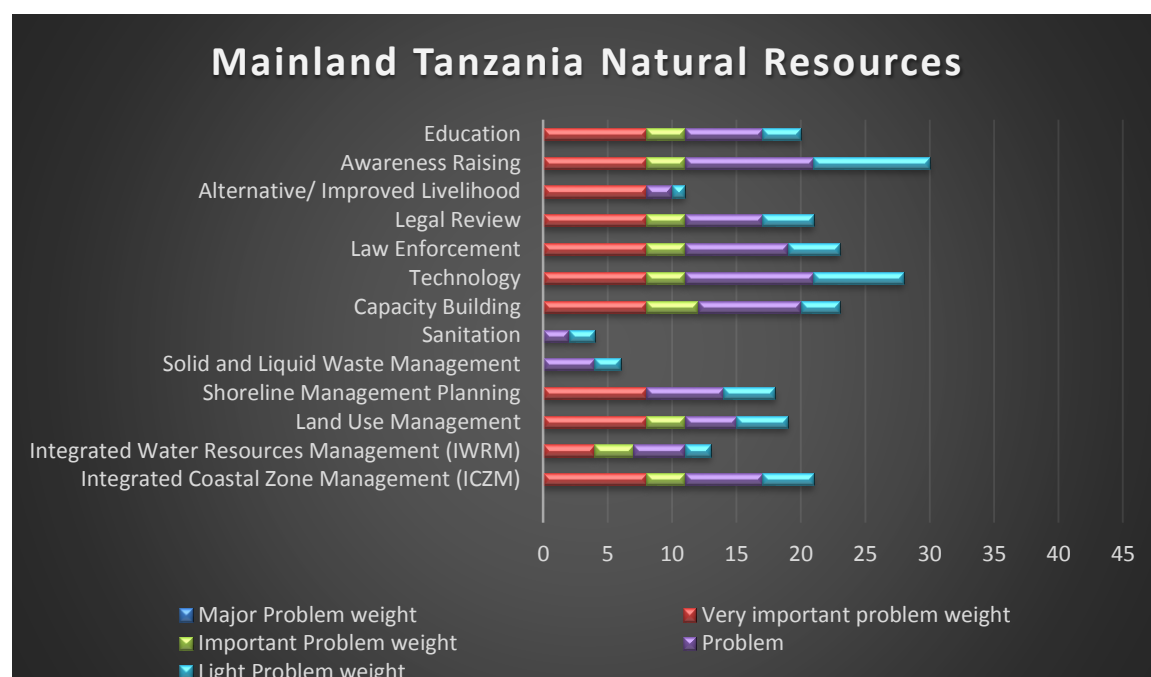


Figure 27: The importance of broad intervention dimension in responding to threats to local communities and ecosystems associated with natural resources.

Freshwater Resources

Nine watersheds, and rivers, cover most of the landscape, though some central areas are extremely dry with little surface water and overall, Tanzania is challenged by a high degree of water resource variability both spatially and temporally. National mean annual rainfall is 1,071 mm but the Lake Tanganyika basin and the southern highlands can receive up to 3,000 mm annually while about half the country receives less than 762 mm annually. Coastal districts receive around 1,000 mm per year.



Water in Tanzania's rivers and reservoirs generate over half of the country's grid electricity through hydropower installations; and water flows nurture the ecosystems, provide numerous provisioning services while also supporting the tourism sector.

Anthropogenic activities related to demand for water for irrigation, livestock, land use changes and hydropower developments have contributed to degradation of the river basins and significantly reduced the fresh water discharges of Tanzania's east flowing rivers, at least during the last five decades.

Land use changes within the upper catchments of the rivers have contributed to the degradation of the river basins with corresponding reduction in the freshwater discharges. In some of the rivers such as the Pangani, Wami and Ruvu, the situation is considered to be critical with multiple socio-economic conflicts and potential ecological and environmental impacts at the coast.

In 2007, Tanzania's renewable water resources per capita was 2,291 m³. Water Stress Indicator. The country's population has grown rapidly in the last 50 years, going from 10 million in 1960 to approximately 45 million in 2010. The projected population for 2015 is 52 million, at which point the country's per capita water resources will fall below 1,700 m³ per person, the definition of water scarcity.

By 2030 the population is expected to be around 75 million and by 2050 it is projected to reach 109 million, further lowering per capita water resources.

Based on the above, the future outlook is clearly one of insufficient water to meet the needs of the population, particularly the large urban centres on the coast as well as in the north of the country, areas where local water supplies are least abundant.

Prioritized Threats

In Table 46 below the threats identified related to freshwater resources have been listed and ranked according to their severity as established using the CRIAM method discussed extensively in Volumes I and II of the Coastal Profile. A rapid assessment has been made on the susceptibility of each threat to impacts of climate change more specifically, changes in whether patterns, extreme events, sea level rise, temperature rise and acidification.

Table 46: Prioritised threats related to freshwater resources and a rapid assessment of threat susceptibility to climate change.

#	Threat as identified in Coastal Profile	Threat Level	Influence from Climate Change					
			Change in Patterns	Extreme events	Sea Level Rise	Temperature rise	Acidification	
M-Fresh-04	Population and economic growth leading to ever increasing need for freshwater.	Major Problem	0	0	0	0	0	No impact from climate change on this threat
M-Fresh-01	Removal of riverine vegetation, erosion of riverbanks, pollution of water bodies from municipal waste dumping, agricultural practices or mining (minerals and river sand), abstraction for water for agriculture (or livestock) or hydropower generation.	Very Important Problem	+	++	0	0	0	Extreme events and changing weather patterns may aggravate impacts.
M-Fresh-03	Degradation of catchments due to land use changes and livestock keeping.	Very Important Problem	+	++	0	0	0	Extreme events and changing weather patterns may aggravate impact of land uses changed and livestock keeping
M-Fresh-07	General lack of information on the patterns of climate change and their impacts on the hydrology of the Tanzanian river systems draining into the coast.	Very Important Problem	0	0	0	0	0	No impact from climate change on this threat
M-Fresh-05	Deterioration of river flows leading to reduced estuarine and marine productivity, especially of delta prawn and small pelagic species (e.g. sardines).	Important Problem	+	+	0	0	0	
M-Fresh-08	Absence of updated data on current river discharges leading to failure to comprehensively monitor river discharges.	Important Problem	0	0	0	0	0	No impact from climate change on this threat
M-Fresh-02	Corruption with the management sectors leading to waste of water or revenues from water usage.	Light Problem	0	0	0	0	0	No impact from climate change on this threat
M-Fresh-06	Pesticide pollution of river deltas from poor agricultural practices resulting in reduced crustacean and fisheries productivity and poisoning of edible marine life.	Light Problem	+	+	0	0	0	Extreme events and changing weather patterns may aggravate impact from poor agriculture practices
+++	Threat is severely aggravated from climate change dimension							
++	Threat is aggravated from climate change dimension							
+	Threat is slightly aggravated from climate change dimension							
0	No influence of threat from climate change dimension							
-	Remediating effect on threat from climate change dimension							

Recommendations for threat mitigation measures

Overall measures to mitigate each of the identified freshwater resources related threats to coastal local communities and ecosystems have been tabulated in Table 179 (page 339) arranged under broad management dimensions headings. Table 20 above provides an overview of the requirements/opportunities expressed within each of these management or intervention dimensions.

Table 47: Broad management intervention dimensions to address identified and prioritised threats to coastal communities and ecosystems associated with freshwater resources in Mainland Tanzania

Intervention Dimension	Statement	Threat pertinence at each RV				
		Major Problem (RV 5)	Very important problem (RV 4)	Important Problem (RV 3)	Problem (RV 2)	Light Problem (RV 1)
Integrated Coastal Zone Management (ICZM)	Ensure coordination and participation in management of coastal land, water and resources use currently under complex pressures. Facilitate dialogues required to alleviate social conflicts over resources use. Link with hinterland management to address catchment and riverbank deforestation, river flow changes and river pollution, all of which affect the coast in many ways (ICARM).	M-Fresh-04: Increasing demand from population and economic growth	M-Fresh-01: Impacts from upstream river and land uses M-Fresh-03: Degradation in catchments from land uses M-Fresh-07: Lack of information on climate impact on river hydrology	M-Fresh-05: Deterioration of river flows M-Fresh-08: Lack of information on river discharges		M-Fresh-06: Pesticide pollution in deltas from agriculture
Integrated Water Resources Management (IWRM)	Link IWRM to coastal integrated planning ensuring upstream/downstream considerations (ICARM). Land use in catchments and its impacts on water resources included in IWRM planning.	M-Fresh-04: Increasing demand from population and economic growth	M-Fresh-01: Impacts from upstream river and land uses M-Fresh-03: Degradation in catchments from land uses M-Fresh-07: Lack of information on climate impact on river hydrology	M-Fresh-05: Deterioration of river flows M-Fresh-08: Lack of information on river discharges		M-Fresh-06: Pesticide pollution in deltas from agriculture

Intervention Dimension	Statement	Threat pertinence at each RV				
		Major Problem (RV 5)	Very important problem (RV 4)	Important Problem (RV 3)	Problem (RV 2)	Light Problem (RV 1)
Land Use Management	Land use information management systems to include ecosystems, habitats and water resources. Incorporate ecosystems, habitats and water resources considerations in spatial planning. Inform hinterland spatial planning to direct zoning to prevent downstream impacts on fisheries habitats.	M-Fresh-04: Increasing demand form population and economic growth	M-Fresh-01: Impacts from upstream river and land uses M-Fresh-03: Degradation in catchments from land uses	M-Fresh-05: Deterioration of river flows		M-Fresh-02: Corruption in water sectors M-Fresh-06: Pesticide pollution in deltas from agriculture
Shoreline Management Planning	Establish a systematic overview of coastal processes through a shoreline management investigation, considering the entire coast, and inform spatial planning accordingly. Sediment cell resolution national effort, management unit resolution regional/district effort.		M-Fresh-03: Degradation in catchments from land uses			
Solid and Liquid Waste Management	Review agrochemical management and inform land use accordingly. Pursue integrated solid and liquid waste management solutions considering: Waste water treatment systems: - collection - treatment technology - discharge Liquid Waste Management Systems: - collection - storage - processing - financing - minimisation - reuse? Green Infrastructure Storm Water Systems		M-Fresh-01: Impacts from upstream river and land uses	M-Fresh-05: Deterioration of river flows		M-Fresh-06: Pesticide pollution in deltas from agriculture
Sanitation						
Capacity Building	Accompany management interventions with appropriate capacity building components. Particular focus on spatial planning, shoreline management, conflict resolution, monitoring, law enforcement. Enhance information management systems to provide for better and systematically informed management decisions.	M-Fresh-04: Increasing demand form population and economic growth	M-Fresh-01: Impacts from upstream river and land uses M-Fresh-03: Degradation in catchments from land uses M-Fresh-07: Lack of information on climate impact on river hydrology	M-Fresh-05: Deterioration of river flows M-Fresh-08: Lack of information on river discharges		M-Fresh-02: Corruption in water sectors M-Fresh-06: Pesticide pollution in deltas from agriculture
Technology	Pursue opportunities through further technology development within: <ul style="list-style-type: none"> Offshore fisheries Aquaculture Value addition Integrated solid and liquid waste management Shoreline management 	M-Fresh-04: Increasing demand form population and economic growth	M-Fresh-01: Impacts from upstream river and land uses M-Fresh-03: Degradation in catchments from land uses M-Fresh-07: Lack of information on climate impact on river hydrology	M-Fresh-05: Deterioration of river flows M-Fresh-08: Lack of information on river discharges		M-Fresh-02: Corruption in water sectors M-Fresh-06: Pesticide pollution in deltas from agriculture
Law Enforcement	7) Integrated review of laws, regulations and their enforcement within amongst others: <ul style="list-style-type: none"> Fisheries, Mangrove exploitation Coral mining Agrochemicals Industrial and domestic waste Land use 8) Optimise enforcement through capacity building and coordination following recommendations from review.	M-Fresh-04: Increasing demand form population and economic growth	M-Fresh-01: Impacts from upstream river and land uses M-Fresh-03: Degradation in catchments from land uses	M-Fresh-05: Deterioration of river flows		M-Fresh-02: Corruption in water sectors M-Fresh-06: Pesticide pollution in deltas from agriculture

Intervention Dimension	Statement	Threat pertinence at each RV				
		Major Problem (RV 5)	Very important problem (RV 4)	Important Problem (RV 3)	Problem (RV 2)	Light Problem (RV 1)
Legal Review	<p>6) Integrated review of laws, regulations and their enforcement within amongst others:</p> <ul style="list-style-type: none"> • Fisheries, • Mangrove exploitation • Coral mining • Agrochemicals • Industrial and domestic waste • Land use <p>7) Initiate revision of existing and develop new laws, regulations according to recommendations from review</p>		M-Fresh-03: Degradation in catchments from land uses			M-Fresh-02: Corruption in water sectors
Alternative/ Improved Livelihood	<p>Develop and offer alternative livelihoods for households currently engaged in destructive resource exploitation practises. Particular efforts to provide alternatives for young generation.</p> <p>Improve current sustainable resource use livelihoods using technology advances and insights.</p>	M-Fresh-04: Increasing demand form population and economic growth	M-Fresh-03: Degradation in catchments from land uses			
Awareness Raising	<p>Develop and launch awareness raising campaigns related to coastal management challenges directed to the public at large and to schools.</p> <p>Develop and launch issue specific awareness raising campaigns targeting stakeholders affected by or affecting the issue.</p>	M-Fresh-04: Increasing demand form population and economic growth	<p>M-Fresh-01: Impacts from upstream river and land uses</p> <p>M-Fresh-03: Degradation in catchments from land uses</p> <p>M-Fresh-07: Lack of information on climate impact on river hydrology</p>	<p>M-Fresh-05: Deterioration of river flows</p> <p>M-Fresh-08: Lack of information on river discharges</p>		<p>M-Fresh-02: Corruption in water sectors</p> <p>M-Fresh-06: Pesticide pollution in deltas from agriculture</p>
Education	<p>Engage in curricula review and development for primary and secondary schools to enhance the knowledge and understanding about coastal management issues- Issue of particular relevance from a fisheries perspective include:</p> <ul style="list-style-type: none"> • Fisheries ecology and sustainable fisheries • Impact from catchment management on coastal fisheries • Environmental management • Coastal ecology • Importance of beaches 	M-Fresh-04: Increasing demand form population and economic growth	<p>M-Fresh-01: Impacts from upstream river and land uses</p> <p>M-Fresh-03: Degradation in catchments from land uses</p> <p>M-Fresh-07: Lack of information on climate impact on river hydrology</p>	<p>M-Fresh-05: Deterioration of river flows</p> <p>M-Fresh-08: Lack of information on river discharges</p>		<p>M-Fresh-02: Corruption in water sectors</p> <p>M-Fresh-06: Pesticide pollution in deltas from agriculture</p>

Action areas

In Table 48 below an overview has been established on how strongly each intervention dimension responds to threats to local communities and ecosystems as perceived by local stakeholders.

For each intervention dimension and for each problem class the number of threats considered to benefit from the intervention have been multiplied by the range value (RV) for the given problem class. The total score for each management dimension has then been calculated by adding the values achieved. The table thus provides an indication of the importance of each intervention dimension in addressing identified and ranked threats. In the same manner Figure 28 gives a graphical presentation of the relevance of intervention dimensions in addressing the identified threats related to with importance of broad management dimension in addressing threats to local communities and ecosystems associated with freshwater resources.

Table 48: Assessment of the importance of broad management dimension in addressing threats to local communities and ecosystems associated with freshwater resources.

Intervention Dimension	Major Problem weight	Very important problem weight	Important Problem weight	Problem weight	Light Problem weight	Total Score
Integrated Coastal Zone Management (ICZM)	5	12	6	0	1	24
Integrated Water Resources Management (IWRM)	5	12	6	0	1	24
Land Use Management	5	8	3	0	2	18
Shoreline Management Planning	0	4	0	0	0	4
Solid and Liquid Waste Management	0	4	3	0	1	8
Sanitation	0	0	0	0	0	0
Capacity Building	5	12	6	0	2	25
Technology	5	12	6	0	2	25
Law Enforcement	5	8	3	0	2	18
Legal Review	0	4	0	0	1	5
Alternative/ Improved Livelihood	5	4	0	0	0	9
Awareness Raising	5	12	6	0	2	25
Education	5	12	6	0	2	25
Mainland Tanzania	Freshwater Resources			Total		210

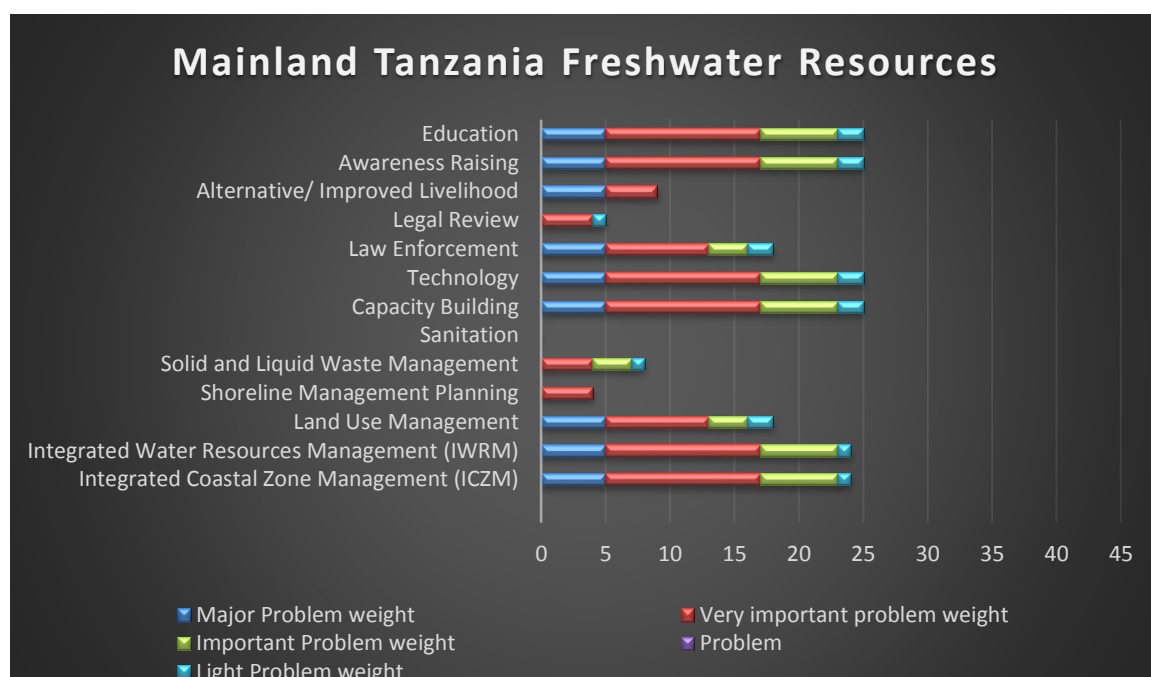


Figure 28: The importance of broad intervention dimension in responding to threats to local communities and ecosystems associated with freshwater resources.

Management Framework for Coastal Zone Management

Prioritized Threats

In Table 49 below the threats identified related to management framework for coastal zone management have been listed and ranked according to their severity as established using the CRIAM method discussed extensively in Volumes I and II of the Coastal Profile. A rapid assessment has been made on the susceptibility of each threat to impacts of climate change more specifically, changes in whether patterns, extreme events, sea level rise, temperature rise and acidification.

Table 49: Prioritised threats related to management framework for coastal zone management and a rapid assessment of threat susceptibility to climate change.

#	Threat as identified in Coastal Profile	Threat Level	Influence from Climate Change					
			Change in Patterns	Extreme events	Sea Level Rise	Temperature rise	Acidification	
M-MFCZM-01	Poor coordination and monitoring between different sectors leading to ineffective governance and failing of enforcement in coastal and marine areas.	Very Important Problem	0	0	0	0	0	No impact from climate change on this threat. The threat needs to be addressed however to mitigate impacts of climate change in general.
M-MFCZM-02	Poor capacity and motivation at local district authority level to implement legal mandates governing natural resource use, resulting in continued deterioration of productivity.	Very Important Problem	0	0	0	0	0	No impact from climate change on this threat. The threat needs to be addressed however to mitigate impacts of climate change in general.
M-MFCZM-03	Absence of financial capacity to address management issues related to coastal and marine resources.	Very Important Problem	0	0	0	0	0	No impact from climate change on this threat
M-MFCZM-04	Corruption at diverse management levels associated with extractive activity related to marine resources, particularly in the fisheries sector, leading to deterioration of the productivity of the resource.	Very Important Problem	0	0	0	0	0	No impact from climate change on this threat. The threat needs to be addressed however to mitigate impacts of climate change in general.
M-MFCZM-05	Continued inability to stop "dynamite" fishing, threatening the productive quality of coastal marine habitats.	Very Important Problem	0	0	0	0	0	No impact from climate change on this threat
M-MFCZM-07	Poor coordination to combat river basin and catchment degradation, resulting in loss of productivity in the coastal zone through reduced seasonal freshwater and nutrient inputs, as well as reduced river sand contribution to the coast; and/or overload of the sediments and freshwater from flash floods.	Important Problem	0	0	0	0	0	No impact from climate change on this threat. The threat needs to be addressed however to mitigate impacts of climate change in general.
M-MFCZM-06	Pollution of beaches and coastal waters.	Problem	0	0	0	0	0	No impact from climate change on this threat. The threat needs to be addressed however to mitigate impacts of climate change in general.
+++	Threat is severely aggravated from climate change dimension							
++	Threat is aggravated from climate change dimension							
+	Threat is slightly aggravated from climate change dimension							
0	No influence of threat from climate change dimension							
-	Remediating effect on threat from climate change dimension							

Recommendations for threat mitigation measures

Overall measures to mitigate each if the identified management framework related threats to coastal local communities and ecosystems have been tabulated in Table 179 (page 339) arranged under broad management dimensions headings. Table 20 above provides an overview of the requirements/opportunities expressed within each of these management or intervention dimensions.

Table 50: Broad management intervention dimensions to address identified and prioritised threats to coastal communities and ecosystems associated with CZM management framework in Mainland Tanzania

Intervention Dimension	Statement	Threat pertinence at each RV				
		Major Problem (RV 5)	Very important problem (RV 4)	Important Problem (RV 3)	Problem (RV 2)	Light Problem (RV 1)
Integrated Coastal Zone Management (ICZM)	<p>Ensure coordination and participation in management of coastal land, water and resources use currently under complex pressures.</p> <p>Facilitate dialogues required to alleviate social conflicts over resources use.</p> <p>Link with hinterland management to address catchment and riverbank deforestation, river flow changes and river pollution, all of which affect the coast in many ways (ICARM).</p>		<p>M-MFCZM-01: Poor coordination and monitoring</p> <p>M-MFCZM-03: Low financial capacity</p>	<p>M-MFCZM-07: Poor coordination to address catchment degradation</p>		
Integrated Water Resources Management (IWRM)	<p>Link IWRM to coastal integrated planning ensuring upstream/downstream considerations (ICARM).</p> <p>Land use in catchments and its impacts on water resources included in IWRM planning.</p>		<p>M-MFCZM-03: Low financial capacity</p>	<p>M-MFCZM-07: Poor coordination to address catchment degradation</p>		
Land Use Management	<p>Land use information management systems to include ecosystems, habitats and water resources.</p> <p>Incorporate ecosystems, habitats and water resources considerations in spatial planning.</p> <p>Inform hinterland spatial planning to direct zoning to prevent downstream impacts on fisheries habitats.</p>			<p>M-MFCZM-07: Poor coordination to address catchment degradation</p>		
Shoreline Management Planning	<p>Establish a systematic overview of coastal processes through a shoreline management investigation, considering the entire coast, and inform spatial planning accordingly. Sediment cell resolution national effort, management unit resolution regional/district effort.</p>			<p>M-MFCZM-07: Poor coordination to address catchment degradation</p>		
Solid and Liquid Waste Management						
Sanitation						
Capacity Building	<p>Accompany management interventions with appropriate capacity building components. Particular focus on spatial planning, shoreline management, conflict resolution, monitoring, law enforcement.</p> <p>Enhance information management systems to provide for better and systematically informed management decisions.</p>		<p>M-MFCZM-01: Poor coordination and monitoring</p> <p>M-MFCZM-02: Poor capacity at local authority</p> <p>M-MFCZM-03: Low financial capacity</p> <p>M-MFCZM-05: Inability to stop dynamite fishing</p>	<p>M-MFCZM-07: Poor coordination to address catchment degradation</p>	<p>M-MFCZM-06: Pollution of beached and coastal waters</p>	
Technology	<p>Pursue opportunities through further technology development within:</p> <ul style="list-style-type: none"> • Offshore fisheries • Aquaculture • Value addition • Integrated solid and liquid waste management • Shoreline management 		<p>M-MFCZM-05: Inability to stop dynamite fishing</p>	<p>M-MFCZM-07: Poor coordination to address catchment degradation</p>		

Intervention Dimension	Statement	Threat pertinence at each RV				
		Major Problem (RV 5)	Very important problem (RV 4)	Important Problem (RV 3)	Problem (RV 2)	Light Problem (RV 1)
Law Enforcement	<p>1) Integrated review of laws, regulations and their enforcement within amongst others:</p> <ul style="list-style-type: none"> • Fisheries, • Mangrove exploitation • Coral mining • Agrochemicals • Industrial and domestic waste • Land use <p>2) Optimise enforcement through capacity building and coordination following recommendations from review.</p>		<p>M-MFCZM-04: Corruption associated with extractive activities</p> <p>M-MFCZM-05: Inability to stop dynamite fishing</p>	<p>M-MFCZM-07: Poor coordination to address catchment degradation</p>	<p>M-MFCZM-06: Pollution of beached and coastal waters</p>	
Legal Review	<p>1) Integrated review of laws, regulations and their enforcement within amongst others:</p> <ul style="list-style-type: none"> • Fisheries, • Mangrove exploitation • Coral mining • Agrochemicals • Industrial and domestic waste • Land use <p>2) Initiate revision of existing and develop new laws, regulations according to recommendations from review</p>		<p>M-MFCZM-01: Poor coordination and monitoring</p> <p>M-MFCZM-02: Poor capacity at local authority</p> <p>M-MFCZM-03: Low financial capacity</p> <p>M-MFCZM-04: Corruption associated with extractive activities</p> <p>M-MFCZM-05: Inability to stop dynamite fishing</p>	<p>M-MFCZM-07: Poor coordination to address catchment degradation</p>	<p>M-MFCZM-06: Pollution of beached and coastal waters</p>	
Alternative/ Improved Livelihood	<p>Develop and offer alternative livelihoods for households currently engaged in destructive resource exploitation practises. Particular efforts to provide alternatives for young generation.</p> <p>Improve current sustainable resource use livelihoods using technology advances and insights.</p>		<p>M-MFCZM-03: Low financial capacity</p> <p>M-MFCZM-05: Inability to stop dynamite fishing</p>	<p>M-MFCZM-07: Poor coordination to address catchment degradation</p>		
Awareness Raising	<p>Develop and launch awareness raising campaigns related to coastal management challenges directed to the public at large and to schools.</p> <p>Develop and launch issue specific awareness raising campaigns targeting stakeholders affected by or affecting the issue.</p>		<p>M-MFCZM-04: Corruption associated with extractive activities</p> <p>M-MFCZM-05: Inability to stop dynamite fishing</p>	<p>M-MFCZM-07: Poor coordination to address catchment degradation</p>	<p>M-MFCZM-06: Pollution of beached and coastal waters</p>	
Education	<p>Engage in curricula review and development for primary and secondary schools to enhance the knowledge and understanding about coastal management issues- Issue of particular relevance from a fisheries perspective include:</p> <ul style="list-style-type: none"> • Fisheries ecology and sustainable fisheries • Impact from catchment management on coastal fisheries • Environmental management • Coastal ecology • Importance of beaches 		<p>M-MFCZM-05: Inability to stop dynamite fishing</p>	<p>M-MFCZM-07: Poor coordination to address catchment degradation</p>	<p>M-MFCZM-06: Pollution of beached and coastal waters</p>	

Action areas

In Table 51 below an overview has been established on how strongly each intervention dimension responds to threats to local communities and ecosystems as perceived by local stakeholders.

For each intervention dimension and for each problem class the number of threats considered to benefit from the intervention have been multiplied by the range value (RV) for the given problem class. The total score for each management dimension has then been calculated by adding the values achieved. The table thus provides an indication of the importance of each intervention dimension in addressing

identified and ranked threats. In the same manner Figure 29 gives a graphical presentation of the relevance of intervention dimensions in addressing the identified threats related to with importance of broad management dimension in addressing threats to local communities and ecosystems associated with management framework for coastal zone management.

Table 51: Assessment of the importance of broad management dimension in addressing threats to local communities and ecosystems associated with management framework for coastal zone management.

Intervention Dimension	Major Problem weight	Very important problem weight	Important Problem weight	Problem weight	Light Problem weight	Total Score
Integrated Coastal Zone Management (ICZM)	0	8	3	0	0	11
Integrated Water Resources Management (IWRM)	0	4	3	0	0	7
Land Use Management	0	0	3	0	0	3
Shoreline Management Planning	0	0	3	0	0	3
Solid and Liquid Waste Management	0	0	0	0	0	0
Sanitation	0	0	0	0	0	0
Capacity Building	0	16	3	2	0	21
Technology	0	4	3	0	0	7
Law Enforcement	0	8	3	2	0	13
Legal Review	0	20	3	2	0	25
Alternative/ Improved Livelihood	0	8	3	0	0	11
Awareness Raising	0	8	3	2	0	13
Education	0	4	3	2	0	9
Mainland Tanzania			Management Framework	Total		123

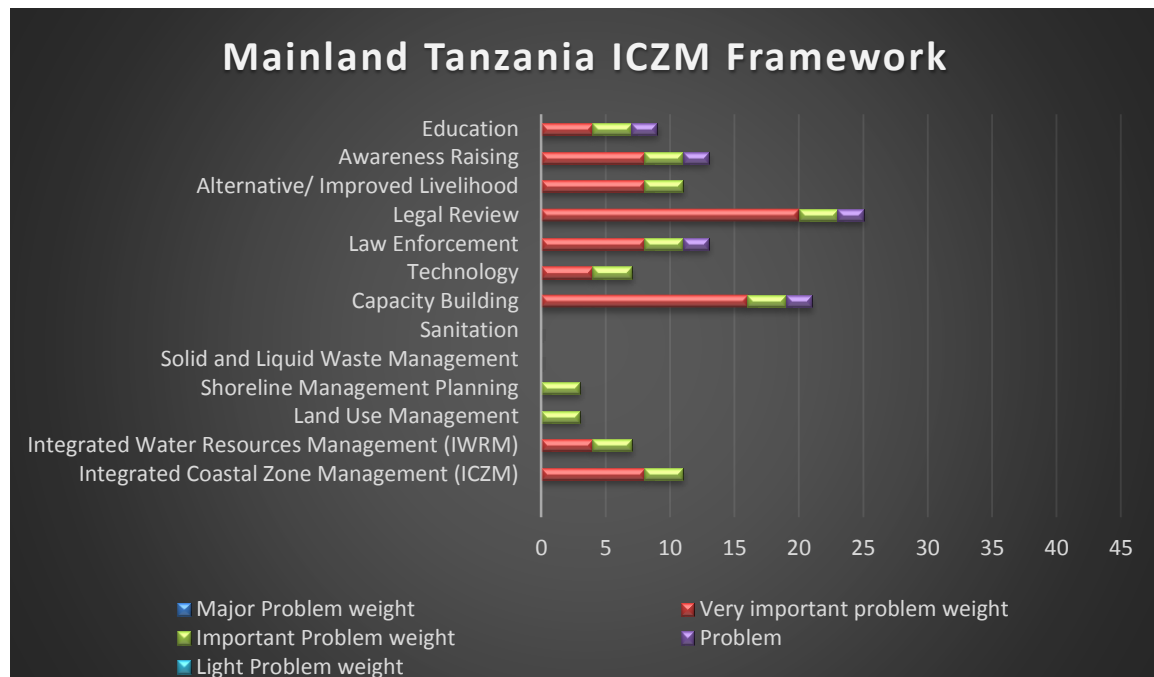


Figure 29: The importance of broad intervention dimension in responding to threats to local communities and ecosystems associated with management framework for CZM.

Mainland Tanzania Districts

Mkinga District

Prioritized Threats

In Table 52 below the threats identified for Mkinga District have been listed and ranked according to their severity as established using the CRIAM method discussed extensively in Volumes I and II of the Coastal Profile. A rapid assessment has been made on the susceptibility of each threat to impacts of climate change more specifically, changes in weather patterns, extreme events, sea level rise, temperature rise and acidification.

Table 52: Prioritised threats for Mkinga District and a rapid assessment of threat susceptibility to climate change.

#	Threat as identified in Coastal Profile	Threat Level	Influence from Climate Change					
			Change in Patterns	Extreme events	Sea Level Rise	Temperature rise	Acidification	
Mkinga-06	Land use conflict	Very important	+	+	0	0	+	Climate change does not impact per se on land speculation and trading, but may impact on use of beach-intertidal areas by local resource users. Reduced fish stocks (e.g. from acidification) or reduced access to marine resources from extreme events may increase conflicts to secure livelihood in the short term.
Mkinga-02	Fisheries decline	Very important	0	-	0	0	0	Changes in climate are not expected to impact per se on the practise of destructive and illegal fisheries. Extreme weather events may in periods have a preventive effect.
Mkinga-01	Beach pollution	Important problem	0	0	0	0	0	Changes in climate are not expected to impact per se on the practise of poor waste disposal that affects beaches.
Mkinga-05	Disease outbreaks	Important problem	++	++	+	+	0	More frequent and severe weather events and sea level rise may increase flooding and standing water and sewage exacerbating disease outbreaks and higher temperatures increase disease propagation
Mkinga-03	Marine environmental pollution	Problem	++	++	0	0	0	More frequent and severe weather events may increase the leaching of pollutants into water resources and thereby exacerbate the levels reaching local marine ecosystems.
Mkinga-04	Heavy metal pollution	Light problem	+	+	0	0	0	More frequent and severe weather events may increase the transport and re-suspension of pollutants into and/or incoastal water and local marine ecosystems.
+++		Threat is severely aggravated from climate change dimension						
++		Threat is aggravated from climate change dimension						
+		Threat is slightly aggravated from climate change dimension						
0		No influence of threat from climate change dimension						
-		Remediating effect on threat from climate change dimension						

Table 53: Prioritised threats for Mkinga District, their location and causes

#	Threat as identified in Coastal Profile	Threat Level	Location	Causes
Mkga-06	Land use conflict	Very important	All along the sandy beach fringed coastal Mkinga	Unplanned selling of beach plots to investors may create big conflict between the community land use interests with investors. Conflict between seaweed farmers and fishermen due to destruction of seaweed farms by fishing vessels. Conflict between bordering villages of Kenya and Mkinga on marine resources use.
Mkga-02	Fisheries decline	Very important	Along Mkinga coastal water and habitats (Kwale, Mkinga, Mtibwani, Manza, Moa)	Destruction of fish nurseries such as mangrove cutting, illegal fishing such as dynamite fishing and other poor fishing methods as well as coral mining for lime production
Mkga-01	Beach pollution	Important problem	All along the coast	Uncontrolled solid and liquid waste disposal, often in creeks; lack of toilets for public as well as residential houses. For instance in Kwale 2002 there was only 48 latrines among 808 households.
Mkga-05	Disease outbreaks	Important problem	Kwale, Moa, Manza, Mtibwani	Lack of latrines, poor solid waste management, uncontrolled food vending
Mkga-03	Marine pollution	Problem	River mouths and vicinity	Use of fertilizers and chemicals for agricultural purposes from upstream river flow.
Mkga-04	Heavy metal pollution	Light problem	River mouths and vicinity	Wastes from tourist hotels, construction sites, workshops, garages and industries located upstream.

Recommendations for threat mitigation measures

Overall measures to mitigate each if the identified natural resources related threats to coastal local communities and ecosystems have been tabulated in Table 205 (page 377) arranged under broad

management dimensions headings. Table 54 below provides an overview of the requirements/opportunities expressed within each of these management or intervention dimensions.

Table 54: Broad management intervention dimensions to address identified and prioritised threats to coastal communities and ecosystems in Mkinga District

Intervention Dimension	Statement	Threat pertinence at each RV				
		Major Problem	Very important problem	Important Problem	Problem	Light Problem
Integrated Coastal Zone Management (ICZM)	<p>Ensure local (district) coordination and participation in management of coastal land, water and resources use currently under complex pressures.</p> <p>Focus areas for integrated management to address include fisheries along entire Mkinga coast (especially Kwale, Mkinga, Mtibwani, Manza, Moa) and pollution, notably at river estuaries.</p>		Mkga-06: Land use conflict Mkga-02: Fisheries decline	Mkga-01: Beach pollution	Mkga-03: Marine pollution	Mkga-04: Heavy metal pollution
Integrated Water Resources Management (IWRM)	<p>Link IWRM to coastal integrated planning to address impacts from upstream pollution, including the Zigi River plus four other smaller rivers (less than 20 km) (ICARM).</p>		Mkga-06: Land use conflict	Mkga-01: Beach pollution Mkga-05: Disease outbreaks	Mkga-03: Marine pollution	Mkga-04: Heavy metal pollution
Land Use Management	<p>Land use information management systems to include ecosystems, habitats and water resources.</p> <p>Incorporate ecosystems, habitats, shoreline processes and water resources considerations in spatial planning.</p> <p>Optimise land use through zoning to minimise conflicts and prevent anarchistic development.</p> <p>Develop and/or update district spatial plan accordingly and within national spatial planning framework.</p>		Mkga-06: Land use conflict Mkga-02: Fisheries decline	Mkga-01: Beach pollution	Mkga-03: Marine pollution	Mkga-04: Heavy metal pollution
Shoreline Management Planning	<p>District's shorelines included in a national level overall shoreline management investigation.</p> <p>Shoreline management units (areas of coast) identified for the district informing district level spatial planning as a basis for local shoreline management regulation.</p>		Mkga-06: Land use conflict Mkga-02: Fisheries decline	Mkga-01: Beach pollution		Mkga-04: Heavy metal pollution
Solid and Liquid Waste Management	<p>Pursue integrated solid and liquid waste management solutions covering entire district, especially Kwale, Moa, Manza and Mtibwani and all estuary areas, considering:</p> <p>Waste water treatment systems: - collection - treatment technology - discharge</p> <p>Liquid and Solid Waste Management Systems: - collection - storage - processing - financing - minimisation - reuse? Green Infrastructure Storm Water Systems</p>			Mkga-01: Beach pollution Mkga-05: Disease outbreaks	Mkga-03: Marine pollution	Mkga-04: Heavy metal pollution
Sanitation	<p>Pursue integrated solid and liquid waste management covering entire district, especially Kwale, Moa, Manza and Mtibwani and all estuary areas, considering:</p> <p>Waste water treatment systems: - collection - treatment technology - discharge</p> <p>Liquid and Solid Waste Management Systems: - collection - storage - processing - financing - minimisation - reuse? Green Infrastructure Storm Water Systems</p>			Mkga-01: Beach pollution Mkga-05: Disease outbreaks		Mkga-04: Heavy metal pollution

Intervention Dimension	Statement	Threat pertinence at each RV				
		Major Problem	Very important problem	Important Problem	Problem	Light Problem
Capacity Building	Accompany management interventions with appropriate capacity building components at district level. Particular focus on conflict resolution, fisheries management, spatial planning, shoreline management, monitoring, law enforcement. Enhance information management systems to provide for better and systematically informed management decisions.		Mkga-06: Land use conflict Mkga-02: Fisheries decline	Mkga-01: Beach pollution Mkga-05: Disease outbreaks	Mkga-03: Marine pollution	Mkga-04: Heavy metal pollution
Technology	Pursue opportunities through further technology development within: <ul style="list-style-type: none"> Shoreline management Offshore fisheries Value added to existing fisheries Water borne disease management Integrated solid and liquid waste management Aquaculture 		Mkga-06: Land use conflict Mkga-02: Fisheries decline	Mkga-01: Beach pollution Mkga-05: Disease outbreaks	Mkga-03: Marine pollution	Mkga-04: Heavy metal pollution
Law Enforcement	1) Enforce reviewed laws relevant to amongst others: <ul style="list-style-type: none"> Land use (especially shoreline and set-back uses) and speculation. Fisheries Industrial and domestic waste Agrochemicals 2) Optimise enforcement through capacity building at district level and aligned with recommendations from national review.		Mkga-06: Land use conflict Mkga-02: Fisheries decline	Mkga-01: Beach pollution Mkga-05: Disease outbreaks	Mkga-03: Marine pollution	Mkga-04: Heavy metal pollution
Legal Review	1) Guided by central integrated review of district legislative and regulatory instruments, including amongst others: <ul style="list-style-type: none"> Land use (especially shoreline and set-back uses) and speculation. Fisheries 2) Follow revision (above) and revise and develop new district legislative and regulatory instruments.		Mkga-06: Land use conflict Mkga-02: Fisheries decline			
Alternative/Improved Livelihood	Develop and offer alternative livelihoods for households currently engaged in destructive resource exploitation practises and those displaced and disadvantaged, focusing on fishing communities at Kwale, Mkinga, Mtibwani, Manza, Moa, with particular efforts to provide alternatives for young generation. Improve current sustainable resource use livelihoods using technology advances and insights.		Mkga-02: Fisheries decline Mkga-02: Fisheries decline ne			
Awareness Raising	Participate in national awareness raising campaigns related to coastal management challenges directed to the public at large and to schools. Develop and implement district level awareness raising campaigns targeting local stakeholders affected by or affecting: <ul style="list-style-type: none"> Land use conflicts Fisheries decline Marine, beach and heavy metal pollution Water borne disease 		Mkga-06: Land use conflict Mkga-02: Fisheries decline	Mkga-01: Beach pollution Mkga-05: Disease outbreaks	Mkga-03: Marine pollution	Mkga-04: Heavy metal pollution
Education	Interact and participate in national curricula review for primary and secondary schools to enhance the knowledge and understanding about coastal management issues. Issues of particular relevance for the district are: <ul style="list-style-type: none"> Fisheries ecology and sustainable fisheries Environmental management Water borne disease Coastal ecology Importance of beaches Climate change impacts 		Mkga-06: Land use conflict Mkga-02: Fisheries decline	Mkga-01: Beach pollution Mkga-05: Disease outbreaks	Mkga-03: Marine pollution	Mkga-04: Heavy metal pollution

Action areas

In Table 55 an overview has been established on how strongly the intervention dimension responds to threats to local communities and ecosystems as perceived by local stakeholders.

For each intervention dimension and for each problem class the number of threats considered to benefit from the intervention have been multiplied by the RV for the given problem class. The total score for each management dimension has then been calculated by adding the values achieved. The table thus provides an indication of the importance of each intervention dimension in addressing identified and ranked threats.

Table 55: Assessment of the importance of broad management dimension in addressing threats to local communities and ecosystems in Mkinga District.

Intervention Dimension	Major Problem weight	Very important problem weight	Important Problem weight	Problem weight	Light Problem weight	Total Score
Integrated Coastal Zone Management (ICZM)	0	8	3	2	1	14
Integrated Water Resources Management (IWRM)	0	4	6	2	1	13
Land Use Management	0	8	3	2	1	14
Shoreline Management Planning	0	8	3	0	1	12
Solid and Liquid Waste Management	0	0	6	2	1	9
Sanitation	0	0	6	0	1	7
Capacity Building	0	8	6	2	1	17
Technology	0	8	6	2	1	17
Law Enforcement	0	8	6	2	1	17
Legal Review	0	4	0	0	0	4
Alternative/ Improved Livelihood	0	8	0	0	0	8
Awareness Raising	0	8	6	2	1	17
Education	0	8	6	2	1	17
Zanzibar			Mkinga District		Total	166

The prioritised location-specific actions for Mkinga district relate to addressing the following:

- Conflicts over coastal land, including land close to the border with Kenya
- Responding to the decline in fisheries productivity due to numerous destructive activities, particularly in the Kwale, Mkinga, Mtibwani, Manza and Moa areas
- Pollution transported to the coast from the Zigi River and four smaller catchments, resulting in beach and marine pollution as well as contributing to disease outbreaks in the district

Tanga Urban District

Prioritized Threats

In Table 56 below the threats identified for Tanga Urban District have been listed and ranked according to their severity as established using the CRIAM method discussed extensively in Volumes I and II of the Coastal Profile. A rapid assessment has been made on the susceptibility of each threat to impacts of climate change more specifically, changes in weather patterns, extreme events, sea level rise, temperature rise and acidification.

Table 56: Prioritised threats for Tanga Urban District and a rapid assessment of threat susceptibility to climate change.

#	Threat as identified in Coastal Profile	Threat Level	Influence from Climate Change					
			Change in Patterns	Extreme events	Sea Level Rise	Temperature rise	Acidification	
Tanga-03	Fisheries decline	Major problem	0	-	0	0	0	Changes in climate are not expected to impact per se on the practise of destructive and illegal fisheries. Extreme weather events may in periods have a preventive effect.
Tanga-01	Beach pollution	Very important	0	0	0	0	0	Changes in climate are not expected to impact per se on the practise of poor waste disposal that affects beaches.
Tanga-05	Marine environmental pollution	Very important	++	++	0	0	0	More frequent and severe weather events may increase the leaching and dispersal of pollutants into water resources and thereby exacerbate the levels reaching local marine ecosystems.
Tanga-02	Beach erosion	Very important	+	+++	+++	0	+	Impact from unsuitable resource use practises leading to beach erosion will be exacerbated notably from extreme events (storms and surges) and sea level rise. Coral growth likely reduce by acidification, increasing wave action and erosion.
Tanga-07	Freshwater supply reduction	Problem	++	+	0	+	0	Increase temperature will increase demand for freshwater, and evaporation rates; changing weather and extreme events likely to aggravate the situation.
Tanga-08	Loss of land and environmental damage	Problem	0	0	0	0	0	Changes in climate are not expected to impact per se on the poor land use management and failure to follow procedures.
Tanga-10	Loss of habitat and agricultural area	Problem	0	0	0	0	0	Changes in climate are not expected to impact per se on increases in urbanization and in migration to the city.
Tanga-04	Heavy metal pollution	Light problem	+	+	0	0	0	More frequent and severe weather events may increase the transport and re-suspension of pollutants into and/or incoastal water and local marine ecosystems.
Tanga-06	Marine pollution (agricultural)	Light problem	++	++	0	0	0	More frequent and severe weather events may increase the leaching of pollutants into water resources and thereby exacerbate the levels reaching local marine ecosystems.
Tanga-09	Land use conflict	Light problem	+	+	0	0	+	Climate change may impact on use of beach-intertidal areas. Reduced stocks (e.g. from acidification) or reduced access to marine resources from extreme events may increase conflicts to secure livelihood in the short term.
+++	Threat is severely aggravated from climate change dimension							
++	Threat is aggravated from climate change dimension							
+	Threat is slightly aggravated from climate change dimension							
0	No influence of threat from climate change dimension							
-	Remediating effect on threat from climate change dimension							

Table 57: Prioritised threats for Tanga Urban District, their location and causes

#	Threat as identified in Coastal Profile	Threat Level	Location	Causes
Tnga-03	Fisheries decline	Major problem	In the near shore waters including: Kisosora, Chumvini, Msakangoto, Sahare	Destruction of fish nurseries such as mangrove cutting, illegal fishing such as dynamite fishing and other poor fishing methods as well as coral mining for lime production and constructions
Tnga-01	Beach pollution	Very important	All along district sea front	Uncontrolled solid waste disposal.
Tnga-05	Marine environmental pollution	Very important	Shores around Tanga city	Inadequate sewerage control and direct disposal to the sea of untreated municipal sewerage, poor quality of sewerage construction, poor solid waste management. 84 % of the population use on site sanitation. The sewerage system is located at central business district only where the effluent is ultimately discharged into Indian ocean.
Tnga-02	Beach erosion	Very important	All along district sea front	Mangrove cutting, dynamite fishing, beach sand mining, unplanned construction along the coast.
Tnga-07	Freshwater supply reduction	Problem	Zigi River	Muheza town needing more freshwater than presently supplied by the Mkulumuzi River.

#	Threat as identified in Coastal Profile	Threat Level	Location	Causes
Tnga-08	Loss of land and environmental damage	Problem	Mwambani port project	Mwambani port project developed without due procedures on impact assessment and local livelihood analysis
Tnga-10	Loss of habitat and agricultural area	Problem	Surrounding suburbs of Tanga city	Rapid urbanization, high increase of immigration into the city.
Tnga-04	Heavy metal pollution	Light problem	Near shore waters along the coast	Wastes from tourist hotels, construction sites, workshops, garages and industries located upstream.
Tnga-06	Marine pollution (agricultural)	Light problem	Shores around Tanga city	Large plantations in the highlands drain into Tanga Urban basin and hence fertilizers, pesticides, herbicides and fungicides may pose as threat to marine environment.
Tnga-09	Land use conflict	Light problem	Shores around Tanga city	Conflict between seaweed farmers and fishers on marine land use; conflict between grazers and farmers

Recommendations for threat mitigation measures

Overall measures to mitigate each if the identified natural resources related threats to coastal local communities and ecosystems have been tabulated in Table 206(page379) arranged under broad management dimensions headings. Table 58 provides an overview of the requirements/opportunities expressed within each of these management or intervention dimensions.

Table 58: Broad management intervention dimensions to address identified and prioritised threats to coastal communities and ecosystems in Tanga Urban District

Intervention Dimension	Statement	Threat pertinence at each RV				
		Major Problem	Very important problem	Important Problem	Problem	Light Problem
Integrated Coastal Zone Management (ICZM)	Ensure local (district) coordination and participation in management of coastal land, water and resources use currently under complex pressures. Focus areas for integrated management to address include fisheries, shoreline (and riverbank) and mangrove deforestation, beach changes along entire district shoreline, especially Kisosora, Chumvini, Msakangoto and Sahare.	Tnga-03: Fisheries decline	Tnga-01: Beach pollution Tnga-02: Beach erosion		Tnga-07: F/water reduction Tnga-08: Land loss & envtl damage Tnga-10: Habitat & agric loss	Tnga-04: Heavy metal pollution Tnga-06: Marine pollution (agricultural) Tnga-09: Land use conflict
Integrated Water Resources Management (IWRM)	Link IWRM to coastal integrated planning to the extent that solid and liquid waste origin from upstream activities, including in Zigi and Mkulumuzi river basins (ICARM).		Tnga-01: Beach pollution Tnga-05: Marine pollution Tnga-02: Beach erosion		Tnga-07: F/water reduction	Tnga-04: Heavy metal pollution Tnga-06: Marine pollution (agricultural)
Land Use Management	Land use information management systems to include ecosystems, habitats and water resources. Incorporate ecosystems, habitats, shoreline processes and water resources considerations in spatial planning. Optimise land use through zoning to minimise conflicts and prevent anarchistic development. Develop and/or update district spatial plan accordingly and within national spatial planning framework.	Tnga-03: Fisheries decline	Tnga-01: Beach pollution Tnga-05: Marine pollution Tnga-02: Beach erosion		Tnga-07: F/water reduction Tnga-08: Land loss & envtl damage Tnga-10: Habitat & agric loss	Tnga-04: Heavy metal pollution Tnga-06: Marine pollution (agricultural) Tnga-09: Land use conflict
Shoreline Management Planning	District's shorelines included in a national level overall shoreline management investigation. Shoreline management units (areas of coast) identified for the district informing district level spatial planning as a basis for local shoreline management regulation.	Tnga-03: Fisheries decline	Tnga-01: Beach pollution Tnga-05: Marine pollution Tnga-02: Beach erosion		Tnga-08: Land loss & envtl damage	Tnga-04: Heavy metal pollution Tnga-09: Land use conflict

Intervention Dimension	Statement	Threat pertinence at each RV				
		Major Problem	Very important problem	Important Problem	Problem	Light Problem
Solid and Liquid Waste Management	<p>Pursue integrated solid and liquid waste management solutions covering entire district, around Tanga city and all coastal villages, considering:</p> <p>Waste water treatment systems:</p> <ul style="list-style-type: none"> - collection - treatment technology - discharge <p>Liquid and Solid Waste Management Systems:</p> <ul style="list-style-type: none"> - collection - storage - processing - financing - minimisation - reuse? <p>Green Infrastructure Storm Water Systems</p>		<p>Tnga-01: Beach pollution</p> <p>Tnga-05: Marine pollution</p>			<p>Tnga-04: Heavy metal pollution</p> <p>Tnga-06: Marine pollution (agricultural)</p>
Sanitation	<p>Pursue integrated solid and liquid waste management covering entire district, around Tanga city and all coastal villages, considering, considering:</p> <p>Waste water treatment systems:</p> <ul style="list-style-type: none"> - collection - treatment technology - discharge <p>Liquid and Solid Waste Management Systems:</p> <ul style="list-style-type: none"> - collection - storage - processing - financing - minimisation - reuse? <p>Green Infrastructure Storm Water Systems</p>		<p>Tnga-01: Beach pollution</p> <p>Tnga-05: Marine pollution</p>			
Capacity Building	<p>Accompany management interventions with appropriate capacity building components at district level. Particular focus on spatial planning, shoreline management, fisheries management, conflict resolution, monitoring, law enforcement.</p> <p>Enhance information management systems to provide for better and systematically informed management decisions.</p>	Tnga-03: Fisheries decline	<p>Tnga-01: Beach pollution</p> <p>Tnga-05: Marine pollution</p> <p>Tnga-02: Beach erosion</p>		<p>Tnga-07: F/water reduction</p> <p>Tnga-08: Land loss & envtl damage</p> <p>Tnga-10: Habitat & agric loss</p>	<p>Tnga-04: Heavy metal pollution</p> <p>Tnga-06: Marine pollution (agricultural)</p> <p>Tnga-09: Land use conflict</p>
Technology	<p>Pursue opportunities through further technology development within:</p> <ul style="list-style-type: none"> • Offshore fisheries • Aquaculture • Value added to existing fisheries • Integrated solid and liquid waste management • Shoreline management • Freshwater resources management <p>Mangrove management</p>	Tnga-03: Fisheries decline	<p>Tnga-01: Beach pollution</p> <p>Tnga-05: Marine pollution</p> <p>Tnga-02: Beach erosion</p>		<p>Tnga-07: F/water reduction</p>	<p>Tnga-04: Heavy metal pollution</p> <p>Tnga-06: Marine pollution (agricultural)</p> <p>Tnga-09: Land use conflict</p>
Law Enforcement	<p>1) Enforce reviewed laws relevant to amongst others:</p> <ul style="list-style-type: none"> • Fisheries • Industrial and domestic waste • Land use (especially shoreline and set-back uses) and speculation. • Mangrove and coastal forest exploitation • Agrochemicals <p>2) Optimise enforcement through capacity building at district level and aligned with recommendations from national review.</p>	Tnga-03: Fisheries decline	<p>Tnga-01: Beach pollution</p> <p>Tnga-05: Marine pollution</p> <p>Tnga-02: Beach erosion</p>		<p>Tnga-07: F/water reduction</p> <p>Tnga-08: Land loss & envtl damage</p> <p>Tnga-10: Habitat & agric loss</p>	<p>Tnga-04: Heavy metal pollution</p> <p>Tnga-06: Marine pollution (agricultural)</p> <p>Tnga-09: Land use conflict</p>
Legal Review	<p>1) Guided by central integrated review of district legislative and regulatory instruments, including amongst others:</p> <ul style="list-style-type: none"> • Fisheries • Coral (and sand) mining • Mangrove exploitation • Land use (especially shoreline and set-back uses) and speculation. <p>2) Follow revision (above) and revise and develop new district legislative and regulatory instruments.</p>	Tnga-03: Fisheries decline	Tnga-02: Beach erosion			Tnga-09: Land use conflict

Intervention Dimension	Statement	Threat pertinence at each RV				
		Major Problem	Very important problem	Important Problem	Problem	Light Problem
Alternative/Improved Livelihood	Develop and offer alternative livelihoods for households currently engaged in destructive resource exploitation practises and those displaced and disadvantaged, focusing Tanga city, Kisosora, Chumvini, Msakangoto and Sahare, with particular efforts to provide alternatives for young generation. Improve current sustainable resource use livelihoods using technology advances and insights.	Tnga-03: Fisheries decline	Tnga-02: Beach erosion		Tnga-10: Habitat & agric loss	
Awareness Raising	Participate in national awareness raising campaigns related to coastal management challenges directed to the public at large and to schools. Develop and implement district level awareness raising campaigns targeting local stakeholders affected by or affecting: <ul style="list-style-type: none"> Fisheries decline Marine and beach pollution Erosion Freshwater resources Loss and degradation of coral Land use conflicts 	Tnga-03: Fisheries decline	Tnga-01: Beach pollution Tnga-05: Marine pollution Tnga-02: Beach erosion		Tnga-07: F/water reduction Tnga-08: Land loss & envtl damage	Tnga-04: Heavy metal pollution Tnga-06: Marine pollution (agricultural) Tnga-09: Land use conflict
Education	Interact and participate in national curricula review for primary and secondary schools to enhance the knowledge and understanding about coastal management issues. Issues of particular relevance for the district are: <ul style="list-style-type: none"> Fisheries ecology and sustainable fisheries Environmental management Water borne disease Climate change impacts Coastal ecology Importance of beaches Sustainable tourism 	Tnga-03: Fisheries decline	Tnga-01: Beach pollution Tnga-05: Marine pollution Tnga-02: Beach erosion		Tnga-07: F/water reduction	Tnga-04: Heavy metal pollution Tnga-06: Marine pollution (agricultural) Tnga-09: Land use conflict

Action areas

Table 59: Assessment of the importance of broad management dimension in addressing threats to local communities and ecosystems in Tanga Urban District.

Intervention Dimension	Major Problem weight	Very important problem weight	Important Problem weight	Problem weight	Light Problem weight	Total Score
Integrated Coastal Zone Management (ICZM)	5	8	0	6	3	22
Integrated Water Resources Management (IWRM)	0	12	0	2	2	16
Land Use Management	5	12	0	6	3	26
Shoreline Management Planning	5	12	0	2	2	21
Solid and Liquid Waste Management	0	8	0	0	2	10
Sanitation	0	8	0	0	0	8
Capacity Building	5	12	0	6	3	26
Technology	5	12	0	2	3	22
Law Enforcement	5	12	0	6	3	26
Legal Review	5	4	0	0	1	10
Alternative/ Improved Livelihood	5	4	0	2	0	11
Awareness Raising	5	12	0	4	3	24
Education	5	12	0	2	3	22
Zanzibar				Tanga Urban District	Total	244

The prioritised location-specific actions for Tanga Urban district relate to addressing the following:

- Responding to the decline in fisheries productivity due to numerous destructive activities, particularly for fishers from the Kisosora, Chumvini, Msakangoto and Sahare areas
- Beach and marine pollution related to inadequate domestic waste and sewage management
- Inadequate freshwater supply from the Mkulumuzi River, projected to be insufficient for future growth in demand (and polluted by agro-chemicals), with Zigi River seen as a potential future source
- Coastal erosion along shores around Tanga city

Muheza District

Prioritized Threats

In Table 60 below the threats identified for Muheza District have been listed and ranked according to their severity as established using the CRIAM method discussed extensively in Volumes I and II of the Coastal Profile. A rapid assessment has been made on the susceptibility of each threat to impacts of climate change more specifically, changes in whether patterns, extreme events, sea level rise, temperature rise and acidification.

Table 60: Prioritised threats for Muheza District and a rapid assessment of threat susceptibility to climate change.

#	Threat as identified in Coastal Profile	Threat Level	Influence from Climate Change					
			Change in Patterns	Extreme events	Sea Level Rise	Temperature rise	Acidification	
Muheza-03	Fisheries decline	Major problem	0	-	0	0	0	Changes in climate are not expected to impact per se on the practise of destructive and illegal fisheries. Extreme weather events may in periods have a preventive effect.
Muheza-02	Beach erosion	Very important	+	+++	+++	0	+	Impact from unsuitable resource use practises leading to beach erosion will be exacerbated notably from extreme events (storms and surges) and sea level rise. Coral growth likely reduce by acidification, increasing wave action and erosion.
Muheza-06	Land use conflict	Very important	0	+	0	0	+	Changes in climate are not expected to impact per se on conflict between sisal and other land users. But reduced stocks (e.g. from acidification) or reduced access to marine resources from extreme events may increase fishery conflicts to secure livelihood in the short term.
Muheza-04	Disease outbreaks	Important problem	++	++	+	+	0	More frequent and severe weather events and sea level rise may increase flooding and standing water and sewage exacerbating disease outbreaks and higher temperatures increase disease propagation.
Muheza-01	Beach pollution	Important problem	0	0	0	0	0	Changes in climate are not expected to impact per se on the practise of poor waste disposal that affects beaches.
Muheza-07	Reduced citrus yields	Light problem	+	+	0	+	0	Climate change may negatively impact citrus production and increase disease/pest problem and soil fertility and moisture content.
Muheza-05	Flooding	Light problem	++	++	+	0	0	Climate change likely to increase flooding if rainfall events are more severe and overall rainfall increases. Kigombe is a coastal village thus sea level rise will worsen the flooding.
+++	Threat is severely aggravated from climate change dimension							
++	Threat is aggravated from climate change dimension							
+	Threat is slightly aggravated from climate change dimension							
0	No influence of threat from climate change dimension							
-	Remediating effect on threat from climate change dimension							

Table 61: Prioritised threats for Muheza District, their location and causes

#	Threat as identified in Coastal Profile	Threat Level	Location	Causes
Mhza-03	Fisheries decline	Major problem	At the near shore coastal area	Destruction of fish nurseries such as mangrove cutting, illegal fishing such as dynamite fishing and other poor fishing methods as well as coral mining for lime production
Mhza-02	Beach erosion	Very important	Kigombe, Msakangoto	Beach sand and gravel excavation, mangrove cutting, dynamite fishing, unplanned construction along the coast.
Mhza-06	Land use conflict	Very important	Kigombe and Msakangoto	Between sisal plantation and community (large land area owned by sisal plantation the fact that deprive community of for their various needs), construction of hotels vs beach access by local community. Conflict on the use of marine resources which emanates to misunderstanding between Immigrants fishers and resident fishing areas without following regulation
Mhza-04	Disease outbreaks	Important problem	Kigombe and Msakangoto	Inadequate sewerage control, flooding, poor solid waste management, uncontrolled food vending.
Mhza-01	Beach pollution	Important problem	Kigombe, Msakangoto	Uncontrolled solid and liquid waste disposal, lack of latrines in many households and public areas. Discharge from industrial wastes
Mhza-07	Reduced citrus yields	Light problem	Across farming sectors of district	Lack of technical support to farmers
Mhza-05	Flooding	Light problem	Kigombe	Poor drainage in the settlement area

Recommendations for threat mitigation measures

Overall measures to mitigate each if the identified natural resources related threats to coastal local communities and ecosystems have been tabulated in Table 204(page375) arranged under broad management dimensions headings. Table 62 provides an overview of the requirements/opportunities expressed within each of these management or intervention dimensions.

Table 62: Broad management intervention dimensions to address identified and prioritised threats to coastal communities and ecosystems in Muheza District

Intervention Dimension	Statement	Threat pertinence at each RV				
		Major Problem	Very important problem	Important Problem	Problem	Light Problem
Integrated Coastal Zone Management (ICZM)	Ensure local (district) coordination and participation in management of coastal land, water and resources use currently under complex pressures. Focus areas for integrated management to address include fisheries, shoreline and beach changes at Kigombe and Msakangoto.	Mhza-03: Fisheries decline	Mhza-02: Beach erosion Mhza-06: Land use conflict	Mhza-04: Disease outbreaks Mhza-01: Beach pollution		Mhza-05: Flooding
Integrated Water Resources Management (IWRM)	Link IWRM to coastal integrated planning to the extent that solid and liquid waste origin from upstream activities in Zigi and Mkulumuzi river basins (which discharge outside Muheza district) (ICARM).		Mhza-02: Beach erosion Mhza-06: Land use conflict	Mhza-04: Disease outbreaks Mhza-01: Beach pollution		Mhza-05: Flooding
Land Use Management	Land use information management systems to include ecosystems, habitats and water resources. Incorporate ecosystems, habitats, shoreline processes and water resources considerations in spatial planning. Optimise land use through zoning to minimise conflicts and prevent anarchistic development. Develop and/or update district spatial plan accordingly and within national spatial planning framework.	Mhza-03: Fisheries decline	Mhza-02: Beach erosion Mhza-06: Land use conflict	Mhza-04: Disease outbreaks Mhza-01: Beach pollution		Mhza-05: Flooding
Shoreline Management Planning	District's shorelines included in a national level overall shoreline management investigation. Shoreline management units (areas of coast) identified for the district informing district level spatial planning as a basis for local shoreline management regulation.	Mhza-03: Fisheries decline	Mhza-02: Beach erosion Mhza-06: Land use conflict	Mhza-01: Beach pollution		
Solid and Liquid Waste Management	Pursue integrated solid and liquid waste management solutions covering entire district, at Kigombe and Msakangoto, considering: Waste water treatment systems: - collection - treatment technology - discharge Liquid and Solid Waste Management Systems: - collection - storage - processing - financing - minimisation - reuse? Green Infrastructure Storm Water Systems			Mhza-04: Disease outbreaks Mhza-01: Beach pollution		

Intervention Dimension	Statement	Threat pertinence at each RV				
		Major Problem	Very important problem	Important Problem	Problem	Light Problem
Sanitation	Pursue integrated solid and liquid waste management covering entire district, from Kigombe and Msakangoto, considering: Waste water treatment systems: - collection - treatment technology - discharge Liquid and Solid Waste Management Systems: - collection - storage - processing - financing - minimisation - reuse? Green Infrastructure Storm Water Systems			Mhza-04: Disease outbreaks Mhza-01: Beach pollution		
Capacity Building	Accompany management interventions with appropriate capacity building components at district level. Particular focus on fisheries management, shoreline management, conflict resolution, spatial planning, monitoring, law enforcement. Enhance information management systems to provide for better and systematically informed management decisions.	Mhza-03: Fisheries decline	Mhza-02: Beach erosion Mhza-06: Land use conflict	Mhza-04: Disease outbreaks Mhza-01: Beach pollution		Mhza-07: Reduced citrus yields Mhza-05: Flooding
Technology	Pursue opportunities through further technology development within: <ul style="list-style-type: none"> Offshore fisheries Aquaculture Value added to existing fisheries Shoreline management Water borne disease management Integrated solid and liquid waste management Agricultural outputs Flooding	Mhza-03: Fisheries decline	Mhza-02: Beach erosion Mhza-06: Land use conflict	Mhza-04: Disease outbreaks Mhza-01: Beach pollution		Mhza-07: Reduced citrus yields Mhza-05: Flooding
Law Enforcement	1) Enforce reviewed laws relevant to amongst others: <ul style="list-style-type: none"> Fisheries Coral (and sand) mining Land use (especially shoreline and set-back uses) and speculation. Industrial and domestic waste 2) Optimise enforcement through capacity building at district level and aligned with recommendations from national review.	Mhza-03: Fisheries decline	Mhza-02: Beach erosion Mhza-06: Land use conflict	Mhza-04: Disease outbreaks Mhza-01: Beach pollution		Mhza-05: Flooding
Legal Review	1) Guided by central integrated review of district legislative and regulatory instruments, including amongst others: <ul style="list-style-type: none"> Fisheries Coral (and sand) mining Land use (especially shoreline and set-back uses) and speculation. 2) Follow revision (above) and revise and develop new district legislative and regulatory instruments.	Mhza-03: Fisheries decline	Mhza-02: Beach erosion Mhza-06: Land use conflict			
Alternative/Improved Livelihood	Develop and offer alternative livelihoods for households currently engaged in destructive resource exploitation practises and those displaced and disadvantaged, focusing on Kigombe and Msakangoto, with particular efforts to provide alternatives for young generation. Improve current sustainable resource use livelihoods using technology advances and insights.	Mhza-03: Fisheries decline	Mhza-02: Beach erosion			
Awareness Raising	Participate in national awareness raising campaigns related to coastal management challenges directed to the public at large and to schools. Develop and implement district level awareness raising campaigns targeting local stakeholders affected by or affecting: <ul style="list-style-type: none"> Fisheries decline Erosion Land use conflicts Marine and beach pollution Water borne disease 	Mhza-03: Fisheries decline	Mhza-02: Beach erosion Mhza-06: Land use conflict	Mhza-04: Disease outbreaks Mhza-01: Beach pollution		

Intervention Dimension	Statement	Threat pertinence at each RV				
		Major Problem	Very important problem	Important Problem	Problem	Light Problem
Education	<p>Interact and participate in national curricula review for primary and secondary schools to enhance the knowledge and understanding about coastal management issues. Issues of particular relevance for the district are:</p> <ul style="list-style-type: none"> • Fisheries ecology and sustainable fisheries • Coastal ecology • Importance of beaches • Sustainable tourism • Water borne disease • Environmental management • Climate change impacts 	Mhza-03: Fisheries decline	<p>Mhza-02: Beach erosion</p> <p>Mhza-06: Land use conflict</p>	<p>Mhza-04: Disease outbreaks</p> <p>Mhza-01: Beach pollution</p>		Mhza-05: Flooding

Action areas

Table 63: Assessment of the importance of broad management dimension in addressing threats to local communities and ecosystems in Muheza District.

Intervention Dimension	Major Problem weight	Very important problem weight	Important Problem weight	Problem weight	Light Problem weight	Total Score
Integrated Coastal Zone Management (ICZM)	5	8	6	0	1	20
Integrated Water Resources Management (IWRM)	0	8	6	0	1	15
Land Use Management	5	8	6	0	1	20
Shoreline Management Planning	5	8	3	0	0	16
Solid and Liquid Waste Management	0	0	6	0	0	6
Sanitation	0	0	6	0	0	6
Capacity Building	5	8	6	0	2	21
Technology	5	8	6	0	2	21
Law Enforcement	5	8	6	0	1	20
Legal Review	5	8	0	0	0	13
Alternative/ Improved Livelihood	5	4	0	0	0	9
Awareness Raising	5	8	6	0	0	19
Education	5	8	6	0	1	20
Zanzibar						
			Muheza District		Total	206

The prioritised location-specific actions for Muheza district relate to addressing the following:

- Responding to the decline in fisheries productivity due to numerous destructive activities
- Beach erosion along shores at Kigombe and Msakangoto
- Land use conflict at Kigombe and Msakangoto
- Beach and marine pollution related to inadequate domestic waste and sewage management

Pangani District

Prioritized Threats

In Table 64 below the threats identified for Pangani District have been listed and ranked according to their severity as established using the CRIAM method discussed extensively in Volumes I and II of the Coastal Profile. A rapid assessment has been made on the susceptibility of each threat to impacts of climate change more specifically, changes in weather patterns, extreme events, sea level rise, temperature rise and acidification.

Table 64: Prioritised threats for Pangani District and a rapid assessment of threat susceptibility to climate change.

#	Threat as identified in Coastal Profile	Threat Level	Influence from Climate Change					
			Change in Patterns	Extreme events	Sea Level Rise	Temperature rise	Acidification	
Pangani-05	Fisheries decline	Very important	0	-	0	0	0	Changes in climate are not expected to impact per se on the practise of destructive and illegal fisheries. Extreme weather events may in periods have a preventive effect.
Pangani-01	Beach pollution	Very important	0	0	0	0	0	
Pangani-02	Beach erosion	Very important	+	+++	+++	0	+	Impact from unsuitable resource use practises leading to beach erosion will be exacerbated notably from extreme events (storms and surges) and sea level rise. Coral growth likely reduce by acidification, increasing wave action and erosion.
Pangani-06	Decline in sea turtles	Very important	++	++	+++	+	+	
Pangani-08	Land use conflict	Important problem	0	0	0	0	0	Changes in climate are not expected to impact per se on conflict between farm land users and protected land areas, nor between hoteliers and other beach users.
Pangani-09	Loss of habitat and agricultural area	Important problem	++	++	+	0	0	
Pangani-07	Increase in HIV infection	Problem	0	0	0	0	0	Changes in climate are not expected to impact per se on sexual practises.
Pangani-03	River erosion	Problem	++	++	+++	+	+	
Pangani-04	Marine pollution	Problem	++	++	0	0	0	More frequent and severe weather events may increase the leaching of pollutants into water resources and thereby exacerbate the levels reaching local marine ecosystems.

Table 65: Prioritised threats for Pangani District, their location and causes

#	Threat as identified in Coastal Profile	Threat Level	Location	Causes
Pgni-05	Fisheries decline	Very important	All along the coastal shore water and especially Matakani	Destruction of fish nurseries such as mangrove cutting, illegal fishing such as dynamite fishing and other poor fishing methods as well as coral mining for lime production, SCUBA fishing
Pgni-01	Beach pollution	Very important	Pangani Town, Pangani River valley	Uncontrolled solid and liquid waste disposal, human excreta due to lack of latrines, coconut husk disposal on the beach.
Pgni-02	Beach erosion	Very important	Along entire coast and in particular at Pangani Town, Ushongo	Mangrove cutting, dynamite fishing, beach sand mining, climate changes, Pangani beach wall degradation
Pgni-06	Turtle decline	Very important	Along Ushongo beaches and other sandy beaches and dunes	Deforestation of old Maziwe Island (now is just a sand bank), destruction of turtle nesting areas, turtle catching and killing for meat.
Pgni-08	Land use conflict	Important problem	Saadani and Buyuni border. Ushongo and	Between Sadani NP and Buyuni Village Community. Hotelier vs village communities on beach access. Land use

#	Threat as identified in Coastal Profile	Threat Level	Location	Causes
			vicinity. Various district areas	conflict between livestock keeper and farmer on the grazing vs cultivation land
Pgni-09	Loss of habitat and agricultural area	Important problem	Various district areas	Mangrove cutting, forest clearing for firewood collection, agricultural and animal rearing purposes, use of fire in cultivation,
Pgni-07	Increase in HIV infection	Problem	All along the district	Unsafe sex, alcoholism and drug abuse, early age sex engagement
Pgni-03	River erosion	Problem	along Pangani River Bank	Dams upstream, plantation along the river, cutting of mangroves in estuarines, SLR/CC.
Pgni-04	Marine pollution	Problem	Pangani River valley, Pangani Town	Large plantations in the highland drain into Pangani basin and hence fertilizers, pesticides, herbicides and fungicides from up land far to Kilimanjaro highlands may pose as threat

Recommendations for threat mitigation measures

Overall measures to mitigate each if the identified natural resources related threats to coastal local communities and ecosystems have been tabulated in Table 207 (page 381) arranged under broad management dimensions headings. Table 66 provides an overview of the requirements/opportunities expressed within each of these management or intervention dimensions.

Table 66: Broad management intervention dimensions to address identified and prioritised threats to coastal communities and ecosystems in Pangani District

Intervention Dimension	Statement	Threat pertinence at each RV				
		Major Problem	Very important problem	Important Problem	Problem	Light Problem
Integrated Coastal Zone Management (ICZM)	<p>Ensure local (district) coordination and participation in management of coastal land, water and resources use currently under complex pressures.</p> <p>Focus areas for integrated management to address include fisheries, shoreline (and riverbank) and mangrove deforestation, beach changes, especially at Pangani Town, Ushongo and Matakani.</p>		<p>Pgni-05: Fisheries decline</p> <p>Pgni-01: Beach pollution</p> <p>Pgni-02: Beach erosion</p> <p>Pgni-06: Turtle decline</p>	<p>Pgni-08: Land use conflict</p> <p>Pgni-09: Habitat & agric loss</p>	<p>Pgni-03: River erosion</p> <p>Pgni-02: Marine pollution</p>	
Integrated Water Resources Management (IWRM)	<p>Link IWRM to coastal integrated planning to address impacts from upstream pollution, including Pangani and Msangasi rivers (ICARM) and to the extent that solid and liquid waste origin from upstream activities.</p>		<p>Pgni-01: Beach pollution</p> <p>Pgni-02: Beach erosion</p>		<p>Pgni-03: River erosion</p> <p>Pgni-02: Marine pollution</p>	
Land Use Management	<p>Land use information management systems to include ecosystems, habitats and water resources.</p> <p>Incorporate ecosystems, habitats, shoreline processes and water resources considerations in spatial planning.</p> <p>Optimise land use through zoning to minimise conflicts and prevent anarchistic development.</p> <p>Develop and/or update district spatial plan accordingly and within national spatial planning framework.</p>		<p>Pgni-05: Fisheries decline</p> <p>Pgni-01: Beach pollution</p> <p>Pgni-02: Beach erosion</p>	<p>Pgni-08: Land use conflict</p> <p>Pgni-09: Habitat & agric loss</p>	<p>Pgni-03: River erosion</p> <p>Pgni-02: Marine pollution</p>	
Shoreline Management Planning	<p>District's shorelines included in a national level overall shoreline management investigation.</p> <p>Shoreline management units (areas of coast) identified for the district informing district level spatial planning as a basis for local shoreline management regulation.</p>		<p>Pgni-05: Fisheries decline</p> <p>Pgni-01: Beach pollution</p> <p>Pgni-02: Beach erosion</p> <p>Pgni-06: Turtle decline</p>	<p>Pgni-09: Habitat & agric loss</p>		

Intervention Dimension	Statement	Threat pertinence at each RV				
		Major Problem	Very important problem	Important Problem	Problem	Light Problem
Solid and Liquid Waste Management	<p>Pursue integrated solid and liquid waste management solutions covering entire district, notably around Pangani town, Pangani River valley and Ushongo, considering:</p> <p>Waste water treatment systems:</p> <ul style="list-style-type: none"> - collection - treatment technology - discharge <p>Liquid and Solid Waste Management Systems:</p> <ul style="list-style-type: none"> - collection - storage - processing - financing - minimisation - reuse? <p>Green Infrastructure Storm Water Systems</p>		<p>Pgni-01: Beach pollution</p> <p>Pgni-06: Turtle decline</p>		Pgni-02: Marine pollution	
Sanitation	<p>Pursue integrated solid and liquid waste management covering entire district, notably Pangani town and Ushongo, considering:</p> <p>Waste water treatment systems:</p> <ul style="list-style-type: none"> - collection - treatment technology - discharge <p>Liquid and Solid Waste Management Systems:</p> <ul style="list-style-type: none"> - collection - storage - processing - financing - minimisation - reuse? <p>Green Infrastructure Storm Water Systems</p>		Pgni-01: Beach pollution		Pgni-02: Marine pollution	
Capacity Building	<p>Accompany management interventions with appropriate capacity building components at district level. Particular focus on spatial planning, shoreline management, fisheries management, conflict resolution, monitoring, law enforcement.</p> <p>Enhance information management systems to provide for better and systematically informed management decisions.</p>		<p>Pgni-05: Fisheries decline</p> <p>Pgni-01: Beach pollution</p> <p>Pgni-02: Beach erosion</p> <p>Pgni-06: Turtle decline</p>	<p>Pgni-08: Land use conflict</p> <p>Pgni-09: Habitat & agric loss</p>	<p>Pgni-07: HIV increase</p> <p>Pgni-03: River erosion</p> <p>Pgni-02: Marine pollution</p>	
Technology	<p>Pursue opportunities through further technology development within:</p> <ul style="list-style-type: none"> • Offshore fisheries • Integrated solid and liquid waste management • Aquaculture • Value added to existing fisheries • Shoreline management • Mangrove management 		<p>Pgni-05: Fisheries decline</p> <p>Pgni-01: Beach pollution</p> <p>Pgni-02: Beach erosion</p>	<p>Pgni-08: Land use conflict</p> <p>Pgni-09: Habitat & agric loss</p>	Pgni-02: Marine pollution	
Law Enforcement	<p>1) Enforce reviewed laws relevant to amongst others:</p> <ul style="list-style-type: none"> • Fisheries • Industrial and domestic waste • Coral (and sand) mining • Turtle/egg harvest • Mangrove and coastal forest exploitation • Land use (especially shoreline and set-back uses) and speculation. • Agrochemicals <p>2) Optimise enforcement through capacity building at district level and aligned with recommendations from national review.</p>		<p>Pgni-05: Fisheries decline</p> <p>Pgni-01: Beach pollution</p> <p>Pgni-02: Beach erosion</p> <p>Pgni-06: Turtle decline</p>	<p>Pgni-08: Land use conflict</p> <p>Pgni-09: Habitat & agric loss</p>	<p>Pgni-07: HIV increase</p> <p>Pgni-03: River erosion</p> <p>Pgni-02: Marine pollution</p>	
Legal Review	<p>1) Guided by central integrated review of district legislative and regulatory instruments, including amongst others:</p> <ul style="list-style-type: none"> • Fisheries • Coral (and sand) mining • Mangrove exploitation • Land use (especially shoreline and set-back uses) and speculation. <p>2) Follow revision (above) and revise and develop new district legislative and regulatory instruments.</p>		<p>Pgni-05: Fisheries decline</p> <p>Pgni-02: Beach erosion</p>	Pgni-08: Land use conflict		

Intervention Dimension	Statement	Threat pertinence at each RV				
		Major Problem	Very important problem	Important Problem	Problem	Light Problem
Alternative/Improved Livelihood	Develop and offer alternative livelihoods for households currently engaged in destructive resource exploitation practises and those displaced and disadvantaged, focusing on Pangani Town, Ushongo and Matakani, with particular efforts to provide alternatives for young generation. Improve current sustainable resource use livelihoods using technology advances and insights.		Pgni-05: Fisheries decline Pgni-02: Beach erosion	Pgni-09: Habitat & agric loss		
Awareness Raising	Participate in national awareness raising campaigns related to coastal management challenges directed to the public at large and to schools. Develop and implement district level awareness raising campaigns targeting local stakeholders affected by or affecting: <ul style="list-style-type: none"> Fisheries decline Marine and beach pollution Erosion Turtle decline Land use conflicts Water borne disease HIV River erosion 		Pgni-05: Fisheries decline Pgni-01: Beach pollution Pgni-02: Beach erosion Pgni-06: Turtle decline	Pgni-08: Land use conflict Pgni-09: Habitat & agric loss	Pgni-07: HIV increase Pgni-03: River erosion Pgni-02: Marine pollution	
Education	Interact and participate in national curricula review for primary and secondary schools to enhance the knowledge and understanding about coastal management issues. Issues of particular relevance for the district are: <ul style="list-style-type: none"> Fisheries ecology and sustainable fisheries Coastal ecology Importance of beaches Sustainable tourism Environmental management HIV Climate change impacts 		Pgni-05: Fisheries decline Pgni-01: Beach pollution Pgni-02: Beach erosion Pgni-06: Turtle decline	Pgni-08: Land use conflict Pgni-09: Habitat & agric loss	Pgni-07: HIV increase Pgni-03: River erosion Pgni-02: Marine pollution	

Action areas

Intervention Dimension	Major Problem weight	Very important problem weight	Important Problem weight	Problem weight	Light Problem weight	Total Score
Integrated Coastal Zone Management (ICZM)	0	16	6	4	0	26
Integrated Water Resources Management (IWRM)	0	8	0	4	0	12
Land Use Management	0	12	6	4	0	22
Shoreline Management Planning	0	16	3	0	0	19
Solid and Liquid Waste Management	0	8	0	2	0	10
Sanitation	0	4	0	2	0	6
Capacity Building	0	16	6	6	0	28
Technology	0	12	6	2	0	20
Law Enforcement	0	16	6	6	0	28
Legal Review	0	8	3	0	0	11
Alternative/ Improved Livelihood	0	8	3	0	0	11
Awareness Raising	0	16	6	6	0	28
Education	0	16	6	6	0	28
Zanzibar			Pangani District		Total	249

The prioritised location-specific actions for Pangani district relate to addressing the following:

- Responding to the decline in fisheries productivity due to numerous destructive activities, especially at Matakani
- Beach pollution related to inadequate domestic waste and sewage management affecting Pangani town and adjacent beach areas
- Beach erosion along shores at particular at Pangani Town and Ushongo
- Turtle and nest harvest at Ushongo beaches
- Reduced Pangani River flows that affect erosion and contribute to marine pollution

Bagamoyo District

Prioritized Threats

In Table 67 below the threats identified for Bagamoyo District have been listed and ranked according to their severity as established using the CRIAM method discussed extensively in Volumes I and II of the Coastal Profile. A rapid assessment has been made on the susceptibility of each threat to impacts of climate change more specifically, changes in weather patterns, extreme events, sea level rise, temperature rise and acidification.

Table 67: Prioritised threats for Bagamoyo District and a rapid assessment of threat susceptibility to climate change.

#	Threat as identified in Coastal Profile	Threat Level	Influence from Climate Change					
			Change in Patterns	Extreme events	Sea Level Rise	Temperature rise	Acidification	
Bagamoyo-03	Beach erosion	Major problem	+	+++	+++	0	+	Impact from unsuitable resource use practises leading to beach erosion will be exacerbated notably from extreme events (storms and surges) and sea level rise. Coral growth likely reduce by acidification, increasing wave action and erosion.
Bagamoyo-09	Loss of habitat and agricultural area	Major problem	0	0	0	0	0	Changes in climate are not expected to impact per se on the poor land use management and failure to follow land use procedures.
Bagamoyo-04	Fisheries decline	Very important	0	-	0	0	0	Changes in climate are not expected to impact per se on the practise of destructive and illegal fisheries. Extreme weather events may in periods have a preventive effect.
Bagamoyo-05	Mangrove decline	Very important	+	+++	+++	0	0	Impact from unsuitable resource use practises leading to mangrove decline will be exacerbated notably from extreme events (storms and surges) and sea level rise.
Bagamoyo-01	Beach pollution	Important problem	0	0	0	0	0	Changes in climate are not expected to impact per se on the practise of poor waste disposal that affects beaches.
Bagamoyo-06	Forest habitat destruction	Important problem	++	++	0	+	0	Impact from unsuitable resource use practises will be exacerbated notably temperature rise and extreme events and changes in climate exacerbating forest stress and fire risk.
Bagamoyo-08	Loss of land & envtl damage	Problem	0	0	0	0	0	Changes in climate are not expected to impact per se on poor land use management and failure to follow land use procedures.
Bagamoyo-02	Beach erosion	Problem	+	+++	+++	+	+	Beach erosion will be exacerbated notably from extreme events (storms and surges) and sea level rise. Coral growth likely reduce by acidification and temperature rise, increasing wave action and erosion.

Table 68: Prioritised threats for Bagamoyo District, their location and causes.

#	Threat as identified in Coastal Profile	Threat Level	Location	Causes
Bmyo-03	Beach erosion	Major problem	Kaole, generally along the coast	Mangrove cutting, dynamite fishing, beach sand mining, unplanned construction along the coast.
Bmyo-09	Loss of habitat and agricultural area	Major problem	Surrounds of city	Rapid urbanization, high increase of people immigration in the city.
Bmyo-04	Fisheries decline	Very important	Bagamoyo Town, Mbegani, Mlingotini, Kaole and Kondo, generally along the coastal estuaries	Destruction of fish nurseries for action such as Mangrove cutting, illegal fishing such as Dynamite fishing and other poor fishing methods such as beach seine and arrow fishing as well as coral mining for lime production. Use of small mesh size reduces shrimp population. Community denied access and use of beaches which front some tourist hotels. Destruction of fish nurseries such as mangrove cutting, illegal fishing such as dynamite fishing and other poor fishing methods as well as coral mining for lime production
Bmyo-05	Mangrove decline	Important problem	Uondwe creek, Wami and Ruvu River Mouth, Bagamoyo Town to Mpji River Mouth	Illegal and un controlled cutting of mangroves, salt production
Bmyo-01	Beach pollution	Important problem	Beach front Bagamoyo harbour and vicinity. Coastal villages.	Uncontrolled solid and liquid waste disposal, often in creeks. lack of easily accessible public toilets
Bmyo-06	Forest habitat destruction	Important problem	Makurunge Forest Reserve	fuelwood collection, logging, pole cutting, forest fires and hunting, due to lack of proper management of the reserve.
Bmyo-08	Loss of land & envtl damage	Problem	Near shore waters	Mwambani port project developed without due procedures on impact assessment and local livelihood analysis (EIA was done – thus removed from further analysis

#	Threat as identified in Coastal Profile	Threat Level	Location	Causes
Bmyo-02	Beach erosion (Mbegani)	Problem	Coastal stretch towards Mbegani	Wave erosion due to physiographic setting or mangrove coverage (Shagude, 2011).

Recommendations for threat mitigation measures

Overall measures to mitigate each of the identified natural resources related threats to coastal local communities and ecosystems have been tabulated in Table 208 (page 383) arranged under broad management dimensions headings. Table 69 provides an overview of the requirements/opportunities expressed within each of these management or intervention dimensions.

Table 69: Broad management intervention dimensions to address identified and prioritised threats to coastal communities and ecosystems in Bagamoyo District

Intervention Dimension	Statement	Threat pertinence at each RV				
		Major Problem	Very important problem	Important Problem	Problem	Light Problem
Integrated Coastal Zone Management (ICZM)	Ensure local (district) coordination and participation in management of coastal land, water and resources use currently under complex pressures. Focus areas for integrated management to address include fisheries, shoreline (and riverbank) and mangrove deforestation, pollution and beach changes from Mbegani to Saadani.	Bmyo-03: Beach erosion Bmyo-09: Habitat & agric loss	Bmyo-04: Fisheries decline	Bmyo-05: Mangrove decline Bmyo-01: Beach pollution Bmyo-06: Forest habitat destruction	Bmyo-02: Beach erosion (Mbgni)	
Integrated Water Resources Management (IWRM)	Link IWRM to coastal integrated planning to address impacts from upstream pollution, to cover Mbegani to Saadani and Ruvu River influences (ICARM).	Bmyo-03: Beach erosion		Bmyo-01: Beach pollution	Bmyo-02: Beach erosion (Mbgni)	
Land Use Management	Land use information management systems to include ecosystems, habitats and water resources. Incorporate ecosystems, habitats, shoreline processes and water resources considerations in spatial planning. Develop and/or update district spatial plan accordingly and within national spatial planning framework.	Bmyo-03: Beach erosion Bmyo-09: Habitat & agric loss	Bmyo-04: Fisheries decline	Bmyo-05: Mangrove decline Bmyo-01: Beach pollution Bmyo-06: Forest habitat destruction	Bmyo-02: Beach erosion (Mbgni)	
Shoreline Management Planning	District's shorelines included in a national level overall shoreline management investigation. Shoreline management units (areas of coast) identified for the district informing district level spatial planning as a basis for local shoreline management regulation.	Bmyo-03: Beach erosion Bmyo-09: Habitat & agric loss	Bmyo-04: Fisheries decline	Bmyo-05: Mangrove decline Bmyo-01: Beach pollution Bmyo-06: Forest habitat destruction	Bmyo-02: Beach erosion (Mbgni)	
Solid and Liquid Waste Management	Pursue integrated solid and liquid waste management solutions covering entire district, especially beach front at Bagamoyo harbour and vicinity, considering: Waste water treatment systems: - collection - treatment technology - discharge Liquid and Solid Waste Management Systems: - collection - storage - processing - financing - minimisation - reuse? Green Infrastructure Storm Water Systems			Bmyo-01: Beach pollution		

Intervention Dimension	Statement	Threat pertinence at each RV				
		Major Problem	Very important problem	Important Problem	Problem	Light Problem
Sanitation	<p>Pursue integrated solid and liquid waste management covering entire district, especially beach front at Bagamoyo harbour and vicinity, considering:</p> <p>Waste water treatment systems:</p> <ul style="list-style-type: none"> - collection - treatment technology - discharge <p>Liquid and Solid Waste Management Systems:</p> <ul style="list-style-type: none"> - collection - storage - processing - financing - minimisation - reuse? <p>Green Infrastructure Storm Water Systems</p>			Bmyo-01: Beach pollution		
Capacity Building	<p>Accompany management interventions with appropriate capacity building components at district level. Particular focus on spatial planning, shoreline management, fisheries management, conflict resolution, monitoring, law enforcement.</p> <p>Enhance information management systems to provide for better and systematically informed management decisions.</p>	<p>Bmyo-03: Beach erosion</p> <p>Bmyo-09: Habitat & agric loss</p>	Bmyo-04: Fisheries decline	<p>Bmyo-05: Mangrove decline</p> <p>Bmyo-01: Beach pollution</p> <p>Bmyo-06: Forest habitat destruction</p>	Bmyo-02: Beach erosion (Mbgni)	
Technology	<p>Pursue opportunities through further technology development within:</p> <ul style="list-style-type: none"> • Shoreline management • Inshore fisheries • Aquaculture • Value added to existing fisheries • Integrated solid and liquid waste management • Mangrove management 	<p>Bmyo-03: Beach erosion</p> <p>Bmyo-09: Habitat & agric loss</p>	Bmyo-04: Fisheries decline	<p>Bmyo-05: Mangrove decline</p> <p>Bmyo-01: Beach pollution</p> <p>Bmyo-06: Forest habitat destruction</p>	Bmyo-02: Beach erosion (Mbgni)	
Law Enforcement	<p>1) Enforce reviewed laws relevant to amongst others:</p> <ul style="list-style-type: none"> • Coral (and sand) mining • Mangrove and coastal forest exploitation • Fisheries • Industrial and domestic waste • Land use (especially shoreline and set-back uses). <p>2) Optimise enforcement through capacity building at district level and aligned with recommendations from national review.</p>	<p>Bmyo-03: Beach erosion</p> <p>Bmyo-09: Habitat & agric loss</p>	Bmyo-04: Fisheries decline	<p>Bmyo-05: Mangrove decline</p> <p>Bmyo-01: Beach pollution</p> <p>Bmyo-06: Forest habitat destruction</p>	Bmyo-02: Beach erosion (Mbgni)	
Legal Review	<p>1) Guided by central integrated review of district legislative and regulatory instruments, including amongst others:</p> <ul style="list-style-type: none"> • Coral (and sand) mining • Fisheries decline • Land use (especially shoreline and set-back uses). <p>2) Follow revision (above) and revise and develop new district legislative and regulatory instruments.</p>	Bmyo-03: Beach erosion	Bmyo-04: Fisheries decline		Bmyo-02: Beach erosion (Mbgni)	
Alternative/Improved Livelihood	<p>Develop and offer alternative livelihoods for households currently engaged in destructive resource exploitation practises and those displaced and disadvantaged, focusing on Mbegani to Saadani, with particular efforts to provide alternatives for young generation.</p> <p>Improve current sustainable resource use livelihoods using technology advances and insights.</p>	<p>Bmyo-03: Beach erosion</p> <p>Bmyo-09: Habitat & agric loss</p>	Bmyo-04: Fisheries decline	<p>Bmyo-05: Mangrove decline</p> <p>Bmyo-06: Forest habitat destruction</p>	Bmyo-02: Beach erosion (Mbgni)	
Awareness Raising	<p>Participate in national awareness raising campaigns related to coastal management challenges directed to the public at large and to schools.</p> <p>Develop and implement district level awareness raising campaigns targeting local stakeholders affected by or affecting:</p> <ul style="list-style-type: none"> • Erosion • Loss and degradation of coastal habitat and agricultural land • Fisheries decline • Marine and beach pollution 	<p>Bmyo-03: Beach erosion</p> <p>Bmyo-09: Habitat & agric loss</p>	Bmyo-04: Fisheries decline	<p>Bmyo-05: Mangrove decline</p> <p>Bmyo-01: Beach pollution</p> <p>Bmyo-06: Forest habitat destruction</p>	Bmyo-02: Beach erosion (Mbgni)	

Intervention Dimension	Statement	Threat pertinence at each RV				
		Major Problem	Very important problem	Important Problem	Problem	Light Problem
Education	Interact and participate in national curricula review for primary and secondary schools to enhance the knowledge and understanding about coastal management issues. Issues of particular relevance for the district are: <ul style="list-style-type: none"> • Coastal ecology • Importance of beaches • Fisheries ecology and sustainable fisheries • Environmental management • Climate change impacts 	Bmyo-03: Beach erosion Bmyo-09: Habitat & agric loss	Bmyo-04: Fisheries decline	Bmyo-05: Mangrove decline Bmyo-01: Beach pollution Bmyo-06: Forest habitat destruction	Bmyo-02: Beach erosion (Mbgni)	

Action areas

Table 70: Assessment of the importance of broad management dimension in addressing threats to local communities and ecosystems in Bagamoyo District.

Intervention Dimension	Major Problem weight	Very important problem weight	Important Problem weight	Problem weight	Light Problem weight	Total Score
Integrated Coastal Zone Management (ICZM)	10	4	9	2	0	25
Integrated Water Resources Management (IWRM)	5	0	3	2	0	10
Land Use Management	10	4	9	2	0	25
Shoreline Management Planning	10	4	9	2	0	25
Solid and Liquid Waste Management	0	0	3	0	0	3
Sanitation	0	0	3	0	0	3
Capacity Building	10	4	9	2	0	25
Technology	10	4	9	2	0	25
Law Enforcement	10	4	9	2	0	25
Legal Review	5	4	0	2	0	11
Alternative/ Improved Livelihood	10	4	6	2	0	22
Awareness Raising	10	4	9	2	0	25
Education	10	4	9	2	0	25
Zanzibar						
			Bagamoyo District		Total	249

The prioritised location-specific actions for Bagamoyo district relate to addressing the following:

- Beach erosion along shores at particular at Kaole and adjacent shores
- Immigration of people from surrounding countryside seeking work and building on agricultural and natural habitat land, requiring urban planning
- Responding to the decline in fisheries productivity due to numerous destructive activities, especially at Bagamoyo town, Mbegani, Mlingotini, Kaole, Kondo and generally along the shores
- Mangrove forest decline particularly at Uondwe creek, Wami and Ruvu river mouths, around Bagamoyo Town to Mpiji River, through poor management and increased extractive pressure
- Beach pollution related to inadequate domestic waste and sewage management affecting Bagamoyo town and adjacent beach areas
- Protection of Ruvu and Wami river catchments that provide vital freshwater supply to Bagamoyo and Dar es Salaam, and likely to witness increased pressures due to rapid population growth in the two urban centres, as well as contributing sediment to mitigate coastal erosion, and nutrients for inshore fisheries, particularly prawns

Recognising that Bagamoyo is adjacent to the fast-growing Dar es Salaam district of Kinondoni and includes plans for a future port construction, the level of importance of the above threats is likely to increase dramatically, hence the need for urgent action.

Kinondoni District

Prioritized Threats

In Table 71 below the threats identified for Kinondoni District have been listed and ranked according to their severity as established using the CRIAM method discussed extensively in Volumes I and II of the Coastal Profile. A rapid assessment has been made on the susceptibility of each threat to impacts of climate change more specifically, changes in weather patterns, extreme events, sea level rise, temperature rise and acidification.

Table 71: Prioritised threats for Kinondoni District and a rapid assessment of threat susceptibility to climate change.

#	Threat as identified in Coastal Profile	Threat Level	Influence from Climate Change					
			Change in Patterns	Extreme events	Sea Level Rise	Temperature rise	Acidification	
Kinondoni-02	Beach erosion	Very important	+	+++	+++	0	+	Impact from unsuitable resource use practises leading to beach erosion will be exacerbated notably from extreme events (storms and surges) and sea level rise. Coral growth likely reduce by acidification, increasing wave action and erosion.
Kinondoni-03	Fisheries decline	Very important	0	-	0	0	0	Changes in climate are not expected to impact per se on the practise of destructive and illegal fisheries. Extreme weather events may in periods have a preventive effect.
Kinondoni-07	Land use conflicts	Very important	+	+	+	0	0	Climate change and sea level rise likely to impact on use of beach-intertidal areas; but not on poor land use management.
Kinondoni-01	Beach pollution	Very important	++	++	0	0	0	More frequent and severe weather events may increase the leaching of pollutants into water resources and thereby exacerbate the levels reaching local marine ecosystems.
Kinondoni-06	Flooding	Very important	++	++	+	0	0	Climate change likely to increase flooding if rainfall events are more severe and overall rainfall increases. Sea level rise will worsen the flooding by backing up floods, especially during big tides.
Kinondoni-05	Disease outbreaks	Important problem	++	++	+	+	0	More frequent and severe weather events and sea level rise may increase flooding and standing water and sewage exacerbating disease outbreaks and higher temperatures increase disease propagation
Kinondoni-04	Heavy metal pollution	Important problem	+	+	0	0	0	More frequent and severe weather events may increase the transport and re-suspension of pollutants into and/or incoastal water and local marine ecosystems.
Kinondoni-08	Loss of habitat and agricultural area	Important problem	0	0	0	0	0	Changes in climate are not expected to impact per se on the poor land use management and failure to follow land use procedures.

Table 72: Prioritised threats for Kinondoni District, their location and causes.

#	Threat as identified in Coastal Profile	Threat Level	Location	Causes
Kndi-02	Beach erosion	Very important	Entire Coast and particularly at Kunduchi area, Ununio and Mbweni	Mangrove cutting, dynamite fishing, beach sand mining, unplanned construction along the coast.
Kndi-03	Fisheries decline	Very important	Entire district coastal are including Ununio, Mbweni and Kunduchi	Destruction of fish nurseries such as mangrove cutting, illegal fishing such as dynamite fishing and other poor fishing methods as well as coral mining for lime production
Kndi-07	Land use conflicts	Very important	Along the coastal front.	Conflict between environmental conservation groups and investors; conflicting interests between sectors e.g. Forestry (mangrove) and mining (salt pans), forestry (mangrove) and lands; conflict between hotel owners and communities on addressing the issue of erosion at Kunduchi Beach areas.
Kndi-01	Beach pollution	Very important	Entire coast and particularly at Kunduchi, Ununio, and Mbweni	Uncontrolled solid and liquid waste disposal, often in creeks.
Kndi-06	Flooding	Very important	Suna and Makuti B in Magomeni ward, Mkunguni A, Mkunguni B and Hanna-Nassif in Hanna-Nassif ward	Construction in vulnerable river valleys, absence of sieves in drainage channels, disposing solid wastes in drainage system, poor drainage system, and blockage of drainage channels and unplanned constructions and developments.
Kndi-05	Disease outbreaks	Important problem	Throughout the coastal and urban areas of the district	Inadequate sewerage control, flooding, poor quality of sewerage construction, poor solid waste management, uncontrolled food vending.

#	Threat as identified in Coastal Profile	Threat Level	Location	Causes
Kndi-04	Heavy metal pollution	Important problem	Msimbazi river valley, Kunduchi, Mbweni and Ununio	Wastes from tourist hotels, construction sites, workshops, garages and industries located upstream.
Kndi-08	Loss of habitat and agricultural area	Important problem	Mabwe Pande Forest, Mpiji River Valley	Rapid urbanization, high increase of people immigration in the city.

Recommendations for threat mitigation measures

Overall measures to mitigate each of the identified natural resources related threats to coastal local communities and ecosystems have been tabulated in Table 209 (page 385) arranged under broad management dimensions headings. Table 73 provides an overview of the requirements/opportunities expressed within each of these management or intervention dimensions.

Table 73: Broad management intervention dimensions to address identified and prioritised threats to coastal communities and ecosystems in Kinondoni District

Intervention Dimension	Statement	Threat pertinence at each RV				
		Major Problem	Very important problem	Important Problem	Problem	Light Problem
Integrated Coastal Zone Management (ICZM)	<p>Ensure local (district) coordination and participation in management of coastal land, water and resources use currently under complex pressures.</p> <p>Focus areas for integrated management to address include erosion, fisheries, land use, shoreline (and riverbank) and mangrove deforestation, beach changes and pollution at Kunduchi area, Ununio and Mbweni coastal areas, and flooding in Suna and Makuti B in Magomeni ward, Mkunguni A, Mkunguni B and Hanna-Nassif in Hanna-Nassif ward.</p>		<p>Kndi-02: Beach erosion</p> <p>Kndi-03: Fisheries decline</p> <p>Kndi-07: Land use conflicts</p> <p>Kndi-01: Beach pollution</p> <p>Kndi-06: Flooding</p>	<p>Kndi-05: Disease outbreaks</p> <p>Kndi-04: Heavy metal pollution</p> <p>Kndi-08: Habitat & agric area loss</p>		
Integrated Water Resources Management (IWRM)	<p>Link IWRM to coastal integrated planning to the extent that solid and liquid waste origin from upstream activities in Msimbazi River basin, to address impacts from upstream pollution and flooding as well as river basin activities in Mwabe Pande Forest and Mpiji River Valley (ICARM).</p>		<p>Kndi-02: Beach erosion</p> <p>Kndi-07: Land use conflicts</p> <p>Kndi-01: Beach pollution</p> <p>Kndi-06: Flooding</p>	<p>Kndi-05: Disease outbreaks</p> <p>Kndi-04: Heavy metal pollution</p> <p>Kndi-08: Habitat & agric area loss</p>		
Land Use Management	<p>Land use information management systems to include ecosystems, habitats and water resources.</p> <p>Incorporate ecosystems, habitats, shoreline processes and water resources considerations in spatial planning.</p> <p>Develop and/or update district spatial plan accordingly and within national spatial planning framework.</p>		<p>Kndi-02: Beach erosion</p> <p>Kndi-03: Fisheries decline</p> <p>Kndi-07: Land use conflicts</p> <p>Kndi-01: Beach pollution</p> <p>Kndi-06: Flooding</p>	<p>Kndi-05: Disease outbreaks</p> <p>Kndi-04: Heavy metal pollution</p> <p>Kndi-08: Habitat & agric area loss</p>		
Shoreline Management Planning	<p>District's shorelines included in a national level overall shoreline management investigation.</p> <p>Shoreline management units (areas of coast) identified for the district informing district level spatial planning as a basis for local shoreline management regulation.</p>		<p>Kndi-02: Beach erosion</p> <p>Kndi-03: Fisheries decline</p> <p>Kndi-07: Land use conflicts</p> <p>Kndi-01: Beach pollution</p>	<p>Kndi-04: Heavy metal pollution</p> <p>Kndi-08: Habitat & agric area loss</p>		
Solid and Liquid Waste Management	<p>Pursue integrated solid and liquid waste management solutions covering entire district, especially in Kunduchi, Ununio and Mbweni, considering:</p> <p>Waste water treatment systems:</p> <ul style="list-style-type: none"> - collection - treatment technology - discharge <p>Liquid and Solid Waste Management Systems:</p> <ul style="list-style-type: none"> - collection - storage - processing - financing - minimisation - reuse? <p>Green Infrastructure</p> <p>Storm Water Systems</p>		<p>Kndi-01: Beach pollution</p> <p>Kndi-06: Flooding</p>	<p>Kndi-05: Disease outbreaks</p> <p>Kndi-04: Heavy metal pollution</p>		

Intervention Dimension	Statement	Threat pertinence at each RV				
		Major Problem	Very important problem	Important Problem	Problem	Light Problem
Sanitation	<p>Pursue integrated solid and liquid waste management covering entire district, especially in Kunduchi, Ununio and Mbweni, considering:</p> <p>Waste water treatment systems:</p> <ul style="list-style-type: none"> - collection - treatment technology - discharge <p>Liquid and Solid Waste Management Systems:</p> <ul style="list-style-type: none"> - collection - storage - processing - financing - minimisation - reuse? <p>Green Infrastructure Storm Water Systems</p>		<p>Kndi-01: Beach pollution</p> <p>Kndi-06: Flooding</p>	<p>Kndi-05: Disease outbreaks</p> <p>Kndi-04: Heavy metal pollution</p>		
Capacity Building	<p>Accompany management interventions with appropriate capacity building components at district level. Particular focus on spatial planning, shoreline management, fisheries management, conflict resolution, monitoring, law enforcement.</p> <p>Enhance information management systems to provide for better and systematically informed management decisions.</p>		<p>Kndi-02: Beach erosion</p> <p>Kndi-03: Fisheries decline</p> <p>Kndi-07: Land use conflicts</p> <p>Kndi-01: Beach pollution</p> <p>Kndi-06: Flooding</p>	<p>Kndi-05: Disease outbreaks</p> <p>Kndi-04: Heavy metal pollution</p> <p>Kndi-08: Habitat & agric area loss</p>		
Technology	<p>Pursue opportunities through further technology development within:</p> <ul style="list-style-type: none"> • Shoreline management • Inshore fisheries • Integrated solid and liquid waste management • Aquaculture • Value added to existing fisheries <p>Mangrove management</p>		<p>Kndi-02: Beach erosion</p> <p>Kndi-03: Fisheries decline</p> <p>Kndi-07: Land use conflicts</p> <p>Kndi-01: Beach pollution</p> <p>Kndi-06: Flooding</p>	<p>Kndi-05: Disease outbreaks</p> <p>Kndi-04: Heavy metal pollution</p> <p>Kndi-08: Habitat & agric area loss</p>		
Law Enforcement	<p>1) Enforce reviewed laws relevant to amongst others:</p> <ul style="list-style-type: none"> • Coral (and sand) mining • Mangrove and coastal forest exploitation • Fisheries • Industrial and domestic waste • Land use (especially shoreline and set-back uses). <p>2) Optimise enforcement through capacity building at district level and aligned with recommendations from national review.</p>		<p>Kndi-02: Beach erosion</p> <p>Kndi-03: Fisheries decline</p> <p>Kndi-07: Land use conflicts</p> <p>Kndi-01: Beach pollution</p> <p>Kndi-06: Flooding</p>	<p>Kndi-05: Disease outbreaks</p> <p>Kndi-04: Heavy metal pollution</p> <p>Kndi-08: Habitat & agric area loss</p>		
Legal Review	<p>1) Guided by central integrated review of district legislative and regulatory instruments, including amongst others:</p> <ul style="list-style-type: none"> • Coral (and sand) mining • Fisheries decline • Land use (especially shoreline and set-back uses). <p>2) Follow revision (above) and revise and develop new district legislative and regulatory instruments.</p>		<p>Kndi-02: Beach erosion</p> <p>Kndi-03: Fisheries decline</p> <p>Kndi-07: Land use conflicts</p>			
Alternative/Improved Livelihood	<p>Develop and offer alternative livelihoods for households currently engaged in destructive resource exploitation practises and those displaced and disadvantaged, focusing on Kunduchi, Ununio and Mbweni, with particular efforts to provide alternatives for young generation.</p> <p>Improve current sustainable resource use livelihoods using technology advances and insights.</p>		<p>Kndi-02: Beach erosion</p> <p>Kndi-03: Fisheries decline</p>	<p>Kndi-08: Habitat & agric area loss</p>		

Intervention Dimension	Statement	Threat pertinence at each RV				
		Major Problem	Very important problem	Important Problem	Problem	Light Problem
Awareness Raising	<p>Participate in national awareness raising campaigns related to coastal management challenges directed to the public at large and to schools.</p> <p>Develop and implement district level awareness raising campaigns targeting local stakeholders affected by or affecting:</p> <ul style="list-style-type: none"> Erosion Fisheries decline Loss and degradation of coastal habitat and agricultural land Marine and beach pollution River basin hydrology Water-borne disease 		Kndi-02: Beach erosion Kndi-03: Fisheries decline Kndi-07: Land use conflicts Kndi-01: Beach pollution Kndi-06: Flooding	Kndi-05: Disease outbreaks Kndi-04: Heavy metal pollution Kndi-08: Habitat & agric area loss		
Education	<p>Interact and participate in national curricula review for primary and secondary schools to enhance the knowledge and understanding about coastal management issues. Issues of particular relevance for the district are:</p> <ul style="list-style-type: none"> Coastal ecology Importance of beaches Fisheries ecology and sustainable fisheries Environmental management Climate change impacts 		Kndi-02: Beach erosion Kndi-03: Fisheries decline Kndi-07: Land use conflicts Kndi-01: Beach pollution Kndi-06: Flooding	Kndi-05: Disease outbreaks Kndi-04: Heavy metal pollution Kndi-08: Habitat & agric area loss		

Action areas

Table 74: Assessment of the importance of broad management dimension in addressing threats to local communities and ecosystems in Kinondoni District.

Intervention Dimension	Major Problem weight	Very important problem weight	Important Problem weight	Problem weight	Light Problem weight	Total Score
Integrated Coastal Zone Management (ICZM)	0	20	9	0	0	29
Integrated Water Resources Management (IWRM)	0	16	9	0	0	25
Land Use Management	0	20	9	0	0	29
Shoreline Management Planning	0	20	6	0	0	26
Solid and Liquid Waste Management	0	8	6	0	0	14
Sanitation	0	8	6	0	0	14
Capacity Building	0	20	9	0	0	29
Technology	0	20	9	0	0	29
Law Enforcement	0	20	9	0	0	29
Legal Review	0	12	0	0	0	12
Alternative/ Improved Livelihood	0	8	3	0	0	11
Awareness Raising	0	20	9	0	0	29
Education	0	20	9	0	0	29
Zanzibar			Kinondoni District		Total	305

The prioritised location-specific actions for Kinondoni district relate to addressing the following:

- Beach erosion along shores at particularly at Kunduchi area, Ununio and Mbweni shores
- Responding to the decline in fisheries productivity due to numerous destructive activities, especially at Kunduchi area, Ununio and Mbweni and generally along the shores
- Land use conflicts over coastal areas between different user groups and means to address erosion
- Beach pollution related to inadequate domestic waste and sewage management affecting most of Kinondoni beach areas, with pollution often in the river catchments (six small rivers: Nyakasangwe, Tegeta, Sinza, Tabata, Minerva and Mbezi and the Mpiji River that forms the northern border with Bagamoyo) that also contribute to the disease problems in the district
- Flooding in the low-lying areas of Suna and Makuti B in Magomeni ward, Mkunguni A, Mkunguni B and Hanna-Nassif in Hanna-Nassif ward, often associated with the above river basins

Recognising that Kinondoni is one of the three fast-growing Dar es Salaam districts, the level of importance of the above threats is likely to increase dramatically, hence the need for urgent action.

Ilala District

Prioritized Threats

In Table 75 below the threats identified for Ilala District have been listed and ranked according to their severity as established using the CRIAM method discussed extensively in Volumes I and II of the Coastal Profile. A rapid assessment has been made on the susceptibility of each threat to impacts of climate change more specifically, changes in weather patterns, extreme events, sea level rise, temperature rise and acidification.

Table 75: Prioritised threats for Ilala District and a rapid assessment of threat susceptibility to climate change.

#	Threat as identified in Coastal Profile	Threat Level	Influence from Climate Change					
			Change in Patterns	Extreme events	Sea Level Rise	Temperature rise	Acidification	
Ilala-04	Fisheries decline	Very important	0	-	0	0	0	Changes in climate are not expected to impact per se on the practise of destructive and illegal fisheries. Extreme weather events may in periods have a preventive effect.
Ilala-08	Disease outbreaks	Very important	++	++	+	+	0	More frequent and severe weather events and sea level rise may increase flooding and standing water and sewage exacerbating disease outbreaks and higher temperatures increase disease propagation
Ilala-06	Oil pollution	Very important	0	0	0	-	0	Changes in climate are not expected to impact per se on the practise of inadequate or poor oil disposal that affects beaches. Increase in temperature may have a preventive effect by increasing oil evaporation rates.
Ilala-05	Heavy metal pollution	Important problem	+	+	0	0	0	More frequent and severe weather events may increase the transport and re-suspension of pollutants into and/or into coastal water and local marine ecosystems.
Ilala-02	Sewage pollution	Important problem	0	0	0	0	0	Changes in climate are not expected to impact per se on the practise of inadequate or poor sewage disposal that affects beaches.
Ilala-07	Industrial pollution	Important problem	0	0	0	0	0	Changes in climate are not expected to impact per se on the practise of inadequate or poor effluent disposal that affects coastal areas.
Ilala-01	Beach and near shore pollution	Important problem	++	++	0	0	0	More frequent and severe weather events may increase the leaching of pollutants into water resources and thereby exacerbate the levels reaching local marine ecosystems.
Ilala-03	Beach erosion	Important problem	+	+++	+++	0	+	Impact from unsuitable resource use practises leading to beach erosion will be exacerbated notably from extreme events (storms and surges) and sea level rise. Coral growth likely reduce by acidification, increasing wave action and erosion.

Table 76: Prioritised threats for Ilala District, their location and causes.

#	Threat as identified in Coastal Profile	Threat Level	Location	Causes
Iala-04:	Fisheries decline	Very important	Msimbazi Bay, district marine waters.	Destruction of fish nurseries due to beach seining and dynamite fishing.
Iala-08:	Disease outbreaks	Very important	Throughout urban areas of the district	In adequate sewerage control, flooding, poor quality of sewerage construction, poor solid waste management.
Iala-06:	Oil pollution	Very important	Dar es Salaam Harbour and vicinity	Waste products from Kigamboni oil terminal, loading and offloading of fuel at Dar es Salaam port, disposal of untreated liquid wastes from some industries and garages.
Iala-05:	Heavy metal pollution	Important problem	Msimbazi River valley, Dar es Salaam Harbour and vicinity, Mtoni River area	Wastes from construction sites, workshops, garages and industries located upstream along the two rivers.
Iala-02:	Sewage pollution	Important problem	Ocean Road beach	AgaKhan Hospital and nearby residences discharging untreated sewage directly onto shore.
Iala-07:	Industrial pollution	Important problem	Dar es Salaam Harbour and vicinity	Effluent from KTM and other industries

#	Threat as identified in Coastal Profile	Threat Level	Location	Causes
Iala-01:	Beach and near shore pollution	Important problem	Selander Bridge beach	Uncontrolled solid waste disposal into Mzimbazi Creek valley, being washed down stream during heavy rain.
Iala-03:	Beach erosion	Important problem	Ocean Road	Local oceanographic conditions...

Recommendations for threat mitigation measures

Overall measures to mitigate each of the identified natural resources related threats to coastal local communities and ecosystems have been tabulated in Table 210 (page 387) arranged under broad management dimensions headings. Table 77 provides an overview of the requirements/opportunities expressed within each of these management or intervention dimensions.

Table 77: Broad management intervention dimensions to address identified and prioritised threats to coastal communities and ecosystems in Ilala District

Intervention Dimension	Statement	Threat pertinence at each RV				
		Major Problem	Very important problem	Important Problem	Problem	Light Problem
Integrated Coastal Zone Management (ICZM)	<p>Ensure local (district) coordination and participation in management of coastal land, water and resources use currently under complex pressures.</p> <p>Focus areas for integrated management to address include fisheries, pollution, riverbank deforestation, beach changes from Dar es Salaam Harbour to Selander Bridge.</p>		<p>Iala-04: Fisheries decline</p> <p>Iala-08: Disease outbreaks</p> <p>Iala-06: Oil pollution</p>	<p>Iala-05: Heavy metal pollution</p> <p>Iala-02: Sewage pollution</p> <p>Iala-07: Industrial pollution</p> <p>Iala-01: Beach & near shore pollution</p> <p>Iala-03: Beach erosion</p>		
Integrated Water Resources Management (IWRM)	<p>Link IWRM to coastal integrated planning to address impacts from upstream pollution, from Dar es Salaam Harbour to Selander Bridge (ICARM).</p>		<p>Iala-08: Disease outbreaks</p>	<p>Iala-05: Heavy metal pollution</p> <p>Iala-01: Beach & near shore pollution</p> <p>Iala-03: Beach erosion</p>		
Land Use Management	<p>Land use information management systems to include ecosystems, habitats and water resources.</p> <p>Incorporate ecosystems, habitats, shoreline processes and water resources considerations in spatial planning.</p> <p>Develop and/or update district spatial plan accordingly and within national spatial planning framework.</p>		<p>Iala-04: Fisheries decline</p> <p>Iala-08: Disease outbreaks</p>	<p>Iala-05: Heavy metal pollution</p> <p>Iala-02: Sewage pollution</p> <p>Iala-07: Industrial pollution</p> <p>Iala-01: Beach & near shore pollution</p> <p>Iala-03: Beach erosion</p>		
Shoreline Management Planning	<p>District's shorelines included in a national level overall shoreline management investigation.</p> <p>Shoreline management units (areas of coast) identified for the district informing district level spatial planning as a basis for local shoreline management regulation.</p>		<p>Iala-04: Fisheries decline</p> <p>Iala-06: Oil pollution</p>	<p>Iala-05: Heavy metal pollution</p> <p>Iala-02: Sewage pollution</p> <p>Iala-07: Industrial pollution</p> <p>Iala-01: Beach & near shore pollution</p> <p>Iala-03: Beach erosion</p>		
Solid and Liquid Waste Management	<p>Pursue integrated solid and liquid waste management solutions covering entire district, from Dar es Salaam Harbour to Selander Bridge, considering:</p> <p>Waste water treatment systems:</p> <ul style="list-style-type: none"> - collection - treatment technology - discharge <p>Liquid and Solid Waste Management Systems:</p> <ul style="list-style-type: none"> - collection - storage - processing - financing - minimisation - reuse? <p>Green Infrastructure</p> <p>Storm Water Systems</p>		<p>Iala-08: Disease outbreaks</p> <p>Iala-06: Oil pollution</p>	<p>Iala-05: Heavy metal pollution</p> <p>Iala-02: Sewage pollution</p> <p>Iala-07: Industrial pollution</p> <p>Iala-01: Beach & near shore pollution</p>		

Intervention Dimension	Statement	Threat pertinence at each RV				
		Major Problem	Very important problem	Important Problem	Problem	Light Problem
Sanitation	<p>Pursue integrated solid and liquid waste management covering entire district, from from Dar es Salaam Harbour to Selander Bridge, considering:</p> <p>Waste water treatment systems:</p> <ul style="list-style-type: none"> - collection - treatment technology - discharge <p>Liquid and Solid Waste Management Systems:</p> <ul style="list-style-type: none"> - collection - storage - processing - financing - minimisation - reuse? <p>Green Infrastructure Storm Water Systems</p>		Iala-08: Disease outbreaks	Iala-05: Heavy metal pollution Iala-02: Sewage pollution Iala-01: Beach & near shore pollution		
Capacity Building	<p>Accompany management interventions with appropriate capacity building components at district level. Particular focus on spatial planning, shoreline management, fisheries management, conflict resolution, monitoring, law enforcement.</p> <p>Enhance information management systems to provide for better and systematically informed management decisions.</p>		Iala-04: Fisheries decline Iala-08: Disease outbreaks Iala-06: Oil pollution	Iala-05: Heavy metal pollution Iala-02: Sewage pollution Iala-07: Industrial pollution Iala-01: Beach & near shore pollution Iala-03: Beach erosion		
Technology	<p>Pursue opportunities through further technology development within:</p> <ul style="list-style-type: none"> • Shoreline management • Inshore fisheries • Integrated solid and liquid waste management • Aquaculture • Value added to existing fisheries <p>Mangrove management</p>		Iala-04: Fisheries decline Iala-08: Disease outbreaks Iala-06: Oil pollution	Iala-05: Heavy metal pollution Iala-02: Sewage pollution Iala-07: Industrial pollution Iala-01: Beach & near shore pollution Iala-03: Beach erosion		
Law Enforcement	<p>1) Enforce reviewed laws relevant to amongst others:</p> <ul style="list-style-type: none"> • Coral (and sand) mining • Mangrove and coastal forest exploitation • Fisheries • Industrial and domestic waste • Land use (especially shoreline and set-back uses). <p>2) Optimise enforcement through capacity building at district level and aligned with recommendations from national review.</p>		Iala-04: Fisheries decline Iala-08: Disease outbreaks Iala-06: Oil pollution	Iala-05: Heavy metal pollution Iala-02: Sewage pollution Iala-07: Industrial pollution Iala-01: Beach & near shore pollution Iala-03: Beach erosion		
Legal Review	<p>1) Guided by central integrated review of district legislative and regulatory instruments, including amongst others:</p> <ul style="list-style-type: none"> • Coral (and sand) mining • Fisheries decline • Land use (especially shoreline and set-back uses). <p>2) Follow revision (above) and revise and develop new district legislative and regulatory instruments.</p>		Iala-04: Fisheries decline	Iala-03: Beach erosion		
Alternative/Improved Livelihood	<p>Develop and offer alternative livelihoods for households currently engaged in destructive resource exploitation practises and those displaced and disadvantaged, focusing on from Dar es Salaam Harbour to Selander Bridge, with particular efforts to provide alternatives for young generation.</p> <p>Improve current sustainable resource use livelihoods using technology advances and insights.</p>		Iala-04: Fisheries decline	Iala-03: Beach erosion		

Intervention Dimension	Statement	Threat pertinence at each RV				
		Major Problem	Very important problem	Important Problem	Problem	Light Problem
Awareness Raising	Participate in national awareness raising campaigns directed to coastal management challenges directed to the public at large and to schools. Develop and implement district level awareness raising campaigns targeting local stakeholders affected by or affecting: <ul style="list-style-type: none"> Erosion Loss and degradation of coastal habitat and agricultural land Fisheries decline Marine and beach pollution 		Iala-04: Fisheries decline Iala-08: Disease outbreaks Iala-06: Oil pollution	Iala-05: Heavy metal pollution Iala-02: Sewage pollution Iala-07: Industrial pollution Iala-01: Beach & near shore pollution Iala-03: Beach erosion		
Education	Interact and participate in national curricula review for primary and secondary schools to enhance the knowledge and understanding about coastal management issues. Issues of particular relevance for the district are: <ul style="list-style-type: none"> Coastal ecology Importance of beaches Fisheries ecology and sustainable fisheries Environmental management Climate change impacts 		Iala-04: Fisheries decline Iala-08: Disease outbreaks	Iala-05: Heavy metal pollution Iala-02: Sewage pollution Iala-07: Industrial pollution Iala-01: Beach & near shore pollution Iala-03: Beach erosion		

Action areas

Table 78: Assessment of the importance of broad management dimension in addressing threats to local communities and ecosystems in Ilala District.

Intervention Dimension	Major Problem weight	Very important problem weight	Important Problem weight	Problem weight	Light Problem weight	Total Score
Integrated Coastal Zone Management (ICZM)	0	12	15	0	0	27
Integrated Water Resources Management (IWRM)	0	4	9	0	0	13
Land Use Management	0	8	15	0	0	23
Shoreline Management Planning	0	8	15	0	0	23
Solid and Liquid Waste Management	0	8	12	0	0	20
Sanitation	0	4	9	0	0	13
Capacity Building	0	12	15	0	0	27
Technology	0	12	15	0	0	27
Law Enforcement	0	12	15	0	0	27
Legal Review	0	4	3	0	0	7
Alternative/ Improved Livelihood	0	4	3	0	0	7
Awareness Raising	0	12	15	0	0	27
Education	0	8	15	0	0	23
Zanzibar			Ilala District		Total	264

The prioritised location-specific actions for Ilala district relate to addressing the following:

- Responding to the decline in fisheries productivity due to numerous destructive activities, especially at Msimbazi Bay area
- Disease outbreaks and sewage pollution, requiring waste and sewage treatment infrastructure
- Oil pollution from the Kigamboni terminal and Dar es Salaam harbour
- Heavy metal, industrial and solid waste pollution transported into coastal waters by Msimbazi and Mtoni rivers

Recognising that Ilala is one of the three fast-growing Dar es Salaam districts, the level of importance of the above threats is likely to increase dramatically, hence the need for urgent action.

Temeke District

Prioritized Threats

In Table 79 below the threats identified for Temeke District have been listed and ranked according to their severity as established using the CRIAM method discussed extensively in Volumes I and II of the Coastal Profile. A rapid assessment has been made on the susceptibility of each threat to impacts of climate change more specifically, changes in weather patterns, extreme events, sea level rise, temperature rise and acidification.

Table 79: Prioritised threats for Temeke District and a rapid assessment of threat susceptibility to climate change.

#	Threat as identified in Coastal Profile	Threat Level	Influence from Climate Change					
			Change in Patterns	Extreme events	Sea Level Rise	Temperature rise	Acidification	
Temeke-03	Fisheries decline	Very important	0	-	0	0	0	Changes in climate are not expected to impact per se on the practise of destructive and illegal fisheries. Extreme weather events may in periods have a preventive effect.
Temeke-02	Beach erosion	Very important	+	+++	+++	0	+	Impact from unsuitable resource use practises leading to beach erosion will be exacerbated notably from extreme events (storms and surges) and sea level rise. Coral growth likely reduce by acidification, increasing wave action and erosion.
Temeke-06	Heavy metal pollution	Important problem	+	+	0	0	0	More frequent and severe weather events may increase the transport and re-suspension of pollutants into and/or incoastal water and local marine ecosystems.
Temeke-01	Beach pollution	Important problem	++	++	0	0	0	More frequent and severe weather events may increase the leaching of pollutants into water resources and thereby exacerbate the levels reaching local marine ecosystems. However, changes in climate are not expected to impact per se on the practise of poor waste disposal that affects beaches.
Temeke-05	River condition decline	Important problem	0	0	0	0	0	Changes in climate are not expected to impact per se on the practise of poor waste disposal into rivers that affects beaches.
Temeke-07	Oil pollution	Important problem	0	0	0	-	0	Changes in climate are not expected to impact per se on the practise of inadequate or poor oil disposal that affects beaches. Increase in temperature may have a preventive effect by increasing oil evaporation rates.
Temeke-09	Flooding	Important problem	++	++	+	0	0	Climate change likely to increase flooding if rainfall events are more severe and overall rainfall increases. Sea level rise will worsen the flooding.
Temeke-04	Forest decline	Important problem	++	++	0	+	0	Impact from unsuitable resource use practises will be exacerbated notably temperature rise and extreme events and changes in climate exacerbating forest stress and fire risk.
Temeke-08	Industrial pollution	Important problem	0	0	0	0	0	Changes in climate are not expected to impact per se on the practise of inadequate or poor effluent disposal that affects coastal areas.
Temeke-10	Loss of habitat & agricultural area	Problem	0	0	0	0	0	Changes in climate are not expected to impact per se on the poor land use management and failure to follow land use procedures.

Table 80: Prioritised threats for Temeke District, their location and causes

#	Threat as identified in Coastal Profile	Threat Level	Location	Causes
Tmke-03:	Fisheries decline	Very important	Mjimwema, Vijibweni, Kigamboni, Mtoni and Kimbiji	Destruction of fish nurseries such as mangrove cutting, illegal fishing such as dynamite fishing and other poor fishing methods as well as coral mining for lime production.
Tmke-02:	Beach erosion	Very important	Kimbiji, Kigamboni, and Vijibweni and small islands	Mangrove cutting, dynamite fishing, beach sand mining, unplanned construction along the coast.
Tmke-06:	Heavy metal pollution	Important problem	Mtoni River and Dar es Salaam Port	Wastes from construction sites, workshops, garages and industries located upstream.

#	Threat as identified in Coastal Profile	Threat Level	Location	Causes
Tmke-01:	Beach pollution	Important problem	Mbagala Kuu and Mjimwema	Uncontrolled solid and liquid waste disposal, often in creeks (such as branches of Mtoni River)
Tmke-05:	River condition decline	Important problem	Mtoni River, Nguva River, seasonal streams	Pollution from dumping of solid and liquid waste
Tmke-07:	Oil pollution	Important problem	Kigamboni and vicinity, Inner Makutumba Island, Msimbazi river valley	Waste products from Kigamboni refinery plant, loading and offloading of fuel at Dar es Salaam port, disposal of untreated liquid wastes from some industries and garages.
Tmke-09:	Flooding	Important problem	Mtoni River valley	Construction in vulnerable river valleys, absence of sieves in drainage channels, disposing solid wastes in drainage system, poor drainage system, and blockage of drainage channels and unplanned constructions and developments.
Tmke-04:	Forest decline	Important problem	Kimbiji, Mjimwema, Mtoni	Exploitation and uncontrollable use of coastal forest and mangrove
Tmke-08:	Industrial pollution	Important problem	Mbagala and Mtoni wards	Effluents from KTM textile industry
Tmke-10:	Loss of habitat & agric area	Problem	Forest reserve and river valley vegetation	Rapid urbanization, high increase of people immigration in the city and spilling over into the northern portions of Temeke.

Recommendations for threat mitigation measures

Overall measures to mitigate each of the identified natural resources related threats to coastal local communities and ecosystems have been tabulated in Table 211 (page 389) arranged under broad management dimensions headings. Table 81 provides an overview of the requirements/opportunities expressed within each of these management or intervention dimensions.

Table 81: Broad management intervention dimensions to address identified and prioritised threats to coastal communities and ecosystems in Temeke District

Intervention Dimension	Statement	Threat pertinence at each RV				
		Major Problem	Very important problem	Important Problem	Problem	Light Problem
Integrated Coastal Zone Management (ICZM)	<p>Ensure local (district) coordination and participation in management of coastal land, water and resources use currently under complex pressures.</p> <p>Focus areas for integrated management to address include fisheries, shoreline (and riverbank) and mangrove deforestation, beach change, pollution and flooding, from Mjimwema, Vijibweni, Kigamboni, Mtoni and Kimbiji, and Mtoni and Dar es Salaam Harbour areas.</p>		<p>Tmke-03: Fisheries decline</p> <p>Tmke-02: Beach erosion</p>	<p>Tmke-06: Heavy metal pollution</p> <p>Tmke-01: Beach pollution</p> <p>Tmke-05: River condition decline</p> <p>Tmke-07: Oil pollution</p> <p>Tmke-09: Flooding</p> <p>Tmke-04: Forest decline</p> <p>Tmke-08: Industrial pollution</p>	<p>Tmke-10: Loss habitat & agric area</p>	
Integrated Water Resources Management (IWRM)	<p>Link IWRM to coastal integrated planning to address impacts from upstream pollution, to cover the polluted Mtoni River and Msimbazi river basins and still mostly clean Nguva River valley from where sand is extracted (ICARM).</p>		<p>Tmke-02: Beach erosion</p>	<p>Tmke-06: Heavy metal pollution</p> <p>Tmke-01: Beach pollution</p> <p>Tmke-05: River condition decline</p> <p>Tmke-09: Flooding</p>	<p>Tmke-10: Loss habitat & agric area</p>	
Land Use Management	<p>Land use information management systems to include ecosystems, habitats and water resources.</p> <p>Incorporate ecosystems, habitats, shoreline processes and water resources considerations in spatial planning.</p> <p>Develop and/or update district spatial plan accordingly and within national spatial planning framework.</p>		<p>Tmke-03: Fisheries decline</p> <p>Tmke-02: Beach erosion</p>	<p>Tmke-06: Heavy metal pollution</p> <p>Tmke-01: Beach pollution</p> <p>Tmke-05: River condition decline</p> <p>Tmke-09: Flooding</p> <p>Tmke-04: Forest decline</p> <p>Tmke-08: Industrial pollution</p>	<p>Tmke-10: Loss habitat & agric area</p>	

Intervention Dimension	Statement	Threat pertinence at each RV				
		Major Problem	Very important problem	Important Problem	Problem	Light Problem
Shoreline Management Planning	District's shorelines included in a national level overall shoreline management investigation. Shoreline management units (areas of coast) identified for the district informing district level spatial planning as a basis for local shoreline management regulation.		Tmke-03: Fisheries decline Tmke-02: Beach erosion	Tmke-06: Heavy metal pollution Tmke-01: Beach pollution Tmke-07: Oil pollution Tmke-04: Forest decline Tmke-08: Industrial pollution	Tmke-10: Loss habitat & agric area	
Solid and Liquid Waste Management	Pursue integrated solid and liquid waste management solutions covering entire district, especially focused on drainage routes (Mtoni River and four smaller independent river catchments) and all coastal settlements, considering: Waste water treatment systems: - collection - treatment technology - discharge Liquid and Solid Waste Management Systems: - collection - storage - processing - financing - minimisation - reuse? Green Infrastructure Storm Water Systems			Tmke-06: Heavy metal pollution Tmke-01: Beach pollution Tmke-05: River condition decline Tmke-07: Oil pollution Tmke-09: Flooding Tmke-08: Industrial pollution		
Sanitation	Pursue integrated solid and liquid waste management covering entire district, especially focused on drainage routes (Mtoni River and four smaller independent river catchments) and all coastal settlements, considering: Waste water treatment systems: - collection - treatment technology - discharge Liquid and Solid Waste Management Systems: - collection - storage - processing - financing - minimisation - reuse? Green Infrastructure Storm Water Systems			Tmke-01: Beach pollution Tmke-05: River condition decline		
Capacity Building	Accompany management interventions with appropriate capacity building components at district level. Particular focus on spatial planning, shoreline management, fisheries management, conflict resolution, monitoring, law enforcement. Enhance information management systems to provide for better and systematically informed management decisions.		Tmke-03: Fisheries decline Tmke-02: Beach erosion	Tmke-06: Heavy metal pollution Tmke-01: Beach pollution Tmke-05: River condition decline Tmke-07: Oil pollution Tmke-09: Flooding Tmke-04: Forest decline Tmke-08: Industrial pollution	Tmke-10: Loss habitat & agric area	

Intervention Dimension	Statement	Threat pertinence at each RV				
		Major Problem	Very important problem	Important Problem	Problem	Light Problem
Technology	<p>Pursue opportunities through further technology development within:</p> <ul style="list-style-type: none"> Inshore fisheries Aquaculture Value added to existing fisheries Shoreline management Integrated solid and liquid waste management Mangrove management Flood management 		<p>Tmke-03: Fisheries decline</p> <p>Tmke-02: Beach erosion</p>	<p>Tmke-06: Heavy metal pollution</p> <p>Tmke-01: Beach pollution</p> <p>Tmke-05: River condition decline</p> <p>Tmke-07: Oil pollution</p> <p>Tmke-09: Flooding</p> <p>Tmke-04: Forest decline</p> <p>Tmke-08: Industrial pollution</p>	<p>Tmke-10: Loss habitat & agric area</p>	
Law Enforcement	<p>1) Enforce reviewed laws relevant to amongst others:</p> <ul style="list-style-type: none"> Fisheries Coral (and sand) mining Mangrove and coastal forest exploitation Industrial and domestic waste Land use (especially shoreline and set-back uses). Riverbank activities <p>2) Optimise enforcement through capacity building at district level and aligned with recommendations from national review.</p>		<p>Tmke-03: Fisheries decline</p> <p>Tmke-02: Beach erosion</p>	<p>Tmke-06: Heavy metal pollution</p> <p>Tmke-01: Beach pollution</p> <p>Tmke-05: River condition decline</p> <p>Tmke-07: Oil pollution</p> <p>Tmke-09: Flooding</p> <p>Tmke-04: Forest decline</p> <p>Tmke-08: Industrial pollution</p>	<p>Tmke-10: Loss habitat & agric area</p>	
Legal Review	<p>1) Guided by central integrated review of district legislative and regulatory instruments, including amongst others:</p> <ul style="list-style-type: none"> Fisheries decline Coral (and sand) mining Land use (especially shoreline and set-back uses). <p>2) Follow revision (above) and revise and develop new district legislative and regulatory instruments.</p>		<p>Tmke-03: Fisheries decline</p> <p>Tmke-02: Beach erosion</p>			
Alternative/Improved Livelihood	<p>Develop and offer alternative livelihoods for households currently engaged in destructive resource exploitation practises and those displaced and disadvantaged, focusing on Mjimwema, Vijibweni, Kigamboni, Mtoni and Kimbiji and Mtoni, with particular efforts to provide alternatives for young generation.</p> <p>Improve current sustainable resource use livelihoods using technology advances and insights.</p>		<p>Tmke-03: Fisheries decline</p> <p>Tmke-02: Beach erosion</p>	<p>Tmke-06: Heavy metal pollution</p> <p>Tmke-09: Flooding</p> <p>Tmke-04: Forest decline</p>	<p>Tmke-10: Loss habitat & agric area</p>	
Awareness Raising	<p>Participate in national awareness raising campaigns related to coastal management challenges directed to the public at large and to schools.</p> <p>Develop and implement district level awareness raising campaigns targeting local stakeholders affected by or affecting:</p> <ul style="list-style-type: none"> Fisheries Erosion Loss and degradation of coastal habitat and agricultural land Fisheries decline Marine and beach pollution 		<p>Tmke-03: Fisheries decline</p> <p>Tmke-02: Beach erosion</p>	<p>Tmke-06: Heavy metal pollution</p> <p>Tmke-01: Beach pollution</p> <p>Tmke-05: River condition decline</p> <p>Tmke-07: Oil pollution</p> <p>Tmke-09: Flooding</p> <p>Tmke-04: Forest decline</p> <p>Tmke-08: Industrial pollution</p>	<p>Tmke-10: Loss habitat & agric area</p>	

Intervention Dimension	Statement	Threat pertinence at each RV				
		Major Problem	Very important problem	Important Problem	Problem	Light Problem
Education	<p>Interact and participate in national curricula review for primary and secondary schools to enhance the knowledge and understanding about coastal management issues. Issues of particular relevance for the district are:</p> <ul style="list-style-type: none"> • Coastal ecology • Importance of beaches • Fisheries ecology and sustainable fisheries • Environmental management • Climate change impacts 		<p>Tmke-03: Fisheries decline</p> <p>Tmke-02: Beach erosion</p>	<p>Tmke-06: Heavy metal pollution</p> <p>Tmke-01: Beach pollution</p> <p>Tmke-05: River condition decline</p> <p>Tmke-07: Oil pollution</p> <p>Tmke-09: Flooding</p> <p>Tmke-04: Forest decline</p> <p>Tmke-08: Industrial pollution</p>	<p>Tmke-10: Loss habitat & agric area</p>	

Action areas

Table 82: Assessment of the importance of broad management dimension in addressing threats to local communities and ecosystems in Temeke District.

Intervention Dimension	Major Problem weight	Very important problem weight	Important Problem weight	Problem weight	Light Problem weight	Total Score
Integrated Coastal Zone Management (ICZM)	0	8	21	2	0	31
Integrated Water Resources Management (IWRM)	0	4	12	2	0	18
Land Use Management	0	8	18	2	0	28
Shoreline Management Planning	0	8	15	2	0	25
Solid and Liquid Waste Management	0	0	18	0	0	18
Sanitation	0	0	6	0	0	6
Capacity Building	0	8	21	2	0	31
Technology	0	8	21	2	0	31
Law Enforcement	0	8	21	2	0	31
Legal Review	0	8	0	0	0	8
Alternative/ Improved Livelihood	0	8	9	2	0	19
Awareness Raising	0	8	21	2	0	31
Education	0	8	21	2	0	31
Zanzibar			Temeke District		Total	308

The prioritised location-specific actions for Temeke district relate to addressing the following:

- Responding to the decline in fisheries productivity due to numerous destructive activities, especially at Mjimwema, Vijibweni, Kigamboni, Mtoni and Kimbiji areas
- Beach erosion at Kigamboni, Vijibweni and Kimbiji areas
- Heavy metal, industrial and solid waste pollution transported into coastal waters by Mtoni rivers (addressed under Ilala district, above)
- Beach and industrial pollution, often in river systems such as Mtoni River (described above under Ilala district), also impacted by solid and liquid wastes, requiring waste and sewage treatment infrastructure
- Oil pollution from the Kigamboni terminal and Dar es Salaam harbour (described above for Ilala district)
- Nguva and other smaller Temeke rivers protected to respond to projected growth in population, especially in light of the soon to be completed Mtoni River Bridge that will more closely link Temeke with the city centre

Recognising that Temeke is one of the three fast-growing Dar es Salaam districts, the level of importance of the above threats is likely to increase dramatically, hence the need for urgent action.

Mkuranga District

Prioritized Threats

In Table 83 below the threats identified for Mkuranga District have been listed and ranked according to their severity as established using the CRIAM method discussed extensively in Volumes I and II of the Coastal Profile. A rapid assessment has been made on the susceptibility of each threat to impacts of climate change more specifically, changes in whether patterns, extreme events, sea level rise, temperature rise and acidification.

Table 83: Prioritised threats for Mkuranga District and a rapid assessment of threat susceptibility to climate change.

#	Threat as identified in Coastal Profile	Threat Level	Influence from Climate Change					
			Change in Patterns	Extreme events	Sea Level Rise	Temperature rise	Acidification	
Mkuranga-03	Fisheries decline	Very important	0	-	0	0	0	Changes in climate are not expected to impact per se on the practise of destructive and illegal fisheries. Extreme weather events may in periods have a preventive effect.
Mkuranga-01	Beach pollution	Important problem	0	0	0	0	0	Changes in climate are not expected to impact per se on the practise of poor waste disposal that affects beaches.
Mkuranga-08	Decrease in mangrove and forest and agricultural areas	Important problem	++	++	0	+	0	Impact from unsuitable resource use practises will be exacerbated notably temperature rise and extreme events and changes in climate exacerbating forest stress and fire risk.
Mkuranga-06	Habitat and agricultural area loss	Important problem	0	0	0	0	0	Changes in climate are not expected to impact per se on the poor land use management and failure to follow land use procedures.
Mkuranga-05	Disease outbreaks	Important problem	++	++	+	+	0	More frequent and severe weather events and sea level rise may increase flooding and standing water and sewage exacerbating disease outbreaks and higher temperatures increase disease propagation
Mkuranga-02	Beach erosion	Problem	+	+++	+++	0	+	Impact from unsuitable resource use practises leading to beach erosion will be exacerbated notably from extreme events (storms and surges) and sea level rise. Coral growth likely reduce by acidification, increasing wave action and erosion.
Mkuranga-07	Land use conflicts	Problem	+	+	+	0	0	Climate change and sea level rise likely to impact on use of beach-intertidal areas; but not on poor land use management.
Mkuranga-04	Loss of biodiversity	Problem	0	-	0	0	0	Changes in climate are not expected to impact per se on the practise of destructive and illegal fisheries and mangrove usage. Extreme weather events may in periods have a preventive effect.

Table 84: Prioritised threats for Mkuranga District, their location and causes

#	Threat as identified in Coastal Profile	Threat Level	Location	Causes
Mkug-03:	Fisheries decline	Very important	Entire district coastal are including	Destruction of fish nurseries for action such as Mangrove cutting, illegal fishing such as Dynamite fishing and other poor fishing methods (fine meshed nets, beach seining) as well as coral mining for lime production. Over utilization of fisheries resources by large number of fisher in the small area
Mkug-01:	Beach pollution	Important problem	Koma, Kwale, Kisiju Pwani,	Indiscriminate dumping of household waste in the beaches and vicinities. Uncontrolled dumping of fish remains and carcasses. Lack of toilets in some coastal households. Weak of enforcement of public health regulations
Mkug-08:	Decrease in mangrove and forest and agricultural areas	Important problem	Koma, Kwale, Kisiju Pwani, Kimanzichana	Illegal and uncontrolled mangrove cutting. Illegal trees cutting in the forest for charcoal burning, Mangrove clearing for salt production. Increase urbanisation and settlement construction.
Mkug-06:	Habitat and agricultural area loss	Important problem	Here and there along the coast	Rapid urbanization, high increase of people immigration in the city. Salt production and livestock.
Mkug-05:	Disease outbreaks	Problem	Throughout the coastal areas of the district	Inadequate sewerage control, flooding, poor quality of sewerage construction, poor solid waste management, uncontrolled food vending. Lack of latrines and toilets in some coastal dwellings
Mkug-02:	Beach erosion	Important problem	Kisiju	Mangrove cutting, Dynamite fishing, unplanned construction along the coast.
Mkug-07:	Land use conflicts	Problem	Along the coastal front	Land use conflict between villages
Mkug-04:	Loss of biodiversity	Problem	Kisiju and vicinity	Destructive fisheries, mangrove cutting, salt production

Recommendations for threat mitigation measures

Overall measures to mitigate each if the identified natural resources related threats to coastal local communities and ecosystems have been tabulated in Table 212(page391) arranged under broad management dimensions headings. Table 85 provides an overview of the requirements/opportunities expressed within each of these management or intervention dimensions.

Table 85: Broad management intervention dimensions to address identified and prioritised threats to coastal communities and ecosystems in Mkuranga District

Intervention Dimension	Statement	Threat pertinence at each RV				
		Major Problem	Very important problem	Important Problem	Problem	Light Problem
Integrated Coastal Zone Management (ICZM)	<p>Ensure local (district) coordination and participation in management of coastal land, water and resources use currently under complex pressures.</p> <p>Focus areas for integrated management to address include fisheries, shoreline (and riverbank) and mangrove deforestation, beach changes, including at Koma, Kwale and Kisiju Pwani.</p>		Mkug-03: Fisheries decline	<p>Mkug-01: Beach pollution</p> <p>Mkug-08: Loss mangr+forest & agric</p> <p>Mkug-06: Habitat & agric loss</p> <p>Mkug-05: Disease outbreaks</p>	<p>Mkug-02: Beach erosion</p> <p>Mkug-07: Land use conflicts</p> <p>Mkug-04: Loss of biodiversity</p>	
Integrated Water Resources Management (IWRM)	<p>Link IWRM to coastal integrated planning to address impacts from upstream pollution, including at Koma, Kwale and Kisiju Pwani(ICARM).</p>			<p>Mkug-01: Beach pollution</p> <p>Mkug-05: Disease outbreaks</p>	<p>Mkug-02: Beach erosion</p>	
Land Use Management	<p>Land use information management systems to include ecosystems, habitats and water resources.</p> <p>Incorporate ecosystems, habitats, shoreline processes and water resources considerations in spatial planning.</p> <p>Develop and/or update district spatial plan accordingly and within national spatial planning framework.</p>		Mkug-03: Fisheries decline	<p>Mkug-01: Beach pollution</p> <p>Mkug-08: Loss mangr+forest & agric</p> <p>Mkug-06: Habitat & agric loss</p> <p>Mkug-05: Disease outbreaks</p>	<p>Mkug-02: Beach erosion</p> <p>Mkug-07: Land use conflicts</p> <p>Mkug-04: Loss of biodiversity</p>	
Shoreline Management Planning	<p>District's shorelines included in a national level overall shoreline management investigation.</p> <p>Shoreline management units (areas of coast) identified for the district informing district level spatial planning as a basis for local shoreline management regulation.</p>		Mkug-03: Fisheries decline	<p>Mkug-01: Beach pollution</p> <p>Mkug-08: Loss mangr+forest & agric</p> <p>Mkug-06: Habitat & agric loss</p>	<p>Mkug-02: Beach erosion</p> <p>Mkug-07: Land use conflicts</p> <p>Mkug-04: Loss of biodiversity</p>	
Solid and Liquid Waste Management	<p>Pursue integrated solid and liquid waste management solutions covering entire district, especially at Koma, Kwale and Kisiju Pwani, considering:</p> <p>Waste water treatment systems:</p> <ul style="list-style-type: none"> - collection - treatment technology - discharge <p>Liquid and Solid Waste Management Systems:</p> <ul style="list-style-type: none"> - collection - storage - processing - financing - minimisation - reuse? <p>Green Infrastructure</p> <p>Storm Water Systems</p>			<p>Mkug-01: Beach pollution</p> <p>Mkug-05: Disease outbreaks</p>		
Sanitation	<p>Pursue integrated solid and liquid waste management covering entire district, especially at Koma, Kwale and Kisiju Pwani, considering:</p> <p>Waste water treatment systems:</p> <ul style="list-style-type: none"> - collection - treatment technology - discharge <p>Liquid and Solid Waste Management Systems:</p> <ul style="list-style-type: none"> - collection - storage - processing - financing - minimisation - reuse? <p>Green Infrastructure</p> <p>Storm Water Systems</p>			<p>Mkug-01: Beach pollution</p> <p>Mkug-05: Disease outbreaks</p>		

Intervention Dimension	Statement	Threat pertinence at each RV				
		Major Problem	Very important problem	Important Problem	Problem	Light Problem
Capacity Building	<p>Accompany management interventions with appropriate capacity building components at district level. Particular focus on spatial planning, shoreline management, fisheries management, conflict resolution, monitoring, law enforcement.</p> <p>Enhance information management systems to provide for better and systematically informed management decisions.</p>		Mkug-03: Fisheries decline	<p>Mkug-01: Beach pollution</p> <p>Mkug-08: Loss mangr+forest & agric</p> <p>Mkug-06: Habitat & agric loss</p> <p>Mkug-05: Disease outbreaks</p>	<p>Mkug-02: Beach erosion</p> <p>Mkug-07: Land use conflicts</p> <p>Mkug-04: Loss of biodiversity</p>	
Technology	<p>Pursue opportunities through further technology development within:</p> <ul style="list-style-type: none"> • Inshore fisheries • Integrated solid and liquid waste management • Shoreline management • Aquaculture • Value added to existing fisheries <p>Mangrove management</p>		Mkug-03: Fisheries decline	<p>Mkug-01: Beach pollution</p> <p>Mkug-08: Loss mangr+forest & agric</p> <p>Mkug-06: Habitat & agric loss</p> <p>Mkug-05: Disease outbreaks</p>	<p>Mkug-02: Beach erosion</p> <p>Mkug-07: Land use conflicts</p> <p>Mkug-04: Loss of biodiversity</p>	
Law Enforcement	<p>1) Enforce reviewed laws relevant to amongst others:</p> <ul style="list-style-type: none"> • Fisheries • Industrial and domestic waste • Mangrove and coastal forest exploitation • Land use (especially shoreline and set-back uses). <p>2) Optimise enforcement through capacity building at district level and aligned with recommendations from national review.</p>		Mkug-03: Fisheries decline	<p>Mkug-01: Beach pollution</p> <p>Mkug-08: Loss mangr+forest & agric</p> <p>Mkug-06: Habitat & agric loss</p> <p>Mkug-05: Disease outbreaks</p>	<p>Mkug-02: Beach erosion</p> <p>Mkug-07: Land use conflicts</p> <p>Mkug-04: Loss of biodiversity</p>	
Legal Review	<p>1) Guided by central integrated review of district legislative and regulatory instruments, including amongst others:</p> <ul style="list-style-type: none"> • Fisheries decline • Land use (especially shoreline and set-back uses). <p>2) Follow revision (above) and revise and develop new district legislative and regulatory instruments.</p>		Mkug-03: Fisheries decline		<p>Mkug-02: Beach erosion</p> <p>Mkug-04: Loss of biodiversity</p>	
Alternative/Improved Livelihood	<p>Develop and offer alternative livelihoods for households currently engaged in destructive resource exploitation practises and those displaced and disadvantaged, focusing especially at Koma, Kwale and Kisiju Pwani, with particular efforts to provide alternatives for young generation.</p> <p>Improve current sustainable resource use livelihoods using technology advances and insights.</p>		Mkug-03: Fisheries decline	<p>Mkug-08: Loss mangr+forest & agric</p> <p>Mkug-06: Habitat & agric loss</p>	<p>Mkug-02: Beach erosion</p> <p>Mkug-07: Land use conflicts</p> <p>Mkug-04: Loss of biodiversity</p>	
Awareness Raising	<p>Participate in national awareness raising campaigns related to coastal management challenges directed to the public at large and to schools.</p> <p>Develop and implement district level awareness raising campaigns targeting local stakeholders affected by or affecting:</p> <ul style="list-style-type: none"> • Fisheries • Marine and beach pollution • Loss and degradation of coastal habitat and agricultural land • Water borne disease • Erosion • Marine and beach pollution • Land use conflicts 		Mkug-03: Fisheries decline	<p>Mkug-01: Beach pollution</p> <p>Mkug-08: Loss mangr+forest & agric</p> <p>Mkug-06: Habitat & agric loss</p> <p>Mkug-05: Disease outbreaks</p>	<p>Mkug-02: Beach erosion</p> <p>Mkug-07: Land use conflicts</p> <p>Mkug-04: Loss of biodiversity</p>	
Education	<p>Interact and participate in national curricula review for primary and secondary schools to enhance the knowledge and understanding about coastal management issues. Issues of particular relevance for the district are:</p> <ul style="list-style-type: none"> • Fisheries ecology and sustainable fisheries • Environmental management • Coastal ecology • Importance of beaches • Climate change impacts 		Mkug-03: Fisheries decline	<p>Mkug-01: Beach pollution</p> <p>Mkug-08: Loss mangr+forest & agric</p> <p>Mkug-06: Habitat & agric loss</p> <p>Mkug-05: Disease outbreaks</p>	<p>Mkug-02: Beach erosion</p> <p>Mkug-07: Land use conflicts</p> <p>Mkug-04: Loss of biodiversity</p>	

Action areas

Table 86: Assessment of the importance of broad management dimension in addressing threats to local communities and ecosystems in Mkurunga District.

Intervention Dimension	Major Problem weight	Very important problem weight	Important Problem weight	Problem weight	Light Problem weight	Total Score
Integrated Coastal Zone Management (ICZM)	0	4	12	6	0	22
Integrated Water Resources Management (IWRM)	0	0	6	2	0	8
Land Use Management	0	4	12	6	0	22
Shoreline Management Planning	0	4	9	6	0	19
Solid and Liquid Waste Management	0	0	6	0	0	6
Sanitation	0	0	6	0	0	6
Capacity Building	0	4	12	6	0	22
Technology	0	4	12	6	0	22
Law Enforcement	0	4	12	6	0	22
Legal Review	0	4	0	4	0	8
Alternative/ Improved Livelihood	0	4	6	6	0	16
Awareness Raising	0	4	12	6	0	22
Education	0	4	12	6	0	22
Zanzibar			Mkurunga District		Total	217

The prioritised location-specific actions for Mkurunga district relate to addressing the following:

- Responding to the decline in fisheries productivity due to numerous destructive activities, along the entire district's shoreline
- Beach pollution, particularly at Koma, Kwale, Kisiju Pwani often associated with poor sewage and waste management
- Decrease in forest cover and habitat destruction from immigration and urbanisation

Rufiji District

Prioritized Threats

In Table 87 below the threats identified for Rufiji District have been listed and ranked according to their severity as established using the CRIAM method discussed extensively in Volumes I and II of the Coastal Profile. A rapid assessment has been made on the susceptibility of each threat to impacts of climate change more specifically, changes in weather patterns, extreme events, sea level rise, temperature rise and acidification.

Table 87: Prioritised threats for Rufiji District and a rapid assessment of threat susceptibility to climate change.

#	Threat as identified in Coastal Profile	Threat Level	Influence from Climate Change					
			Change in Patterns	Extreme events	Sea Level Rise	Temperature rise	Acidification	
Rufiji-03	Fisheries decline	Very important	0	-	0	0	0	Changes in climate are not expected to impact per se on the practise of destructive and illegal fisheries. Extreme weather events may in periods have a preventive effect.
Rufiji-08	Loss of habitat and agricultural area	Very important	0	+	0	+	0	Changes in climate are not expected to impact per se on the poor land use management and failure to follow land use procedures. Impact from unsuitable resource use practises will be exacerbated notably temperature rise and extreme events and changes in climate exacerbating forest stress and fire risk.
Rufiji-02	Marine pollution	Very important	++	++	0	0	0	More frequent and severe weather events may increase the leaching of pollutants into water resources and thereby exacerbate the levels reaching local marine ecosystems.
Rufiji-01	Beach pollution	Very important	0	0	0	0	0	Changes in climate are not expected to impact per se on the practise of poor waste disposal that affects beaches.
Rufiji-06	Land use conflicts	Important problem	0	0	0	0	0	Climate change not likely to affect poor land use management.
Rufiji-04	Disease outbreaks	Important problem	++	++	+	+	0	More frequent and severe weather events and sea level rise may increase flooding and standing water and sewage exacerbating disease outbreaks and higher temperatures increase disease propagation
Rufiji-09	River and estuary pollution	Important problem	++	++	0	0	0	More frequent and severe weather events may increase the leaching of pollutants into water resources and thereby exacerbate the levels reaching local marine ecosystems.
Rufiji-05	Flooding of construction areas and vulnerable river valleys	Important problem	++	++	+	0	0	Climate change likely to increase flooding if rainfall events are more severe and overall rainfall increases. Sea level rise will worsen the flooding by backing up floods, especially during big tides.

Table 88: Prioritised threats for Rufiji District, their location and causes.

#	Threat as identified in Coastal Profile	Threat Level	Location	Causes
Rfji-03:	Fisheries decline	Very important	All along the shore	Destruction of fish nurseries such as mangrove cutting, illegal fishing such as dynamite fishing and other poor fishing methods
Rfji-08:	Loss of habitat and agricultural area	Very important	Along Rufiji Delta and coastal forests	Rapid urbanization, high increase of people immigration in the rapidly growing towns/villages. Uncontrolled mangrove cutting, forest clearing for firewood collection, charcoal production, logging and pole collection
Rfji-02:	Marine pollution	Very important	Along the near shores	Large plantations in the highland drain into Rufiji basin and hence fertilizers, pesticides, herbicides and fungicides may pose as threat
Rfji-01:	Beach pollution	Very important	Populated area such as Kibanjo, Kiasi, Simbaulanga	Uncontrolled solid and liquid waste disposal, often in creeks.
Rfji-06:	Land use conflicts	Problem	Ikwiriri, Kibiti and in many villages and wards	Land utilization for animal grazing and cultivation (cultivators vs grazers). Conflicts between villages on village borders disputes.
Rfji-04:	Disease outbreaks	Important problem	In coastal villages such as Kiasi and Kibanjo	Inadequate sewerage control, flooding, poor quality of sewerage construction, poor solid waste management, uncontrolled food vending, lack of latrines, lack of clean domestic water
Rfji-09:	River and estuary pollution	Important problem	Rufiji River	Organochlorine pesticides used to control crab pest in rice paddies, potentially affecting carapace formation in prawn and other shellfish (Stadlinger et al 2003).
Rfji-05:	Flooding of construction areas and vulnerable river valleys	Important problem	Rufiji delta and river basin	Climate influences such as El-Nino and storm rains, heavy rains up Rufiji Valley Basin

Recommendations for threat mitigation measures

Overall measures to mitigate each if the identified natural resources related threats to coastal local communities and ecosystems have been tabulated in Table 213(page393) arranged under broad management dimensions headings. Table 89 provides an overview of the requirements/opportunities expressed within each of these management or intervention dimensions.

Table 89: Broad management intervention dimensions to address identified and prioritised threats to coastal communities and ecosystems in Rufiji District

Intervention Dimension	Statement	Threat pertinence at each RV				
		Major Problem	Very important problem	Important Problem	Problem	Light Problem
Integrated Coastal Zone Management (ICZM)	<p>Ensure local (district) coordination and participation in management of coastal land, water and resources use currently under complex pressures.</p> <p>Focus areas for integrated management to address include fisheries, shoreline (and riverbank) and mangrove deforestation, pollution and flooding along the entire district coast, including the coastal villages of Kibanjo, Kiasi and Simba Ulanga.</p>		<p>Rfji-03: Fisheries decline</p> <p>Rfji-08: Habitat & agric loss</p> <p>Rfji-02: Marine pollution</p> <p>Rfji-01: Beach pollution</p>	<p>Rfji 06: Land use conflicts</p> <p>Rfji 04: Disease outbreaks</p> <p>Rfji-09: River-estuary pollution</p> <p>Rfji-05: Flooding</p>		
Integrated Water Resources Management (IWRM)	<p>Link IWRM to coastal integrated planning to address impacts from upstream pollution, to cover pollution and flooding in the delta and coastal villages of Kibanjo, Kiasi and Simba Ulanga(ICARM).</p>		<p>Rfji-08: Habitat & agric loss</p> <p>Rfji-02: Marine pollution</p> <p>Rfji-01: Beach pollution</p>	<p>Rfji 04: Disease outbreaks</p> <p>Rfji-09: River-estuary pollution</p> <p>Rfji-05: Flooding</p>		
Land Use Management	<p>Land use information management systems to include ecosystems, habitats and water resources.</p> <p>Incorporate ecosystems, habitats, shoreline processes and water resources considerations in spatial planning.</p> <p>Develop and/or update district spatial plan accordingly and within national spatial planning framework.</p>		<p>Rfji-03: Fisheries decline</p> <p>Rfji-08: Habitat & agric loss</p> <p>Rfji-02: Marine pollution</p> <p>Rfji-01: Beach pollution</p>	<p>Rfji 06: Land use conflicts</p> <p>Rfji 04: Disease outbreaks</p> <p>Rfji-09: River-estuary pollution</p> <p>Rfji-05: Flooding</p>		
Shoreline Management Planning	<p>District's shorelines included in a national level overall shoreline management investigation.</p> <p>Shoreline management units (areas of coast) identified for the district informing district level spatial planning as a basis for local shoreline management regulation.</p>		<p>Rfji-03: Fisheries decline</p> <p>Rfji-08: Habitat & agric loss</p> <p>Rfji-01: Beach pollution</p>	<p>Rfji 06: Land use conflicts</p>		
Solid and Liquid Waste Management	<p>Pursue integrated solid and liquid waste management solutions covering entire district, including Kibanjo, Kiasi and Simba Ulanga and other coastal villages, considering:</p> <p>Waste water treatment systems:</p> <ul style="list-style-type: none"> - collection - treatment technology - discharge <p>Liquid and Solid Waste Management Systems:</p> <ul style="list-style-type: none"> - collection - storage - processing - financing - minimisation - reuse? <p>Green Infrastructure</p> <p>Storm Water Systems</p>		<p>Rfji-02: Marine pollution</p> <p>Rfji-01: Beach pollution</p>	<p>Rfji 04: Disease outbreaks</p> <p>Rfji-09: River-estuary pollution</p>		

Intervention Dimension	Statement	Threat pertinence at each RV				
		Major Problem	Very important problem	Important Problem	Problem	Light Problem
Sanitation	<p>Pursue integrated solid and liquid waste management covering entire district, including Kibanjo, Kiasi and Simba Ulanga and other coastal villages, considering:</p> <p>Waste water treatment systems:</p> <ul style="list-style-type: none"> - collection - treatment technology - discharge <p>Liquid and Solid Waste Management Systems:</p> <ul style="list-style-type: none"> - collection - storage - processing - financing - minimisation - reuse? <p>Green Infrastructure Storm Water Systems</p>		Rfji-01: Beach pollution	Rfji 04: Disease outbreaks		
Capacity Building	<p>Accompany management interventions with appropriate capacity building components at district level. Particular focus on spatial planning, shoreline management, fisheries management, conflict resolution, monitoring, law enforcement.</p> <p>Enhance information management systems to provide for better and systematically informed management decisions.</p>		<p>Rfji-03: Fisheries decline</p> <p>Rfji-08: Habitat & agric loss</p> <p>Rfji-02: Marine pollution</p> <p>Rfji-01: Beach pollution</p>	<p>Rfji 06: Land use conflicts</p> <p>Rfji 04: Disease outbreaks</p> <p>Rfji-09: River-estuary pollution</p> <p>Rfji-05: Flooding</p>		
Technology	<p>Pursue opportunities through further technology development within:</p> <ul style="list-style-type: none"> • Inshore fisheries • Integrated solid and liquid waste management • Aquaculture • Value added to existing fisheries • Shoreline management • Mangrove management <p>Agricultural waste and chemicals management</p>		<p>Rfji-03: Fisheries decline</p> <p>Rfji-08: Habitat & agric loss</p> <p>Rfji-02: Marine pollution</p> <p>Rfji-01: Beach pollution</p>	<p>Rfji 06: Land use conflicts</p> <p>Rfji 04: Disease outbreaks</p> <p>Rfji-09: River-estuary pollution</p> <p>Rfji-05: Flooding</p>		
Law Enforcement	<p>1) Enforce reviewed laws relevant to amongst others:</p> <ul style="list-style-type: none"> • Fisheries • Mangrove and coastal forest exploitation • Domestic waste • Land use (especially shoreline and set-back uses) • Agro-chemical usage <p>2) Optimise enforcement through capacity building at district level and aligned with recommendations from national review.</p>		<p>Rfji-03: Fisheries decline</p> <p>Rfji-08: Habitat & agric loss</p> <p>Rfji-02: Marine pollution</p> <p>Rfji-01: Beach pollution</p>	<p>Rfji 04: Disease outbreaks</p> <p>Rfji-09: River-estuary pollution</p> <p>Rfji-05: Flooding</p>		
Legal Review	<p>1) Guided by central integrated review of district legislative and regulatory instruments, including amongst others:</p> <ul style="list-style-type: none"> • Fisheries decline • Land use (especially shoreline and set-back uses). <p>2) Follow revision (above) and revise and develop new district legislative and regulatory instruments.</p>					
Alternative/Improved Livelihood	<p>Develop and offer alternative livelihoods for households currently engaged in destructive resource exploitation practises and those displaced and disadvantaged, focusing on Kibanjo, Kiasi and Simba Ulanga and other coastal villages, with particular efforts to provide alternatives for young generation.</p> <p>Improve current sustainable resource use livelihoods using technology advances and insights.</p>		<p>Rfji-03: Fisheries decline</p> <p>Rfji-08: Habitat & agric loss</p>	Rfji 06: Land use conflicts		

Intervention Dimension	Statement	Threat pertinence at each RV				
		Major Problem	Very important problem	Important Problem	Problem	Light Problem
Awareness Raising	<p>Participate in national awareness raising campaigns related to coastal management challenges directed to the public at large and to schools.</p> <p>Develop and implement district level awareness raising campaigns targeting local stakeholders affected by or affecting:</p> <ul style="list-style-type: none"> Fisheries decline Loss and degradation of coastal habitat and agricultural land Marine and beach pollution Agro-chemical usage 		Rfji-03: Fisheries decline Rfji-08: Habitat & agric loss Rfji-02: Marine pollution Rfji-01: Beach pollution	Rfji 06: Land use conflicts Rfji 04: Disease outbreaks Rfji-09: River-estuary pollution Rfji-05: Flooding		
Education	<p>Interact and participate in national curricula review for primary and secondary schools to enhance the knowledge and understanding about coastal management issues. Issues of particular relevance for the district are:</p> <ul style="list-style-type: none"> Coastal ecology Importance of beaches Fisheries ecology and sustainable fisheries Environmental management Climate change impacts 		Rfji-08: Habitat & agric loss Rfji-02: Marine pollution Rfji-01: Beach pollution	Rfji 06: Land use conflicts Rfji 04: Disease outbreaks Rfji-09: River-estuary pollution Rfji-05: Flooding		

Action areas

Table 90: Assessment of the importance of broad management dimension in addressing threats to local communities and ecosystems in Rufiji District.

Intervention Dimension	Major Problem weight	Very important problem weight	Important Problem weight	Problem weight	Light Problem weight	Total Score
Integrated Coastal Zone Management (ICZM)	0	16	12	0	0	28
Integrated Water Resources Management (IWRM)	0	12	9	0	0	21
Land Use Management	0	16	12	0	0	28
Shoreline Management Planning	0	12	3	0	0	15
Solid and Liquid Waste Management	0	8	6	0	0	14
Sanitation	0	4	3	0	0	7
Capacity Building	0	16	12	0	0	28
Technology	0	16	12	0	0	28
Law Enforcement	0	16	9	0	0	25
Legal Review	0	0	0	0	0	0
Alternative/ Improved Livelihood	0	8	3	0	0	11
Awareness Raising	0	16	12	0	0	28
Education	0	12	12	0	0	24
Zanzibar			Rufiji District		Total	257

The prioritised location-specific actions for Rufiji district relate to addressing the following:

- Responding to the decline in fisheries productivity due to numerous destructive activities, along the entire district's shoreline
- Decrease in forest cover and habitat destruction, especially in the Rufiji Delta area, from immigration and urbanisation
- Marine and beach pollution from the Rufiji River catchment, often associated with poor sewage and waste management at coastal villages of Kibanjo, Kiasi, Simba Ulanga, leading to disease outbreaks

Mafia District

Prioritized Threats

In Table 91 below the threats identified for Mafia District have been listed and ranked according to their severity as established using the CRIAM method discussed extensively in Volumes I and II of the Coastal Profile. A rapid assessment has been made on the susceptibility of each threat to impacts of climate change more specifically, changes in whether patterns, extreme events, sea level rise, temperature rise and acidification.

Table 91: Prioritised threats for Mafia District and a rapid assessment of threat susceptibility to climate change.

#	Threat as identified in Coastal Profile	Threat Level	Influence from Climate Change					
			Change in Patterns	Extreme events	Sea Level Rise	Temperature rise	Acidification	
Mafia-03	Fisheries decline	Very important	0	-	0	0	0	Changes in climate are not expected to impact per se on the practise of destructive and illegal fisheries. Extreme weather events may in periods have a preventive effect.
Mafia-01	Beach pollution	Important problem	0	0	0	0	0	Changes in climate are not expected to impact per se on the practise of poor waste disposal that affects beaches.
Mafia-05	Disease outbreaks	Important problem	++	++	+	+	0	More frequent and severe weather events and sea level rise may increase flooding and standing water and sewage exacerbating disease outbreaks and higher temperatures increase disease propagation.
Mafia-09	Loss of habitat	Important problem	++	++	+	0	0	Impact from unsuitable resource use practises will be exacerbated notable from extreme events (storms and surges), stress from changed weather patterns and from sea level rise.
Mafia-06	HIV/AIDS increase	Important problem	0	0	0	0	0	Changes in climate are not expected to impact per se on sexual practises.
Mafia-02	Beach erosion	Problem	+	+++	+++	0	+	Impact from unsuitable resource use practises leading to beach erosion will be exacerbated notably from extreme events (storms and surges) and sea level rise. Coral growth likely reduce by acidification, increasing wave action and erosion.
Mafia-04	Marine (oil) pollution	Problem	0	0	0	-	0	Changes in climate are not expected to impact per se on the practise of inadequate or poor oil disposal that affects beaches. Increase in temperature may have a preventive effect by increasing oil evaporation rates.
Mafia-07	Land use conflicts	Problem	+	+	+	0	0	Climate change and sea level rise likely to impact on use of beach-intertidal areas; but not on poor land use management.

Table 92: Prioritised threats for Mafia District, their location and causes

#	Threat as identified in Coastal Profile	Threat Level	Location	Causes
Mfia-03:	Fisheries decline	Very important	All along the near shore areas	Destruction of fish nurseries such as mangrove cutting, illegal fishing such as dynamite fishing and other poor fishing methods such as purse seine, beach seine, poisonous fishing, SCUBA gun fishing, etc.
Mfia-01:	Beach pollution	Important problem	Kilindoni	Uncontrolled solid and liquid waste disposal, lack of toilets for public as well as residential houses
Mfia-05:	Disease outbreaks	Important problem	Kilindoni, Bwejuu, Jibondo	Inadequate sewerage control, poor solid waste management, uncontrolled food vending.
Mfia-09:	Loss of habitat	Important problem	All along the coast	Mangrove cutting, blast fishing, coral mining, salt production, prawn farming
Mfia-06:	HIV/AIDS increase	Important problem	Especially at Kilindoni and dago (migrant fishing csm) areas	In-migration of many seasonal fishers from Dar es Salaam, Pemba, Unguja and other mainland coastal areas.
Mfia-02:	Beach erosion	Problem	Utende, Kilindoni, Bwejuu, Juani, Jibondo	Mangrove cutting, dynamite fishing, beach sand mining for construction purposes, unplanned construction along the coast
Mfia-04:	Marine (oil) pollution	Problem	Kilindoni	Possible oil leakages and pollution from loading and off loading at Kilindoni Harbour, garages, and factory; concern for future increases as port develops
Mfia-07:	Land use conflicts	Problem	Mafia Island Marine Park area	Conflict between environmental conservation authorities and groups and community that want to utilize resources, especially marine resources, e.g. MIMP and fishermen.

Recommendations for threat mitigation measures

Overall measures to mitigate each if the identified natural resources related threats to coastal local communities and ecosystems have been tabulated in Table 214(page395) arranged under broad management dimensions headings. Table 93 provides an overview of the requirements/opportunities expressed within each of these management or intervention dimensions.

Table 93: Broad management intervention dimensions to address identified and prioritised threats to coastal communities and ecosystems in Mafia District

Intervention Dimension	Statement	Threat pertinence at each RV				
		Major Problem	Very important problem	Important Problem	Problem	Light Problem
Integrated Coastal Zone Management (ICZM pressures. Focus areas for integrated)	Ensure local (district) coordination and participation in management of coastal land, water and resources use currently under complex pressures. Focus areas for integrated management to address include fisheries, pollution, shoreline and mangrove deforestation, beach changes on all shores of Mafia district.		Mfia-03: Fisheries decline	Mfia-01: Beach pollution Mfia-09: Loss of habitat	Mfia-02: Beach erosion Mfia-04: Marine pollution Mfia-07: Land use conflicts	
Integrated Water Resources Management (IWRM)	Link IWRM to coastal integrated planning to the extent that pollution derives from upstream sources, of the few rivers on Mafia (ICARM).			Mfia-01: Beach pollution	Mfia-02: Beach erosion	
Land Use Management	Land use information management systems to include ecosystems, habitats and water resources. Incorporate ecosystems, habitats, shoreline processes and water resources considerations in spatial planning. Develop and/or update district spatial plan accordingly and within national spatial planning framework.		Mfia-03: Fisheries decline	Mfia-01: Beach pollution Mfia-05: Disease outbreaks Mfia-09: Loss of habitat	Mfia-02: Beach erosion Mfia-07: Land use conflicts	
Shoreline Management Planning	District's shorelines included in a national level overall shoreline management investigation. Shoreline management units (areas of coast) identified for the district informing district level spatial planning as a basis for local shoreline management regulation.		Mfia-03: Fisheries decline	Mfia-01: Beach pollution Mfia-09: Loss of habitat	Mfia-02: Beach erosion Mfia-04: Marine pollution	
Solid and Liquid Waste Management	Pursue integrated solid and liquid waste management solutions covering entire district, especially around Kilindoni, Bwejuu, Jibondo and all minor harbours, considering: Waste water treatment systems: - collection - treatment technology - discharge Liquid and Solid Waste Management Systems: - collection - storage - processing - financing - minimisation - reuse? Green Infrastructure Storm Water Systems			Mfia-01: Beach pollution Mfia-05: Disease outbreaks	Mfia-04: Marine pollution	
Sanitation	Pursue integrated solid and liquid waste management covering entire district, especially around Kilindoni, Bwejuu, Jibondo and all minor harbours, considering: Waste water treatment systems: - collection - treatment technology - discharge Liquid and Solid Waste Management Systems: - collection - storage - processing - financing - minimisation - reuse? Green Infrastructure Storm Water Systems			Mfia-01: Beach pollution Mfia-05: Disease outbreaks		

Intervention Dimension	Statement	Threat pertinence at each RV				
		Major Problem	Very important problem	Important Problem	Problem	Light Problem
Capacity Building	<p>Accompany management interventions with appropriate capacity building components at district level. Particular focus on spatial planning, shoreline management, fisheries management, conflict resolution, monitoring, law enforcement.</p> <p>Enhance information management systems to provide for better and systematically informed management decisions.</p>		Mfia-03: Fisheries decline	<p>Mfia-01: Beach pollution</p> <p>Mfia-05: Disease outbreaks</p> <p>Mfia-09: Loss of habitat</p> <p>Mfia-06: HIV/AIDS increase</p>	<p>Mfia-02: Beach erosion</p> <p>Mfia-04: Marine pollution</p> <p>Mfia-07: Land use conflicts</p>	
Technology	<p>Pursue opportunities through further technology development within:</p> <ul style="list-style-type: none"> • Inshore fisheries • Integrated solid and liquid waste management • Aquaculture • Value added to existing fisheries • Waste management • Shoreline management • Mangrove management 		Mfia-03: Fisheries decline	<p>Mfia-01: Beach pollution</p> <p>Mfia-05: Disease outbreaks</p> <p>Mfia-09: Loss of habitat</p>	<p>Mfia-02: Beach erosion</p> <p>Mfia-04: Marine pollution</p> <p>Mfia-07: Land use conflicts</p>	
Law Enforcement	<p>1) Enforce reviewed laws relevant to amongst others:</p> <ul style="list-style-type: none"> • Mangrove and coastal forest exploitation • Fisheries • Industrial and domestic waste • Coral (and sand) mining • Land use (especially shoreline and set-back uses). <p>2) Optimise enforcement through capacity building at district level and aligned with recommendations from national review.</p>		Mfia-03: Fisheries decline	<p>Mfia-01: Beach pollution</p> <p>Mfia-05: Disease outbreaks</p> <p>Mfia-09: Loss of habitat</p> <p>Mfia-06: HIV/AIDS increase</p>	<p>Mfia-02: Beach erosion</p> <p>Mfia-04: Marine pollution</p> <p>Mfia-07: Land use conflicts</p>	
Legal Review	<p>1) Guided by central integrated review of district legislative and regulatory instruments, including amongst others:</p> <ul style="list-style-type: none"> • Fisheries decline • Coral (and sand) mining • Land use (especially shoreline and set-back uses). <p>2) Follow revision (above) and revise and develop new district legislative and regulatory instruments.</p>		Mfia-03: Fisheries decline		Mfia-02: Beach erosion	
Alternative/Improved Livelihood	<p>Develop and offer alternative livelihoods for households currently engaged in destructive resource exploitation practises and those displaced and disadvantaged, focusing on Kilindoni, Bwejuu, Jibondo and all minor harbours, with particular efforts to provide alternatives for young generation.</p> <p>Improve current sustainable resource use livelihoods using technology advances and insights.</p>		Mfia-03: Fisheries decline	<p>Mfia-09: Loss of habitat</p> <p>Mfia-06: HIV/AIDS increase</p>	Mfia-02: Beach erosion	
Awareness Raising	<p>Participate in national awareness raising campaigns related to coastal management challenges directed to the public at large and to schools.</p> <p>Develop and implement district level awareness raising campaigns targeting local stakeholders affected by or affecting:</p> <ul style="list-style-type: none"> • Fisheries decline • Marine and beach pollution • Erosion • Waste management • Loss and degradation of coastal habitat and agricultural land 		Mfia-03: Fisheries decline	<p>Mfia-01: Beach pollution</p> <p>Mfia-05: Disease outbreaks</p> <p>Mfia-09: Loss of habitat</p> <p>Mfia-06: HIV/AIDS increase</p>	<p>Mfia-02: Beach erosion</p> <p>Mfia-04: Marine pollution</p> <p>Mfia-07: Land use conflicts</p>	
Education	<p>Interact and participate in national curricula review for primary and secondary schools to enhance the knowledge and understanding about coastal management issues. Issues of particular relevance for the district are:</p> <ul style="list-style-type: none"> • Fisheries ecology and sustainable fisheries • Environmental management • Coastal ecology • Importance of beaches • Climate change impacts 		Mfia-03: Fisheries decline	<p>Mfia-01: Beach pollution</p> <p>Mfia-05: Disease outbreaks</p> <p>Mfia-09: Loss of habitat</p> <p>Mfia-06: HIV/AIDS increase</p>	<p>Mfia-02: Beach erosion</p> <p>Mfia-07: Land use conflicts</p>	

Action areas

Table 94: Assessment of the importance of broad management dimension in addressing threats to local communities and ecosystems in Mafia District.

Intervention Dimension	Major Problem weight	Very important problem weight	Important Problem weight	Problem weight	Light Problem weight	Total Score
Integrated Coastal Zone Management (ICZM)	0	4	6	6	0	16
Integrated Water Resources Management (IWRM)	0	0	3	2	0	5
Land Use Management	0	4	9	4	0	17
Shoreline Management Planning	0	4	6	4	0	14
Solid and Liquid Waste Management	0	0	6	2	0	8
Sanitation	0	0	6	0	0	6
Capacity Building	0	4	12	6	0	22
Technology	0	4	9	6	0	19
Law Enforcement	0	4	12	6	0	22
Legal Review	0	4	0	2	0	6
Alternative/ Improved Livelihood	0	4	6	2	0	12
Awareness Raising	0	4	12	6	0	22
Education	0	4	12	4	0	20
Zanzibar			Mafia District		Total	189

The prioritised location-specific actions for Mafia district relate to addressing the following:

- Responding to the decline in fisheries productivity due to numerous destructive activities, along the entire district's shoreline
- Beach pollution (and oil pollution) at Kilindoni, usually associated with poor sewage and waste management, leading to disease outbreaks
- Poor sewage and waste management leading to disease outbreaks at Jibondo and Bwejuu islands

Kilwa District

Prioritized Threats

In Table 95 below the threats identified for Kilwa District have been listed and ranked according to their severity as established using the CRIAM method discussed extensively in Volumes I and II of the Coastal Profile. A rapid assessment has been made on the susceptibility of each threat to impacts of climate change more specifically, changes in whether patterns, extreme events, sea level rise, temperature rise and acidification.

Table 95: Prioritised threats for Kilwa District and a rapid assessment of threat susceptibility to climate change.

#	Threat as identified in Coastal Profile	Threat Level	Influence from Climate Change					
			Change in Patterns	Extreme events	Sea Level Rise	Temperature rise	Acidification	
Kilwa-03	Fisheries decline	Very important	0	-	0	0	0	Changes in climate are not expected to impact per se on the practise of destructive and illegal fisheries. Extreme weather events may in periods have a preventive effect.
Kilwa-01	Beach pollution	Problem	0	0	0	0	0	
Kilwa-02	Beach erosion	Problem	+	+++	+++	0	+	Impact from unsuitable resource use practises leading to beach erosion will be exacerbated notably from extreme events (storms and surges) and sea level rise. Coral growth likely reduce by acidification, increasing wave action and erosion.
Kilwa-04	Marine (oil and agrochemical) pollution	Problem	++	++	0	-	0	
			More frequent and severe weather events may increase the leaching of pollutants into water resources and thereby exacerbate the levels reaching local marine ecosystems. However, changes in climate not expected to impact per se on the practise of inadequate or poor oil disposal that affects beaches, though increase in temperature may have a preventive effect by increasing oil evaporation rates.					

Table 96: Prioritised threats for Kilwa District, their location and causes

#	Threat as identified in Coastal Profile	Threat Level	Location	Causes
Kilwa-03:	Fisheries decline	Very important	All along the Kilwa coast including Kiswera Harbour, Ruhaha, Mamba, Songo Mnara, Kilwa Masoko, Tikwoiri, Gigwera, Ras Wango, Songo archipelago	Destruction of fish nurseries such as mangrove cutting, illegal fishing such as dynamite fishing and other poor fishing methods as well as coral mining for lime production
Kilwa 01:	Beach pollution	Problem	Kilwa Kivinje	Uncontrolled solid and liquid waste disposal, often in creeks.
Kilwa-02:	Beach erosion	Problem	Masoko, Rushungi, Kilwa Kisiwani World Heritage monuments.	Mangrove cutting, dynamite fishing, beach sand mining, unplanned construction along the coast.
Kilwa-04:	Marine (oil and agrochemical) pollution	Problem	Songo Songo, Kilwa Masoko and Kilwa Kivinje	Potential oil spills from Songo Songo gas processing plant (plant discharges and fuel transfers), Kilwa Masoko and Kilwa Kisiwani Harbour fuel transfers, agrochemicals from upstream agriculture.

Recommendations for threat mitigation measures

Overall measures to mitigate each if the identified natural resources related threats to coastal local communities and ecosystems have been tabulated in Table 215 (page 397) arranged under broad management dimensions headings. Table 97 provides an overview of the requirements/opportunities expressed within each of these management or intervention dimensions.

Table 97: Broad management intervention dimensions to address identified and prioritised threats to coastal communities and ecosystems in Kilwa District

Intervention Dimension	Statement	Threat pertinence at each RV				
		Major Problem	Very important problem	Important Problem	Problem	Light Problem
Integrated Coastal Zone Management (ICZM)	<p>Ensure local (district) coordination and participation in management of coastal land, water and resources use currently under complex pressures.</p> <p>Focus areas for integrated management to address include fisheries, shoreline (and riverbank) and mangrove deforestation, beach changes at Kiswera Harbour, Ruhaha, Mamba, Songo Mnara, Kilwa Masoko, Tikwoiri, Gigwera, Ras Wango, Songo Songo Archipelago.</p>		Klwa-03: Fisheries decline	Klwa 01: Beach pollution Klwa-02: Beach erosion Klwa-04: Marine pollution		
Integrated Water Resources Management (IWRM)	<p>Link IWRM to coastal integrated planning to address impacts from upstream pollution, to cover Songo Songo, Kilwa Masoko and Kilwa Kivinje (ICARM).</p>			Klwa 01: Beach pollution Klwa-04: Marine pollution		
Land Use Management	<p>Land use information management systems to include ecosystems, habitats and water resources.</p> <p>Incorporate ecosystems, habitats, shoreline processes and water resources considerations in spatial planning.</p> <p>Develop and/or update district spatial plan accordingly and within national spatial planning framework.</p>		Klwa-03: Fisheries decline	Klwa 01: Beach pollution Klwa-02: Beach erosion Klwa-04: Marine pollution		
Shoreline Management Planning	<p>District's shorelines included in a national level overall shoreline management investigation.</p> <p>Shoreline management units (areas of coast) identified for the district informing district level spatial planning as a basis for local shoreline management regulation.</p>		Klwa-03: Fisheries decline	Klwa 01: Beach pollution Klwa-02: Beach erosion Klwa-04: Marine pollution		
Solid and Liquid Waste Management	<p>Pursue integrated solid and liquid waste management solutions covering entire district, to cover Songo Songo, Kilwa Masoko and Kilwa Kivinje, considering:</p> <p>Waste water treatment systems:</p> <ul style="list-style-type: none"> - collection - treatment technology - discharge <p>Liquid and Solid Waste Management Systems:</p> <ul style="list-style-type: none"> - collection - storage - processing - financing - minimisation - reuse? <p>Green Infrastructure Storm Water Systems</p>			Klwa 01: Beach pollution Klwa-04: Marine pollution		
Sanitation	<p>Pursue integrated solid and liquid waste management covering entire district, to cover especially Kilwa Kivinje, considering:</p> <p>Waste water treatment systems:</p> <ul style="list-style-type: none"> - collection - treatment technology - discharge <p>Liquid and Solid Waste Management Systems:</p> <ul style="list-style-type: none"> - collection - storage - processing - financing - minimisation - reuse? <p>Green Infrastructure Storm Water Systems</p>			Klwa 01: Beach pollution		
Capacity Building	<p>Accompany management interventions with appropriate capacity building components at district level. Particular focus on spatial planning, shoreline management, fisheries management, conflict resolution, monitoring, law enforcement.</p> <p>Enhance information management systems to provide for better and systematically informed management decisions.</p>		Klwa-03: Fisheries decline	Klwa 01: Beach pollution Klwa-02: Beach erosion Klwa-04: Marine pollution		

Intervention Dimension	Statement	Threat pertinence at each RV				
		Major Problem	Very important problem	Important Problem	Problem	Light Problem
Technology	<p>Pursue opportunities through further technology development within:</p> <ul style="list-style-type: none"> • Inshore fisheries • Aquaculture • Value added to existing fisheries • Shoreline management • Integrated solid and liquid waste management <p>Mangrove management</p>		Klwa-03: Fisheries decline	Klwa 01: Beach pollution Klwa-02: Beach erosion Klwa-04: Marine pollution		
Law Enforcement	<p>1) Enforce reviewed laws relevant to amongst others:</p> <ul style="list-style-type: none"> • Fisheries • Industrial and domestic waste • Coral (and sand) mining • Mangrove and coastal forest exploitation • Land use (especially shoreline and set-back uses). <p>2) Optimise enforcement through capacity building at district level and aligned with recommendations from national review.</p>		Klwa-03: Fisheries decline	Klwa 01: Beach pollution Klwa-02: Beach erosion Klwa-04: Marine pollution		
Legal Review	<p>1) Guided by central integrated review of district legislative and regulatory instruments, including amongst others:</p> <ul style="list-style-type: none"> • Fisheries decline • Coral (and sand) mining • Land use (especially shoreline and set-back uses). <p>2) Follow revision (above) and revise and develop new district legislative and regulatory instruments.</p>		Klwa-03: Fisheries decline	Klwa-02: Beach erosion		
Alternative/Improved Livelihood	<p>Develop and offer alternative livelihoods for households currently engaged in destructive resource exploitation practises and those displaced and disadvantaged, focusing on to cover Songo Songo, Kilwa Masoko and Kilwa Kivinje, with particular efforts to provide alternatives for young generation.</p> <p>Improve current sustainable resource use livelihoods using technology advances and insights.</p>		Klwa-03: Fisheries decline	Klwa-02: Beach erosion		
Awareness Raising	<p>Participate in national awareness raising campaigns related to coastal management challenges directed to the public at large and to schools.</p> <p>Develop and implement district level awareness raising campaigns targeting local stakeholders affected by or affecting:</p> <ul style="list-style-type: none"> • Fisheries decline • Marine and beach pollution • Erosion • Loss and degradation of coastal habitat and agricultural land 		Klwa-03: Fisheries decline	Klwa 01: Beach pollution Klwa-02: Beach erosion Klwa-04: Marine pollution		
Education	<p>Interact and participate in national curricula review for primary and secondary schools to enhance the knowledge and understanding about coastal management issues. Issues of particular relevance for the district are:</p> <ul style="list-style-type: none"> • Fisheries ecology and sustainable fisheries • Environmental management • Coastal ecology • Importance of beaches • Climate change impacts 		Klwa-03: Fisheries decline	Klwa 01: Beach pollution Klwa-02: Beach erosion Klwa-04: Marine pollution		

Action areas

Table 98: Assessment of the importance of broad management dimension in addressing threats to local communities and ecosystems in Milwa District.

Intervention Dimension	Major Problem weight	Very important problem weight	Important Problem weight	Problem weight	Light Problem weight	Total Score
Integrated Coastal Zone Management (ICZM)	0	4	9	0	0	13
Integrated Water Resources Management (IWRM)	0	0	6	0	0	6
Land Use Management	0	4	9	0	0	13
Shoreline Management Planning	0	4	9	0	0	13
Solid and Liquid Waste Management	0	4	9	0	0	13
Sanitation	0	0	6	0	0	6
Capacity Building	0	0	3	0	0	3
Technology	0	4	9	0	0	13
Law Enforcement	0	4	9	0	0	13
Legal Review	0	4	9	0	0	13
Alternative/ Improved Livelihood	0	4	3	0	0	7
Awareness Raising	0	4	9	0	0	13
Education	0	4	9	0	0	13
Kilwa						139
			Kilwa District		Total	

The prioritised location-specific actions for Kilwa district relate to addressing the following:

- Responding to the decline in fisheries productivity due to numerous destructive activities, along the entire district's shoreline, particularly at the following fishing centres: Kiswere Harbour, Ruhaha, Mamba, Songo Mnara, Kilwa Masoko, Tikwoiri, Gigwera, Ras Wango and Songo Songo Archipelago where fisheries is of primary economic importance
- Beach pollution at Kilwa Kivinje, usually associated with poor waste management, often into creeks
- Coastal erosion at Kilwa Masoko, Kilwa Kisiwani (World Heritage Site) and Rushungi, attributed to destructive human coastal activities.

Lindi Rural District

Prioritized Threats

In Table 99 below the threats identified for Lindi Rural District have been listed and ranked according to their severity as established using the CRIAM method discussed extensively in Volumes I and II of the Coastal Profile. A rapid assessment has been made on the susceptibility of each threat to impacts of climate change more specifically, changes in weather patterns, extreme events, sea level rise, temperature rise and acidification.

Table 99: Prioritised threats for Lindi Rural District and a rapid assessment of threat susceptibility to climate change.

#	Threat as identified in Coastal Profile	Threat Level	Influence from Climate Change					
			Change in Patterns	Extreme events	Sea Level Rise	Temperature rise	Acidification	
Lindi Rural-03	Fisheries decline	Very important	0	-	0	0	0	Changes in climate are not expected to impact per se on the practise of destructive and illegal fisheries. Extreme weather events may in periods have a preventive effect.
Lindi Rural-05	Water source drying	Very important	++	+	+	+	0	Increase temperature will increase demand for freshwater, and evaporation rates; extreme events likely to slightly aggravate the situation with sea level rise having an impact.
Lindi Rural-06	Loss of forest habitat	Important problem	0	+	0	+	0	Changes in climate are not expected to impact per se on the poor land use management and failure to follow land use procedures. Impact from unsuitable resource use practises will be exacerbated notably temperature rise and extreme events and changes in climate exacerbating forest stress and fire risk.
Lindi Rural-02	Beach erosion	Problem	+	+++	+++	0	+	Impact from unsuitable resource use practises leading to beach erosion will be exacerbated notably from extreme events (storms and surges) and sea level rise. Coral growth likely reduce by acidification, increasing wave action and erosion.
Lindi Rural-01	Beach pollution	Light problem	0	0	0	0	0	Changes in climate are not expected to impact per se on the practise of poor waste disposal that affects beaches.
Lindi Rural-04	Marine pollution	Light problem	++	++	0	0	0	More frequent and severe weather events may increase the leaching of pollutants into water resources and thereby exacerbate the levels reaching local marine ecosystems.

Table x: Prioritised threats for Lindi Rural District, their location and causes.

#	Threat as identified in Coastal Profile	Threat Level	Location	Causes
LdiR-03:	Fisheries decline	Very important	All along the near shore Lindi	Destruction of fish nurseries such as mangrove cutting, illegal fishing such as dynamite fishing and other poor fishing methods as well as coral mining for lime production, poisonous fishing
LdiR-05:	Water source drying	Very important	River valley wells throughout	Forest clearing for agricultural purposes, burning charcoal, shifting cultivation
LdiR-06:	Loss of forest habitat	Important problem	Forested areas	Forest clearing for agricultural purposes, burning charcoal, shifting cultivation, mangrove cutting, dynamite fishing and other poor fishing methods
LdiR-02:	Beach erosion	Problem	Sudi, Shuka, Mmumbu, Kikwetu, Mbanja, Mchingana Kijiweni	Mangrove cutting, dynamite fishing, beach sand mining, unplanned construction along the coast.
LdiR-01:	Beach pollution	Light problem	Mchinga	Uncontrolled solid waste disposal, lack of latrines in some coastal houses, lack of proper fish landing facilities
LdiR 04:	Marine pollution	Light problem	River mouths	Influx of agrochemicals from upstream, poisonous fishing

Recommendations for threat mitigation measures

Overall measures to mitigate each if the identified natural resources related threats to coastal local communities and ecosystems have been tabulated in Table 216 (page 398) arranged under broad management dimensions headings. Table 100 provides an overview of the requirements/opportunities expressed within each of these management or intervention dimensions.

Table 100: Broad management intervention dimensions to address identified and prioritised threats to coastal communities and ecosystems in Lindi Rural District

Intervention Dimension	Statement	Threat pertinence at each RV				
		Major Problem	Very important problem	Important Problem	Problem	Light Problem
Integrated Coastal Zone Management (ICZM)	<p>Ensure local (district) coordination and participation in management of coastal land, water and resources use currently under complex pressures.</p> <p>Focus areas for integrated management to address include fisheries, shoreline (and riverbank) and mangrove deforestation, beach changes at Sudi, Shuka, Mmumbu, Kikwetu, Mbanja, Mchinga and Kijiweni.</p>		<p>LdiR-03: Fisheries decline</p> <p>LdiR-05: F/water drying</p>	LdiR-06: Forest loss	LdiR-02: Beach erosion	<p>LdiR-01: Beach pollution</p> <p>LdiR 04: Marine pollution</p>
Integrated Water Resources Management (IWRM)	<p>Link IWRM to coastal integrated planning to address impacts from upstream pollution, to cover Bwemburu, Namguru, Lukuledi river basin influences (ICARM).</p>		LdiR-05: F/water drying		LdiR-02: Beach erosion	<p>LdiR-01: Beach pollution</p> <p>LdiR 04: Marine pollution</p>
Land Use Management	<p>Land use information management systems to include ecosystems, habitats and water resources.</p> <p>Incorporate ecosystems, habitats, shoreline processes and water resources considerations in spatial planning.</p> <p>Develop and/or update district spatial plan accordingly and within national spatial planning framework.</p>		<p>LdiR-03: Fisheries decline</p> <p>LdiR-05: F/water drying</p>	LdiR-06: Forest loss	LdiR-02: Beach erosion	<p>LdiR-01: Beach pollution</p> <p>LdiR 04: Marine pollution</p>
Shoreline Management Planning	<p>District's shorelines included in a national level overall shoreline management investigation.</p> <p>Shoreline management units (areas of coast) identified for the district informing district level spatial planning as a basis for local shoreline management regulation.</p>		LdiR-03: Fisheries decline	LdiR-06: Forest loss	LdiR-02: Beach erosion	<p>LdiR-01: Beach pollution</p> <p>LdiR 04: Marine pollution</p>
Solid and Liquid Waste Management	<p>Pursue integrated solid and liquid waste management solutions covering entire district, especially Mchinga Bay and all harbours, considering:</p> <p>Waste water treatment systems:</p> <ul style="list-style-type: none"> - collection - treatment technology - discharge <p>Liquid and Solid Waste Management Systems:</p> <ul style="list-style-type: none"> - collection - storage - processing - financing - minimisation - reuse? <p>Green Infrastructure</p> <p>Storm Water Systems</p>					<p>LdiR-01: Beach pollution</p> <p>LdiR 04: Marine pollution</p>
Sanitation	<p>Pursue integrated solid and liquid waste management covering entire district, notably Mchinga Bay, considering:</p> <p>Waste water treatment systems:</p> <ul style="list-style-type: none"> - collection - treatment technology - discharge <p>Liquid and Solid Waste Management Systems:</p> <ul style="list-style-type: none"> - collection - storage - processing - financing - minimisation - reuse? <p>Green Infrastructure</p> <p>Storm Water Systems</p>					LdiR-01: Beach pollution

Intervention Dimension	Statement	Threat pertinence at each RV				
		Major Problem	Very important problem	Important Problem	Problem	Light Problem
Capacity Building	<p>Accompany management interventions with appropriate capacity building components at district level. Particular focus on spatial planning, shoreline management, fisheries management, conflict resolution, monitoring, law enforcement.</p> <p>Enhance information management systems to provide for better and systematically informed management decisions.</p>		<p>LdiR-03: Fisheries decline</p> <p>LdiR-05: F/water drying</p>	LdiR-06: Forest loss	LdiR-02: Beach erosion	<p>LdiR-01: Beach pollution</p> <p>LdiR 04: Marine pollution</p>
Technology	<p>Pursue opportunities through further technology development within:</p> <ul style="list-style-type: none"> • Inshore fisheries • Aquaculture • Value added to existing fisheries • Freshwater resources management • Integrated solid and liquid waste management • Forestry management • Shoreline management 		<p>LdiR-03: Fisheries decline</p> <p>LdiR-05: F/water drying</p>	LdiR-06: Forest loss	LdiR-02: Beach erosion	<p>LdiR-01: Beach pollution</p> <p>LdiR 04: Marine pollution</p>
Law Enforcement	<p>1) Enforce reviewed laws relevant to amongst others:</p> <ul style="list-style-type: none"> • Fisheries • Freshwater abstraction • Mangrove and coastal forest exploitation • Industrial and domestic waste • Land use (especially shoreline and set-back uses). • Coral (and sand) mining <p>2) Optimise enforcement through capacity building at district level and aligned with recommendations from national review.</p>		<p>LdiR-03: Fisheries decline</p> <p>LdiR-05: F/water drying</p>	LdiR-06: Forest loss	LdiR-02: Beach erosion	<p>LdiR-01: Beach pollution</p> <p>LdiR 04: Marine pollution</p>
Legal Review	<p>1) Guided by central integrated review of district legislative and regulatory instruments, including amongst others:</p> <ul style="list-style-type: none"> • Fisheries decline • Coral (and sand) mining • Land use (especially shoreline and set-back uses). <p>2) Follow revision (above) and revise and develop new district legislative and regulatory instruments.</p>		LdiR-03: Fisheries decline		LdiR-02: Beach erosion	
Alternative/Improved Livelihood	<p>Develop and offer alternative livelihoods for households currently engaged in destructive resource exploitation practises and those displaced and disadvantaged, focusing on Sudi, Shuka, Mmumbu, Kikwetu, Mbanja, Mchinga and Kijiweni, with particular efforts to provide alternatives for young generation.</p> <p>Improve current sustainable resource use livelihoods using technology advances and insights.</p>		<p>LdiR-03: Fisheries decline</p> <p>LdiR-05: F/water drying</p>	LdiR-06: Forest loss	LdiR-02: Beach erosion	
Awareness Raising	<p>Participate in national awareness raising campaigns related to coastal management challenges directed to the public at large and to schools.</p> <p>Develop and implement district level awareness raising campaigns targeting local stakeholders affected by or affecting:</p> <ul style="list-style-type: none"> • Fisheries decline • Freshwater management • Loss and degradation of coastal habitat and agricultural land • Erosion • Marine and beach pollution 		<p>LdiR-03: Fisheries decline</p> <p>LdiR-05: F/water drying</p>	LdiR-06: Forest loss	LdiR-02: Beach erosion	<p>LdiR-01: Beach pollution</p> <p>LdiR 04: Marine pollution</p>
Education	<p>Interact and participate in national curricula review for primary and secondary schools to enhance the knowledge and understanding about coastal management issues. Issues of particular relevance for the district are:</p> <ul style="list-style-type: none"> • Fisheries ecology and sustainable fisheries • Freshwater management and harvesting • Coastal ecology • Importance of beaches • Environmental management • Climate change impacts 		<p>LdiR-03: Fisheries decline</p> <p>LdiR-05: F/water drying</p>	LdiR-06: Forest loss	LdiR-02: Beach erosion	LdiR-01: Beach pollution

Action areas

Table 101: Assessment of the importance of broad management dimension in addressing threats to local communities and ecosystems in Lindi Rural District.

Intervention Dimension	Major Problem weight	Very important problem weight	Important Problem weight	Problem weight	Light Problem weight	Total Score
Integrated Coastal Zone Management (ICZM)	0	8	3	2	2	15
Integrated Water Resources Management (IWRM)	0	4	0	2	2	8
Land Use Management	0	8	3	2	2	15
Shoreline Management Planning	0	4	3	2	2	11
Solid and Liquid Waste Management	0	0	0	0	2	2
Sanitation	0	0	0	0	1	1
Capacity Building	0	8	3	2	2	15
Technology	0	8	3	2	2	15
Law Enforcement	0	8	3	2	2	15
Legal Review	0	4	0	2	0	6
Alternative/ Improved Livelihood	0	8	3	2	0	13
Awareness Raising	0	8	3	2	2	15
Education	0	8	3	2	1	14
Kilwa						
			Lindi Rural District		Total	145

The prioritised location-specific actions for Lindi Rural district relate to addressing the following:

- Responding to the decline in fisheries productivity due to numerous destructive activities, along the entire district's shoreline
- Freshwater sources declining through improper land use
- Loss of coastal forest habitat attributed to destructive human coastal activities

Lindi Urban District

Prioritized Threats

In Table 102 below the threats identified for Lindi Urban District have been listed and ranked according to their severity as established using the CRIAM method discussed extensively in Volumes I and II of the Coastal Profile. A rapid assessment has been made on the susceptibility of each threat to impacts of climate change more specifically, changes in weather patterns, extreme events, sea level rise, temperature rise and acidification.

Table 102: Prioritised threats for Lindi Urban District and a rapid assessment of threat susceptibility to climate change.

#	Threat as identified in Coastal Profile	Threat Level	Influence from Climate Change					
			Change in Patterns	Extreme events	Sea Level Rise	Temperature rise	Acidification	
Lindi Urban-03	Fisheries decline	Very important	0	-	0	0	0	Changes in climate are not expected to impact per se on the practise of destructive and illegal fisheries. Extreme weather events may in periods have a preventive effect.
Lindi Urban-06	Bush fires	Important problem	++	++	0	+	0	Impact from unsuitable resource use practises will be exacerbated notably temperature rise and extreme events and changes in climate exacerbating forest stress and fire risk.
Lindi Urban-01	Beach pollution	Problem	0	0	0	0	0	Changes in climate are not expected to impact per se on the practise of poor waste disposal that affects beaches.
Lindi Urban-02	Beach erosion	Problem	+	+++	+++	0	+	Impact from unsuitable resource use practises leading to beach erosion will be exacerbated notably from extreme events (storms and surges) and sea level rise. Coral growth likely reduce by acidification, increasing wave action and erosion.
Lindi Urban-04	Disease outbreak	Light problem	++	++	+	+	0	More frequent and severe weather events and sea level rise may increase flooding and standing water and sewage exacerbating disease outbreaks and higher temperatures increase disease propagation
Lindi Urban-05	Loss of habitat and agricultural areas	Light problem	0	+	0	+	0	Changes in climate are not expected to impact per se on the poor land use management and failure to follow land use procedures. Impact from unsuitable resource use practises will be exacerbated notably temperature rise and extreme events and changes in climate exacerbating forest stress and fire risk.

Table 103: Prioritised threats for Lindi Urban District, their location and causes.

#	Threat as identified in Coastal Profile	Threat Level	Location	Causes
LdiU-03:	Fisheries decline	Very important	All along the near shore waters	Destruction of fish nurseries such as mangrove cutting, illegal fishing such as dynamite fishing, poisonous fishing, beach seining and other poor fishing methods as well as coral mining for lime production
LdiU-06:	Bush fires	Important problem	Sub-urban wards	Agricultural use of fire to clear land
LdiU-01:	Beach pollution	Problem	Lindi Town	Uncontrolled solid and liquid waste disposal, lack of latrines in public areas (e.g. landing sites) and residential houses
LdiU-02:	Beach erosion	Problem	Many spots along the district beach stretch	Mangrove cutting, dynamite fishing, beach sand mining, coral mining
LdiU-04	Disease outbreak	Light problem	Urban centre and settlements	Inadequate sewerage control, flooding, poor quality of sewerage construction, poor solid waste management, uncontrolled food vending, lack of toilets in public areas
LdiU-05:	Loss of habitat and agricultural areas	Light problem	Lindi Town	Rapid urbanization, high increase of people immigration in the city, shifting cultivation

Recommendations for threat mitigation measures

Overall measures to mitigate each of the identified natural resources related threats to coastal local communities and ecosystems have been tabulated in Table 217 (page 399) arranged under broad management dimensions headings. Table 104 provides an overview of the requirements/opportunities expressed within each of these management or intervention dimensions.

Table 104: Broad management intervention dimensions to address identified and prioritised threats to coastal communities and ecosystems in Lindi Urban District

Intervention Dimension	Statement	Threat pertinence at each RV				
		Major Problem	Very important problem	Important Problem	Problem	Light Problem
Integrated Coastal Zone Management (ICZM)	<p>Ensure local (district) coordination and participation in management of coastal land, water and resources use currently under complex pressures.</p> <p>Focus areas for integrated management to address include fisheries, shoreline (and riverbank) and mangrove deforestation, beach changes around Lindi town.</p>		LdiU-03: Fisheries decline		LdiU-01: Beach pollution LdiU-02: Beach erosion	LdiU-04: Disease outbreak LdiU-05: Loss habitat & agric areas
Integrated Water Resources Management (IWRM)	Link IWRM to coastal integrated planning to address impacts from upstream pollution, to cover Lindi town and Lukuledi River (ICARM).				LdiU-01: Beach pollution LdiU-02: Beach erosion	LdiU-04: Disease outbreak
Land Use Management	<p>Land use information management systems to include ecosystems, habitats and water resources.</p> <p>Incorporate ecosystems, habitats, shoreline processes and water resources considerations in spatial planning.</p> <p>Develop and/or update district spatial plan accordingly and within national spatial planning framework.</p>		LdiU-03: Fisheries decline	LdiU-06: Bush fires	LdiU-01: Beach pollution LdiU-02: Beach erosion	LdiU-04: Disease outbreak LdiU-05: Loss habitat & agric areas
Shoreline Management Planning	<p>District's shorelines included in a national level overall shoreline management investigation.</p> <p>Shoreline management units (areas of coast) identified for the district informing district level spatial planning as a basis for local shoreline management regulation.</p>		LdiU-03: Fisheries decline		LdiU-01: Beach pollution LdiU-02: Beach erosion	LdiU-05: Loss habitat & agric areas
Solid and Liquid Waste Management	<p>Pursue integrated solid and liquid waste management solutions covering entire district, around Lindi town, considering:</p> <p>Waste water treatment systems:</p> <ul style="list-style-type: none"> - collection - treatment technology - discharge <p>Liquid and Solid Waste Management Systems:</p> <ul style="list-style-type: none"> - collection - storage - processing - financing - minimisation - reuse? <p>Green Infrastructure Storm Water Systems</p>				LdiU-01: Beach pollution	LdiU-04: Disease outbreak
Sanitation	<p>Pursue integrated solid and liquid waste management covering entire district, around Lindi town, considering:</p> <p>Waste water treatment systems:</p> <ul style="list-style-type: none"> - collection - treatment technology - discharge <p>Liquid and Solid Waste Management Systems:</p> <ul style="list-style-type: none"> - collection - storage - processing - financing - minimisation - reuse? <p>Green Infrastructure Storm Water Systems</p>				LdiU-01: Beach pollution	LdiU-04: Disease outbreak
Capacity Building	<p>Accompany management interventions with appropriate capacity building components at district level. Particular focus on spatial planning, shoreline management, fisheries management, conflict resolution, monitoring, law enforcement.</p> <p>Enhance information management systems to provide for better and systematically informed management decisions.</p>		LdiU-03: Fisheries decline	LdiU-06: Bush fires	LdiU-01: Beach pollution LdiU-02: Beach erosion	LdiU-04: Disease outbreak LdiU-05: Loss habitat & agric areas

Intervention Dimension	Statement	Threat pertinence at each RV				
		Major Problem	Very important problem	Important Problem	Problem	Light Problem
Technology	<p>Pursue opportunities through further technology development within:</p> <ul style="list-style-type: none"> • Inshore fisheries • Agricultural fire management • Integrated solid and liquid waste management • Aquaculture • Value added to existing fisheries • Shoreline management <p>Mangrove management</p>		LdiU-03: Fisheries decline	LdiU-06: Bush fires	LdiU-01: Beach pollution LdiU-02: Beach erosion	LdiU-04: Disease outbreak LdiU-05: Loss habitat & agric areas
Law Enforcement	<p>1) Enforce reviewed laws relevant to amongst others:</p> <ul style="list-style-type: none"> • Fisheries • Forest exploitation and fire management • Industrial and domestic waste • Coral (and sand) mining • Land use (especially shoreline and set-back uses). <p>2) Optimise enforcement through capacity building at district level and aligned with recommendations from national review.</p>		LdiU-03: Fisheries decline	LdiU-06: Bush fires	LdiU-01: Beach pollution LdiU-02: Beach erosion	LdiU-04: Disease outbreak LdiU-05: Loss habitat & agric areas
Legal Review	<p>1) Guided by central integrated review of district legislative and regulatory instruments, including amongst others:</p> <ul style="list-style-type: none"> • Fisheries decline • Coral (and sand) mining • Land use (especially shoreline and set-back uses). <p>2) Follow revision (above) and revise and develop new district legislative and regulatory instruments.</p>		LdiU-03: Fisheries decline		LdiU-02: Beach erosion	
Alternative/Improved Livelihood	<p>Develop and offer alternative livelihoods for households currently engaged in destructive resource exploitation practises and those displaced and disadvantaged, focusing on Lindi town area, with particular efforts to provide alternatives for young generation.</p> <p>Improve current sustainable resource use livelihoods using technology advances and insights.</p>		LdiU-03: Fisheries decline	LdiU-06: Bush fires	LdiU-02: Beach erosion	LdiU-05: Loss habitat & agric areas
Awareness Raising	<p>Participate in national awareness raising campaigns related to coastal management challenges directed to the public at large and to schools.</p> <p>Develop and implement district level awareness raising campaigns targeting local stakeholders affected by or affecting:</p> <ul style="list-style-type: none"> • Fisheries decline • Loss and degradation of coastal habitat and agricultural land • Marine and beach pollution • Erosion 		LdiU-03: Fisheries decline	LdiU-06: Bush fires	LdiU-01: Beach pollution LdiU-02: Beach erosion	LdiU-04: Disease outbreak LdiU-05: Loss habitat & agric areas
Education	<p>Interact and participate in national curricula review for primary and secondary schools to enhance the knowledge and understanding about coastal management issues. Issues of particular relevance for the district are:</p> <ul style="list-style-type: none"> • Fisheries ecology and sustainable fisheries • Environmental management • Coastal ecology • Importance of beaches • Climate change impacts 		LdiU-03: Fisheries decline	LdiU-06: Bush fires	LdiU-01: Beach pollution LdiU-02: Beach erosion	LdiU-04: Disease outbreak LdiU-05: Loss habitat & agric areas

Action areas

Table 105: Assessment of the importance of broad management dimension in addressing threats to local communities and ecosystems in Lindi Urban District.

Intervention Dimension	Major Problem weight	Very important problem weight	Important Problem weight	Problem weight	Light Problem weight	Total Score
Integrated Coastal Zone Management (ICZM)	0	4	0	4	2	10
Integrated Water Resources Management (IWRM)	0	0	0	4	1	5
Land Use Management	0	4	3	4	2	13
Shoreline Management Planning	0	4	0	4	1	9
Solid and Liquid Waste Management	0	0	0	2	1	3
Sanitation	0	0	0	2	1	3
Capacity Building	0	4	3	4	2	13
Technology	0	4	3	4	2	13
Law Enforcement	0	4	3	4	2	13
Legal Review	0	4	0	2	0	6
Alternative/ Improved Livelihood	0	4	3	2	1	10
Awareness Raising	0	4	3	4	2	13
Education	0	4	3	4	2	13
Kilwa				Lindi Urban District	Total	124

The prioritised location-specific actions for Lindi Urban district relate to addressing the following:

- Responding to the decline in fisheries productivity due to numerous destructive activities, along the entire district's shoreline
- Bush fires from poor agricultural practices
- Beach pollution at Lindi town, usually associated with fish landing sites and poor waste management, and linked to poor sanitation and disease outbreaks

Mtwara Rural District

Prioritized Threats

In Table 106 below the threats identified for Mtwara Rural District have been listed and ranked according to their severity as established using the CRIAM method discussed extensively in Volumes I and II of the Coastal Profile. A rapid assessment has been made on the susceptibility of each threat to impacts of climate change more specifically, changes in whether patterns, extreme events, sea level rise, temperature rise and acidification.

Table 106: Prioritised threats for Mtwara Rural District and a rapid assessment of threat susceptibility to climate change.

#	Threat as identified in Coastal Profile	Threat Level	Influence from Climate Change					
			Change in Patterns	Extreme events	Sea Level Rise	Temperature rise	Acidification	
Mtwara Rural-03	Fisheries decline	Very important	0	-	0	0	0	Changes in climate are not expected to impact per se on the practise of destructive and illegal fisheries. Extreme weather events may in periods have a preventive effect.
Mtwara Rural-05	Land use conflict	Very important	0	0	0	0	0	Climate change not likely to affect poor land use management.
Mtwara Rural-06	Habitat destruction	Important problem	0	0	0	0	0	Changes in climate are not expected to impact per se on the poor land use management and failure to follow land use procedures.
Mtwara Rural-01	Beach pollution	Problem	++	++	0	0	0	More frequent and severe weather events may increase the leaching of pollutants into water resources and thereby exacerbate the levels reaching local marine ecosystems. However, changes in climate are not expected to impact per se on the practise of poor waste disposal that affects beaches.
Mtwara Rural-02	Beach erosion	Problem	+	+++	+++	0	+	Impact from unsuitable resource use practises leading to beach erosion will be exacerbated notably from extreme events (storms and surges) and sea level rise. Coral growth likely reduce by acidification, increasing wave action and erosion.
Mtwara Rural-07	River-estuary pollution	Light problem	++	++	0	0	0	More frequent and severe weather events may increase the leaching of pollutants into water resources and thereby exacerbate the levels reaching local marine ecosystems.
Mtwara Rural-04	Disease outbreak	Light problem	++	++	+	+	0	More frequent and severe weather events and sea level rise may increase flooding and standing water and sewage exacerbating disease outbreaks and higher temperatures increase disease propagation

Table 107: Prioritised threats for Mtwara Rural District, their location and causes

#	Threat as identified in Coastal Profile	Threat Level	Location	Causes
MtwR-03:	Fisheries decline	Very important	All along the near shores of the district	Destruction of fish nurseries such as mangrove cutting, illegal fishing such as dynamite fishing and beach seining and other poor fishing methods as well as coral mining for lime production
MtwR-05:	Land use conflict	Very important	All along the coast	Conflict between environmental conservation groups and resource users; conflicting interests between sectors e.g. Forestry (mangrove) and mining (salt pans), forestry (mangrove) and lands;
MtwR-06:	Habitat destruction	Important problem	In many villages	Clearing of forest for agricultural use, deforestation, bush fires, coral mining, mangrove cutting, shifting cultivation, poverty, low level of education
MtwR-01:	Beach pollution	Problem	All along the coastal populated areas such as Msimbati	Uncontrolled solid and liquid waste disposal, often in creeks.
MtwR-02:	Beach erosion	Problem	Lijombe, Ras Mivinjeni, Sinda Bay, Mnazi Village	Mangrove cutting, dynamite fishing, beach sand mining, unplanned construction along the coast.
MtwR-07:	River-estuary pollution	Light problem	Ruvuma River	Mercury from gold mining upstream (Tamatama pers. com.).
MtwR-04:	Disease outbreak	Light problem	In many highly populated areas in the district	Inadequate liquid and solid waste product disposal and management system control, uncontrolled food vending.

Recommendations for threat mitigation measures

Overall measures to mitigate each if the identified natural resources related threats to coastal local communities and ecosystems have been tabulated in Table 218(page401) arranged under broad

management dimensions headings. Table 108 provides an overview of the requirements/opportunities expressed within each of these management or intervention dimensions.

Table 108: Broad management intervention dimensions to address identified and prioritised threats to coastal communities and ecosystems in Mtwara Rural District

Intervention Dimension	Statement	Threat pertinence at each RV				
		Major Problem	Very important problem	Important Problem	Problem	Light Problem
Integrated Coastal Zone Management (ICZM)	<p>Ensure local (district) coordination and participation in management of coastal land, water and resources use currently under complex pressures.</p> <p>Focus areas for integrated management to address include fisheries, shoreline (and riverbank) and mangrove deforestation, beach changes throughout the district, especially coastal villages of Msimbati, Lijombe, Ras Mivinjeni, Sinde Bay and Mnazi.</p>		MtwR-03: Fisheries decline MtwR-05: Land use conflict	MtwR-06: Habitat destruction	MtwR-01: Beach pollution MtwR-02: Beach erosion	MtwR-07: River-estuary pollution
Integrated Water Resources Management (IWRM)	Link IWRM to coastal integrated planning to address impacts from upstream pollution, to cover the Ruvuma River (ICARM).		MtwR-05: Land use conflict		MtwR-01: Beach pollution MtwR-02: Beach erosion	MtwR-07: River-estuary pollution
Land Use Management	<p>Land use information management systems to include ecosystems, habitats and water resources.</p> <p>Incorporate ecosystems, habitats, shoreline processes and water resources considerations in spatial planning.</p> <p>Develop and/or update district spatial plan accordingly and within national spatial planning framework.</p>		MtwR-03: Fisheries decline MtwR-05: Land use conflict	MtwR-06: Habitat destruction	MtwR-01: Beach pollution MtwR-02: Beach erosion	MtwR-07: River-estuary pollution MtwR-04: Disease outbreak
Shoreline Management Planning	<p>District's shorelines included in a national level overall shoreline management investigation.</p> <p>Shoreline management units (areas of coast) identified for the district informing district level spatial planning as a basis for local shoreline management regulation.</p>		MtwR-03: Fisheries decline MtwR-05: Land use conflict	MtwR-06: Habitat destruction	MtwR-01: Beach pollution MtwR-02: Beach erosion	
Solid and Liquid Waste Management	<p>Pursue integrated solid and liquid waste management solutions covering entire district, especially coastal villages of Msimbati, Lijombe, Ras Mivinjeni, Sinde Bay and Mnazi and all harbours, considering:</p> <p>Waste water treatment systems: - collection - treatment technology - discharge</p> <p>Liquid and Solid Waste Management Systems: - collection - storage - processing - financing - minimisation - reuse?</p> <p>Green Infrastructure Storm Water Systems</p>				MtwR-01: Beach pollution	MtwR-07: River-estuary pollution MtwR-04: Disease outbreak
Sanitation	<p>Pursue integrated solid and liquid waste management covering entire district, from especially coastal villages of Msimbati, Lijombe, Ras Mivinjeni, Sinde Bay and Mnazi, considering:</p> <p>Waste water treatment systems: - collection - treatment technology - discharge</p> <p>Liquid and Solid Waste Management Systems: - collection - storage - processing - financing - minimisation - reuse?</p> <p>Green Infrastructure Storm Water Systems</p>				MtwR-01: Beach pollution	MtwR-04: Disease outbreak

Intervention Dimension	Statement	Threat pertinence at each RV				
		Major Problem	Very important problem	Important Problem	Problem	Light Problem
Capacity Building	<p>Accompany management interventions with appropriate capacity building components at district level. Particular focus on spatial planning, shoreline management, fisheries management, conflict resolution, monitoring, law enforcement.</p> <p>Enhance information management systems to provide for better and systematically informed management decisions.</p>		<p>MtwR-03: Fisheries decline</p> <p>MtwR-05: Land use conflict</p>	MtwR-06: Habitat destruction	<p>MtwR-01: Beach pollution</p> <p>MtwR-02: Beach erosion</p>	<p>MtwR-07: River-estuary pollution</p> <p>MtwR-04: Disease outbreak</p>
Technology	<p>Pursue opportunities through further technology development within:</p> <ul style="list-style-type: none"> • Shoreline management • Inshore fisheries • Integrated solid and liquid waste management • Aquaculture • Value added to existing fisheries • Mangrove management 		<p>MtwR-03: Fisheries decline</p> <p>MtwR-05: Land use conflict</p>	MtwR-06: Habitat destruction	<p>MtwR-01: Beach pollution</p> <p>MtwR-02: Beach erosion</p>	<p>MtwR-07: River-estuary pollution</p> <p>MtwR-04: Disease outbreak</p>
Law Enforcement	<p>1) Enforce reviewed laws relevant to amongst others:</p> <ul style="list-style-type: none"> • Coral (and sand) mining • Mangrove and coastal forest exploitation • Fisheries • Industrial and domestic waste • Land use (especially shoreline and set-back uses). <p>2) Optimise enforcement through capacity building at district level and aligned with recommendations from national review.</p>		<p>MtwR-03: Fisheries decline</p> <p>MtwR-05: Land use conflict</p>	MtwR-06: Habitat destruction	<p>MtwR-01: Beach pollution</p> <p>MtwR-02: Beach erosion</p>	<p>MtwR-07: River-estuary pollution</p> <p>MtwR-04: Disease outbreak</p>
Legal Review	<p>1) Guided by central integrated review of district legislative and regulatory instruments, including amongst others:</p> <ul style="list-style-type: none"> • Fisheries decline • Land use (especially shoreline and set-back uses). • Coral (and sand) mining <p>2) Follow revision (above) and revise and develop new district legislative and regulatory instruments.</p>		<p>MtwR-03: Fisheries decline</p> <p>MtwR-05: Land use conflict</p>		MtwR-02: Beach erosion	
Alternative/Improved Livelihood	<p>Develop and offer alternative livelihoods for households currently engaged in destructive resource exploitation practises and those displaced and disadvantaged, focusing especially on coastal villages of Msimbati, Lijombe, Ras Mivinjani, Sinde Bay and Mnazi, with particular efforts to provide alternatives for young generation.</p> <p>Improve current sustainable resource use livelihoods using technology advances and insights.</p>		<p>MtwR-03: Fisheries decline</p> <p>MtwR-05: Land use conflict</p>	MtwR-06: Habitat destruction	MtwR-02: Beach erosion	
Awareness Raising	<p>Participate in national awareness raising campaigns related to coastal management challenges directed to the public at large and to schools.</p> <p>Develop and implement district level awareness raising campaigns targeting local stakeholders affected by or affecting:</p> <ul style="list-style-type: none"> • Fisheries decline • Land use conflict • Loss and degradation of coastal habitat and agricultural land • Erosion • Marine and beach pollution 		<p>MtwR-03: Fisheries decline</p> <p>MtwR-05: Land use conflict</p>	MtwR-06: Habitat destruction	<p>MtwR-01: Beach pollution</p> <p>MtwR-02: Beach erosion</p>	<p>MtwR-07: River-estuary pollution</p> <p>MtwR-04: Disease outbreak</p>
Education	<p>Interact and participate in national curricula review for primary and secondary schools to enhance the knowledge and understanding about coastal management issues. Issues of particular relevance for the district are:</p> <ul style="list-style-type: none"> • Fisheries ecology and sustainable fisheries • Coastal ecology • Importance of beaches • Environmental management • Climate change impacts 		<p>MtwR-03: Fisheries decline</p> <p>MtwR-05: Land use conflict</p>	MtwR-06: Habitat destruction	<p>MtwR-01: Beach pollution</p> <p>MtwR-02: Beach erosion</p>	<p>MtwR-07: River-estuary pollution</p> <p>MtwR-04: Disease outbreak</p>

Action areas

Table 109: Assessment of the importance of broad management dimension in addressing threats to local communities and ecosystems in Mtwara Rural District.

Intervention Dimension	Major Problem weight	Very important problem weight	Important Problem weight	Problem weight	Light Problem weight	Total Score
Integrated Coastal Zone Management (ICZM)	0	8	3	4	1	16
Integrated Water Resources Management (IWRM)	0	4	0	4	1	9
Land Use Management	0	8	3	4	2	17
Shoreline Management Planning	0	8	3	4	0	15
Solid and Liquid Waste Management	0	0	0	2	2	4
Sanitation	0	0	0	2	1	3
Capacity Building	0	8	3	4	2	17
Technology	0	8	3	4	2	17
Law Enforcement	0	8	3	4	2	17
Legal Review	0	8	0	2	0	10
Alternative/ Improved Livelihood	0	8	3	2	0	13
Awareness Raising	0	8	3	4	2	17
Education	0	8	3	4	2	17
Kilwa						
			Mtwara Rural District		Total	172

The prioritised location-specific actions for Mtwara Rural district relate to addressing the following:

- Responding to the decline in fisheries productivity due to numerous destructive activities, along the entire district's shoreline
- Land use conflict at various locations along the coast
- Forest habitat destruction from poor agricultural practices
- Beach pollution at Msimbati, usually associated with poor sanitation and waste management
- Beach erosion at diverse sites within Mnzai Bay

Mtwara Urban District

Prioritized Threats

In Table 110 below the threats identified for Mtwara Urban District have been listed and ranked according to their severity as established using the CRIAM method discussed extensively in Volumes I and II of the Coastal Profile. A rapid assessment has been made on the susceptibility of each threat to impacts of climate change more specifically, changes in weather patterns, extreme events, sea level rise, temperature rise and acidification.

Table 110: Prioritised threats for Mtwara Urban District and a rapid assessment of threat susceptibility to climate change.

#	Threat as identified in Coastal Profile	Threat Level	Influence from Climate Change					
			Change in Patterns	Extreme events	Sea Level Rise	Temperature rise	Acidification	
Mtwara Urban-03	Fisheries decline	Very important	0	-	0	0	0	Changes in climate are not expected to impact per se on the practise of destructive and illegal fisheries. Extreme weather events may in periods have a preventive effect.
Mtwara Urban -05	Beach pollution	Very important	0	0	0	0	0	Changes in climate are not expected to impact per se on the practise of poor waste disposal that affects beaches.
Mtwara Urban -06	Beach erosion	Very important	+	+++	+++	0	+	Impact from unsuitable resource use practises leading to beach erosion will be exacerbated notably from extreme events (storms and surges) and sea level rise. Coral growth likely reduce by acidification, increasing wave action and erosion.
Mtwara Urban -01	Loss of habitat and agricultural area	Very important	0	0	0	0	0	Changes in climate are not expected to impact per se on the poor land use management and failure to follow land use procedures.
Mtwara Urban -02	Disease outbreak	Problem	++	++	+	+	0	More frequent and severe weather events and sea level rise may increase flooding and standing water and sewage exacerbating disease outbreaks and higher temperatures increase disease propagation
Mtwara Urban -07	Heavy metal pollution	Light problem	+	+	0	0	0	More frequent and severe weather events may increase the transport and re-suspension of pollutants into and/or incoastal water and local marine ecosystems.

Table 111: Prioritised threats for Mtwara Urban District, their location and causes

#	Threat as identified in Coastal Profile	Threat Level	Location	Causes
MtwU-03:	Fisheries decline	Very important	All along the near shore seas	Destruction of fish nurseries such as mangrove cutting, illegal fishing such as dynamite fishing and other poor fishing methods (beach seine) as well as coral mining for lime production
MtwU-05:	Beach pollution	Very important	At the passage to Mtwara Port, Mikindani	Uncontrolled solid and liquid waste disposal
MtwU-06:	Beach erosion	Very important	Mikindani and Mtwara towns	Mangrove cutting, dynamite fishing, beach sand mining, unplanned construction along the coast.
MtwU-01:	Loss of habitat & agric area	Very important	Mtwara urban suburbs, near shores	Rapid urbanization, high increase of people immigration in the city. Beach seining, coral mining, dynamite fishing.
MtwU-02:	Disease outbreak	Problem	Mtwara Town, Mikindani	Inadequate sewerage control, poor solid waste management, uncontrolled food vending.
MtwU-07:	Heavy metal pollution	Light problem	Within Mtwara Port waters, near shore waters	Ships and machineries produced wastes at the port and nearby upstream areas

Recommendations for threat mitigation measures

Overall measures to mitigate each if the identified natural resources related threats to coastal local communities and ecosystems have been tabulated in Table 219 (page 403) arranged under broad management dimensions headings. Table 112 provides an overview of the requirements/opportunities expressed within each of these management or intervention dimensions.

Table 112: Broad management intervention dimensions to address identified and prioritised threats to coastal communities and ecosystems in Mtwara Urban District

Intervention Dimension	Statement	Threat pertinence at each RV				
		Major Problem	Very important problem	Important Problem	Problem	Light Problem
Integrated Coastal Zone Management (ICZM)	<p>Ensure local (district) coordination and participation in management of coastal land, water and resources use currently under complex pressures.</p> <p>Focus areas for integrated management to address include fisheries, shoreline (and riverbank) and mangrove deforestation, beach changes from Mikindani and Mtwara towns.</p>		<p>MtwU-03: Fisheries decline</p> <p>MtwU-05: Beach pollution</p> <p>MtwU-06: Beach erosion</p> <p>MtwU-01: Loss of habitat & agric area</p>			MtwU-07: Heavy metal pollution
Integrated Water Resources Management (IWRM)	<p>Link IWRM to coastal integrated planning to address impacts from upstream pollution (from five minor streams and Ruvuma River), and to cover Mikindani and Mtwara towns (ICARM).</p>		<p>MtwU-05: Beach pollution</p> <p>MtwU-06: Beach erosion</p>			MtwU-07: Heavy metal pollution
Land Use Management	<p>Land use information management systems to include ecosystems, habitats and water resources.</p> <p>Incorporate ecosystems, habitats, shoreline processes and water resources considerations in spatial planning.</p> <p>Develop and/or update district spatial plan accordingly and within national spatial planning framework.</p>		<p>MtwU-03: Fisheries decline</p> <p>MtwU-05: Beach pollution</p> <p>MtwU-06: Beach erosion</p> <p>MtwU-01: Loss of habitat & agric area</p>		MtwU-02: Disease outbreak	MtwU-07: Heavy metal pollution
Shoreline Management Planning	<p>District's shorelines included in a national level overall shoreline management investigation.</p> <p>Shoreline management units (areas of coast) identified for the district informing district level spatial planning as a basis for local shoreline management regulation.</p>		<p>MtwU-03: Fisheries decline</p> <p>MtwU-05: Beach pollution</p> <p>MtwU-06: Beach erosion</p>			MtwU-07: Heavy metal pollution
Solid and Liquid Waste Management	<p>Pursue integrated solid and liquid waste management solutions covering entire district, from Mikindani and Mtwara towns and all harbours, considering:</p> <p>Waste water treatment systems:</p> <ul style="list-style-type: none"> - collection - treatment technology - discharge <p>Liquid and Solid Waste Management Systems:</p> <ul style="list-style-type: none"> - collection - storage - processing - financing - minimisation - reuse? <p>Green Infrastructure</p> <p>Storm Water Systems</p>		MtwU-05: Beach pollution		MtwU-02: Disease outbreak	MtwU-07: Heavy metal pollution
Sanitation	<p>Pursue integrated solid and liquid waste management covering entire district, from Mikindani and Mtwara towns, considering:</p> <p>Waste water treatment systems:</p> <ul style="list-style-type: none"> - collection - treatment technology - discharge <p>Liquid and Solid Waste Management Systems:</p> <ul style="list-style-type: none"> - collection - storage - processing - financing - minimisation - reuse? <p>Green Infrastructure</p> <p>Storm Water Systems</p>		MtwU-05: Beach pollution		MtwU-02: Disease outbreak	

Intervention Dimension	Statement	Threat pertinence at each RV				
		Major Problem	Very important problem	Important Problem	Problem	Light Problem
Capacity Building	<p>Accompany management interventions with appropriate capacity building components at district level. Particular focus on spatial planning, shoreline management, fisheries management, conflict resolution, monitoring, law enforcement.</p> <p>Enhance information management systems to provide for better and systematically informed management decisions.</p>		<p>MtwU-03: Fisheries decline</p> <p>MtwU-05: Beach pollution</p> <p>MtwU-06: Beach erosion</p> <p>MtwU-01: Loss of habitat & agric area</p>		MtwU-02: Disease outbreak	MtwU-07: Heavy metal pollution
Technology	<p>Pursue opportunities through further technology development within:</p> <ul style="list-style-type: none"> Inshore fisheries Aquaculture Value added to existing fisheries Integrated solid and liquid waste management Shoreline management Mangrove management <p>Water borne diseases</p>		<p>MtwU-03: Fisheries decline</p> <p>MtwU-05: Beach pollution</p> <p>MtwU-06: Beach erosion</p> <p>MtwU-01: Loss of habitat & agric area</p>		MtwU-02: Disease outbreak	MtwU-07: Heavy metal pollution
Law Enforcement	<p>1) Enforce reviewed laws relevant to amongst others:</p> <ul style="list-style-type: none"> Fisheries Industrial and domestic waste Coral (and sand) mining Mangrove and coastal forest exploitation Land use (especially shoreline and set-back uses). Mining waste management <p>2) Optimise enforcement through capacity building at district level and aligned with recommendations from national review.</p>		<p>MtwU-03: Fisheries decline</p> <p>MtwU-05: Beach pollution</p> <p>MtwU-06: Beach erosion</p> <p>MtwU-01: Loss of habitat & agric area</p>		MtwU-02: Disease outbreak	MtwU-07: Heavy metal pollution
Legal Review	<p>1) Guided by central integrated review of district legislative and regulatory instruments, including amongst others:</p> <ul style="list-style-type: none"> Fisheries decline Coral (and sand) mining Land use (especially shoreline and set-back uses). <p>2) Follow revision (above) and revise and develop new district legislative and regulatory instruments.</p>		<p>MtwU-03: Fisheries decline</p> <p>MtwU-06: Beach erosion</p>			
Alternative/Improved Livelihood	<p>Develop and offer alternative livelihoods for households currently engaged in destructive resource exploitation practises and those displaced and disadvantaged, focusing on Mikindani and Mtwara towns, with particular efforts to provide alternatives for young generation.</p> <p>Improve current sustainable resource use livelihoods using technology advances and insights.</p>		<p>MtwU-03: Fisheries decline</p> <p>MtwU-06: Beach erosion</p> <p>MtwU-01: Loss of habitat & agric area</p>			MtwU-07: Heavy metal pollution
Awareness Raising	<p>Participate in national awareness raising campaigns related to coastal management challenges directed to the public at large and to schools.</p> <p>Develop and implement district level awareness raising campaigns targeting local stakeholders affected by or affecting:</p> <ul style="list-style-type: none"> Fisheries decline Marine and beach pollution Erosion Loss and degradation of coastal habitat and agricultural land Water borne diseases Mining waste management 		<p>MtwU-03: Fisheries decline</p> <p>MtwU-05: Beach pollution</p> <p>MtwU-06: Beach erosion</p> <p>MtwU-01: Loss of habitat & agric area</p>		MtwU-02: Disease outbreak	MtwU-07: Heavy metal pollution
Education	<p>Interact and participate in national curricula review for primary and secondary schools to enhance the knowledge and understanding about coastal management issues. Issues of particular relevance for the district are:</p> <ul style="list-style-type: none"> Fisheries ecology and sustainable fisheries Coastal ecology Importance of beaches Environmental management Climate change impacts Mining waste management 		<p>MtwU-03: Fisheries decline</p> <p>MtwU-05: Beach pollution</p> <p>MtwU-06: Beach erosion</p> <p>MtwU-01: Loss of habitat & agric area</p>		MtwU-02: Disease outbreak	MtwU-07: Heavy metal pollution

Action areas

Table 113: Assessment of the importance of broad management dimension in addressing threats to local communities and ecosystems in Mtwara Urban District.

Intervention Dimension	Major Problem weight	Very important problem weight	Important Problem weight	Problem weight	Light Problem weight	Total Score
Integrated Coastal Zone Management (ICZM)	0	16	0	0	1	17
Integrated Water Resources Management (IWRM)	0	8	0	0	1	9
Land Use Management	0	16	0	2	1	19
Shoreline Management Planning	0	12	0	0	1	13
Solid and Liquid Waste Management	0	4	0	2	1	7
Sanitation	0	4	0	2	0	6
Capacity Building	0	16	0	2	1	19
Technology	0	16	0	2	1	19
Law Enforcement	0	16	0	2	1	19
Legal Review	0	8	0	0	0	8
Alternative/ Improved Livelihood	0	12	0	0	1	13
Awareness Raising	0	12	0	2	1	15
Education	0	12	0	2	1	15
Kilwa						
			Mtwara Urban District		Total	179

The prioritised location-specific actions for Mtwara Urban district relate to addressing the following:

- Responding to the decline in fisheries productivity due to numerous destructive activities, along the entire district's shoreline
- Beach pollution at Mtwara Port area and Mikindani, usually associated with poor sanitation and waste management
- Beach erosion at Mikindani and Mtwara towns
- Immigration of people from surrounding countryside seeking work and building on agricultural and natural habitat land, requiring urban planning
- Disease outbreaks in Mtwara and Mikindani towns from inadequate sewage and waste management as well as unhygienic food vending

Zanzibar Themes

Fisheries

The fisheries sector is a very important contributor to the Zanzibar economy at around 7% of GDP. It is also important for generating income and employment. Fisheries is mostly artisanal with a small semi-industrial component. Cultivation and export of dry seaweed is a significant economic activity on Zanzibar.



Most fishing takes place near the islands within internal and territorial water. There are two principal focus areas in the finfish fishery of Zanzibar: the inshore demersal fishery and the pelagic fishery (both inshore and offshore). Due to the virtual absence of standing freshwater bodies on the main islands of Zanzibar, fishery of freshwater species is insignificant.

The pragmatic outlook on the fisheries sector on Zanzibar is that there is little room for expansion and the current pressure is damaging the productivity. Catches are unlikely to increase with more fishing effort.

Some potential increase may be gained from deeper water operations, improvements in efficiency and/or value-added in the small pelagic fishery and from coastal aquaculture.

The current policy of “open access” raises concern as overfishing is taking place. Access may need regulation to ensure that the catch realised does not exceed maximum sustainable yields.

Prioritized Threats

In Table 114 below the threats identified related to fisheries have been listed and ranked according to their severity as established using the CRIAM method discussed extensively in Volumes I and II of the Coastal Profile. A rapid assessment has been made on the susceptibility of each threat to impacts of climate change more specifically, changes in weather patterns, extreme events, sea level rise, temperature rise and acidification.

Table 114: Prioritised threats related to fisheries and a rapid assessment of threat susceptibility to climate change.

#	Threat as identified in Coastal Profile	Threat Level	Influence from Climate Change					
			Change in Patterns	Extreme events	Sea Level Rise	Temperature rise	Acidification	
Z-Fish-03	Destructive and illegal fishing - causing decline in productivity due to habitat destruction through beach seine, spear guns and dragnets, adversely affecting the fisher community livelihoods.	Major Problem	0	-	0	0	0	Changes in climate are not expected to impact per se on the practise of destructive and illegal fisheries. Extreme weather events may in periods have a preventive effect.
Z-Fish-02	Social conflicts over access to resource - where cultural and historical rivalry over “traditional” fishing grounds increases as pressure on the resource increases; also includes increasing resentment of migratory fishing groups of “dago” fishers during seasonal visits, using gears considered destructive or conflict with local traditions.	Very Important Problem	0	0	0	0	0	
Z-Fish-04	Weaknesses in management leading to conflicts with tourists over coral reefs to dive and to snorkel, fish landing sites and tourist hotels; to seaweed farming conflict with boat users and tourists; allowing open access fishery, thus increasing fishing pressure and stock depletion is difficult to manage.	Very Important Problem	0	0	0	0	0	No impact from climate change on this threat
Z-Fish-05	Limited alternatives or investment, are all attributed as causes for the current behaviour of fishers.	Very Important Problem	0	0	0	0	0	No impact from climate change on this threat
Z-Fish-06	Absence of weather (climate) forecasting resulting in losses of drying seaweed	Very Important Problem	+	++	0	0	0	Changed weather patterns and extreme event may aggravate the impact of not having an efficient forecasting

#	Threat as identified in Coastal Profile	Threat Level	Influence from Climate Change				
			Change in Patterns	Extreme events	Sea Level Rise	Temperature rise	Acidification
Z-Fish-07	Inadequate understanding of fisheries resources biology in support of management	Very Important Problem	0	0	0	0	0
No impact from climate change on this threat							
Z-Fish-08	Weak dissemination of aquaculture techniques	Very Important Problem	0	0	0	0	0
No impact from climate change on this threat							
Z-Fish-01	Social conflicts over fishing gears - where local fishers use gears or methods (some of which are illegal) that are not acceptable by neighbouring villages.	Important Problem	0	0	0	0	0
No impact from climate change on this threat							
+++	Threat is severely aggravated from climate change dimension						
++	Threat is aggravated from climate change dimension						
+	Threat is slightly aggravated from climate change dimension						
0	No influence of threat from climate change dimension						
-	Remediating effect on threat from climate change dimension						

Recommendations for threat mitigation measures

Overall measures to mitigate each of the identified fisheries related threats to coastal local communities and ecosystems have been tabulated in Table 190 (page 355) arranged under broad management dimensions headings. Table 115 below provides an overview of the requirements/opportunities expressed within each of these management or intervention dimensions.

Table 115: Broad management intervention dimensions to address identified and prioritised threats to coastal communities and ecosystems associated with fisheries in Zanzibar

Intervention Dimension	Statement	Threat pertinence at each RV				
		Major Problem (RV 5)	Very important problem (RV 4)	Important Problem (RV 3)	Problem (RV 2)	Light Problem (RV 1)
Integrated Coastal Zone Management (ICZM)	Ensure coordination and participation in management of coastal land, water and resources use currently under complex pressures. Facilitate dialogues required to alleviate social conflicts over resources use. Link with hinterland management to address catchment and riverbank deforestation, river flow changes and river pollution, all of which affect the coast in many ways (ICARM).	Z-Fish-03: Destructive and illegal fishing	Z-Fish-02: Social conflicts over access to resource Z-Fish-04: Weakness in fisheries management	Z-Fish-01: Social conflict over fishing gear		
Integrated Water Resources Management (IWRM)						
Land Use Management	Land use information management systems to include ecosystems, habitats and water resources. Incorporate ecosystems, habitats and water resources considerations in spatial planning. Inform hinterland spatial planning to direct zoning to prevent downstream impacts on fisheries habitats.	Z-Fish-03: Destructive and illegal fishing	Z-Fish-02: Social conflicts over access to resource Z-Fish-04: Weakness in fisheries management	Z-Fish-01: Social conflict over fishing gear		
Shoreline Management Planning	Establish a systematic overview of coastal processes through a shoreline management investigation, considering the entire coast, and inform spatial planning accordingly. Sediment cell resolution national effort, management unit resolution regional/ district effort.	Z-Fish-03: Destructive and illegal fishing	Z-Fish-02: Social conflicts over access to resource Z-Fish-04: Weakness in fisheries management	Z-Fish-01: Social conflict over fishing gear		
Solid and Liquid Waste Management						
Sanitation						

Intervention Dimension	Statement	Threat pertinence at each RV				
		Major Problem (RV 5)	Very important problem (RV 4)	Important Problem (RV 3)	Problem (RV 2)	Light Problem (RV 1)
Capacity Building	<p>Accompany management interventions with appropriate capacity building components. Particular focus on spatial planning, shoreline management, conflict resolution, monitoring, law enforcement.</p> <p>Enhance information management systems to provide for better and systematically informed management decisions.</p>	Z-Fish-03: Destructive and illegal fishing	<p>Z-Fish-02: Social conflicts over access to resource</p> <p>Z-Fish-04: Weakness in fisheries management</p> <p>Z-Fish-06: Absence of weather forecasting causing seaweed loss</p> <p>Z-Fish-07: Inadequate understanding of fisheries resources biology</p> <p>Z-Fish-08: Weak extension of aquaculture techniques</p>	Z-Fish-01: Social conflict over fishing gear		
Technology	<p>Pursue opportunities through further technology development within:</p> <ul style="list-style-type: none"> • Offshore fisheries • Aquaculture • Value addition • Integrated solid and liquid waste management • Shoreline management 	Z-Fish-03: Destructive and illegal fishing	<p>Z-Fish-02: Social conflicts over access to resource</p> <p>Z-Fish-05: Limited alternatives and investments</p> <p>Z-Fish-06: Absence of weather forecasting causing seaweed loss</p> <p>Z-Fish-07: Inadequate understanding of fisheries resources biology</p> <p>Z-Fish-08: Weak extension of aquaculture techniques</p>	Z-Fish-01: Social conflict over fishing gear		
Law Enforcement	<p>1) Integrated review of laws, regulations and their enforcement within amongst others:</p> <ul style="list-style-type: none"> • Fisheries, • Mangrove exploitation • Coral mining • Agrochemicals • Industrial and domestic waste • Land use <p>2) Optimise enforcement through capacity building and coordination following recommendations from review.</p>	Z-Fish-03: Destructive and illegal fishing	<p>Z-Fish-02: Social conflicts over access to resource</p> <p>Z-Fish-04: Weakness in fisheries management</p>	Z-Fish-01: Social conflict over fishing gear		
Legal Review	<p>1) Integrated review of laws, regulations and their enforcement within amongst others:</p> <ul style="list-style-type: none"> • Fisheries, • Mangrove exploitation • Coral mining • Agrochemicals • Industrial and domestic waste • Land use <p>2) Initiate revision of existing and develop new laws, regulations according to recommendations from review</p>	Z-Fish-03: Destructive and illegal fishing	<p>Z-Fish-02: Social conflicts over access to resource</p> <p>Z-Fish-04: Weakness in fisheries management</p>	Z-Fish-01: Social conflict over fishing gear		
Alternative/ Improved Livelihood	<p>Develop and offer alternative livelihoods for households currently engaged in destructive resource exploitation practises. Particular efforts to provide alternatives for young generation.</p> <p>Improve current sustainable resource use livelihoods using technology advances and insights.</p>	Z-Fish-03: Destructive and illegal fishing	<p>Z-Fish-02: Social conflicts over access to resource</p> <p>Z-Fish-05: Limited alternatives and investments</p>	Z-Fish-01: Social conflict over fishing gear		

Intervention Dimension	Statement	Threat pertinence at each RV				
		Major Problem (RV 5)	Very important problem (RV 4)	Important Problem (RV 3)	Problem (RV 2)	Light Problem (RV 1)
Awareness Raising	Develop and launch awareness raising campaigns related to coastal management challenges directed to the public at large and to schools. Develop and launch issue specific awareness raising campaigns targeting stakeholders affected by or affecting the issue.	Z-Fish-03: Destructive and illegal fishing	Z-Fish-02: Social conflicts over access to resource Z-Fish-04: Weakness in fisheries management Z-Fish-05: Limited alternatives and investments Z-Fish-06: Absence of weather forecasting causing seaweed loss Z-Fish-07: Inadequate understanding of fisheries resources biology	Z-Fish-01: Social conflict over fishing gear		
Education	Engage in curricula review and development for primary and secondary schools to enhance the knowledge and understanding about coastal management issues- Issue of particular relevance from a fisheries perspective include: <ul style="list-style-type: none"> • Fisheries ecology and sustainable fisheries • Impact from catchment management on coastal fisheries • Environmental management • Coastal ecology • Importance of beaches 	Z-Fish-03: Destructive and illegal fishing	Z-Fish-02: Social conflicts over access to resource Z-Fish-04: Weakness in fisheries management Z-Fish-05: Limited alternatives and investments Z-Fish-07: Inadequate understanding of fisheries resources biology	Z-Fish-01: Social conflict over fishing gear		

Action areas

In Table 116 below an overview has been established on how strongly each intervention dimension responds to threats to local communities and ecosystems as perceived by local stakeholders.

For each intervention dimension and for each problem class the number of threats considered to benefit from the intervention have been multiplied by the range value (RV) for the given problem class. The total score for each management dimension has then been calculated by adding the values achieved. The table thus provides an indication of the importance of each intervention dimension in addressing identified and ranked threats. In the same manner Figure 30 gives a graphical presentation of the relevance of intervention dimensions in addressing the identified threats related to with fisheries.

Table 116: Assessment of the importance of broad management dimension in addressing threats to local communities and ecosystems associated with fisheries.

Intervention Dimension	Major Problem weight	Very important problem weight	Important Problem weight	Problem weight	Light Problem weight	Total Score
Integrated Coastal Zone Management (ICZM)	5	8	3	0	0	16
Integrated Water Resources Management (IWRM)	0	0	0	0	0	0
Land Use Management	5	8	3	0	0	16
Shoreline Management Planning	5	8	3	0	0	16
Solid and Liquid Waste Management	0	0	0	0	0	0
Sanitation	0	0	0	0	0	0
Capacity Building	5	20	3	0	0	28
Technology	5	20	3	0	0	28
Law Enforcement	5	8	3	0	0	16
Legal Review	5	8	3	0	0	16
Alternative/ Improved Livelihood	5	8	3	0	0	16
Awareness Raising	5	20	3	0	0	28
Education	5	20	3	0	0	28
Zanzibar				Fisheries	Total	208

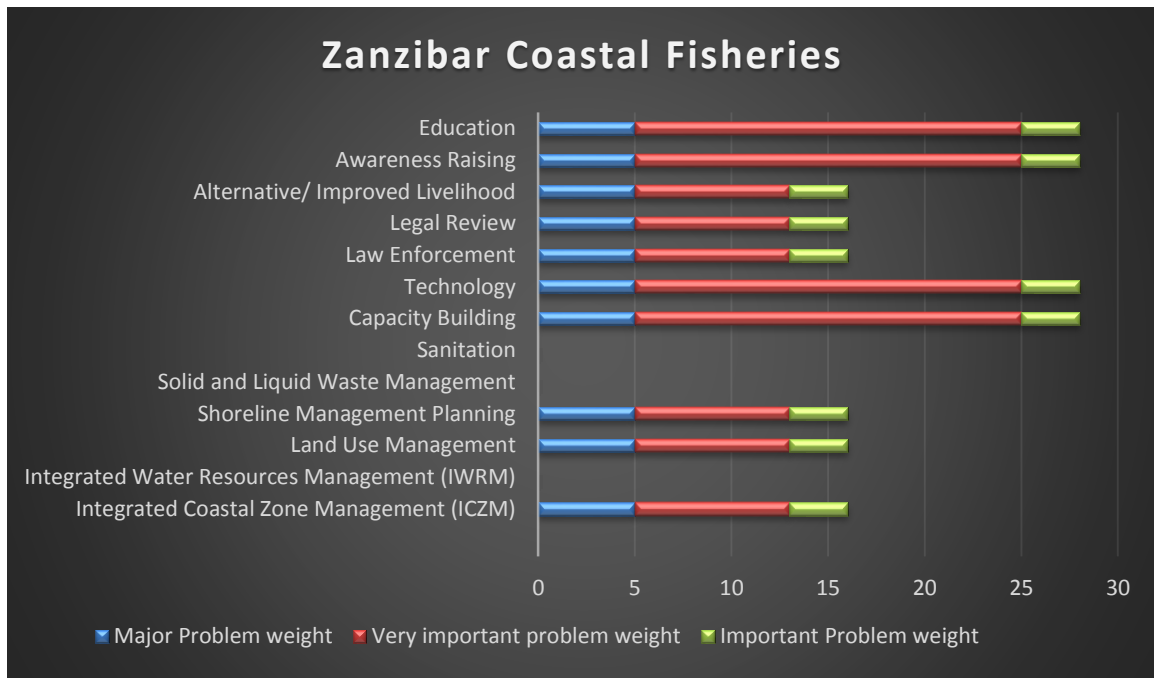


Figure 30: The importance of broad intervention dimension in responding to threats to local communities and ecosystems associated with coastal fisheries.

Tourism

Zanzibar has great attraction to international tourists, due to the fascinating history of the islands, their architecture, cultural identity, the production of cloves and spices, and the natural environment - particular the coast and the sea. Four areas are broadly characterised as wildlife tourism focusing on the Jozani Forest Reserve and other conservation areas, and on water birds; marine-based tourism focusing on marine parks, diving, snorkelling and deep sea fishing; cultural tourism focusing on historical heritage and cultural sites; and beach tourism focusing on beaches, hotels and resorts, restaurants, shops, and handicrafts. There is considerable overlap within these types, but the bulk of present interest is the coastal beach experience.



Over 70% of Zanzibar's economy is driven by the tourism sector, which includes the hotel trade plus a diverse array of associated activities. The growth in tourism since the early 1990s has overtaken the traditional, subsistence based livelihood activities such as agriculture and the contribution of the tourism to GDP has been estimated to over 35%, and representing 60% of all foreign investment.

The tourism sector employs about 35,000 - 45,000 people in direct and indirect employment and estimates suggest that some 200,000 people on Zanzibar benefit from the tourism sector.

The tourism policy of Government of Zanzibar aims at sustainable, environmentally and culturally friendly tourism, which benefits hoteliers, villagers and the nation as a whole. The public expectation is that tourism will bring many socio-economic gains to improve the standard of living of the local population, mindful that as the industry has expanded, there has been a wide range of negative effects. Climate impacts aside, if the present state of affairs is left unattended, harmony and prosperity of the local population in the future will be highly uncertain (VPO, 2012). This calls for a tourism policy reform, adoption of more eco-friendly tourism practices, with incentives for environmental conscious investors, ICZM zoning and enforcement of related sector laws, and inclusion of climate change adaptation and mitigation.

Prioritized Threats

In Table 117 below the threats identified related to tourism have been listed and ranked according to their severity as established using the CRIAM method discussed extensively in Volumes I and II of the Coastal Profile. A rapid assessment has been made on the susceptibility of each threat to impacts of climate change more specifically, changes in weather patterns, extreme events, sea level rise, temperature rise and acidification.

Table 117: Prioritised threats related to tourism and a rapid assessment of threat susceptibility to climate change.

#	Threat as identified in Coastal Profile	Threat Level	Influence from Climate Change				
			Change in Patterns	Extreme events	Sea Level Rise	Temperature Rise	Acidification
Z-Tour-05	Inadequate sewage infrastructure and waste management causing pollution of the coastal zone, further exacerbated by the illegal dumping of waste and litter from some developments.	Major Problem	++	++	++	0	0
			Climate change will aggravate the effects of inadequate sewage infrastructure and waste management.				
Z-Tour-06	Reduced freshwater supply now estimated to meet only 51% of the demand (from a rising population and expanding industries and tourism).	Major Problem	+	++	++		
			Climate change will further aggravate the shortage of freshwater supply.				
Z-Tour-01	Worsening personal security due to increased crime and violence.	Very Important Problem	0	0	0	0	0
			No impact from climate change on this threat				
Z-Tour-02	Deterioration of conservation areas due to failure of management to address encroachment and resource over-utilisation, especially forests.	Very Important Problem	0	0	0	0	0
			No impact from climate change on this threat				
Z-Tour-04	Deterioration of marine environment from destructive fishing practices.	Very Important Problem	0	0	0	0	0
			No impact from climate change on this threat				
Z-Tour-08	Increased beach erosion from unchecked sand mining for hotel construction or for road construction in Zanzibar.	Very Important Problem	++	++	++	0	0
			Changes in weather patterns, increased frequency and strengths of extreme events and sea level rise may significantly alter erosion, accretion patterns along the coast.				
Z-Tour-10	Conflicts between local communities and tourism developers over natural resources.	Very Important Problem	0	0	0	0	0
			No impact from climate change on this threat				
Z-Tour-07	Increased beach erosion from anarchistic tourism development constructed too close to or below the high water mark, due to inadequate management and enforcement tools.	Important Problem	+	++	++	0	0
			Changes in weather patterns, increased frequency and strengths of extreme events and sea level rise may significantly alter erosion, accretion patterns along the coast.				
Z-Tour-09	Loss of employment opportunities by locals to more qualified and better trained staff from mainland Tanzania and Kenya.	Important Problem	0	0	0	0	0
			No impact from climate change on this threat				
Z-Tour-03	Increase in water-borne disease such as malaria, dengue fever, typhoid and dysentery.	Light Problem	+	+	+	0	0
+++	Threat is severely aggravated from climate change dimension						
++	Threat is aggravated from climate change dimension						
+	Threat is slightly aggravated from climate change dimension						
0	No influence of threat from climate change dimension						
-	Remediating effect on threat from climate change dimension						

Recommendations for threat mitigation measures

Overall measures to mitigate each of the identified tourism related threats to coastal local communities and ecosystems have been tabulated in Table 191 (page 357) arranged under broad management dimensions headings. Table 118 below provides an overview of the requirements/opportunities expressed within each of these management or intervention dimensions.

Table 118: Broad management intervention dimensions to address identified and prioritised threats to coastal communities and ecosystems associated with tourism in Zanzibar

Intervention Dimension	Statement	Threat pertinence at each RV				
		Major Problem (RV 5)	Very important problem (RV 4)	Important Problem (RV 3)	Problem (RV 2)	Light Problem (RV 1)
Integrated Coastal Zone Management (ICZM)	<p>Ensure coordination and participation in management of coastal land, water and resources use currently under complex pressures.</p> <p>Link with hinterland management to address catchment and riverbank deforestation, river flow changes and river pollution, all of which affect the coast in many ways (ICARM).</p>	Z-Tour-05: Inadequate waste management	<p>Z-Tour-02: Deterioration of conservation area</p> <p>Z-Tour-04: Deterioration of marine environment</p> <p>Z-Tour-08: Beach erosion from sand mining and near shore construction</p> <p>Z-Tour-10: Conflicts over natural resources</p>	Z-Tour-07: Beach erosion from anarchistic tourism development	Z-Tour-09: Loss of employment to non-Zanzibaris	Z-Tour-03: Increase in waterborne diseases

Intervention Dimension	Statement	Threat pertinence at each RV				
		Major Problem (RV 5)	Very important problem (RV 4)	Important Problem (RV 3)	Problem (RV 2)	Light Problem (RV 1)
Integrated Water Resources Management (IWRM)	Link IWRM to coastal integrated planning to address impacts from upstream pollution (ICARM).		Z-Tour-08: Beach erosion form sand mining and near shore construction Z-Tour-10: Conflicts over natural resources	Z-Tour-07: Beach erosion form anarchistic tourism development		Z-Tour-03: Increase in waterborne diseases
Land Use Management	Land use information management systems to include ecosystems, habitats and water resources. Incorporate ecosystems, habitats, shoreline processes and water resources considerations in spatial planning. Optimise land use through zoning to minimise conflicts and prevent anarchistic development.	Z-Tour-05: Inadequate waste management	Z-Tour-02: Deterioration of conservation area Z-Tour-04: Deterioration of marine environment Z-Tour-08: Beach erosion form sand mining and near shore construction Z-Tour-10: Conflicts over natural resources	Z-Tour-07: Beach erosion form anarchistic tourism development		Z-Tour-03: Increase in waterborne diseases
Shoreline Management Planning	Establish a systematic overview of coastal processes through a shoreline management investigation, considering the entire coast, and inform spatial planning accordingly. Sediment cell resolution national effort, management unit resolution regional/ district effort.	Z-Tour-05: Inadequate waste management	Z-Tour-02: Deterioration of conservation area Z-Tour-04: Deterioration of marine environment Z-Tour-08: Beach erosion form sand mining and near shore construction Z-Tour-10: Conflicts over natural resources	Z-Tour-07: Beach erosion form anarchistic tourism development		
Solid and Liquid Waste Management	Pursue integrated solid and liquid waste management solutions considering: Waste water treatment systems: - collection - treatment technology - discharge Liquid Waste Management Systems: - collection - storage - processing - financing - minimisation - reuse? Green Infrastructure Storm Water Systems	Z-Tour-05: Inadequate waste management				Z-Tour-03: Increase in waterborne diseases
Sanitation	Pursue integrated solid and liquid waste management considering: Waste water treatment systems: - collection - treatment technology - discharge Liquid Waste Management Systems: - collection - storage - processing - financing - minimisation - reuse? Green Infrastructure Storm Water Systems	Z-Tour-05: Inadequate waste management				Z-Tour-03: Increase in waterborne diseases

Intervention Dimension	Statement	Threat pertinence at each RV				
		Major Problem (RV 5)	Very important problem (RV 4)	Important Problem (RV 3)	Problem (RV 2)	Light Problem (RV 1)
Capacity Building	<p>Emphasise local tradition and culture as a tourism attraction.</p> <p>Accompany management interventions with appropriate capacity building components. Particular focus on spatial planning, shoreline management, ecosystems and species management, cultural heritage management, conflict resolution, monitoring, law enforcement.</p> <p>Enhance information management systems to provide for better and systematically informed management decisions.</p> <p>Develop and diversify local skills at all levels to enhance local participation in tourism sector and encourage local client sector.</p>	<p>Z-Tour-05: Inadequate waste management</p> <p>Z-Tour-06: Reduced freshwater supply</p>	<p>Z-Tour-01: Low security due to crime and violence</p> <p>Z-Tour-02: Deterioration of conservation area</p> <p>Z-Tour-04: Deterioration of marine environment</p> <p>Z-Tour-08: Beach erosion form sand mining and near shore construction</p> <p>Z-Tour-10: Conflicts over natural resources</p>	<p>Z-Tour-07: Beach erosion form anarchistic tourism development</p> <p>Z-Tour-09: Loss of employment to non-Zanzibaris</p>		<p>Z-Tour-03: Increase in waterborne diseases</p>
Technology	<p>Pursue opportunities through further technology development within:</p> <p>Integrated solid and liquid waste management</p> <p>Shoreline management</p> <p>Coastal forest management</p> <p>Offshore fisheries</p> <p>Aquaculture</p>	<p>Z-Tour-05: Inadequate waste management</p> <p>Z-Tour-06: Reduced freshwater supply</p>	<p>Z-Tour-01: Low security due to crime and violence</p> <p>Z-Tour-02: Deterioration of conservation area</p> <p>Z-Tour-04: Deterioration of marine environment</p> <p>Z-Tour-08: Beach erosion form sand mining and near shore construction</p>	<p>Z-Tour-07: Beach erosion form anarchistic tourism development</p> <p>Z-Tour-09: Loss of employment to non-Zanzibaris</p>		<p>Z-Tour-03: Increase in waterborne diseases</p>
Law Enforcement	<p>Integrated review of laws, regulations and their enforcement within amongst others:</p> <p>Fisheries,</p> <p>Mangrove and coastal forest exploitation</p> <p>Ecosystems and species</p> <p>Coral (and sand) mining</p> <p>Agrochemicals</p> <p>Industrial and domestic waste</p> <p>Land use (especially shoreline and set-back uses) and speculation.</p> <p>Tourism revenues</p> <p>Anti-social behaviour</p> <p>Construction around monuments.</p> <p>Optimise enforcement through capacity building and coordination following recommendations from review.</p>	<p>Z-Tour-05: Inadequate waste management</p>	<p>Z-Tour-01: Low security due to crime and violence</p> <p>Z-Tour-02: Deterioration of conservation area</p> <p>Z-Tour-04: Deterioration of marine environment</p> <p>Z-Tour-08: Beach erosion form sand mining and near shore construction</p> <p>Z-Tour-10: Conflicts over natural resources</p>	<p>Z-Tour-07: Beach erosion form anarchistic tourism development</p> <p>Z-Tour-09: Loss of employment to non-Zanzibaris</p>		<p>Z-Tour-03: Increase in waterborne diseases</p>
Legal Review	<p>Integrated review of laws, regulations and their enforcement within amongst others:</p> <p>Fisheries,</p> <p>Mangrove exploitation</p> <p>Ecosystems and species</p> <p>Coral mining</p> <p>Agrochemicals</p> <p>Industrial and domestic waste</p> <p>Land use (especially shoreline and set-back uses) and speculation.</p> <p>Tourism revenues</p> <p>Local content employment of staff in the sector.</p> <p>Initiate revision of existing and develop new laws, regulations according to recommendations from review</p>		<p>Z-Tour-04: Deterioration of marine environment</p> <p>Z-Tour-08: Beach erosion form sand mining and near shore construction</p> <p>Z-Tour-10: Conflicts over natural resources</p>	<p>Z-Tour-09: Loss of employment to non-Zanzibaris</p>		

Intervention Dimension	Statement	Threat pertinence at each RV				
		Major Problem (RV 5)	Very important problem (RV 4)	Important Problem (RV 3)	Problem (RV 2)	Light Problem (RV 1)
Alternative/Improved Livelihood	Develop and offer alternative livelihoods for households currently engaged in destructive resource exploitation practises and those displaced and disadvantaged. Particular efforts to provide alternatives for young generation. Improve current sustainable resource use livelihoods using technology advances and insights.		Z-Tour-02: Deterioration of conservation area Z-Tour-04: Deterioration of marine environment Z-Tour-08: Beach erosion form sand mining and near shore construction			
Awareness Raising	Develop and launch awareness raising campaigns related to coastal management challenges directed to the public at large and to schools. Develop and launch issue specific awareness raising campaigns targeting stakeholders affected by or affecting the issue.	Z-Tour-05: Inadequate waste management Z-Tour-06: Reduced freshwater supply	Z-Tour-02: Deterioration of conservation area Z-Tour-04: Deterioration of marine environment Z-Tour-08: Beach erosion form sand mining and near shore construction Z-Tour-10: Conflicts over natural resources	Z-Tour-07: Beach erosion form anarchistic tourism development Z-Tour-09: Loss of employment to non-Zanzibaris		Z-Tour-03: Increase in waterborne diseases
Education	Engage in curricula review and development for primary and secondary schools to enhance the knowledge and understanding about coastal management issues- Issue of particular relevance from a tourism perspective include: <ul style="list-style-type: none"> • Fisheries ecology and sustainable fisheries • Environmental management • Coastal ecology • Importance of beaches • Sustainable tourism 	Z-Tour-05: Inadequate waste management Z-Tour-06: Reduced freshwater supply	Z-Tour-02: Deterioration of conservation area Z-Tour-04: Deterioration of marine environment Z-Tour-08: Beach erosion form sand mining and near shore construction Z-Tour-10: Conflicts over natural resources	Z-Tour-07: Beach erosion form anarchistic tourism development Z-Tour-09: Loss of employment to non-Zanzibaris		Z-Tour-03: Increase in waterborne diseases

Action areas

In Table 119 below an overview has been established on how strongly each intervention dimension responds to threats to local communities and ecosystems as perceived by local stakeholders.

For each intervention dimension and for each problem class the number of threats considered to benefit from the intervention have been multiplied by the range value (RV) for the given problem class. The total score for each management dimension has then been calculated by adding the values achieved. The table thus provides an indication of the importance of each intervention dimension in addressing identified and ranked threats. In the same manner Figure 31 gives a graphical presentation of the relevance of intervention dimensions in addressing the identified threats related to with tourism.

Table 119: Assessment of the importance of broad management dimension in addressing threats to local communities and ecosystems associated with tourism.

Intervention Dimension	Major Problem weight	Very important problem weight	Important Problem weight	Problem weight	Light Problem weight	Total Score
Integrated Coastal Zone Management (ICZM)	5	16	6	0	1	28
Integrated Water Resources Management (IWRM)	0	8	3	0	1	12
Land Use Management	5	16	3	0	1	25
Shoreline Management Planning	5	16	3	0	0	24
Solid and Liquid Waste Management	5	0	0	0	1	6
Sanitation	5	0	0	0	1	6
Capacity Building	10	20	6	0	1	37
Technology	10	16	6	0	1	33
Law Enforcement	5	20	6	0	1	32
Legal Review	0	12	3	0	0	15
Alternative/ Improved Livelihood	0	12	0	0	0	12
Awareness Raising	10	16	6	0	1	33
Education	10	16	6	0	1	33
Zanzibar				Tourism	Total	296

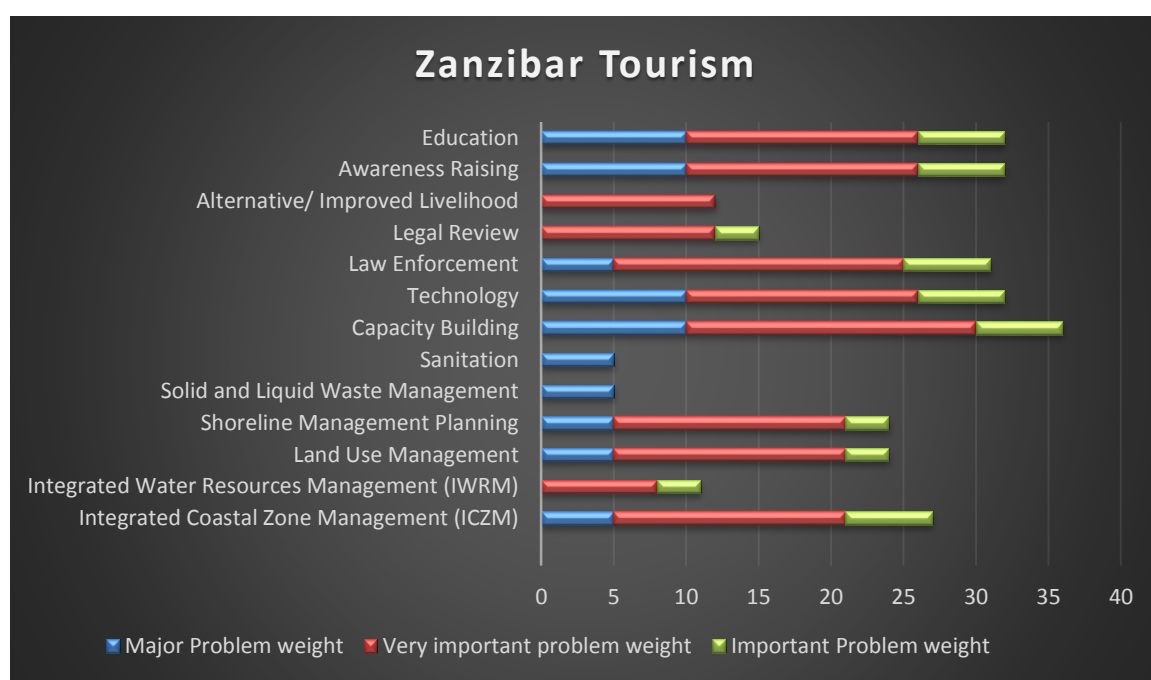


Figure 31: The importance of broad intervention dimension in responding to threats to local communities and ecosystems associated with coastal tourism.

Agriculture

Agriculture is one of the key economic sectors of Zanzibar, contributing around 30% of GDP with crops contributing just over 20% and livestock just under 5% (VPO, 2012), citing Office of the Chief Government Statistician, RGZ, 2013). Agriculture dominates exports (at 95% by value) with cloves and seaweed making up 66-75% of the foreign exchange value. Agriculture is the main source of employment for 80% of the population who derive their livelihood directly or indirectly from the sector. There is a high proportion of mixed (agriculture and livestock) farming, with approximately 160,000 cattle on the



islands, 50,000 goats and over a million chickens, and VPO (2012) notes that the livestock sub-sector is expanding rapidly. However, the sector is very climate-sensitive, mostly dependent on rain-fed agriculture making production vulnerable to adverse rainfall patterns such as drought or intermittent dry spells during the rainy season.

Zanzibar is not self-sufficient on agricultural production, and relies on food imports, particularly rice and wheat, but also beans, pulses, maize flour, sugar, fruits and vegetables. While most of the staples required for food security, such as rice, wheat flour and sugar are imported from East Asia and Europe, maize, flour and pulses come mainly from the mainland.

Agriculture is key priority for adaptation in the ZAPA, which calls for awareness raising, institutional strengthening (particularly for extension services and research), and early (no regret) benefits from better information, with short-term and seasonal forecasting, and early agro-meteorological warning systems (e.g. for heavy rain and flood risks, and droughts).

In a survey, VPO (2012) noted there was a strong preference for rainwater harvesting, agroforestry and crop switching, as well as sustainable agriculture and soil and water conservation, complemented with capacity building and agricultural research. SMOLE (2010) considers that there is a large potential for growth, especially based on the agricultural sector, and advocates for the ZAPA.

Prioritized Threats

In Table 120 below the threats identified related to agriculture have been listed and ranked according to their severity as established using the CRIAM method discussed extensively in Volumes I and II of the Coastal Profile. A rapid assessment has been made on the susceptibility of each threat to impacts of climate change more specifically, changes in whether patterns, extreme events, sea level rise, temperature rise and acidification.

Table 120: Prioritised threats related to agriculture and a rapid assessment of threat susceptibility to climate change.

#	Threat as identified in Coastal Profile	Threat Level	Influence from Climate Change				
			Change in Patterns	Extreme events	Sea Level Rise	Temperature Rise	Acidification
Z-Agr-02	Loss of public land (coral rag) to agriculture.	Major Problem	0	0	0	0	0
			No impact from climate change on this threat				
Z-Agr-03	Reduced land for agriculture on Unguja due to intense competition (Coles et al. 2007).	Major Problem	0	0	0	0	0
			No impact from climate change on this threat				
Z-Agr-01	Social conflicts over land use	Very Important Problem	0	0	0	0	0
			No impact from climate change on this threat				
Z-Agr-04	Invasion of freshwater sources	Very Important Problem	0	0	0	0	0
			No impact from climate change on this threat				
Z-Agr-07	High production cost	Very Important Problem	0	0	0	0	0
			No impact from climate change on this threat				
Z-Agr-10	Insufficient freshwater for irrigation	Very Important Problem	++	++	++	0	0
			Change in precipitation will alter conditions for agriculture and impact on irrigation potential				
Z-Agr-11	Limited business/financial management skills among producers and suppliers, limits the success of agribusiness.	Very Important Problem	0	0	0	0	0
			No impact from climate change on this threat				
Z-Agr-12	Salt water inundation	Very Important Problem	++	+	++	0	0
			Changes in precipitation and sea level rise will impact on salinisation in coastal areas. Extreme events will increase severity and frequency of sea water flooding.				
Z-Agr-13	Insufficient climate information forecasting and early warning systems	Very Important Problem					
			Greater variability and changes in weather require early management responses to sustain productivity.				
Z-Agr-14	Social conflicts over land due to poor land management	Very Important Problem	0	0	0	0	0
			No impact from climate change on this threat				
Z-Agr-05	Inadequate agricultural product supply leading to tourism operators seeking suppliers elsewhere.	Important Problem	0	0	0	0	0
			No impact from climate change on this threat				
Z-Agr-08	Freshwater scarcity and irregular supply	Important Problem	++	++	+	0	0
			Change in precipitation will alter conditions for agriculture and impact on irrigation potential				
Z-Agr-09	Poor farming practice	Important Problem	0	0	0	0	0
			No impact from climate change on this threat				
Z-Agr-06	Unpredictable demand by tourism operators due to uncertain occupancy rates mean hotels cannot guarantee long term orders.	Problem	0	0	0	0	0
			No impact from climate change on this threat				
+++	Threat is severely aggravated from climate change dimension						
++	Threat is aggravated from climate change dimension						
+	Threat is slightly aggravated from climate change dimension						
0	No influence of threat from climate change dimension						
-	Remediating effect on threat from climate change dimension						

Recommendations for threat mitigation measures

Overall measures to mitigate each if the identified agriculture related threats to coastal local communities and ecosystems have been tabulated in Table 192 (page 359) arranged under broad management dimensions headings. Table 121 below provides an overview of the requirements/opportunities expressed within each of these management or intervention dimensions.

Table 121: Broad management intervention dimensions to address identified and prioritised threats to coastal communities and ecosystems associated with agriculture in Zanzibar

Intervention Dimension	Statement	Threat pertinence at each RV				
		Major Problem (RV 5)	Very important problem (RV 4)	Important Problem (RV 3)	Problem (RV 2)	Light Problem (RV 1)
Integrated Coastal Zone Management (ICZM)	<p>Ensure coordination and participation in management of coastal land, water and resources use currently under complex pressures.</p> <p>Facilitate dialogues required to alleviate social conflicts over land use</p> <p>Coordinated response system to climate challenges.</p> <p>Link with hinterland management to address catchment and riverbank deforestation, river flow changes and river pollution, all of which affect the coast in many ways (ICARM).</p>	<p>Z-Agr-02: Loss of coral rag to agriculture</p> <p>Z-Agr-03: Competition for agriculture land</p>	<p>Z-Agr-01: Social conflict over land use</p> <p>Z-Agr-13: Insufficient climate information</p> <p>Z-Agr-14: Social conflict over land due to poor management</p>			

Intervention Dimension	Statement	Threat pertinence at each RV				
		Major Problem (RV 5)	Very important problem (RV 4)	Important Problem (RV 3)	Problem (RV 2)	Light Problem (RV 1)
Integrated Water Resources Management (IWRM)	<p>Link IWRM to coastal integrated planning ensuring upstream/ downstream considerations (ICARM).</p> <p>Land use in catchments and its impacts on water resources included in IWRM planning.</p> <p>Upstream water management incorporating impacts on coastal ecosystems and livelihoods in IWRM plans (ICARM)</p>		<p>Z-Agr-10: Insufficient water for irrigation</p> <p>Z-Agr-12: Salt water inundation</p> <p>Z-Agr-13: Insufficient climate information</p>	Z-Agr-08: Freshwater scarcity and irregular supply		
Land Use Management	<p>Land use information management systems to duly include agriculture potential, uses and use sustainability.</p> <p>Incorporate agriculture land uses in spatial planning.</p> <p>Inform hinterland spatial planning to direct zoning to address downstream impacts agriculture potential and practises.</p>	<p>Z-Agr-02: Loss of coral rag to agriculture</p> <p>Z-Agr-03: Competition for agriculture land</p>	<p>Z-Agr-01: Social conflict over land use</p> <p>Z-Agr-04: Invasion of freshwater sources</p> <p>Z-Agr-10: Insufficient water for irrigation</p> <p>Z-Agr-12: Salt water inundation</p> <p>Z-Agr-14: Social conflict over land due to poor management</p>	<p>Z-Agr-08: Freshwater scarcity and irregular supply</p> <p>Z-Agr-09: Poor farming practise</p>		
Shoreline Management Planning	<p>Establish a systematic overview of coastal processes through a shoreline management investigation, considering the entire coast, and inform spatial planning accordingly. Sediment cell resolution national effort, management unit resolution regional/ district effort.</p>	<p>Z-Agr-02: Loss of coral rag to agriculture</p>	<p>Z-Agr-01: Social conflict over land use</p> <p>Z-Agr-14: Social conflict over land due to poor management</p>			
Solid and Liquid Waste Management						
Sanitation						
Capacity Building	<p>Accompany management interventions with appropriate capacity building components. Particular focus on</p> <ul style="list-style-type: none"> • spatial planning, • sustainable land and water use, • catchment management, • agriculture extension, • conflict resolution, • monitoring, • law enforcement. <p>Enhance information management systems to provide for better and systematically informed management decisions.</p>	<p>Z-Agr-02: Loss of coral rag to agriculture</p> <p>Z-Agr-03: Competition for agriculture land</p>	<p>Z-Agr-01: Social conflict over land use</p> <p>Z-Agr-04: Invasion of freshwater sources</p> <p>Z-Agr-07: High production cost</p> <p>Z-Agr-10: Insufficient water for irrigation</p> <p>Z-Agr-11: Limited business skills</p> <p>Z-Agr-12: Salt water inundation</p> <p>Z-Agr-13: Insufficient climate information</p> <p>Z-Agr-14: Social conflict over land due to poor management</p>	<p>Z-Agr-05: Inadequate agriculture production to supply local needs</p> <p>Z-Agr-08: Freshwater scarcity and irregular supply</p> <p>Z-Agr-09: Poor farming practise</p>	Z-Agr-06: Unpredictable tourist load	

Intervention Dimension	Statement	Threat pertinence at each RV				
		Major Problem (RV 5)	Very important problem (RV 4)	Important Problem (RV 3)	Problem (RV 2)	Light Problem (RV 1)
Technology	<p>Pursue opportunities through further technology development within:</p> <ul style="list-style-type: none"> • Agriculture soil improvement • Green infrastructure • Farming • Monitoring, remote imageries • GIS • Agriculture postharvest and marketing • Rainwater harvesting • Aquifer recharging 	<p>Z-Agr-02: Loss of coral rag to agriculture</p> <p>Z-Agr-03: Competition for agriculture land</p>	<p>Z-Agr-01: Social conflict over land use</p> <p>Z-Agr-04: Invasion of freshwater sources</p> <p>Z-Agr-07: High production cost</p> <p>Z-Agr-10: Insufficient water for irrigation</p> <p>Z-Agr-11: Limited business skills</p> <p>Z-Agr-12: Salt water inundation</p> <p>Z-Agr-13: Insufficient climate information</p> <p>Z-Agr-14: Social conflict over land due to poor management</p>	<p>Z-Agr-05: Inadequate agriculture production to supply local needs</p> <p>Z-Agr-08: Freshwater scarcity and irregular supply</p> <p>Z-Agr-09: Poor farming practise</p>	<p>Z-Agr-06: Unpredictable tourist load</p>	
Law Enforcement	<ol style="list-style-type: none"> 1) Integrated review of laws, regulations and their enforcement within amongst others: <ul style="list-style-type: none"> • Resource exploration • Sand mining • Shoreline construction • Spatial planning • Water abstraction 2) Optimise enforcement through capacity building and coordination following recommendations from review. 	<p>Z-Agr-02: Loss of coral rag to agriculture</p> <p>Z-Agr-03: Competition for agriculture land</p>	<p>Z-Agr-01: Social conflict over land use</p> <p>Z-Agr-04: Invasion of freshwater sources</p> <p>Z-Agr-10: Insufficient water for irrigation</p> <p>Z-Agr-12: Salt water inundation</p> <p>Z-Agr-14: Social conflict over land due to poor management</p>	<p>Z-Agr-08: Freshwater scarcity and irregular supply</p>		
Legal Review	<ol style="list-style-type: none"> 1) Integrated review of laws, regulations and their enforcement within amongst others: <ul style="list-style-type: none"> • Resource exploration • Sand mining • Shoreline construction • Spatial planning • Water abstraction 2) Initiate revision of existing and develop new laws, regulations according to recommendations from review 		<p>Z-Agr-01: Social conflict over land use</p> <p>Z-Agr-04: Invasion of freshwater sources</p> <p>Z-Agr-07: High production cost</p> <p>Z-Agr-10: Insufficient water for irrigation</p> <p>Z-Agr-14: Social conflict over land due to poor management</p>	<p>Z-Agr-08: Freshwater scarcity and irregular supply</p>		
Alternative/ Improved Livelihood	<p>Develop and offer alternative livelihoods for households currently engaged in destructive resource exploitation practises. Particular efforts to provide alternatives for young generation.</p> <p>Improve current sustainable resource use livelihoods using technology advances and insights.</p>	<p>Z-Agr-02: Loss of coral rag to agriculture</p> <p>Z-Agr-03: Competition for agriculture land</p>	<p>Z-Agr-12: Salt water inundation</p>			

Intervention Dimension	Statement	Threat pertinence at each RV				
		Major Problem (RV 5)	Very important problem (RV 4)	Important Problem (RV 3)	Problem (RV 2)	Light Problem (RV 1)
Awareness Raising	<p>Develop and launch awareness raising campaigns related to coastal management challenges directed to the public at large and to schools.</p> <p>Develop and launch issue specific awareness raising campaigns targeting stakeholders affected by or affecting the issue.</p> <p>These may address:</p> <ul style="list-style-type: none"> • Sustainable development planning and development control • Impact of pollution on environment and health • Pollution pathways including upstream downstream <p>And Target:</p> <ul style="list-style-type: none"> • Farmers • District authorities • Land-users • Stakeholders benefitting from beaches • Stakeholders benefitting from mangrove services and products • Tourists 	<p>Z-Agr-02: Loss of coral rag to agriculture</p> <p>Z-Agr-03: Competition for agriculture land</p>	<p>Z-Agr-01: Social conflict over land use</p> <p>Z-Agr-04: Invasion of freshwater sources</p> <p>Z-Agr-10: Insufficient water for irrigation</p> <p>Z-Agr-12: Salt water inundation</p> <p>Z-Agr-13: Insufficient climate information</p> <p>Z-Agr-14: Social conflict over land due to poor management</p>	<p>Z-Agr-08: Freshwater scarcity and irregular supply</p> <p>Z-Agr-09: Poor farming practise</p>	<p>Z-Agr-06: Unpredictable tourist load</p>	
Education	<p>Engage in curricula review and development for primary and secondary schools to enhance the knowledge and understanding about coastal management issues- Issue of particular relevance from an agriculture perspective include:</p> <ul style="list-style-type: none"> • Sustainable development in areas under high development pressure (coastal, urban) • Importance of coasts and coastal habitats and resources • Importance of environmentally sound agriculture production. • Importance of integrated management (upstream / downstream). • Importance of marine environment. • Pollution, environment, health. • Waste minimisation and recycling. • Hydrological cycle 	<p>Z-Agr-02: Loss of coral rag to agriculture</p> <p>Z-Agr-03: Competition for agriculture land</p>	<p>Z-Agr-01: Social conflict over land use</p> <p>Z-Agr-04: Invasion of freshwater sources</p> <p>Z-Agr-10: Insufficient water for irrigation</p> <p>Z-Agr-12: Salt water inundation</p> <p>Z-Agr-13: Insufficient climate information</p> <p>Z-Agr-14: Social conflict over land due to poor management</p>	<p>Z-Agr-08: Freshwater scarcity and irregular supply</p> <p>Z-Agr-09: Poor farming practise</p>	<p>Z-Agr-06: Unpredictable tourist load</p>	

Action areas

In Table 122 below an overview has been established on how strongly each intervention dimension responds to threats to local communities and ecosystems as perceived by local stakeholders.

For each intervention dimension and for each problem class the number of threats considered to benefit from the intervention have been multiplied by the range value (RV) for the given problem class. The total score for each management dimension has then been calculated by adding the values achieved. The table thus provides an indication of the importance of each intervention dimension in addressing identified and ranked threats. In the same manner Figure 32 gives a graphical presentation of the relevance of intervention dimensions in addressing the identified threats related to with agriculture.

Table 122: Assessment of the importance of broad management dimension in addressing threats to local communities and ecosystems associated with agriculture.

Intervention Dimension	Major Problem weight	Very important problem weight	Important Problem weight	Problem weight	Light Problem weight	Total Score
Integrated Coastal Zone Management (ICZM)	10	12	0	0	0	22
Integrated Water Resources Management (IWRM)	0	12	3	0	0	15
Land Use Management	10	20	6	0	0	36
Shoreline Management Planning	5	8	0	0	0	13
Solid and Liquid Waste Management	0	0	0	0	0	0
Sanitation	0	0	0	0	0	0
Capacity Building	10	32	9	2	0	53
Technology	10	32	9	2	0	53
Law Enforcement	10	20	3	0	0	33
Legal Review	0	20	3	0	0	23
Alternative/ Improved Livelihood	10	4	0	0	0	14
Awareness Raising	10	24	6	2	0	42
Education	10	24	6	2	0	42
Zanzibar	Agriculture			Total		346

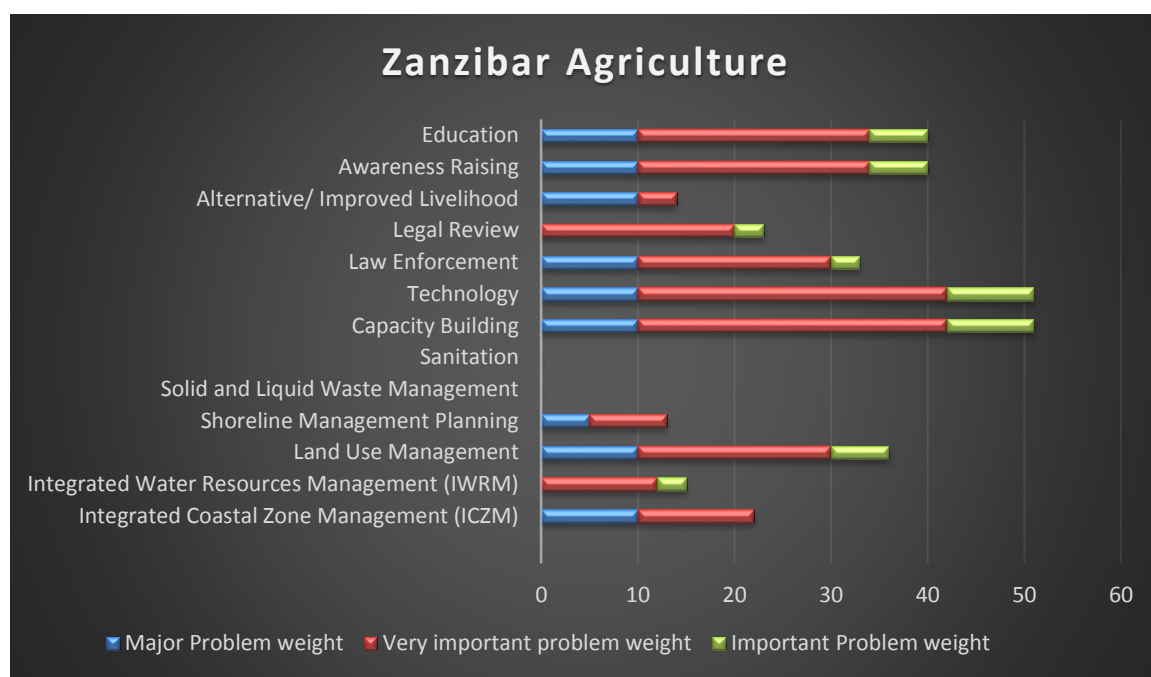


Figure 32: The importance of broad intervention dimension in responding to threats to local communities and ecosystems associated with coastal agriculture.

Forestry

Forests resources on Zanzibar can be categorized as true forests, limited to the protected reserves of Jozani in Unguja Island, and Ngezi and Msitu Mkuu in Pemba Island (SMOLE, 2010), all with high and often unique bio-diversity; coastal forest and thickets on general land, mostly on the coral rag areas and used mostly for timber, charcoal or agriculture; and mangrove forest that are protected under law, but used for amongst others timber, poles, and charcoal.

The true forests, like their associated isolated patches on mainland hilltops, are remnants of the once extensive ancient forests of East Africa (VPO 2003).



Zanzibar's forests and woodlands cover an estimated 60% of the total land coverage and provide key elements to the livelihoods of over 80% of Zanzibar's population. Direct benefits include firewood and charcoal, building materials and dyes, while indirectly the forests of Zanzibar serve as an attraction for tourism and in fisheries ecosystem services.

Remnants of true forests in Zanzibar are all found on the coral rag zone or on areas left behind during the establishment of coconut and clove plantations, while mangroves forests mainly on the western shores on the two main islands, occupy 18,000 ha and contribute in diverse ways to local livelihoods.

Regardless of climate change, the deforestation rate of Zanzibar's forest estimated to 0.8–1.2%/year, is likely to increase as demand for forest products grow in the absence of alternatives. Meanwhile, the ability of the management institutions to contain or reduce the degradation is questionable, despite the large number of initiatives, NGOs and donors that support forest conservation programs. With 80% of Zanzibar's population using fuel wood for cooking there is a need to address fuel alternatives as the area with greatest potential for reducing forest degradation.

The REDD Strategy 2012, addresses the current use of forest resources, proposing strategies to halt forest deforestation and degradation, so as to raise significant carbon financing through the 'Reducing Emissions from Deforestation and forest Degradation (REDD+) scheme.

Prioritized Threats

In Table 123 below the threats identified related to forestry have been listed and ranked according to their severity as established using the CRIAM method discussed extensively in Volumes I and II of the Coastal Profile. A rapid assessment has been made on the susceptibility of each threat to impacts of climate change more specifically, changes in whether patterns, extreme events, sea level rise, temperature rise and acidification.

Table 123: Prioritised threats related to forestry and a rapid assessment of threat susceptibility to climate change.

#	Threat as identified in Coastal Profile	Threat Level	Influence from Climate Change					
			Change in Patterns	Extreme events	Sea Level Rise	Temperature rise	Acidification	
Z-Forest-01	Forest degradation due to over-exploitation or poor harvest methods (e.g. slash and burn).	Major Problem	0	0	0	0	0	No impact from climate change on this threat
Z-Forest-02	Inadequate enforcement of forest management regulations resulting in illegal clearing and over-harvesting of mangrove forests and coastal forests	Very Important Problem	0	0	0	0	0	No impact from climate change on this threat
Z-Forest-05	Conflict over illegal mangrove cutting.	Very Important Problem	0	0	0	0	0	No impact from climate change on this threat
Z-Forest-06	Ineffective land use management resulting in encroachment of expanding agriculture and settlements into forests or clearance for salt works, aquaculture (on Pemba) or tourism.	Very Important Problem	0	0	0	0	0	No impact from climate change on this threat
Z-Forest-08	Declining ground water (freshwater) quality	Very Important Problem	+	++	++			Changes in weather patterns, extreme events and higher frequency and impact of sea water inundation threatens ground water quality
Z-Forest-09	Fire	Very Important Problem	++	++	0	0	0	Reduction in precipitation and drought situation increases frequency and impacts of fire
Z-Forest-03	Pests and grazing damage	Light Problem	0	0	0	0	0	No impact from climate change on this threat
Z-Forest-04	Erosion of mangrove stands.	Light Problem	+	++	++	0	0	Higher sea levels and extreme event will heighten pressure on vulnerable mangrove stands.
+++	Threat is severely aggravated from climate change dimension							
++	Threat is aggravated from climate change dimension							
+	Threat is slightly aggravated from climate change dimension							
0	No influence of threat from climate change dimension							
-	Remediating effect on threat from climate change dimension							

Recommendations for threat mitigation measures

Overall measures to mitigate each of the identified forestry related threats to coastal local communities and ecosystems have been tabulated in Table 193 (page 361) arranged under broad management dimensions headings. Table 124 below provides an overview of the requirements/opportunities expressed within each of these management or intervention dimensions.

Table 124: Broad management intervention dimensions to address identified and prioritised threats to coastal communities and ecosystems associated with forestry in Zanzibar

Intervention Dimension	Statement	Threat pertinence at each RV				
		Major Problem (RV 5)	Very important problem (RV 4)	Important Problem (RV 3)	Problem (RV 2)	Light Problem (RV 1)
Integrated Coastal Zone Management (ICZM)	<p>Ensure coordination and participation in management of coastal land, water and resources use currently under complex pressures.</p> <p>Ensures coordinated and integrated management of forestry resources considering linkages to other sectors.</p> <p>Facilitate dialogues required to alleviate social conflicts over land use</p> <p>Link with hinterland management to address catchment and riverbank deforestation, river flow changes and river pollution, all of which affect the coast in many ways (ICARM).</p>	Z-Forest-01: Forest degradation from over-exploitation	Z-Forest-02: Inadequate enforcement of forest management regulations Z-Forest-05: Conflict over mangrove cutting Z-Forest-06: Ineffective land use leading to encroachment			Z-Forest-04: Erosion of mangrove stands
Integrated Water Resources Management (IWRM)	<p>Link IWRM to coastal integrated planning ensuring upstream/downstream considerations (ICARM).</p> <p>Land use in catchments and its impacts on water resources included in IWRM planning.</p> <p>Upstream water management incorporating impacts on coastal forests in IWRM plans (ICARM).</p>		Z-Forest-08: Declining ground water quality			Z-Forest-04: Erosion of mangrove stands

Intervention Dimension	Statement	Threat pertinence at each RV				
		Major Problem (RV 5)	Very important problem (RV 4)	Important Problem (RV 3)	Problem (RV 2)	Light Problem (RV 1)
Land Use Management	Land use information management systems to duly include forests and forest reserves. Incorporate forest reserves and forest uses in spatial planning. Inform hinterland spatial planning to direct zoning to address downstream impacts on coastal forests.	Z-Forest-01: Forest degradation from over-exploitation	Z-Forest-02: Inadequate enforcement of forest management regulations Z-Forest-05: Conflict over mangrove cutting Z-Forest-06: Ineffective land use leading to encroachment Z-Forest-08: Declining ground water quality Z-Forest-09: Fire			Z-Forest-03: Pests and grazing damage Z-Forest-04: Erosion of mangrove stands
Shoreline Management Planning	Establish a systematic overview of coastal processes through a shoreline management investigation, considering the entire coast, and inform spatial planning accordingly. Sediment cell resolution national effort, management unit resolution regional/district effort. Identifying management units to incorporate coastal forest concerns.	Z-Forest-01: Forest degradation from over-exploitation	Z-Forest-02: Inadequate enforcement of forest management regulations Z-Forest-06: Ineffective land use leading to encroachment			Z-Forest-03: Pests and grazing damage
Solid and Liquid Waste Management						
Sanitation						
Capacity Building	Accompany management interventions with appropriate capacity building components. Particular focus on <ul style="list-style-type: none"> Monitoring forest reserves and their exploitation Monitoring wildlife reserve Catchment management Conflict resolution Enhance information management systems to provide for better and systematically informed management decisions. Targeting relevant government departments at national and local levels, BMUs	Z-Forest-01: Forest degradation from over-exploitation	Z-Forest-02: Inadequate enforcement of forest management regulations Z-Forest-05: Conflict over mangrove cutting Z-Forest-06: Ineffective land use leading to encroachment Z-Forest-08: Declining ground water quality Z-Forest-09: Fire			Z-Forest-03: Pests and grazing damage Z-Forest-04: Erosion of mangrove stands
Technology	Pursue opportunities through further technology development within: <ul style="list-style-type: none"> Best forest management practises Alternative livelihoods remove pressure on forestry reserves and wildlife Alternative energy resources for households Monitoring, remote imageries GIS 	Z-Forest-01: Forest degradation from over-exploitation	Z-Forest-02: Inadequate enforcement of forest management regulations Z-Forest-06: Ineffective land use leading to encroachment Z-Forest-08: Declining ground water quality Z-Forest-09: Fire			Z-Forest-03: Pests and grazing damage Z-Forest-04: Erosion of mangrove stands

Intervention Dimension	Statement	Threat pertinence at each RV				
		Major Problem (RV 5)	Very important problem (RV 4)	Important Problem (RV 3)	Problem (RV 2)	Light Problem (RV 1)
Law Enforcement	<p>1) Integrated review of laws, regulations and their enforcement within amongst others:</p> <ul style="list-style-type: none"> Coastal forest exploitation Use of fire to clear areas Coastal mining Wildlife Agrochemicals Mangrove <p>2) Optimise enforcement through capacity building and coordination following recommendations from review.</p>	Z-Forest-01: Forest degradation from over-exploitation	Z-Forest-02: Inadequate enforcement of forest management regulations Z-Forest-05: Conflict over mangrove cutting Z-Forest-06: Ineffective land use leading to encroachment Z-Forest-08: Declining ground water quality Z-Forest-09: Fire			Z-Forest-03: Pests and grazing damage Z-Forest-04: Erosion of mangrove stands
Legal Review	<p>1) Integrated review of laws, regulations and their enforcement within amongst others:</p> <ul style="list-style-type: none"> Coastal forest exploitation Use of fire to clear areas Coastal mining Wildlife Agrochemicals Mangrove <p>2) Initiate revision of existing and develop new laws, regulations according to recommendations from review</p>		Z-Forest-05: Conflict over mangrove cutting Z-Forest-06: Ineffective land use leading to encroachment Z-Forest-08: Declining ground water quality Z-Forest-09: Fire			Z-Forest-03: Pests and grazing damage Z-Forest-04: Erosion of mangrove stands
Alternative/ Improved Livelihood	<p>Develop and offer alternative livelihoods for households currently engaged in destructive exploitation of coastal forests. Particular efforts to provide alternatives for young generation.</p> <p>Explore in particular alternatives to fuel wood extraction.</p> <p>Improve current sustainable resource use livelihoods using technology advances and insights.</p>	Z-Forest-01: Forest degradation from over-exploitation	Z-Forest-02: Inadequate enforcement of forest management regulations Z-Forest-05: Conflict over mangrove cutting Z-Forest-09: Fire			Z-Forest-03: Pests and grazing damage Z-Forest-04: Erosion of mangrove stands
Awareness Raising	<p>Develop and launch awareness raising campaigns related to coastal management challenges directed to the public at large and to schools.</p> <p>Develop and launch issue specific awareness raising campaigns targeting stakeholders affected by or affecting the issue.</p> <p>And Target:</p> <ul style="list-style-type: none"> Stakeholders benefitting from coastal forest services and products Stakeholders benefitting from mangrove services and products Tourists 	Z-Forest-01: Forest degradation from over-exploitation	Z-Forest-02: Inadequate enforcement of forest management regulations Z-Forest-05: Conflict over mangrove cutting Z-Forest-06: Ineffective land use leading to encroachment Z-Forest-08: Declining ground water quality Z-Forest-09: Fire			Z-Forest-03: Pests and grazing damage Z-Forest-04: Erosion of mangrove stands
Education	<p>Engage in curricula review and development for primary and secondary schools to enhance the knowledge and understanding about coastal management issues- Issue of particular relevance from a forestry perspective include:</p> <ul style="list-style-type: none"> Coastal forest and wildlife ecology Coastal forest management 	Z-Forest-01: Forest degradation from over-exploitation	Z-Forest-02: Inadequate enforcement of forest management regulations Z-Forest-05: Conflict over mangrove cutting Z-Forest-06: Ineffective land use leading to encroachment Z-Forest-08: Declining ground water quality Z-Forest-09: Fire			Z-Forest-03: Pests and grazing damage Z-Forest-04: Erosion of mangrove stands

Action areas

In Table 125 below an overview has been established on how strongly each intervention dimension responds to threats to local communities and ecosystems as perceived by local stakeholders.

For each intervention dimension and for each problem class the number of threats considered to benefit from the intervention have been multiplied by the range value (RV) for the given problem class. The total score for each management dimension has then been calculated by adding the values achieved. The table thus provides an indication of the importance of each intervention dimension in addressing identified and ranked threats. In the same manner Figure 33 gives a graphical presentation of the relevance of intervention dimensions in addressing the identified threats related to with forestry.

Table 125: Assessment of the importance of broad management dimension in addressing threats to local communities and ecosystems associated with forestry.

Intervention Dimension	Major Problem weight	Very important problem weight	Important Problem weight	Problem weight	Light Problem weight	Total Score
Integrated Coastal Zone Management (ICZM)	5	12	0	0	0	17
Integrated Water Resources Management (IWRM)	0	4	0	0	1	5
Land Use Management	5	20	0	0	2	27
Shoreline Management Planning	5	8	0	0	1	14
Solid and Liquid Waste Management	0	0	0	0	0	0
Sanitation	0	0	0	0	0	0
Capacity Building	5	20	0	0	2	27
Technology	5	16	0	0	2	23
Law Enforcement	5	20	0	0	2	27
Legal Review	0	16	0	0	2	18
Alternative/ Improved Livelihood	5	12	0	0	2	19
Awareness Raising	5	20	0	0	2	27
Education	5	20	0	0	2	27
Zanzibar				Forestry	Total	231

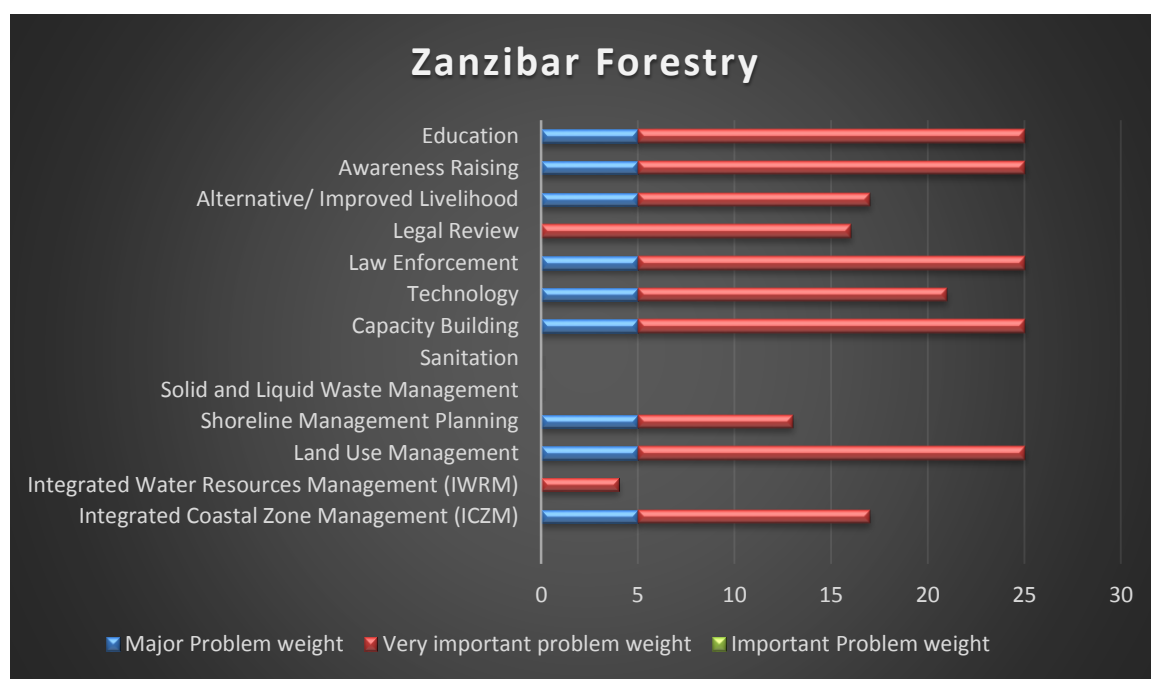


Figure 33: The importance of broad intervention dimension in responding to threats to local communities and ecosystems associated with forestry.

Industry

On Zanzibar, the industry sector is characterized by small businesses and the manufacturing sector in Zanzibar is dominated by Small and Medium Enterprises (SMEs). The current leading manufacturing activities are furniture, soft drinks, mineral water, articles of concrete cement and plaster, bakery products, clothing, printing, other fabricated metal products, cordage, rope, twine and netting, reproduction of recorded materials, etc, with most of them basically Micro, Small and Medium Enterprises (MSMEs).

Industry and manufacturing on the isles of Zanzibar contribute a very small amount to GDP, partly because there is very little activity and secondly because most of what is produced is done so in the informal sector, by small-scale producers. Processed clove oil and other natural oils as well as honey are well known products from Pemba, while production of wood carvings, tourist souvenirs and the like are mainly undertaken on Unguja. Textiles were a major industry on the isles until recently.



The importance of the manufacturing sector in terms of employment creation and development of linkages with the rest of economy is recognized. One area of strategic importance is agro-processing. Between the two main islands, the number of those employed in the manufacturing, industry and construction sub-sector is like to range from a 5,000 to 10,000.

Agriculture and services (tourism) are still the key economic activities, while manufacturing does not yet play a significant role in economic growth and employment generation.

Given the large role of exports of raw spices, increased value addition in that sector could present a starting point for diversification

Given the serious current challenges, Zanzibar will need to actively promote its manufacturing sector over a substantial period of time to tap into the potentials that do exist.

Prioritized Threats

In Table 126 below the threats identified related to industry have been listed and ranked according to their severity as established using the CRIAM method discussed extensively in Volumes I and II of the Coastal Profile. A rapid assessment has been made on the susceptibility of each threat to impacts of climate change more specifically, changes in weather patterns, extreme events, sea level rise, temperature rise and acidification.

Table 126: Prioritised threats related to industry and a rapid assessment of threat susceptibility to climate change.

#	Threat as identified in Coastal Profile	Threat Level	Influence from Climate Change				
			Change in Patterns	Extreme events	Sea Level Rise	Temperature rise	Acidification
Z-Industry-01	Inadequate infrastructure management unable to maintain supply of services (electricity, transport, freshwater supply), resulting in a disincentive for industry to be attracted to Zanzibar and develop.	Very Important Problem	+	++	+++	0	0
			Demands for infrastructure increases to respond to sea level rise and impacts during extreme events.				
Z-Industry-02	Lack of coordination of the choice of location of new industries underlines the need for integrated planning.	Very Important Problem	++	++	++	0	0
			The consequences of uncoordinated planning of industrial development will be aggravated from sea level rise and more frequent extreme events.				
Z-Industry-03	Failure to monitor industry liquid waste leading to pollution of waterways and ground water.	Very Important Problem	+	+	+	0	0
			Flooding and inundations due to changed weather patterns and extreme events exacerbates impacts of industrial pollution				
Z-Industry-04	Failure to monitor industry solid waste leading to pollution of waterways and open ground.	Very Important Problem	+	+	+	0	0
			Flooding and inundations due to changed weather patterns and extreme events exacerbates impacts of industrial pollution				
Z-Industry-05	Air emission leading to air pollution.	Very Important Problem	0	0	0	0	0
			No impact from climate change on this threat				
Z-Industry-06	Lack of raw materials leading to less adequate investment potentials	Very Important Problem	0	0	0	0	0
			No impact from climate change on this threat				
Z-Industry-07	Inadequate prioritisation in the industrial sector	Important Problem	0	0	0	0	0
			No impact from climate change on this threat				
+++ Threat is severely aggravated from climate change dimension ++ Threat is aggravated from climate change dimension + Threat is slightly aggravated from climate change dimension 0 No influence of threat from climate change dimension - Remediating effect on threat from climate change dimension							

Recommendations for threat mitigation measures

Overall measures to mitigate each of the identified industry related threats to coastal local communities and ecosystems have been tabulated in Table 194 (page 363) arranged under broad management dimensions headings. Table 127 below provides an overview of the requirements/opportunities expressed within each of these management or intervention dimensions.

Table 127: Broad management intervention dimensions to address identified and prioritised threats to coastal communities and ecosystems associated with industry in Zanzibar

Intervention Dimension	Statement	Threat pertinence at each RV				
		Major Problem (RV 5)	Very important problem (RV 4)	Important Problem (RV 3)	Problem (RV 2)	Light Problem (RV 1)
Integrated Coastal Zone Management (ICZM)	Ensure coordination and participation in management of coastal land, water and resources use currently under complex pressures. Ensures coordinated and integrated management of industries considering linkages to other sectors. Facilitate dialogues required to alleviate social conflicts over land use Link with hinterland management to address catchment and riverbank deforestation, river flow changes and river pollution, all of which affect the coast in many ways (ICARM).		Z-Industry-03: Lack of monitoring of liquid waste Z-Industry-04: Lack of monitoring of solid waste	Z-Industry-07: Inadequate prioritisation within sector		
Integrated Water Resources Management (IWRM)						

Intervention Dimension	Statement	Threat pertinence at each RV				
		Major Problem (RV 5)	Very important problem (RV 4)	Important Problem (RV 3)	Problem (RV 2)	Light Problem (RV 1)
Land Use Management	<p>Land use information management systems to duly include industry locations.</p> <p>Incorporate industries in spatial planning.</p> <p>Inform hinterland spatial planning to direct zoning to address downstream impacts from industries.</p>		<p>Z-Industry-01: Inadequate infrastructure provision</p> <p>Z-Industry-02: Lack of coordinated siting</p> <p>Z-Industry-03: Lack of monitoring of liquid waste</p> <p>Z-Industry-04: Lack of monitoring of solid waste</p> <p>Z-Industry-05: Air pollution</p> <p>Z-Industry-06: Lack of raw materials</p>	Z-Industry-07: Inadequate prioritisation within sector		
Shoreline Management Planning						
Solid and Liquid Waste Management	<p>Review of management of industrial wastes.</p> <p>Pursue integrated solid and liquid waste management solutions considering:</p> <p>Industrial waste water treatment systems:</p> <ul style="list-style-type: none"> - collection - treatment technology - discharge <p>Industrial solid waste management systems:</p> <ul style="list-style-type: none"> - collection - storage - processing - financing - minimisation - reuse? <p>Green Infrastructure</p> <p>Storm Water Systems</p>		<p>Z-Industry-03: Lack of monitoring of liquid waste</p> <p>Z-Industry-04: Lack of monitoring of solid waste</p> <p>Z-Industry-05: Air pollution</p> <p>Z-Industry-06: Lack of raw materials</p>			
Sanitation						
Capacity Building	<p>Accompany management interventions with appropriate capacity building components. Particular focus on</p> <ul style="list-style-type: none"> • Spatial planning • Industrial waste <p>Enhance information management systems to provide for better and systematically informed management decisions. Include:</p> <ul style="list-style-type: none"> • Industrial waste streams • Industrial pollution streams <p>Targeting relevant government departments at national and local levels.</p>		<p>Z-Industry-01: Inadequate infrastructure provision</p> <p>Z-Industry-02: Lack of coordinated siting</p> <p>Z-Industry-03: Lack of monitoring of liquid waste</p> <p>Z-Industry-04: Lack of monitoring of solid waste</p> <p>Z-Industry-05: Air pollution</p>			

Intervention Dimension	Statement	Threat pertinence at each RV				
		Major Problem (RV 5)	Very important problem (RV 4)	Important Problem (RV 3)	Problem (RV 2)	Light Problem (RV 1)
Technology	Pursue opportunities through further technology development within: <ul style="list-style-type: none"> Clean industrial technologies Waste solid and liquid industrial waste treatment Air emission treatment Monitoring, remote imageries GIS 		Z-Industry-01: Inadequate infrastructure provision Z-Industry-03: Lack of monitoring of liquid waste Z-Industry-04: Lack of monitoring of solid waste Z-Industry-05: Air pollution Z-Industry-06: Lack of raw materials			
Law Enforcement	1) Integrated review of laws, regulations and their enforcement within amongst others: <ul style="list-style-type: none"> Industrial waste treatment and disposal Air pollution 2) Optimise enforcement through capacity building and coordination following recommendations from review.		Z-Industry-03: Lack of monitoring of liquid waste Z-Industry-04: Lack of monitoring of solid waste Z-Industry-05: Air pollution			
Legal Review						
Alternative/ Improved Livelihood						
Awareness Raising	Develop and launch awareness raising campaigns related to coastal management challenges directed to the public at large and to schools. Develop and launch issue specific awareness raising campaigns targeting stakeholders affected by or affecting the issue. And Target: <ul style="list-style-type: none"> Relevant industries/activities 		Z-Industry-03: Lack of monitoring of liquid waste Z-Industry-04: Lack of monitoring of solid waste Z-Industry-05: Air pollution			
Education	Engage in curricula review and development for primary and secondary schools to enhance the knowledge and understanding about coastal management issues. Issue of particular relevance from an industry perspective include: <ul style="list-style-type: none"> Environmentally sound industries Integrated management (cross sector, upstream/downstream, ICARM) 		Z-Industry-03: Lack of monitoring of liquid waste Z-Industry-04: Lack of monitoring of solid waste Z-Industry-05: Air pollution			

Action areas

In Table 128 below an overview has been established on how strongly each intervention dimension responds to threats to local communities and ecosystems as perceived by local stakeholders.

For each intervention dimension and for each problem class the number of threats considered to benefit from the intervention have been multiplied by the range value (RV) for the given problem class. The total score for each management dimension has then been calculated by adding the values achieved. The table thus provides an indication of the importance of each intervention dimension in addressing identified and ranked threats. In the same manner Figure 34 gives a graphical presentation of the relevance of intervention dimensions in addressing the identified threats related to with industry.

Table 128: Assessment of the importance of broad management dimension in addressing threats to local communities and ecosystems associated with industry.

Intervention Dimension	Major Problem weight	Very important problem weight	Important Problem weight	Problem weight	Light Problem weight	Total Score
Integrated Coastal Zone Management (ICZM)	0	8	3	0	0	11
Integrated Water Resources Management (IWRM)	0	0	0	0	0	0
Land Use Management	0	24	3	0	0	27
Shoreline Management Planning	0	0	0	0	0	0
Solid and Liquid Waste Management	0	16	0	0	0	16
Sanitation	0	0	0	0	0	0
Capacity Building	0	20	0	0	0	20
Technology	0	20	0	0	0	20
Law Enforcement	0	12	0	0	0	12
Legal Review	0	0	0	0	0	0
Alternative/ Improved Livelihood	0	0	0	0	0	0
Awareness Raising	0	12	0	0	0	12
Education	0	12	0	0	0	12
Zanzibar				Industry	Total	130

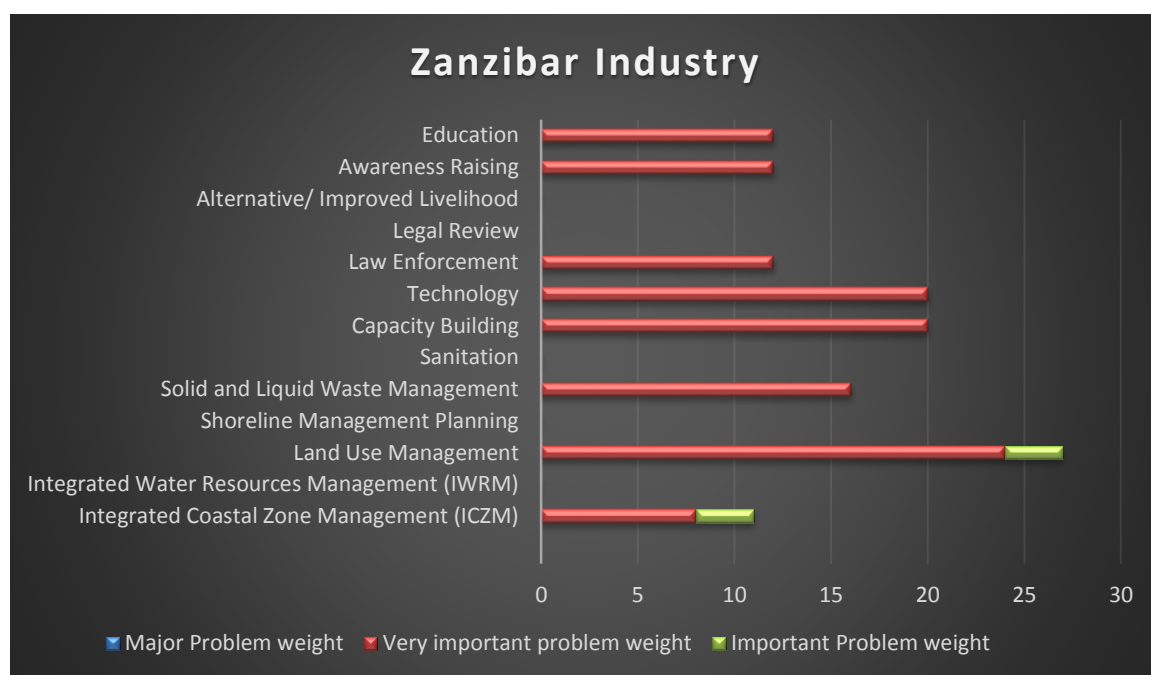


Figure 34: The importance of broad intervention dimension in responding to threats to local communities and ecosystems associated with industry.

Ports and Harbours

Zanzibar and Pemba Islands are served by five ports (Malindi and Zanzibar ports, plus minor ports located in Mkokotoni (Unguja), Mkoani and Wete on Pemba Island (ICAM, 2000). Given the island's strategic location, the port at Malindi (known as the Zanzibar Port) is one of the principal ports in East Africa and handles around 90% of Zanzibar's trade (ZRG 2004).



The port also services passenger ferries commuting between Dar es Salaam, Pemba and at times Tanga, handling over 1,000 ferry passengers daily, including a large proportion of the tourism visits).



From the ports to the consumers, road transportation infrastructure is responsible for delivery and movement on land. Harbours are thus integrally dependent on roads to move goods and people.

A recent refurbishment was completed in 2009 but there is a need for a new port and there are plans for a container port at Maruhubi area (north of the existing port) which will facilitate Zanzibar's economic development and the growth of trade as well as the movement of cargo along Africa's east coast (ZRG, 2010).

Since approximately 90% of Zanzibar's trade transits through the port of Malindi, improvements to this facility (especially its efficiency) should be prioritized. The planned construction of a new port at Maruhubi will improve the efficiency and lower cost of trade, so important for these small islands.

Prioritized Threats

In Table 129 below the threats identified related to ports and harbours have been listed and ranked according to their severity as established using the CRIAM method discussed extensively in Volumes I and II of the Coastal Profile. A rapid assessment has been made on the susceptibility of each threat to impacts of climate change more specifically, changes in whether patterns, extreme events, sea level rise, temperature rise and acidification.

Table 129: Prioritised threats related to ports and harbours and a rapid assessment of threat susceptibility to climate change.

#	Threat as identified in Coastal Profile	Threat Level	Influence from Climate Change				
			Change in Patterns	Extreme events	Sea Level Rise	Temperature rise	Acidification
Z-P&H-01	Inefficient operation at Malindi port leading to greater costs of imported and exported goods.	Very Important Problem	0	0	0	0	0
No impact from climate change on this threat							
Z-P&H-03	Erosion of shorelines adjacent to some secondary ports: Mkoani and Wete (Pemba), and Mkokotoni (Unguja).	Important Problem	++	++	++	0	0
Changened weather patterns may interfere with sediment balances. Extreme events and sea level rise aggravate erosion.							
Z-P&H-04	Inadequate environmental mitigation during new port construction leading to environmental degradation e.g. siltation of reefs.	Problem	+	+	+	0	0
Extreme events, sea level rise and chaged weather patterns may aggravate environmental degradation caused by port expansion.							

#	Threat as identified in Coastal Profile	Threat Level	Influence from Climate Change				
			Change in Patterns	Extreme events	Sea Level Rise	Temperature rise	Acidification
Z-P&H-05	Pollution arising from port activities and traffic.	Problem	+	+	+	0	0
			Flooding and inondations due to changed weather patterns and extreme events exacerbates impacts of pollution				
+++	Threat is severely aggravated from climate change dimension						
++	Threat is aggravated from climate change dimension						
+	Threat is slightly aggravated from climate change dimension						
0	No influence of threat from climate change dimension						
-	Remediating effect on threat from climate change dimension						

Recommendations for threat mitigation measures

Overall measures to mitigate each if the identified ports and harbours related threats to coastal local communities and ecosystems have been tabulated in Table 195(page364) arranged under broad management dimensions headings. Table 130below provides an overview of the requirements/opportunities expressed within each of these management or intervention dimensions.

Table 130: Broad management intervention dimensions to address identified and prioritised threats to coastal communities and ecosystems associated with ports and harbours in Zanzibar

Intervention Dimension	Statement	Threat pertinence at each RV				
		Major Problem (RV 5)	Very important problem (RV 4)	Important Problem (RV 3)	Problem (RV 2)	Light Problem (RV 1)
Integrated Coastal Zone Management (ICZM)	Ensure coordination and participation in management of coastal land, water and resources use currently under complex pressures. Facilitate dialogues required to alleviate social conflicts over resources use. Link with hinterland management to address catchment and riverbank deforestation, river flow changes and river sedimentation loads, all of which affect the coastlines in many ways (ICARM).			Z-P&H-03: Erosion of shorelines adjacent to some secondary ports	Z-P&H-04:Inadequate environmental mitigation in developing new ports Z-P&H-05: Pollution from port activities and traffic	
Integrated Water Resources Management (IWRM)	Link IWRM to coastal integrated planning ensuring upstream/downstream considerations (ICARM). Land use in catchments and its impacts on coastlines included in IWRM planning.					
Land Use Management	Land use information management systems to shoreline management parameters. Incorporate shoreline management concerns in spatial planning. Inform hinterland spatial planning to direct zoning to mitigate downstream impacts on coastlines.			Z-P&H-03: Erosion of shorelines adjacent to some secondary ports	Z-P&H-05: Pollution from port activities and traffic	
Shoreline Management Planning	Establish a systematic overview of coastal processes through a shoreline management investigation, considering the entire coast, and inform spatial planning accordingly. Sediment cell resolution national effort, management unit resolution regional/ district effort.			Z-P&H-03: Erosion of shorelines adjacent to some secondary ports	Z-P&H-04:Inadequate environmental mitigation in developing new ports Z-P&H-05: Pollution from port activities and traffic	

Intervention Dimension	Statement	Threat pertinence at each RV				
		Major Problem (RV 5)	Very important problem (RV 4)	Important Problem (RV 3)	Problem (RV 2)	Light Problem (RV 1)
Solid and Liquid Waste Management	Pursue integrated solid and liquid waste management solutions considering: Waste water management system in ports and on ships: - collection - treatment technology - discharge Liquid Waste Management Systems in ports and on ships: - collection - storage - processing - financing - minimisation - reuse?				Z-P&H-05: Pollution from port activities and traffic	
Sanitation						
Capacity Building	Accompany management interventions with appropriate capacity building components. Particular focus on spatial planning, shoreline management, pollution control. Enhance information management systems to provide for better and systematically informed management decisions.		Z-P&H-01: Inefficient management of Malindi Port	Z-P&H-03: Erosion of shorelines adjacent to some secondary ports	Z-P&H-04: Inadequate environmental mitigation in developing new ports Z-P&H-05: Pollution from port activities and traffic	
Technology	Pursue opportunities through further technology development within: <ul style="list-style-type: none"> Port management Shoreline management Pollution management in ports and on ships 		Z-P&H-01: Inefficient management of Malindi Port	Z-P&H-03: Erosion of shorelines adjacent to some secondary ports	Z-P&H-04: Inadequate environmental mitigation in developing new ports Z-P&H-05: Pollution from port activities and traffic	
Law Enforcement	1) Integrated review of laws, regulations and their enforcement within amongst others: <ul style="list-style-type: none"> Land appropriation Environmental and Social Impact Assessments (ESIA) Waste management in ports and on ships Shoreline management 2) Optimise enforcement through capacity building and coordination following recommendations from review.			Z-P&H-03: Erosion of shorelines adjacent to some secondary ports	Z-P&H-05: Pollution from port activities and traffic	
Legal Review	1) Integrated review of laws, regulations and their enforcement within amongst others: <ul style="list-style-type: none"> Land appropriation Environmental and Social Impact Assessments (ESIA) Waste management in ports and on ships Shoreline management 2) Initiate revision of existing and develop new laws, regulations according to recommendations from review			Z-P&H-03: Erosion of shorelines adjacent to some secondary ports		
Alternative/ Improved Livelihood	Develop and offer alternative livelihoods for households currently engaged in destructive practises impacting on shorelines. Improve current sustainable resource use livelihoods using technology advances and insights.					
Awareness Raising	Develop and launch awareness raising campaigns related to coastal management challenges directed to the public at large and to schools. Develop and launch issue specific awareness raising campaigns targeting stakeholders affected by or affecting the issue. Particular emphasis on shoreline processes and impacts on shorelines and environment from ports and marine traffic and on contingency planning.			Z-P&H-03: Erosion of shorelines adjacent to some secondary ports	Z-P&H-05: Pollution from port activities and traffic	

Intervention Dimension	Statement	Threat pertinence at each RV				
		Major Problem (RV 5)	Very important problem (RV 4)	Important Problem (RV 3)	Problem (RV 2)	Light Problem (RV 1)
Education	Engage in curricula review and development for primary and secondary schools to enhance the knowledge and understanding about coastal management issues- Issue of particular relevance from a fisheries perspective include: <ul style="list-style-type: none"> • Importance of beaches • Pollution, environment health • Waste minimisation and recycling • Contingency planning 				Z-P&H-05: Pollution from port activities and traffic	

Action areas

In Table 131 below an overview has been established on how strongly each intervention dimension responds to threats to local communities and ecosystems as perceived by local stakeholders.

For each intervention dimension and for each problem class the number of threats considered to benefit from the intervention have been multiplied by the range value (RV) for the given problem class. The total score for each management dimension has then been calculated by adding the values achieved. The table thus provides an indication of the importance of each intervention dimension in addressing identified and ranked threats. In the same manner Figure 35 gives a graphical presentation of the relevance of intervention dimensions in addressing the identified threats related to with ports and harbours.

Table 131: Assessment of the importance of broad management dimension in addressing threats to local communities and ecosystems associated with ports and harbours.

Intervention Dimension	Major Problem weight	Very important problem weight	Important Problem weight	Problem weight	Light Problem weight	Total Score
Integrated Coastal Zone Management (ICZM)	0	0	3	4	0	7
Integrated Water Resources Management (IWRM)	0	0	0	0	0	0
Land Use Management	0	0	3	2	0	5
Shoreline Management Planning	0	0	3	4	0	7
Solid and Liquid Waste Management	0	0	0	1	0	1
Sanitation	0	0	0	0	0	0
Capacity Building	0	4	3	4	0	11
Technology	0	4	3	4	0	11
Law Enforcement	0	0	3	2	0	5
Legal Review	0	0	3	0	0	3
Alternative/ Improved Livelihood	0	0	0	0	0	0
Awareness Raising	0	0	3	2	0	5
Education	0	0	0	2	0	2
Zanzibar				Ports and Harbours	Total	57

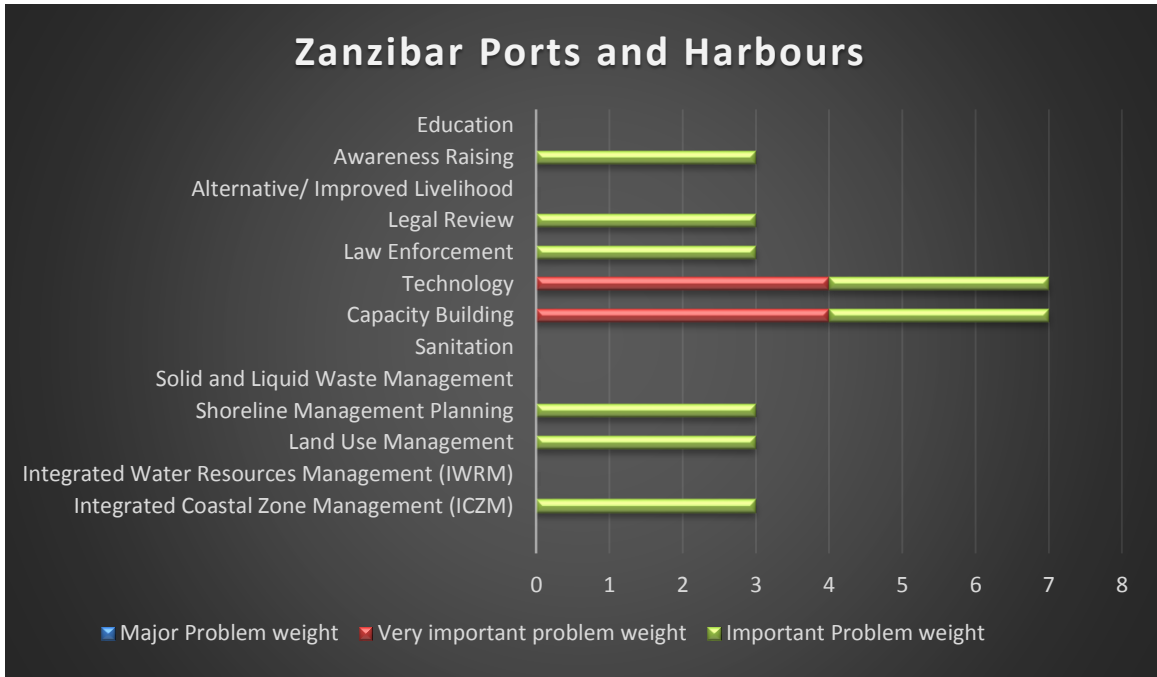


Figure 35: The importance of broad intervention dimension in responding to threats to local communities and ecosystems associated with ports and harbours.

Infrastructure

The rate of population growth, urbanisation and the need for infrastructure is seen in many parts of Zanzibar places enormous pressure on the local authorities to match the provision of basic services (clean water supply, power and energy, transportation, health, education, etc.). Some of the sub-sector fare better than others, for example the ICT developments over recent years are far more impressive than the development in provision of electricity



- **Power and Energy** Zanzibar is connected to the National (Tanzania) power grid with electricity through two underwater submarine cable connection with a capacity of 45 MW and 100 MW. Pemba has a submarine cable of smaller capacity (20 MW) linking with Tanga on the mainland.
- **Ports** The islands rely heavily on marine transport and these infrastructure aspects are covered in a separate theme.
- **Roads** A network of tarmac trunk road covers most parts of Zanzibar, totalling some 120 km. A passable network of tertiary roads reaches all rural areas. A main road connects the three main cities of Pemba.
- **Air Transport** Zanzibar International Airport can handle international sized aircrafts and is undergoing major rehabilitation for the extension of its runway and the enhancement of the passenger terminal and other facilities. There is a secondary airport on Pemba, outside Chake Chake.
- **Water** The overall coverage of water is currently at 65% at an average of daily service of 12 hours, thus leaving 35% of the population, especially in rural areas, with no access to safe drinking water. Stone Town, Mkoani, Chake Chake, Wete have piped water.
- **Health** The 2004/05 Household Budget Survey indicates that more than 75% of the households in the rural area are within 1 km from the health centre.



Zanzibar is likely to continue to see considerable development in business and tourism in the coming 5-10 years. Oil and gas development has commenced in Zanzibar waters, and may produce the benefits that are beginning to be seen on the mainland.

Agricultural output, development and general trade are likely to witness accelerated growth in the near future, especially in the urban industrial zones. Improved roads and upgraded electricity will support the trend. The challenge will be for the responsible ministries and local authorities

to implement and maintain the infrastructure sub-sectors that need developing.

Prioritized Threats

In Table 132 below the threats identified related to infrastructure have been listed and ranked according to their severity as established using the CRIAM method discussed extensively in Volumes I and II of the Coastal Profile. A rapid assessment has been made on the susceptibility of each threat to impacts of

climate change more specifically, changes in whether patterns, extreme events, sea level rise, temperature rise and acidification.

Table 132: Prioritised threats related to infrastructure and a rapid assessment of threat susceptibility to climate change.

#	Threat as identified in Coastal Profile	Threat Level	Influence from Climate Change				
			Change in Patterns	Extreme events	Sea Level Rise	Temperature rise	Acidification
Z-Infra-01	Poor land use and infrastructure management leading to poor or biased choices for development, for example.	Very Important Problem	+	++	++	0	0
			Infrastructure needs to be carefully planned and managed with due considerations to climate change to avoid or mitigate impacts from sea level rise and extreme events				
Z-Infra-02	Inadequate infrastructure management unable to maintain supply of services (electricity, transport, freshwater supply, health and education services and ICT) to coastal regions, resulting in a deterioration of living standards, business development and prosperity.	Very Important Problem	+	++	++	0	0
			Infrastructure needs to be carefully planned and managed with due considerations to climate change to avoid or mitigate impacts from sea level rise and extreme events and to optimise infrastructure services delivery.				
+++	Threat is severely aggravated from climate change dimension						
++	Threat is aggravated from climate change dimension						
+	Threat is slightly aggravated from climate change dimension						
0	No influence of threat from climate change dimension						
-	Remediating effect on threat from climate change dimension						

Recommendations for threat mitigation measures

Overall measures to mitigate each if the identified infrastructure related threats to coastal local communities and ecosystems have been tabulated in Table 196(page365) arranged under broad management dimensions headings. Table 133below provides an overview of the requirements/opportunities expressed within each of these management or intervention dimensions.

Table 133: Broad management intervention dimensions to address identified and prioritised threats to coastal communities and ecosystems associated with infrastructure in Zanzibar

Intervention Dimension	Statement	Threat pertinence at each RV				
		Major Problem (RV 5)	Very important problem (RV 4)	Important Problem (RV 3)	Problem (RV 2)	Light Problem (RV 1)
Integrated Coastal Zone Management (ICZM)	Ensure coordination and participation in management of coastal land, water and resources use currently under complex pressures. Develop infrastructure accommodating sector coordination and delivering to local levels. Link with hinterland management to facilitate infrastructure coherence in sustainably delivering services and products satisfying requirements at the coast (ICARM).		Z-Infra-01: Poor land use and infrastructure management Z-Infra-02: Poor delivery of services through infrastructure			
Integrated Water Resources Management (IWRM)						
Land Use Management	Land use information management systems to include infrastructure. Incorporate infrastructure required to satisfy development objectives in spatial planning. Inform hinterland spatial planning to enable infrastructure linkages.		Z-Infra-01: Poor land use and infrastructure management Z-Infra-02: Poor delivery of services through infrastructure			
Shoreline Management Planning						
Solid and Liquid Waste Management						
Sanitation						

Intervention Dimension	Statement	Threat pertinence at each RV				
		Major Problem (RV 5)	Very important problem (RV 4)	Important Problem (RV 3)	Problem (RV 2)	Light Problem (RV 1)
Capacity Building	Accompany management interventions with appropriate capacity building components. Particular focus on spatial planning. Enhance information management systems to provide for better and systematically informed management decisions.		Z-Infra-01: Poor land use and infrastructure management Z-Infra-02: Poor delivery of services through infrastructure			
Technology	Apply new infrastructure technologies to minimize impacts and increase cost-effectiveness		Z-Infra-02: Poor delivery of services through infrastructure			
Law Enforcement	Integrated review of laws, regulations and their enforcement within amongst others: <ul style="list-style-type: none"> Development planning and control Optimise enforcement through capacity building and coordination following recommendations from review.		Z-Infra-01: Poor land use and infrastructure management			
Legal Review						
Alternative/ Improved Livelihood						
Awareness Raising	Develop and launch awareness raising campaigns related to coastal management challenges directed to the public at large and to schools. Develop and launch issue specific awareness raising campaigns targeting stakeholders affected by or affecting the issue.		Z-Infra-01: Poor land use and infrastructure management			
Education						

Action areas

In Table 134 below an overview has been established on how strongly each intervention dimension responds to threats to local communities and ecosystems as perceived by local stakeholders.

For each intervention dimension and for each problem class the number of threats considered to benefit from the intervention have been multiplied by the range value (RV) for the given problem class. The total score for each management dimension has then been calculated by adding the values achieved. The table thus provides an indication of the importance of each intervention dimension in addressing identified and ranked threats. In the same manner Figure 36 gives a graphical presentation of the relevance of intervention dimensions in addressing the identified threats related to with infrastructure.

Table 134: Assessment of the importance of broad management dimension in addressing threats to local communities and ecosystems associated with infrastructure.

Intervention Dimension	Major Problem weight	Very important problem weight	Important Problem weight	Problem weight	Light Problem weight	Total Score
Integrated Coastal Zone Management (ICZM)	0	8	0	0	0	8
Integrated Water Resources Management (IWRM)	0	0	0	0	0	0
Land Use Management	0	8	0	0	0	8
Shoreline Management Planning	0	0	0	0	0	0
Solid and Liquid Waste Management	0	0	0	0	0	0
Sanitation	0	0	0	0	0	0
Capacity Building	0	8	0	0	0	8
Technology	0	4	0	0	0	4
Law Enforcement	0	4	0	0	0	4
Legal Review	0	0	0	0	0	0
Alternative/ Improved Livelihood	0	0	0	0	0	0
Awareness Raising	0	4	0	0	0	4
Education	0	0	0	0	0	0
Zanzibar			Infrastructure	Total		36

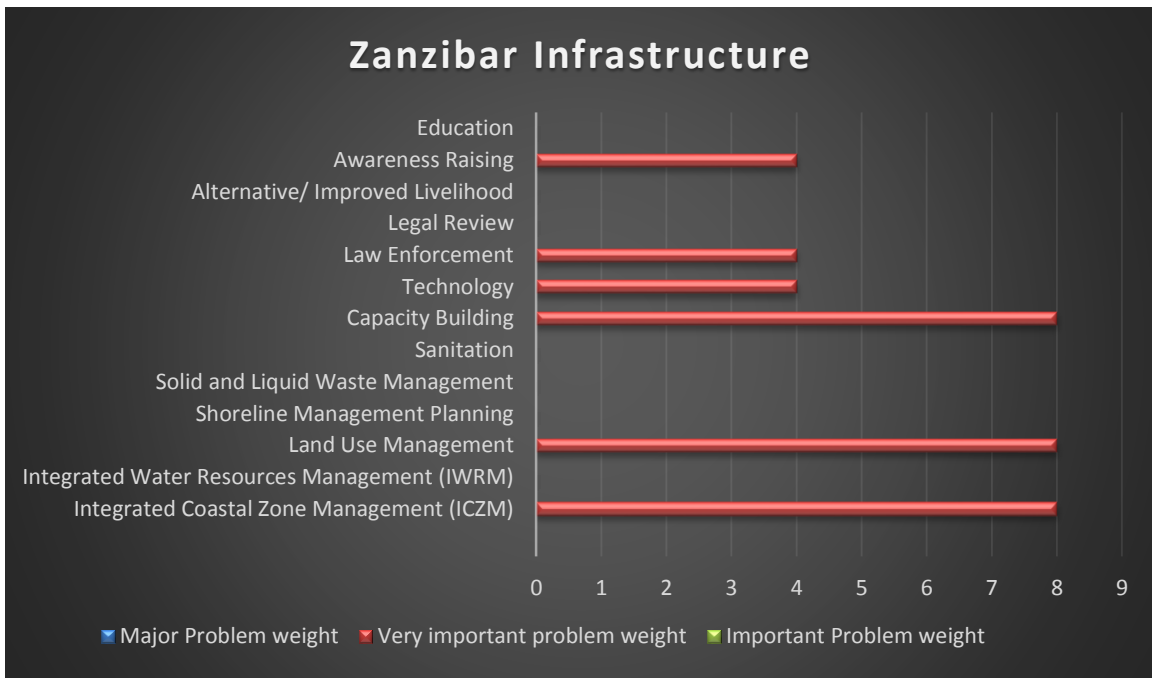


Figure 36: The importance of broad intervention dimension in responding to threats to local communities and ecosystems associated with infrastructure.

Urbanisation

Zanzibar is a predominantly rural archipelago within a largely rural population (60%), with most people living in villages, far removed from urban life. From the 1980s, the growth of some villages into small towns and towns into large cities has been transforming the physical and social landscape.

The population of Zanzibar is estimated at over 1 million, of which 40% now live in urban areas. Cities like Zanzibar Stone Town (including surrounding suburbs) are growing at a rate of between 7% and 11% per annum.

Despite rapid urbanisation, there has been a threefold increase in the rural population, adding to pressure on land and other resources in rural areas (Wenban-Smith 2014). The advantages to citizens of urban life are many, the most obvious being access to facilities, services, infrastructure and amenities, more options for jobs and education.



On the isles of Zanzibar five areas are classified urban: the cities of Wete, Chake Chake and Mkoani on Pemba and Zanzibar Stone Town (in Urban West Region) and Makunduchi on Unguja.



Urban growth in Zanzibar is projected to continue in the coming decades, and could even accelerate. If the current predicament in urban centres is not addressed soon, conditions will deteriorate. As density increases and unplanned settlements become more congested, investments in facilities, services and infrastructure are likely to become costlier, both

financially and socially. Already Zanzibar has one of the highest proportions of urban residents living in unplanned settlements in all of sub-Saharan Africa (UNICEF 2012).

Prioritized Threats

In Table 135 below the threats identified related to urbanisation have been listed and ranked according to their severity as established using the CRIAM method discussed extensively in Volumes I and II of the Coastal Profile. A rapid assessment has been made on the susceptibility of each threat to impacts of climate change more specifically, changes in weather patterns, extreme events, sea level rise, temperature rise and acidification.

Table 135: Prioritised threats related to urbanisation and a rapid assessment of threat susceptibility to climate change.

#	Threat as identified in Coastal Profile	Threat Level	Influence from Climate Change				
			Change in Patterns	Extreme events	Sea Level Rise	Temperature Rise	Acidification
Z-Urban-01	Poor urban management leading to overcrowding informal settlements that lack clean water and adequate sanitation, leading to increase health and well-being problems from contaminated water and from mosquitos and other pests that thrive in unsanitary environments.	Very Important Problem	++	++	++	0	0
			These impacts may be aggravated due to extreme events and sea level rise				
Z-Urban-02	Inadequate solid waste management causing pollution of the landscape, watersheds and the coast.	Very Important Problem	+	++	++	0	0
			Impacts of solid waste pollution is aggravated from extreme events and sea level rise.				
Z-Urban-03	Inadequate sanitation causing pollution and health issues.	Very Important Problem	+	++	++	0	0
			Impacts of inadequate sanitation is aggravated from extreme events and sea level rise.				
Z-Urban-04	Failure of housing for the youth and children exposing them to human predators, violence, abuse and sexual assault that increase their risk of HIV infection.	Very Important Problem	0	0	0	0	0
			No impact from climate change on this threat				
Z-Urban-05	Increasing vehicular/pedestrian congestion, conflicts and air pollution.	Very Important Problem	0	0	0	0	0
			No impact from climate change on this threat				
Z-Urban-07	Poor urban management threatening the status of the Stone Town World Heritage Site and thus the tourism industry on Zanzibar.	Important Problem	0	0	0	0	0
			No impact from climate change on this threat				
Z-Urban-06	Poor vehicular management leading to increasing vehicular congestion resulting in loss of working hours and fatigue among the workforce.	Light Problem	0	0	0	0	0
			No impact from climate change on this threat				
+++	Threat is severely aggravated from climate change dimension						
++	Threat is aggravated from climate change dimension						
+	Threat is slightly aggravated from climate change dimension						
0	No influence of threat from climate change dimension						
-	Remediating effect on threat from climate change dimension						

Recommendations for threat mitigation measures

Overall measures to mitigate each if the identified natural resources related threats to coastal local communities and ecosystems have been tabulated in Table 197(page366) arranged under broad management dimensions headings. Table 136below provides an overview of the requirements/opportunities expressed within each of these management or intervention dimensions.

Table 136: Broad management intervention dimensions to address identified and prioritised threats to coastal communities and ecosystems associated with urbanisation in Zanzibar

Intervention Dimension	Statement	Threat pertinence at each RV				
		Major Problem (RV 5)	Very important problem (RV 4)	Important Problem (RV 3)	Problem (RV 2)	Light Problem (RV 1)
Integrated Coastal Zone Management (ICZM)	Ensure coordination and participation in management of coastal land, water and resources use currently under complex pressures particularly in urban areas.		Z-Urban-02: Pollution due to inadequate solid waste management			
Integrated Water Resources Management (IWRM)			Z-Urban-01: Overcrowding and inadequate services due to poor urban management Z-Urban-02: Pollution due to inadequate solid waste management			
Land Use Management	Land use information management systems include urban areas, urban services and available zoning within. Consider urbanisation in spatial planning.		Z-Urban-01: Overcrowding and inadequate services due to poor urban management Z-Urban-02: Pollution due to inadequate solid waste management Z-Urban-05: Traffic congestion	Z-Urban-06: Working hour loss due to congestion in traffic	Z-Urban-07 : Stone Town status threatened by poor urban management	

Intervention Dimension	Statement	Threat pertinence at each RV				
		Major Problem (RV 5)	Very important problem (RV 4)	Important Problem (RV 3)	Problem (RV 2)	Light Problem (RV 1)
Shoreline Management Planning	Establish a systematic overview of coastal processes through a shoreline management investigation, considering the entire coast, and inform spatial planning accordingly. Sediment cell resolution national effort, management unit resolution regional/district effort. Develop policies for development control in management units directing spatial planning.		Z-Urban-02: Pollution due to inadequate solid waste management			
Solid and Liquid Waste Management	Pursue integrated solid and liquid waste management solutions considering: Waste water treatment systems: - collection - treatment technology - discharge Liquid Waste Management Systems: - collection - storage - processing - financing - minimisation - reuse? Green Infrastructure Storm Water Systems		Z-Urban-01: Overcrowding and inadequate services due to poor urban management Z-Urban-02: Pollution due to inadequate solid waste management Z-Urban-03: Pollution and health problems due to poor sanitation			
Sanitation	Pursue integrated solid and liquid waste management considering: Waste water treatment systems: - collection - treatment technology - discharge Liquid Waste Management Systems: - collection - storage - processing - financing - minimisation - reuse? Green Infrastructure Storm Water Systems		Z-Urban-01: Overcrowding and inadequate services due to poor urban management Z-Urban-02: Pollution due to inadequate solid waste management Z-Urban-03: Pollution and health problems due to poor sanitation			
Capacity Building	Accompany management interventions with appropriate capacity building components. Particular focus on spatial planning, urbanisation, shoreline management, conflict resolution, monitoring, law enforcement. Enhance information management systems to provide for better and systematically informed management decisions.		Z-Urban-01: Overcrowding and inadequate services due to poor urban management Z-Urban-02: Pollution due to inadequate solid waste management Z-Urban-03: Pollution and health problems due to poor sanitation Z-Urban-04: Exposure of youth to abuse due to lack of housing Z-Urban-05: Traffic congestion	Z-Urban-06: Working hour loss due to congestion in traffic	Z-Urban-07 : Stone Town status threatened by poor urban management	

Intervention Dimension	Statement	Threat pertinence at each RV				
		Major Problem (RV 5)	Very important problem (RV 4)	Important Problem (RV 3)	Problem (RV 2)	Light Problem (RV 1)
Technology	<p>Pursue opportunities through further technology development within:</p> <ul style="list-style-type: none"> • Integrated solid and liquid waste management • Traffic planning • Shoreline management 		<p>Z-Urban-01: Overcrowding and inadequate services due to poor urban management</p> <p>Z-Urban-02: Pollution due to inadequate solid waste management</p> <p>Z-Urban-03: Pollution and health problems due to poor sanitation</p> <p>Z-Urban-05: Traffic congestion</p>	<p>Z-Urban-06: Working hour loss due to congestion in traffic</p>		
Law Enforcement	<p>1) Integrated review of laws, regulations and their enforcement within amongst others:</p> <ul style="list-style-type: none"> • Resource exploitation • Sand mining • Near shore construction • Traffic • Child welfare • Urban land use • Spatial planning <p>2) Optimise enforcement through capacity building and coordination following recommendations from review.</p>		<p>Z-Urban-01: Overcrowding and inadequate services due to poor urban management</p> <p>Z-Urban-02: Pollution due to inadequate solid waste management</p> <p>Z-Urban-03: Pollution and health problems due to poor sanitation</p> <p>Z-Urban-04: Exposure of youth to abuse due to lack of housing</p> <p>Z-Urban-05: Traffic congestion</p>	<p>Z-Urban-06: Working hour loss due to congestion in traffic</p>	<p>Z-Urban-07 : Stone Town status threatened by poor urban management</p>	
Legal Review						
Alternative/ Improved Livelihood						
Awareness Raising	<p>Develop and launch awareness raising campaigns related to coastal management challenges directed to the public at large and to schools.</p> <p>Develop and launch issue specific awareness raising campaigns targeting stakeholders affected by or affecting the issue.</p>		<p>Z-Urban-01: Overcrowding and inadequate services due to poor urban management</p> <p>Z-Urban-02: Pollution due to inadequate solid waste management</p> <p>Z-Urban-03: Pollution and health problems due to poor sanitation</p> <p>Z-Urban-04: Exposure of youth to abuse due to lack of housing</p> <p>Z-Urban-05: Traffic congestion</p>	<p>Z-Urban-06: Working hour loss due to congestion in traffic</p>	<p>Z-Urban-07 : Stone Town status threatened by poor urban management</p>	

Intervention Dimension	Statement	Threat pertinence at each RV				
		Major Problem (RV 5)	Very important problem (RV 4)	Important Problem (RV 3)	Problem (RV 2)	Light Problem (RV 1)
Education	<p>Engage in curricula review and development for primary and secondary schools to enhance the knowledge and understanding about coastal management issues- Issue of particular relevance from a fisheries perspective include:</p> <ul style="list-style-type: none"> Sustainable development in areas under high demographic and economic development pressure (coastal areas, urban areas). Importance of coasts and coastal habitats and resources. 		<p>Z-Urban-01: Overcrowding and inadequate services due to poor urban management</p> <p>Z-Urban-02: Pollution due to inadequate solid waste management</p> <p>Z-Urban-03: Pollution and health problems due to poor sanitation</p> <p>Z-Urban-05: Traffic congestion</p>	<p>Z-Urban-06: Working hour loss due to congestion in traffic</p>	<p>Z-Urban-07 : Stone Town status threatened by poor urban management</p>	

Action areas

In Table 137 below an overview has been established on how strongly each intervention dimension responds to threats to local communities and ecosystems as perceived by local stakeholders.

For each intervention dimension and for each problem class the number of threats considered to benefit from the intervention have been multiplied by the range value (RV) for the given problem class. The total score for each management dimension has then been calculated by adding the values achieved. The table thus provides an indication of the importance of each intervention dimension in addressing identified and ranked threats. In the same manner Figure 37 gives a graphical presentation of the relevance of intervention dimensions in addressing the identified threats related to with urbanisation.

Table 137: Assessment of the importance of broad management dimension in addressing threats to local communities and ecosystems associated with urbanisation.

Intervention Dimension	Major Problem weight	Very important problem weight	Important Problem weight	Problem weight	Light Problem weight	Total Score
Integrated Coastal Zone Management (ICZM)	0	4	0	0	0	4
Integrated Water Resources Management (IWRM)	0	8	0	0	0	8
Land Use Management	0	12	3	2	0	17
Shoreline Management Planning	0	4	0	0	0	4
Solid and Liquid Waste Management	0	12	0	0	0	12
Sanitation	0	12	0	0	0	12
Capacity Building	0	20	3	2	0	25
Technology	0	16	3	0	0	19
Law Enforcement	0	20	3	2	0	25
Legal Review	0	0	0	0	0	0
Alternative/ Improved Livelihood	0	0	0	0	0	0
Awareness Raising	0	20	3	2	0	25
Education	0	16	3	2	0	21
Zanzibar				Urbanisation	Total	172

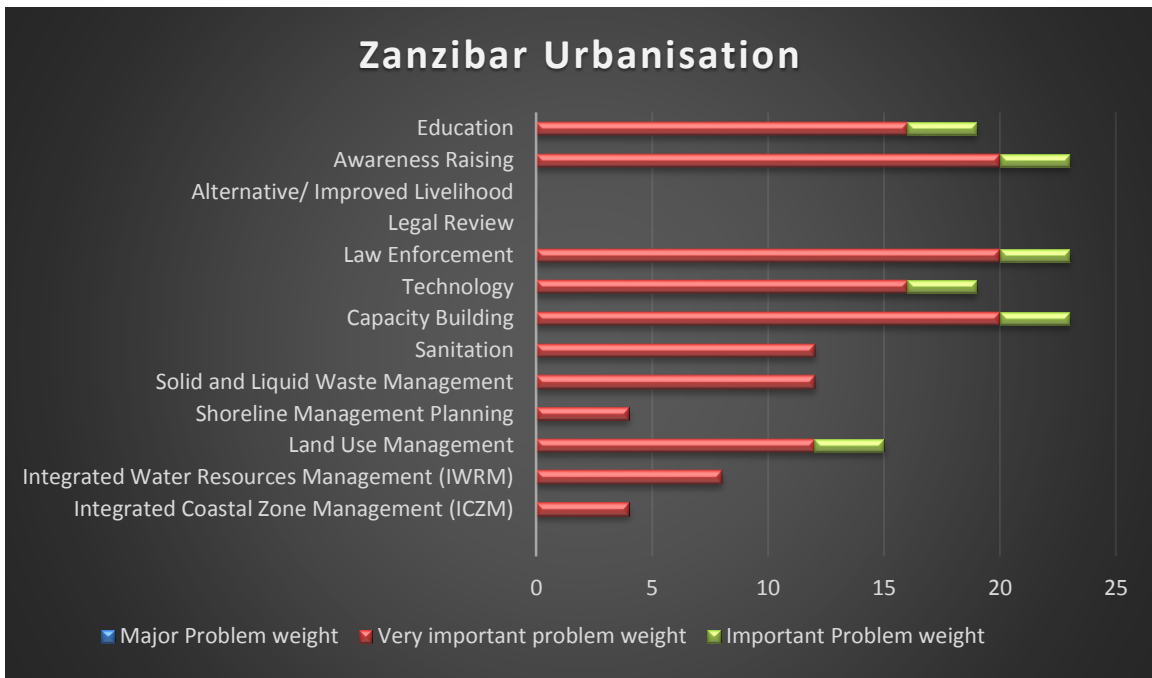


Figure 37: The importance of broad intervention dimension in responding to threats to local communities and ecosystems associated with urbanisation.

Hydrocarbons

The island of Pemba has long been known to contain hydrocarbons, with a natural seep of oil on the west coast. Such a seep indicates that the conditions required to produce hydrocarbons are present, but there is no guarantee that commercial quantities are available. Unlike on mainland Tanzania, there has been very little exploration drilling to date on Zanzibar and no commercial reserves of oil (or gas) have been discovered.

The reason for the little exploration is that the Constitution clearly states that all oil and gas reserves are union property, contrary to the perception and beliefs of the people and government of Zanzibar. More recently, the first draft constitution of the United Republic of Tanzania is proposing removal of the gas and oil on the list of union matters and under a recent agreement (still awaiting ratification by the union government) between the mainland and Zanzibar governments, exploration in and around Pemba and Unguja islands, and northernmost offshore blocks (numbers 9 to 12), will be managed by the Department of Energy on Zanzibar.

The outlook for oil and gas industry in Zanzibar, from upstream to downstream operations is potentially likely to witness significant increase in volumes extracted and traded, income generated and employment created.



Prioritized Threats

In Table 138 below the threats identified related to hydrocarbons have been listed and ranked according to their severity as established using the CRIAM method discussed extensively in Volumes I and II of the Coastal Profile. A rapid assessment has been made on the susceptibility of each threat to impacts of climate change more specifically, changes in weather patterns, extreme events, sea level rise, temperature rise and acidification.

Table 138: Prioritised threats related to hydrocarbons and a rapid assessment of threat susceptibility to climate change.

#	Threat as identified in Coastal Profile	Threat Level	Influence from Climate Change				
			Change in Patterns	Extreme events	Sea Level Rise	Temperature Rise	Acidification
Z-O&G-01	Degradation of the natural marine and coastal environment and thus impact on livelihoods, from failure of exploration companies to adhere to environmental and socio-economic safeguards, partly due to weakness in the oversight provided by the Department of Environment, responsible for issuing licences and monitoring the operations that have been subjected to EIAs.	Very Important Problem	++	++	++	0	0
			Degradation may become more severe in cases of extreme events and due to sea level rise				
Z-O&G-02	Piracy attacks against offshore operations.	Problem	0	0	0	0	0
			No impact from climate change on this threat				
Z-O&G-04	Social and/or political unrest related to behaviour of the Government and stakeholders.	Light Problem	0	0	0	0	0
			No impact from climate change on this threat				
+++	Threat is severely aggravated from climate change dimension						
++	Threat is aggravated from climate change dimension						
+	Threat is slightly aggravated from climate change dimension						
0	No influence of threat from climate change dimension						
-	Remediating effect on threat from climate change dimension						

Recommendations for threat mitigation measures

Overall measures to mitigate each of the identified hydrocarbon related threats to coastal local communities and ecosystems have been tabulated in Table 198 (page 367) arranged under broad management dimensions headings. Table 139 below provides an overview of the requirements/opportunities expressed within each of these management or intervention dimensions.

Table 139: Broad management intervention dimensions to address identified and prioritised threats to coastal communities and ecosystems associated with hydrocarbons in Zanzibar

Intervention Dimension	Statement	Threat pertinence at each RV				
		Major Problem (RV 5)	Very important problem (RV 4)	Important Problem (RV 3)	Problem (RV 2)	Light Problem (RV 1)
Integrated Coastal Zone Management (ICZM)						
Integrated Water Resources Management (IWRM)						
Land Use Management						
Shoreline Management Planning	Establish a systematic overview of coastal processes through a shoreline management investigation, considering the entire coast, and inform spatial planning accordingly. Sediment cell resolution national effort, management unit resolution regional/district effort.		Z-O&G-01: Degradation of marine and coastal habitats from failure to adhere to environmental and social safeguards			
Solid and Liquid Waste Management						
Sanitation						
Capacity Building	Accompany management interventions with appropriate capacity building components. Particular focus on spatial planning, shoreline management, pollution control and hydropower regulation. Enhance information management systems to provide for better and systematically informed management decisions.		Z-O&G-01: Degradation of marine and coastal habitats from failure to adhere to environmental and social safeguards		Z-O&G-02: Piracy threats offshore	

Intervention Dimension	Statement	Threat pertinence at each RV				
		Major Problem (RV 5)	Very important problem (RV 4)	Important Problem (RV 3)	Problem (RV 2)	Light Problem (RV 1)
Technology	Pursue opportunities through further technology development within: <ul style="list-style-type: none"> Remote sensing monitoring 		Z-O&G-01: Degradation of marine and coastal habitats from failure to adhere to environmental and social safeguards		Z-O&G-02: Piracy threats offshore	Z-O&G-04: Social and/or political unrest related to government and stakeholder behaviour.
Law Enforcement	1) Integrated review of laws, regulations and their enforcement within amongst others: <ul style="list-style-type: none"> Hydrocarbon exploration International agreements 2) Optimise enforcement through capacity building and coordination following recommendations from review.		Z-O&G-01: Degradation of marine and coastal habitats from failure to adhere to environmental and social safeguards			Z-O&G-04: Social and/or political unrest related to government and stakeholder behaviour.
Legal Review	1) Integrated review of laws, regulations and their enforcement within amongst others: <ul style="list-style-type: none"> Acts of piracy 2) Initiate revision of existing and develop new laws, regulations according to recommendations from review		Z-O&G-01: Degradation of marine and coastal habitats from failure to adhere to environmental and social safeguards		Z-O&G-02: Piracy threats offshore	
Alternative/ Improved Livelihood						
Awareness Raising	Develop and launch awareness raising campaigns related to coastal management challenges directed to the public at large and to schools. Develop and launch issue specific awareness raising campaigns targeting stakeholders affected by or affecting the issue. Particular emphasis on shoreline processes and impacts on shorelines and environment from hydrocarbon exploration and development and on contingency planning.		Z-O&G-01: Degradation of marine and coastal habitats from failure to adhere to environmental and social safeguards			Z-O&G-04: Social and/or political unrest related to government and stakeholder behaviour.
Education			Z-O&G-01: Degradation of marine and coastal habitats from failure to adhere to environmental and social safeguards			Z-O&G-04: Social and/or political unrest related to government and stakeholder behaviour.

Action areas

In Table 140 below an overview has been established on how strongly each intervention dimension responds to threats to local communities and ecosystems as perceived by local stakeholders.

For each intervention dimension and for each problem class the number of threats considered to benefit from the intervention have been multiplied by the range value (RV) for the given problem class. The total score for each management dimension has then been calculated by adding the values achieved. The table thus provides an indication of the importance of each intervention dimension in addressing identified and ranked threats. In the same manner Figure 38 gives a graphical presentation of the relevance of intervention dimensions in addressing the identified threats related to with hydrocarbons.

Table 140: Assessment of the importance of broad management dimension in addressing threats to local communities and ecosystems associated with hydrocarbons.

Intervention Dimension	Major Problem weight	Very important problem weight	Important Problem weight	Problem weight	Light Problem weight	Total Score
Integrated Coastal Zone Management (ICZM)	0	0	0	0	0	0
Integrated Water Resources Management (IWRM)	0	0	0	0	0	0
Land Use Management	0	0	0	0	0	0
Shoreline Management Planning	0	4	0	0	0	4
Solid and Liquid Waste Management	0	0	0	0	0	0
Sanitation	0	0	0	0	0	0
Capacity Building	0	4	0	2	0	6
Technology	0	4	0	2	1	7
Law Enforcement	0	4	0	0	1	5
Legal Review	0	4	0	2	0	6
Alternative/ Improved Livelihood	0	0	0	0	0	0
Awareness Raising	0	4	0	0	1	5
Education	0	4	0	0	1	5
Zanzibar	Hydrocarbons				Total	38

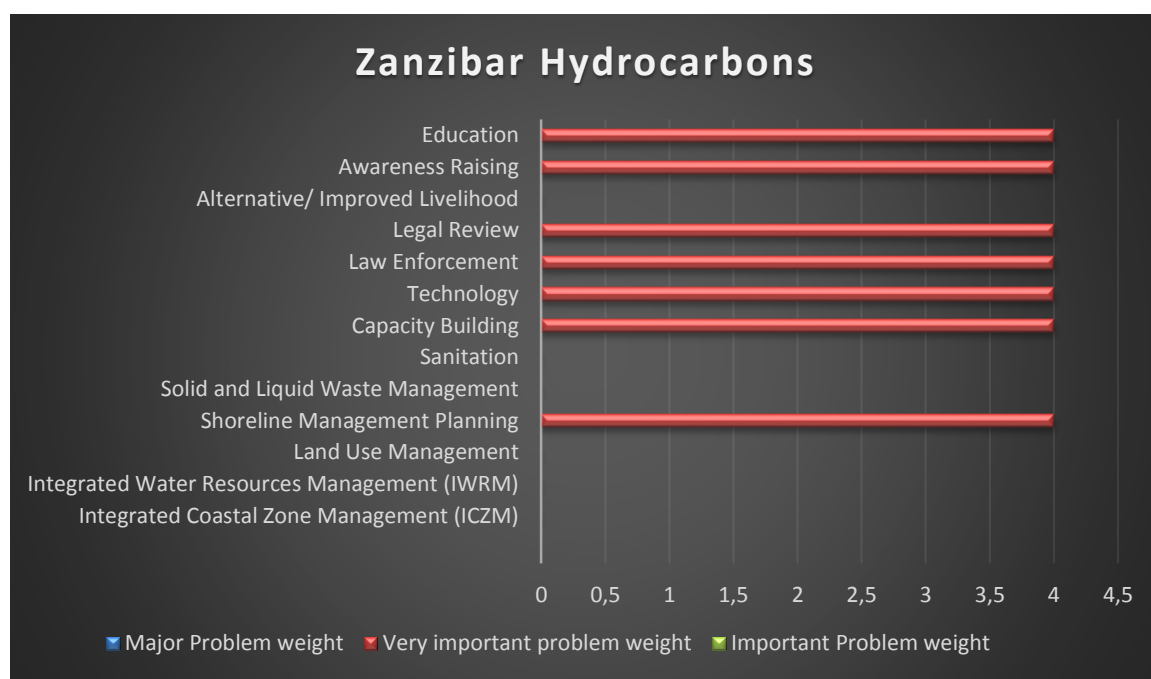


Figure 38: The importance of broad intervention dimension in responding to threats to local communities and ecosystems associated with hydrocarbons.

Sand and Rock Mining

The islands of Zanzibar are of a different geological origin than mainland Tanzania and does not generate the high value minerals and gemstones present on the mainland. However, mining operations do exist and are focused on fossil coral rock (limestone) for building and baked for production of lime, as well as beach sand for the construction industry. With no significant rivers on Unguja and few small rivers on Pemba, there is virtually no excavation of sand from river beds. On Zanzibar live coral is no longer extracted from the sea for the construction industry.



The Zanzibar mining sector contributes a very small amount to the GDP of the isles and probably employs a few thousand people, though figures are not available mainly because the excavation and trade is mostly unregulated. Excavated sand and rock that are mined for the building industry are usually sold by volume, with little if any royalties or taxes accrued to the government, other than fees to the quarry owner.



With Zanzibar's GDP growth rate reaching 6-7%, there has been significant increases in mining and quarrying and construction sub-sectors. The extraction and mining of these materials and resulting impacts could increase substantially (Yager 2002).

Given the rapid rate of urbanization along parts of Zanzibar, especially Stone Town suburbs, the accompanying rates of sand and rock extraction are likely to continue to rise.

The outlook for beach sand extraction in Zanzibar is likely to witness significant increase

in volumes traded, income generated and employment created if left un-regulated.

While financial resources are limited and environmental management remains uncoordinated, NGO involvement in coastal zone management and the development of new cement projects on the coast suggest further growth in the mining sector.

Despite some of the environmental issues surrounding the mining sector on the coast, the incentive to invest in the region also remains high.

Prioritized Threats

In Table 141 below the threats identified related to sand and rock mining have been listed and ranked according to their severity as established using the CRIAM method discussed extensively in Volumes I and II of the Coastal Profile. A rapid assessment has been made on the susceptibility of each threat to impacts of climate change more specifically, changes in whether patterns, extreme events, sea level rise, temperature rise and acidification.

Table 141: Prioritised threats related to natural resources and a rapid assessment of threat susceptibility to climate change.

#	Threat as identified in Coastal Profile	Threat Level	Influence from Climate Change				
			Change in Patterns	Extreme events	Sea Level Rise	Temperature Rise	Acidification
Z-S&R-01	Poor management of shores (e.g. coastal developments), lack of understanding of coastal erosion causative factors leading to loss of shoreline.	Very Important Problem	++	+++	+++	0	0
			Changes in weather patterns influence hydrolic conditions in catchments and thereby sediment balance along shores, extreme events and sea level rise may dramatically impact on shorelines.				
Z-S&R-02	Corrupt and uncoordinated institutional enforcement of mining policy to protect the natural environment, particularly the coastline.	Very Important Problem	++	++	++	0	0
			Impact of inadequate enforcement is aggravated from climate change				
Z-S&R-05	Loss of beach habitats for turtle nesting.	Problem	+	++	++	0	0
Z-S&R-03	Anarchistic sand and rock extraction from coastal zone resulting in increased erosion.	Light Problem	++	++	++	0	0
			Climate change exacerbates impacts on erosion				
Z-S&R-04	Loss of river basin habitat from un-regulated sand extraction.	Light Problem	++	++	++	0	0
			Changes in weather patterns influence hydrolic conditions in catchments and thereby sediment balance.				
Z-S&R-06	Economic losses through tourist abandonment	Light Problem	0	0	0	0	0
			No impact from climate change on this threat				
Z-S&R-07	Loss of coastal aesthetics	Light Problem	0	0	0	0	0
			No impact from climate change on this threat				
Z-S&R-08	Increase in water borne diseases from quarries that fill with rainwater.	Light Problem	+	+	+	0	0
			Flooding and inundations may aggravate this.				
Z-S&R-09	Shallow freshwater table contamination from poor citing of rock quarries.	Light Problem	+	+	+	0	0
			Flooding and inundations may aggravate this.				
+++		Threat is severely aggravated from climate change dimension					
++		Threat is aggravated from climate change dimension					
+		Threat is slightly aggravated from climate change dimension					
0		No influence of threat from climate change dimension					
-		Remediating effect on threat from climate change dimension					

Recommendations for threat mitigation measures

Overall measures to mitigate each if the identified natural resources related threats to coastal local communities and ecosystems have been tabulated in Table 199(page368) arranged under broad management dimensions headings. Table 142below provides an overview of the requirements/opportunities expressed within each of these management or intervention dimensions.

Table 142: Broad management intervention dimensions to address identified and prioritised threats to coastal communities and ecosystems associated with natural resources in Zanzibar

Intervention Dimension	Statement	Threat pertinence at each RV				
		Major Problem (RV 5)	Very important problem (RV 4)	Important Problem (RV 3)	Problem (RV 2)	Light Problem (RV 1)
Integrated Coastal Zone Management (ICZM)	Ensure coordination and participation in management of coastal land, water and resources use currently under complex pressures. Facilitate dialogues required to alleviate social conflicts over resources use. Link with hinterland management to address catchment and riverbank deforestation, river flow changes and sand extraction upstream, all of which affect the coast in many ways (ICARM).		Z-S&R-01: Poor management of shores Z-S&R-02: Corrupt and uncoordinated enforcement		Z-S&R-05: Loss of habitats for turtle nesting	Z-S&R-03: Anarchistic extraction Z-S&R-04: Loss of river basin habitat from un-regulated sand extraction
Integrated Water Resources Management (IWRM)	Link IWRM to coastal integrated planning ensuring upstream/downstream considerations (ICARM). Land use in catchments and its impacts on water resources included in IWRM planning. Sand extraction in in upstream river beds and its impact on shorelines and coastal areas included in IWRM planning.		Z-S&R-01: Poor management of shores			Z-S&R-03: Anarchistic extraction Z-S&R-04: Loss of river basin habitat from un-regulated sand extraction

Intervention Dimension	Statement	Threat pertinence at each RV				
		Major Problem (RV 5)	Very important problem (RV 4)	Important Problem (RV 3)	Problem (RV 2)	Light Problem (RV 1)
Land Use Management	<p>Land use information management systems to include ecosystems, habitats and water resources.</p> <p>Incorporate ecosystems, habitats and water resources considerations in spatial planning, including sediment flow to nourish shorelines.</p> <p>Inform hinterland spatial planning to direct zoning to prevent downstream impacts on shorelines.</p>		<p>Z-S&R-01: Poor management of shores</p> <p>Z-S&R-02: Corrupt and uncoordinated enforcement</p>			<p>Z-S&R-03: Anarchistic extraction</p> <p>Z-S&R-04: Loss of river basin habitat from unregulated sand extraction</p>
Shoreline Management Planning	<p>Establish a systematic overview of coastal processes through a shoreline management investigation, considering the entire coast, and inform spatial planning accordingly. Sediment cell resolution national effort, management unit resolution regional/district effort.</p> <p>Develop policies at sediment cell level to address erosion and accretion problems along the shores.</p> <p>Direct the development of similar policies for management units at district level.</p>		<p>Z-S&R-01: Poor management of shores</p> <p>Z-S&R-02: Corrupt and uncoordinated enforcement</p>		Z-S&R-05: Loss of habitats for turtle nesting	<p>Z-S&R-03: Anarchistic extraction</p> <p>Z-S&R-04: Loss of river basin habitat from unregulated sand extraction</p> <p>Z-S&R-06: Economic losses through tourist abandonment</p> <p>Z-S&R-07: Loss of coastal aesthetics</p>
Solid and Liquid Waste Management	<p>Develop policies for quarry siting, management and restoration as basis for regulations.</p>				Z-S&R-05: Loss of habitats for turtle nesting	
Sanitation						
Capacity Building	<p>Accompany management interventions with appropriate capacity building components. Particular focus on spatial planning, shoreline management, conflict resolution, monitoring, law enforcement.</p> <p>Enhance information management systems to provide for better and systematically informed management decisions.</p>		<p>Z-S&R-01: Poor management of shores</p> <p>Z-S&R-02: Corrupt and uncoordinated enforcement</p>		Z-S&R-05: Loss of habitats for turtle nesting	<p>Z-S&R-03: Anarchistic extraction</p> <p>Z-S&R-04: Loss of river basin habitat from unregulated sand extraction</p> <p>Z-S&R-06: Economic losses through tourist abandonment</p> <p>Z-S&R-07: Loss of coastal aesthetics</p> <p>Z-S&R-08: Increase in water borne diseases from quarries</p> <p>Z-S&R-09: Contamination of shallow aquifers from poor siting of quarries</p>
Technology	<p>Pursue opportunities through further technology development within:</p> <ul style="list-style-type: none"> • Beach protection (soft) • Turtle tracking geographically and seasonally • Shoreline management 		<p>Z-S&R-01: Poor management of shores</p> <p>Z-S&R-02: Corrupt and uncoordinated enforcement</p>		Z-S&R-05: Loss of habitats for turtle nesting	<p>Z-S&R-03: Anarchistic extraction</p> <p>Z-S&R-04: Loss of river basin habitat from unregulated sand extraction</p>

Intervention Dimension	Statement	Threat pertinence at each RV				
		Major Problem (RV 5)	Very important problem (RV 4)	Important Problem (RV 3)	Problem (RV 2)	Light Problem (RV 1)
Law Enforcement	<p>1) Integrated review of laws, regulations and their enforcement within amongst others:</p> <ul style="list-style-type: none"> • Resources exploitation • Sand mining • Quarries • Turtle protection • Coral mining • ESIA related to mining and freshwater • Marine resources <p>2) Optimise enforcement through capacity building and coordination following recommendations from review.</p>		<p>Z-S&R-01: Poor management of shores</p> <p>Z-S&R-02: Corrupt and uncoordinated enforcement</p>		Z-S&R-05: Loss of habitats for turtle nesting	<p>Z-S&R-03: Anarchistic extraction</p> <p>Z-S&R-04: Loss of river basin habitat from unregulated sand extraction</p> <p>Z-S&R-06: Economic losses through tourist abandonment</p> <p>Z-S&R-07: Loss of coastal aesthetics</p> <p>Z-S&R-08: Increase in water borne diseases from quarries</p> <p>Z-S&R-09: Contamination of shallow aquifers from poor siting of quarries</p>
Legal Review	<p>1) Integrated review of laws, regulations and their enforcement within amongst others:</p> <ul style="list-style-type: none"> • Resources exploitation • Sand mining • Quarries • Turtle protection • Coral mining • ESIA related to mining and freshwater • Marine resources <p>2) Initiate revision of existing and develop new laws, regulations according to recommendations from review</p>		Z-S&R-01: Poor management of shores			Z-S&R-04: Loss of river basin habitat from unregulated sand extraction
Alternative/ Improved Livelihood	<p>Develop and offer alternative livelihoods for households currently engaged in destructive sand and rock mining practices. Particular efforts to provide alternatives for young generation.</p> <p>Improve current sustainable resource use livelihoods using technology advances and insights.</p>		<p>Z-S&R-01: Poor management of shores</p> <p>Z-S&R-02: Corrupt and uncoordinated enforcement</p>			<p>Z-S&R-03: Anarchistic extraction</p> <p>Z-S&R-04: Loss of river basin habitat from unregulated sand extraction</p> <p>Z-S&R-06: Economic losses through tourist abandonment</p> <p>Z-S&R-07: Loss of coastal aesthetics</p>
Awareness Raising	<p>Develop and launch awareness raising campaigns related to coastal management challenges directed to the public at large and to schools.</p> <p>Develop and launch issue specific awareness raising campaigns targeting stakeholders affected by or affecting the issue.</p>		<p>Z-S&R-01: Poor management of shores</p> <p>Z-S&R-02: Corrupt and uncoordinated enforcement</p>		Z-S&R-05: Loss of habitats for turtle nesting	<p>Z-S&R-03: Anarchistic extraction</p> <p>Z-S&R-04: Loss of river basin habitat from unregulated sand extraction</p> <p>Z-S&R-06: Economic losses through tourist abandonment</p> <p>Z-S&R-07: Loss of coastal aesthetics</p> <p>Z-S&R-08: Increase in water borne diseases from quarries</p> <p>Z-S&R-09: Contamination of shallow aquifers from poor siting of quarries</p>

Intervention Dimension	Statement	Threat pertinence at each RV				
		Major Problem (RV 5)	Very important problem (RV 4)	Important Problem (RV 3)	Problem (RV 2)	Light Problem (RV 1)
Education	Engage in curricula review and development for primary and secondary schools to enhance the knowledge and understanding about coastal management issues- Issue of particular relevance from a fisheries perspective include: <ul style="list-style-type: none"> • Importance of beaches • Importance of shoreline management 		Z-S&R-01: Poor management of shores Z-S&R-02: Corrupt and uncoordinated enforcement		Z-S&R-05: Loss of habitats for turtle nesting	Z-S&R-03: Anarchistic extraction Z-S&R-04: Loss of river basin habitat from unregulated sand extraction Z-S&R-06: Economic losses through tourist abandonment Z-S&R-07: Loss of coastal aesthetics Z-S&R-08: Increase in water borne diseases from quarries Z-S&R-09: Contamination of shallow aquifers from poor siting of quarries

Action areas

In Table 143 below an overview has been established on how strongly each intervention dimension responds to threats to local communities and ecosystems as perceived by local stakeholders.

For each intervention dimension and for each problem class the number of threats considered to benefit from the intervention have been multiplied by the range value (RV) for the given problem class. The total score for each management dimension has then been calculated by adding the values achieved. The table thus provides an indication of the importance of each intervention dimension in addressing identified and ranked threats. In the same manner Figure 39 gives a graphical presentation of the relevance of intervention dimensions in addressing the identified threats related to with sand and rock mining.

Table 143: Assessment of the importance of broad management dimension in addressing threats to local communities and ecosystems associated with sand and rock mining.

Intervention Dimension	Major Problem weight	Very important problem weight	Important Problem weight	Problem weight	Light Problem weight	Total Score
Integrated Coastal Zone Management (ICZM)	0	8	0	2	2	12
Integrated Water Resources Management (IWRM)	0	4	0	0	2	6
Land Use Management	0	8	0	0	2	10
Shoreline Management Planning	0	8	0	2	4	14
Solid and Liquid Waste Management	0	0	0	2	0	2
Sanitation	0	0	0	0	0	0
Capacity Building	0	8	0	2	6	16
Technology	0	8	0	2	2	12
Law Enforcement	0	8	0	2	6	16
Legal Review	0	4	0	0	1	5
Alternative/ Improved Livelihood	0	8	0	0	4	12
Awareness Raising	0	8	0	2	6	16
Education	0	8	0	2	6	16
Zanzibar			Sand and Rock Mining		Total	137

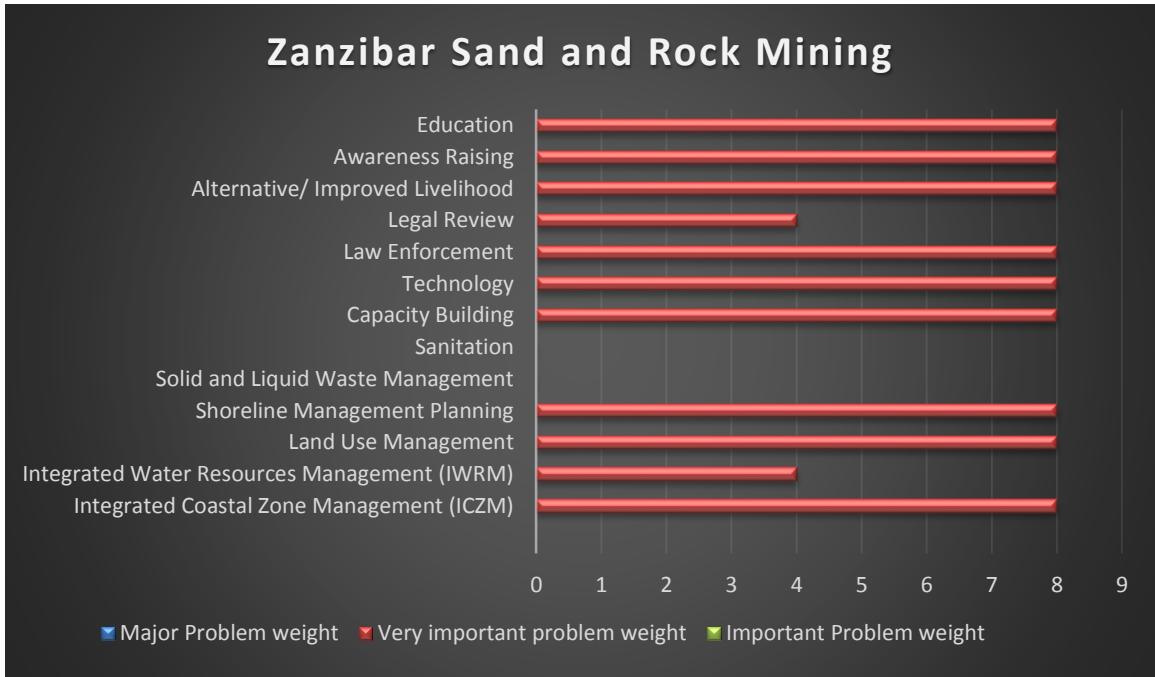


Figure 39: The importance of broad intervention dimension in responding to threats to local communities and ecosystems associated with sand and rock mining.

Salt Production

Based on satellite imagery analysis, on Zanzibar there are 105 hectares (ca. 1 km²) of salt pans, (www. tansea.org 2013). Most production is on Pemba, producing approximately 2,000 tonnes of salt every year, usually for local consumption (UNICEF, 2013). Most of the industry is unregulated and does not contribute significantly to the national GDP.



The solar salt industry in Zanzibar suffers from inconsistent iodisation. Continued efforts are needed to rectify the situation.

Small scale salt producers usually have limited financial means and lack access to technical assistance. As a result, the salt produced is of poor quality. Inputs identified to improve production are improvements to technology and product quality, to health hazards among workers; better organization of supply chains from small-scale producers to industrial plants and private consumers; and need for training programs and strengthening of the cooperation with public institutions.

Due to the relatively small quantities of salt produced in Zanzibar, which is also insufficient for local needs, the importance in terms of national GDP is very low. However, local salt production is more significant with respect to the vital importance of salt for human nutrition.

Employment in the sector is based on a core staff to run the salt works and additional personnel recruited for harvesting. Though employment figures are difficult to find, estimates based on small-scale salt works (UNICEF, 2007), suggest that several hundred people may be employed in the sector along Zanzibar's coasts.

On Zanzibar, based on the information uncovered, it seems that the solar salt industry has very little room for expansion, to the benefit of the wider economy and population, and the livelihoods of those involved.

There are grave concerns in the industry on the taxes and levies which salt producers are required to pay, increasing operation costs. In addition, producers are obliged to charge VAT (18%) on the saleable product which makes it more expensive to the consumer. VAT is not charged on other food products. The financial burdens are a disincentive to development of the sector.

Prioritized Threats

In Table 144 below the threats identified related to salt production have been listed and ranked according to their severity as established using the CRIAM method discussed extensively in Volumes I and II of the Coastal Profile. A rapid assessment has been made on the susceptibility of each threat to impacts of climate change more specifically, changes in whether patterns, extreme events, sea level rise, temperature rise and acidification.

Table 144: Prioritised threats related to natural resources and a rapid assessment of threat susceptibility to climate change.

#	Threat as identified in Coastal Profile	Threat Level	Influence from Climate Change				
			Change in Patterns	Extreme events	Sea Level Rise	Temperature rise	Acidification
Z-Salt-03	Unplanned urbanization in some areas reduces land availability into which to expand.	Very Important Problem	0	0	0	0	0
			No impact from climate change on this threat				
Z-Salt-04	Unsustainable practices resulting in degradation of mangrove forests for ponds and timber (for boiling salt water), causing losses to the wider environment with respect to shelter from wave action to fisheries production.	Very Important Problem	++	++	++	0	0
			Weakened mangroves further threatened from impacts of climate change				

#	Threat as identified in Coastal Profile	Threat Level	Influence from Climate Change				
			Change in Patterns	Extreme events	Sea Level Rise	Temperature rise	Acidification
Z-Salt-07	Solid and liquid wastes from improper disposal	Very Important Problem	+	++	++	0	0
			Extreme events and sea water rise aggravates effects of improper disposal				
Z-Salt-05	Sea level rise threatening infrastructure (dykes and buildings, etc.).	Problem	0	++	++	0	0
			Extreme events further exacerbates this impact				
Z-Salt-01	Lack of suitable habitat for artisanal (non-pump) and industrial systems into which to expand/adapt, particularly with respect to land and availability of clay to construct dykes.	Light Problem	0	+	++	0	0
			Extreme events and sea level rise may reduce areas suitable for salt production				
Z-Salt-06	Local population hazard from low iodisation of salt from small-scale producers in Zanzibar (iodine deficiency disorders).	Light Problem	0	0	0	0	0
			No impact from climate change on this threat				
+++	Threat is severely aggravated from climate change dimension						
++	Threat is aggravated from climate change dimension						
+	Threat is slightly aggravated from climate change dimension						
0	No influence of threat from climate change dimension						
-	Remediating effect on threat from climate change dimension						

Recommendations for threat mitigation measures

Overall measures to mitigate each of the identified natural resources related threats to coastal local communities and ecosystems have been tabulated in Table 200 (page 370) arranged under broad management dimensions headings. Table 145 below provides an overview of the requirements/opportunities expressed within each of these management or intervention dimensions.

Table 145: Broad management intervention dimensions to address identified and prioritised threats to coastal communities and ecosystems associated with natural resources in Zanzibar

Intervention Dimension	Statement	Threat pertinence at each RV				
		Major Problem (RV 5)	Very important problem (RV 4)	Important Problem (RV 3)	Problem (RV 2)	Light Problem (RV 1)
Integrated Coastal Zone Management (ICZM)	<p>Ensure coordination and participation in management of coastal land, water and resources use currently under complex pressures.</p> <p>Facilitate dialogues required to alleviate social conflicts over resources use.</p> <p>Link with hinterland management to address catchment and riverbank deforestation, river flow changes and sand extraction upstream, all of which affect the coast in many ways (ICARM).</p>		<p>Z-Salt-03: Lack of land due to unplanned urban expanse</p> <p>Z-Salt-04: Mangrove degradation due to unsustainable slat practises</p>		Z-Salt-05: Sea level rise	
Integrated Water Resources Management (IWRM)						
Land Use Management	<p>Land use information management systems to include ecosystems, habitats and water resources.</p> <p>Incorporate ecosystems, habitats and water resources considerations in spatial planning, including sediment flow to nourish shorelines.</p> <p>Inform hinterland spatial planning to direct zoning to prevent downstream impacts on shorelines.</p>		<p>Z-Salt-03: Lack of land due to unplanned urban expanse</p> <p>Z-Salt-04: Mangrove degradation due to unsustainable slat practises</p>		Z-Salt-05: Sea level rise	
Shoreline Management Planning	<p>Establish a systematic overview of coastal processes through a shoreline management investigation, considering the entire coast, and inform spatial planning accordingly. Sediment cell resolution national effort, management unit resolution regional/district effort.</p> <p>Develop policies at sediment cell level to address erosion and accretion problems along the shores.</p> <p>Direct the development of similar policies for management units at district level.</p>		<p>Z-Salt-03: Lack of land due to unplanned urban expanse</p> <p>Z-Salt-04: Mangrove degradation due to unsustainable slat practises</p>		Z-Salt-05: Sea level rise	

Intervention Dimension	Statement	Threat pertinence at each RV				
		Major Problem (RV 5)	Very important problem (RV 4)	Important Problem (RV 3)	Problem (RV 2)	Light Problem (RV 1)
Solid and Liquid Waste Management	Develop policies for quarry siting, management and restoration as basis for regulations.		Z-Salt-07: Solid and liquid waste from improper disposal			
Sanitation	Develop policies for quarry siting, management and restoration as basis for regulations.					
Capacity Building	Accompany management interventions with appropriate capacity building components. Particular focus on spatial planning, shoreline management, conflict resolution, monitoring, law enforcement. Enhance information management systems to provide for better and systematically informed management decisions.		Z-Salt-03: Lack of land due to unplanned urban expanse Z-Salt-04: Mangrove degradation due to unsustainable slat practises			
Technology	Pursue opportunities through further technology development within: <ul style="list-style-type: none"> Beach protection (soft) Turtle tracking geographically and seasonally Shoreline management 		Z-Salt-03: Lack of land due to unplanned urban expanse Z-Salt-04: Mangrove degradation due to unsustainable slat practises		Z-Salt-05: Sea level rise	Z-Salt-06: IDD hazard associated with small-scale producers
Law Enforcement	1) Integrated review of laws, regulations and their enforcement within amongst others: <ul style="list-style-type: none"> Resources exploitation Sand mining Quarries Turtle protection Coral mining ESIA related to mining and freshwater Marine resources 2) Optimise enforcement through capacity building and coordination following recommendations from review.		Z-Salt-03: Lack of land due to unplanned urban expanse Z-Salt-04: Mangrove degradation due to unsustainable slat practises			Z-Salt-06: IDD hazard associated with small-scale producers
Legal Review	1) Integrated review of laws, regulations and their enforcement within amongst others: <ul style="list-style-type: none"> Resources exploitation Sand mining Quarries Turtle protection Coral mining ESIA related to mining and freshwater Marine resources 2) Initiate revision of existing and develop new laws, regulations according to recommendations from review		Z-Salt-03: Lack of land due to unplanned urban expanse			Z-Salt-06: IDD hazard associated with small-scale producers
Alternative/ Improved Livelihood	Develop and offer alternative livelihoods for households currently engaged in destructive sand and rock mining practices. Particular efforts to provide alternatives for young generation. Improve current sustainable resource use livelihoods using technology advances and insights.		Z-Salt-04: Mangrove degradation due to unsustainable slat practises			
Awareness Raising	Develop and launch awareness raising campaigns related to coastal management challenges directed to the public at large and to schools. Develop and launch issue specific awareness raising campaigns targeting stakeholders affected by or affecting the issue.		Z-Salt-04: Mangrove degradation due to unsustainable slat practises			Z-Salt-06: IDD hazard associated with small-scale producers

Intervention Dimension	Statement	Threat pertinence at each RV				
		Major Problem (RV 5)	Very important problem (RV 4)	Important Problem (RV 3)	Problem (RV 2)	Light Problem (RV 1)
Education	Engage in curricula review and development for primary and secondary schools to enhance the knowledge and understanding about coastal management issues- Issue of particular relevance from a fisheries perspective include: <ul style="list-style-type: none"> • Importance of beaches • Importance of shoreline management 		Z-Salt-04: Mangrove degradation due to unsustainable silt practises			Z-Salt-06: IDD hazard associated with small-scale producers

Action areas

In Table 146 below an overview has been established on how strongly each intervention dimension responds to threats to local communities and ecosystems as perceived by local stakeholders.

For each intervention dimension and for each problem class the number of threats considered to benefit from the intervention have been multiplied by the range value (RV) for the given problem class. The total score for each management dimension has then been calculated by adding the values achieved. The table thus provides an indication of the importance of each intervention dimension in addressing identified and ranked threats. In the same manner Figure 40 gives a graphical presentation of the relevance of intervention dimensions in addressing the identified threats related to with salt production.

Table 146: Assessment of the importance of broad management dimension in addressing threats to local communities and ecosystems associated with salt production.

Intervention Dimension	Major Problem weight	Very important problem weight	Important Problem weight	Problem weight	Light Problem weight	Total Score
Integrated Coastal Zone Management (ICZM)	0	8	0	2	0	10
Integrated Water Resources Management (IWRM)	0	0	0	0	0	0
Land Use Management	0	8	0	2	0	10
Shoreline Management Planning	0	8	0	2	0	10
Solid and Liquid Waste Management	0	8	0	0	0	8
Sanitation	0	0	0	0	0	0
Capacity Building	0	8	0	0	0	8
Technology	0	8	0	2	1	11
Law Enforcement	0	8	0	0	1	9
Legal Review	0	8	0	0	1	9
Alternative/ Improved Livelihood	0	8	0	0	0	8
Awareness Raising	0	8	0	0	1	9
Education	0	8	0	0	1	9
Zanzibar			Salt Production		Total	101

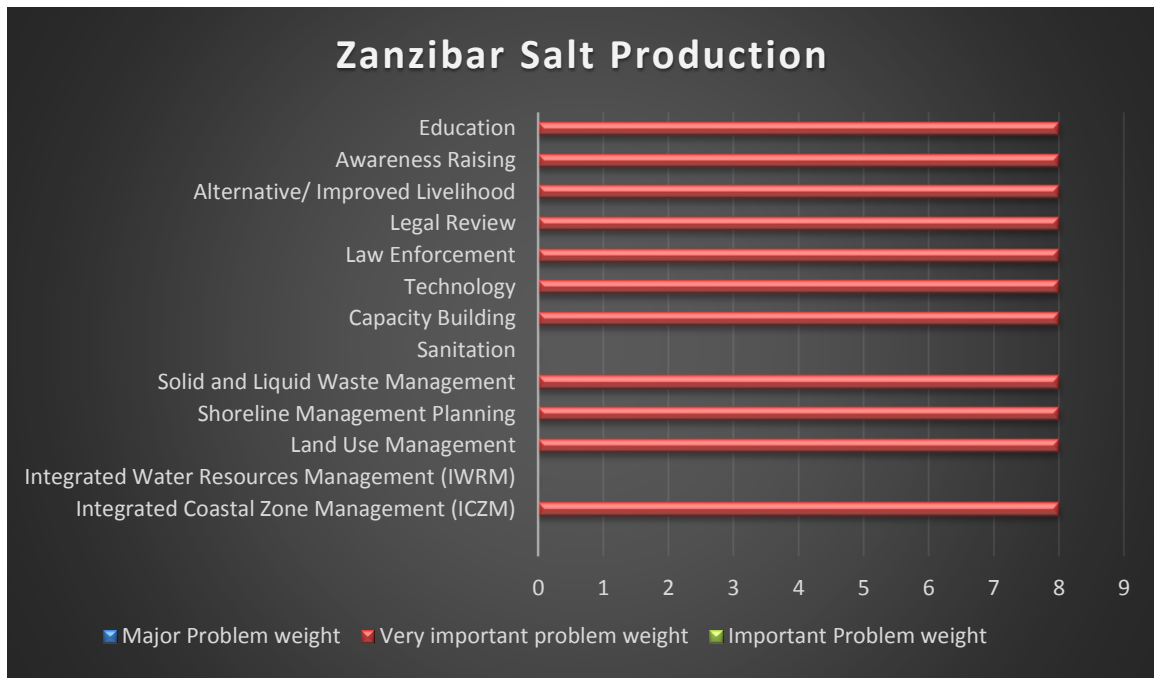


Figure 40: The importance of broad intervention dimension in responding to threats to local communities and ecosystems associated with salt production.

Natural Resources

About two thirds of the coastline of both major islands supports fringing coral reefs, often close to the shoreline, broken by creek outlets such as at Chwaka Bay and Fumba Bay on Unguja Island and Chake Chake Bay and Adamson Bay on Pemba Island.



Features of interest within the coastal zone include the coastline, continental shelf, corals, mangroves, and seagrass beds. These are characterized by high marine biodiversity and rich marine and coastal resources.

The few rivers of Pemba, each less than 10 km in length flow to the Indian Ocean and to a certain extent influence the coastal environment through creation of productive brackish water environments in estuaries, tidal flats and shorelines and nourishment of mangroves and seagrass beds. These coastal ecosystems subsequently interact with each other and together sustain a tremendous diversity of marine life, which supports the livelihood of coastal communities.

A wide range of important and valued species are found along the coast, including an estimated 150 species of corals in 13 families; 8,000 species of invertebrates; 1,000 species of fish; five species of marine turtles, at least 30 species of marine mammals and many seabirds.

The pragmatic outlook on the coastal ecosystems of Zanzibar is that most areas, especially those close to large urban centres (particularly Stone Town, parts of the east coast of Unguja, close to the main ports of Pemba) are experiencing such a level of degradation from various anthropogenic impacts that the current pressure is damaging their integrity and productivity. These areas represent a relatively large portion of the total coverage of the coastal ecosystems, some 70-80%. At present, the natural coastal environment is being over-harvested, damaged by destructive fishing gears, and polluted from riverine, urban or agricultural sources. The focus is to conserve or boost the productive status of much of the coastline, through education and reduced population pressure and impact.

Prioritized Threats

In Table 147 below the threats identified related to natural resources have been listed and ranked according to their severity as established using the CRIAM method discussed extensively in Volumes I and II of the Coastal Profile. A rapid assessment has been made on the susceptibility of each threat to impacts of climate change more specifically, changes in whether patterns, extreme events, sea level rise, temperature rise and acidification.

Table 147: Prioritised threats related to natural resources and a rapid assessment of threat susceptibility to climate change.

#	Threat as identified in Coastal Profile	Threat Level	Influence from Climate Change				
			Change in Patterns	Extreme events	Sea Level Rise	Temperature rise	Acidification
Z-NatRes-02	Illegal (destructive) fishing damaging seaweed, seagrass beds and coral reefs [1].	Major Problem	0	0	0	0	0
			No impact from climate change on this threat				
Z-NatRes-13	Invasive Indian house crow causing loss of bird diversity through ferocious predation on eggs of local bird species thus threatening indigenous populations	Major Problem	0	0	0	0	0
			No impact from climate change on this threat				
Z-NatRes-01	Poor management of the shores (e.g. coastal developments) and lack of understanding of coastal erosion leading to loss of shoreline.	Very Important Problem	++	+++	+++	0	0
			Increased pressures on shoreline management will arise under extreme events and due to sea level rise.				

#	Threat as identified in Coastal Profile	Threat Level	Influence from Climate Change				
			Change in Patterns	Extreme events	Sea Level Rise	Temperature rise	Acidification
Z-NatRes-06	Coral bleaching from El Nino sea surface temperature rise damaging coral reefs.	Very Important Problem	0	0	0	+++	0
			Increasing water surface temperatures will further coral bleaching.				
Z-NatRes-09	Pollution through nutrient enrichment, particularly from sewage disposal impacting the structure of coral reef ecosystems.	Very Important Problem	0	++	++	0	0
			Impacts from pollution will be further enhanced due to flooding and inundation.				
Z-NatRes-11	Habitat alteration from land use changes (salt pans in mangrove areas, shoreline alterations and inundation).	Very Important Problem	0	0	0	0	0
			No impact from climate change on this threat				
Z-NatRes-14	Gillnetting threatening turtles (adults and sub-adults). Gillnetting threatening whales, especially migrating Humpback whales and dolphins.	Very Important Problem	0	0	0	0	0
			No impact from climate change on this threat				
Z-NatRes-17	Predation and disturbance of turtle nesting sites	Very Important Problem	0	0	0	0	0
			No impact from climate change on this threat				
Z-NatRes-05	Waste disposal, in solid and liquid form causing harm to seagrass beds and estuaries and lagoons.	Important Problem	1	11	1	0	0
			Impacts from pollution will be further enhanced due to flooding and inundation.				
Z-NatRes-03	Tourist activities damaging seagrass beds and coral reefs [2].	Problem	0	0	0	0	0
			No impact from climate change on this threat				
Z-NatRes-08	Overharvest of invertebrate marine life negatively affecting sea grass meadows.	Problem	0	0	0	0	0
			No impact from climate change on this threat				
OZ-NatRes-10	Sedimentation of coral reefs from river discharges, sewage discharges and dredging.	Problem	+	+	0	0	0
			Changes in weather patterns will influence hydrology and sediment loads in rivers as will extreme events.				
Z-NatRes-16	Seismic surveys by oil and gas companies deterring whales, especially migrating Humpback whales with calves.	Problem	0	0	0	0	0
			No impact from climate change on this threat				
Z-NatRes-04	Poor upstream land use affecting seaweed and seagrass productivity [3].	Light Problem	+	++	0	0	0
			Changes in weather patterns will influence hydrology and sediment loads in rivers as will extreme events.				
+++	Threat is severely aggravated from climate change dimension						
++	Threat is aggravated from climate change dimension						
+	Threat is slightly aggravated from climate change dimension						
0	No influence of threat from climate change dimension						
-	Remediating effect on threat from climate change dimension						

Recommendations for threat mitigation measures

Overall measures to mitigate each if the identified natural resources related threats to coastal local communities and ecosystems have been tabulated in Table 201(page371) arranged under broad management dimensions headings. Table 148below provides an overview of the requirements/opportunities expressed within each of these management or intervention dimensions.

Table 148: Broad management intervention dimensions to address identified and prioritised threats to coastal communities and ecosystems associated with natural resources in Zanzibar

Intervention Dimension	Statement	Threat pertinence at each RV				
		Major Problem (RV 5)	Very important problem (RV 4)	Important Problem (RV 3)	Problem (RV 2)	Light Problem (RV 1)
Integrated Coastal Zone Management (ICZM)	<p>Ensure coordination and participation in management of coastal land, water and resources use currently under complex pressures.</p> <p>Facilitate dialogues required to alleviate social conflicts over resources use.</p> <p>Link with hinterland management to address catchment and riverbank deforestation, river flow changes and river pollution, all of which affect the coast in many ways (ICARM).</p>	Z-NatRes-02: Destructive fishing	Z-NatRes-01: Poor shoreline management Z-NatRes-09: Nutrient pollution Z-NatRes-11: Habitat alterations from land uses Z-NatRes-17: Predation and disturbance of turtle nesting sites	Z-NatRes-05: Estuaries and lagoons harmed by waste disposal	Z-NatRes-03: Destructive tourist activities Z-NatRes-08: Seagrass damage due to invertebrate harvest Z-NatRes-10: Sedimentation of coral reefs	

Intervention Dimension	Statement	Threat pertinence at each RV				
		Major Problem (RV 5)	Very important problem (RV 4)	Important Problem (RV 3)	Problem (RV 2)	Light Problem (RV 1)
Integrated Water Resources Management (IWRM)	Link IWRM to coastal integrated planning ensuring upstream/ downstream considerations (ICARM). Land use in catchments and its impacts on water resources included in IWRM planning.		Z-NatRes-09: Nutrient pollution	Z-NatRes-05: Estuaries and lagoons harmed by waste disposal	Z-NatRes-10: Sedimentation of coral reefs	Z-NatRes-04: Poor upstream landuse affecting seaweed and seagrass
Land Use Management	Land use information management systems to include ecosystems, habitats and water resources. Incorporate ecosystems, habitats and water resources considerations in spatial planning. Inform hinterland spatial planning to direct zoning to prevent downstream impacts on fisheries habitats.	Z-NatRes-02: Destructive fishing	Z-NatRes-01: Poor shoreline management Z-NatRes-09: Nutrient pollution Z-NatRes-11: Habitat alterations from land uses	Z-NatRes-05: Estuaries and lagoons harmed by waste disposal	Z-NatRes-03: Destructive tourist activities Z-NatRes-08: Seagrass damage due to invertebrate harvest Z-NatRes-10: Sedimentation of coral reefs	Z-NatRes-04: Poor upstream landuse affecting seaweed and seagrass
Shoreline Management Planning	Establish a systematic overview of coastal processes through a shoreline management investigation, considering the entire coast, and inform spatial planning accordingly. Sediment cell resolution national effort, management unit resolution regional/district effort.	Z-NatRes-02: Destructive fishing	Z-NatRes-01: Poor shoreline management Z-NatRes-09: Nutrient pollution Z-NatRes-11: Habitat alterations from land uses Z-NatRes-17: Predation and disturbance of turtle nesting sites	Z-NatRes-05: Estuaries and lagoons harmed by waste disposal	Z-NatRes-03: Destructive tourist activities Z-NatRes-08: Seagrass damage due to invertebrate harvest Z-NatRes-10: Sedimentation of coral reefs	Z-NatRes-04: Poor upstream landuse affecting seaweed and seagrass
Solid and Liquid Waste Management	Review agrochemical management and inform land use accordingly. Pursue integrated solid and liquid waste management solutions considering: Waste water treatment systems: - collection - treatment technology - discharge Liquid Waste Management Systems: - collection - storage - processing - financing - minimisation - reuse? Green Infrastructure Storm Water Systems	Z-NatRes-13: Invasive Indian crow	Z-NatRes-09: Nutrient pollution	Z-NatRes-05: Estuaries and lagoons harmed by waste disposal	Z-NatRes-10: Sedimentation of coral reefs	
Sanitation	Pursue integrated solid and liquid waste management considering: Waste water treatment systems: - collection - treatment technology - discharge Liquid Waste Management Systems: - collection - storage - processing - financing - minimisation - reuse? Green Infrastructure Storm Water Systems		Z-NatRes-09: Nutrient pollution	Z-NatRes-05: Estuaries and lagoons harmed by waste disposal	Z-NatRes-10: Sedimentation of coral reefs	
Capacity Building	Accompany management interventions with appropriate capacity building components. Particular focus on spatial planning, shoreline management, conflict resolution, monitoring, law enforcement. Enhance information management systems to provide for better and systematically informed management decisions.	Z-NatRes-02: Destructive fishing	Z-NatRes-01: Poor shoreline management Z-NatRes-09: Nutrient pollution Z-NatRes-11: Habitat alterations from land uses	Z-NatRes-05: Estuaries and lagoons harmed by waste disposal	Z-NatRes-03: Destructive tourist activities Z-NatRes-08: Seagrass damage due to invertebrate harvest Z-NatRes-10: Sedimentation of coral reefs Z-NatRes-16: Seismic survey noise	Z-NatRes-04: Poor upstream landuse affecting seaweed and seagrass

Intervention Dimension	Statement	Threat pertinence at each RV				
		Major Problem (RV 5)	Very important problem (RV 4)	Important Problem (RV 3)	Problem (RV 2)	Light Problem (RV 1)
Technology	<p>Pursue opportunities through further technology development within:</p> <ul style="list-style-type: none"> Offshore fisheries Aquaculture Value addition Integrated solid and liquid waste management Shoreline management 	<p>Z-NatRes-02: Destructive fishing</p> <p>Z-NatRes-13: Invasive Indian crow</p>	<p>Z-NatRes-01: Poor shoreline management</p> <p>Z-NatRes-09: Nutrient pollution</p> <p>Z-NatRes-11: Habitat alterations from land uses</p> <p>Z-NatRes-14: Turtle gill netting</p> <p>Z-NatRes-17: Predation and disturbance of turtle nesting sites</p>	<p>Z-NatRes-05: Estuaries and lagoons harmed by waste disposal</p>	<p>Z-NatRes-08: Seagrass damage due to invertebrate harvest</p> <p>Z-NatRes-10: Sedimentation of coral reefs</p> <p>Z-NatRes-16: Seismic survey noise</p>	<p>Z-NatRes-04: Poor upstream landuse affecting seaweed and seagrass</p>
Law Enforcement	<ol style="list-style-type: none"> Integrated review of laws, regulations and their enforcement within amongst others: <ul style="list-style-type: none"> Fisheries, Mangrove exploitation Coral mining Agrochemicals Industrial and domestic waste Land use Optimise enforcement through capacity building and coordination following recommendations from review. 	<p>Z-NatRes-02: Destructive fishing</p>	<p>Z-NatRes-01: Poor shoreline management</p> <p>Z-NatRes-06: Sea temperature increase bleaching corals</p> <p>Z-NatRes-09: Nutrient pollution</p> <p>Z-NatRes-11: Habitat alterations from land uses</p> <p>Z-NatRes-14: Turtle gill netting</p> <p>Z-NatRes-17: Predation and disturbance of turtle nesting sites</p>	<p>Z-NatRes-05: Estuaries and lagoons harmed by waste disposal</p>	<p>Z-NatRes-08: Seagrass damage due to invertebrate harvest</p> <p>Z-NatRes-10: Sedimentation of coral reefs</p> <p>Z-NatRes-16: Seismic survey noise</p>	<p>Z-NatRes-04: Poor upstream landuse affecting seaweed and seagrass</p>
Legal Review	<ol style="list-style-type: none"> Integrated review of laws, regulations and their enforcement within amongst others: <ul style="list-style-type: none"> Fisheries, Mangrove exploitation Coral mining Agrochemicals Industrial and domestic waste Land use Initiate revision of existing and develop new laws, regulations according to recommendations from review 	<p>Z-NatRes-02: Destructive fishing</p>	<p>Z-NatRes-01: Poor shoreline management</p> <p>Z-NatRes-11: Habitat alterations from land uses</p> <p>Z-NatRes-14: Turtle gill netting</p> <p>Z-NatRes-17: Predation and disturbance of turtle nesting sites</p>		<p>Z-NatRes-08: Seagrass damage due to invertebrate harvest</p> <p>Z-NatRes-10: Sedimentation of coral reefs</p> <p>Z-NatRes-16: Seismic survey noise</p>	
Alternative/ Improved Livelihood	<p>Develop and offer alternative livelihoods for households currently engaged in destructive resource exploitation practises. Particular efforts to provide alternatives for young generation.</p> <p>Improve current sustainable resource use livelihoods using technology advances and insights.</p>	<p>Z-NatRes-02: Destructive fishing</p>	<p>Z-NatRes-01: Poor shoreline management</p> <p>Z-NatRes-11: Habitat alterations from land uses</p>		<p>Z-NatRes-08: Seagrass damage due to invertebrate harvest</p>	
Awareness Raising	<p>Develop and launch awareness raising campaigns related to coastal management challenges directed to the public at large and to schools.</p> <p>Develop and launch issue specific awareness raising campaigns targeting stakeholders affected by or affecting the issue.</p>	<p>Z-NatRes-02: Destructive fishing</p> <p>Z-NatRes-13: Invasive Indian crow</p>	<p>Z-NatRes-01: Poor shoreline management</p> <p>Z-NatRes-09: Nutrient pollution</p> <p>Z-NatRes-11: Habitat alterations from land uses</p> <p>Z-NatRes-14: Turtle gill netting</p> <p>Z-NatRes-17: Predation and disturbance of turtle nesting sites</p>	<p>Z-NatRes-05: Estuaries and lagoons harmed by waste disposal</p>	<p>Z-NatRes-03: Destructive tourist activities</p> <p>Z-NatRes-08: Seagrass damage due to invertebrate harvest</p> <p>Z-NatRes-10: Sedimentation of coral reefs</p> <p>Z-NatRes-16: Seismic survey noise</p>	

Intervention Dimension	Statement	Threat pertinence at each RV				
		Major Problem (RV 5)	Very important problem (RV 4)	Important Problem (RV 3)	Problem (RV 2)	Light Problem (RV 1)
Education	Engage in curricula review and development for primary and secondary schools to enhance the knowledge and understanding about coastal management issues- Issue of particular relevance from a fisheries perspective include: <ul style="list-style-type: none"> Fisheries ecology and sustainable fisheries Impact from catchment management on coastal fisheries Environmental management Coastal ecology Importance of beaches 	Z-NatRes-02: Destructive fishing	Z-NatRes-01: Poor shoreline management Z-NatRes-09: Nutrient pollution Z-NatRes-11: Habitat alterations from land uses Z-NatRes-17: Predation and disturbance of turtle nesting sites	Z-NatRes-05: Estuaries and lagoons harmed by waste disposal	Z-NatRes-08: Seagrass damage due to invertebrate harvest Z-NatRes-10: Sedimentation of coral reefs	

Action areas

In Table 149 below an overview has been established on how strongly each intervention dimension responds to threats to local communities and ecosystems as perceived by local stakeholders.

For each intervention dimension and for each problem class the number of threats considered to benefit from the intervention have been multiplied by the range value (RV) for the given problem class. The total score for each management dimension has then been calculated by adding the values achieved. The table thus provides an indication of the importance of each intervention dimension in addressing identified and ranked threats. In the same manner Figure 41 gives a graphical presentation of the relevance of intervention dimensions in addressing the identified threats related to with natural resources.

Table 149: Assessment of the importance of broad management dimension in addressing threats to local communities and ecosystems associated with natural resources.

Invention Dimension	Major Problem weight	Very important problem weight	Important Problem weight	Problem weight	Light Problem weight	Total Score
Integrated Coastal Zone Management (ICZM)	5	12	3	6	0	26
Integrated Water Resources Management (IWRM)	0	4	3	2	1	10
Land Use Management	5	12	3	6	1	27
Shoreline Management Planning	5	16	3	6	1	31
Solid and Liquid Waste Management	5	4	3	2	0	14
Sanitation	0	4	3	2	0	9
Capacity Building	5	12	3	8	1	29
Technology	10	20	3	6	1	40
Law Enforcement	5	24	3	6	1	39
Legal Review	5	16	0	6	0	27
Alternative/ Improved Livelihood	5	8	0	2	0	15
Awareness Raising	10	20	3	8	0	41
Education	5	16	3	4	0	28
Zanzibar	Natural Resources				Total	336

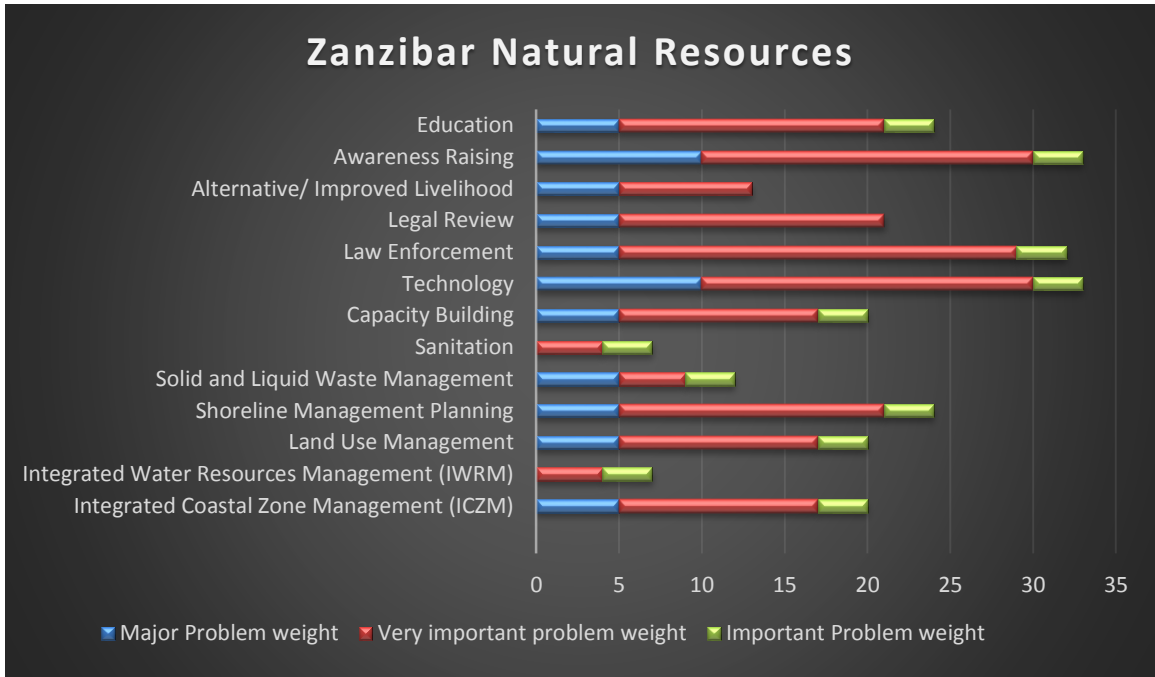


Figure 41: The importance of broad intervention dimension in responding to threats to local communities and ecosystems associated with natural resources.

Freshwater Resources

Zanzibar receives a relatively high annual rainwater volume (1,916 mm on Pemba and 1,565 mm on Unguja, reported by Francis et al. 2001)

Total water withdrawal by the domestic sector and irrigation in Zanzibar is estimated to be about 42 million m³ (Unguja Island 33 million m³, Pemba Island 9 million m³ (IWMI 2010)).

Pemba has small surface water streams as the valleys are flat bottomed and filled with eroded silt and sand. The island does not have major aquifers, and the small aquifers lack transmissive structures and are only suitable for small local supply schemes.



Unguja Island has larger underground aquifers, which are the main sources for drinking water, being from natural springs, limestone caves, hand dug wells and boreholes tapping the (shallow) aquifers. The aquifers are recharged by rainfall, and the overflow discharges to the sea preventing saltwater intrusion. There is not much detailed information on the shape and size of Zanzibar's aquifers (IWMI 2010), though studies carried out in the early 1990's estimated the total annual acceptable yield of the Unguja aquifer is about 50% of the total recharge i.e. 290 Mm³ per year (Zanzibar Water Policy 2006).

The outlook is clearly one of insufficient water to meet the needs of the population, particularly the large urban centres on the coast (Stone Town, Mkoani and Chake Chake) but also in the drier eastern coral rag areas where local water supplies are least abundant and tourism resorts more dense than elsewhere.

The expected increase in tourist numbers on Zanzibar will increase the pressure on freshwater resources and sustainable supply has to be established to tap this important development opportunity for the islands.

Prioritized Threats

In Table 150 below the threats identified related to freshwater resources have been listed and ranked according to their severity as established using the CRIAM method discussed extensively in Volumes I and II of the Coastal Profile. A rapid assessment has been made on the susceptibility of each threat to impacts of climate change more specifically, changes in whether patterns, extreme events, sea level rise, temperature rise and acidification.

Table 150: Prioritised threats related to natural resources and a rapid assessment of threat susceptibility to climate change.

#	Threat as identified in Coastal Profile	Threat Level	Influence from Climate Change				
			Change in Patterns	Extreme events	Sea Level Rise	Temperature rise	Acidification
Z-Fresh-05	Degradation of catchments due to land use changes and livestock keeping.	Very Important Problem	+	++	0	0	0
			Extreme events and changing weather patterns may aggravate impact of land uses changed and livestock keeping				
Z-Fresh-06	Population and economic growth leading to increasing demand for freshwater.	Very Important Problem	0	0	0	0	0
			No impact from climate change on this threat				
Z-Fresh-08	Lack of information on climate change and its impacts on Zanzibar's aquifers.	Very Important Problem	0	0	0	0	0
			No impact from climate change on this threat				

#	Threat as identified in Coastal Profile	Threat Level	Influence from Climate Change				
			Change in Patterns	Extreme events	Sea Level Rise	Temperature rise	Acidification
Z-Fresh-09	Lack of updated data on current river discharges on Pemba and aquifer recharges on both islands leading to failure to comprehensively control water supplies.	Very Important Problem	0	0	0	0	0
			No impact from climate change on this threat				
Z-Fresh-01	Inefficient management of piped freshwater supply leading to leaks and loss of water.	Important Problem	0	0	0	0	0
			No impact from climate change on this threat				
Z-Fresh-02	Increased demand from tourism sector exceeding supply.	Important Problem	0	0	0	0	0
			No impact from climate change on this threat				
Z-Fresh-03	Removal of riverine vegetation, erosion of riverbanks, pollution of water bodies from municipal waste dumping, agricultural practices or mining (minerals and river sand) or abstraction for water for agriculture (or livestock).	Important Problem	++	++	0	0	0
			Impacts will become more severe with chaged weather patterns and extreme events				
Z-Fresh-07	Pesticide and waste water pollution of aquifers on Pemba and Unguja from poor agricultural practices, or pollution from municipal waste dumping or inadequate sewage systems.	Problem	+	+	0	0	0
			Extreme events and chaning weather patterns may aggravate impact from poor agriculture practises				
+++	Threat is severely aggravated from climate change dimension						
++	Threat is aggravated from climate change dimension						
+	Threat is slightly aggravated from climate change dimension						
0	No influence of threat from climate change dimension						
-	Remediating effect on threat from climate change dimension						

Recommendations for threat mitigation measures

Overall measures to mitigate each if the identified natural resources related threats to coastal local communities and ecosystems have been tabulated in Table 202(page373) arranged under broad management dimensions headings. Table 151below provides an overview of the requirements/opportunities expressed within each of these management or intervention dimensions.

Table 151: Broad management intervention dimensions to address identified and prioritised threats to coastal communities and ecosystems associated with freshwater resources in Zanzibar

Intervention Dimension	Statement	Threat pertinence at each RV				
		Major Problem (RV 5)	Very important problem (RV 4)	Important Problem (RV 3)	Problem (RV 2)	Light Problem (RV 1)
Integrated Coastal Zone Management (ICZM)	Ensure coordination and participation in management of coastal land, water and resources use currently under complex pressures. Facilitate dialogues required to alleviate social conflicts over resources use. Link with hinterland management to address catchment and riverbank deforestation, river flow changes and river pollution, all of which affect the coast in many ways (ICARM).		Z-Fresh-08: Lack of information on climate change and its impacts on Zanzibar's aquifers. Z-Fresh-09: Lack of information on water resources	Z-Fresh-03: Impacts from upstream river and land uses		
Integrated Water Resources Management (IWRM)	Link IWRM to coastal integrated planning ensuring upstream/downstream considerations (ICARM). Land use in catchments and its impacts on water resources included in IWRM planning.		Z-Fresh-05: Degradation in catchments from land uses Z-Fresh-06: Increasing demand form population and economic growth Z-Fresh-08: Lack of information on climate change and its impacts on Zanzibar's aquifers. Z-Fresh-09: Lack of information on water resources	Z-Fresh-03: Impacts from upstream river and land uses	Z-Fresh-07: Pesticide and waste water pollution of aquifers	

Intervention Dimension	Statement	Threat pertinence at each RV				
		Major Problem (RV 5)	Very important problem (RV 4)	Important Problem (RV 3)	Problem (RV 2)	Light Problem (RV 1)
Land Use Management	Land use information management systems to include ecosystems, habitats and water resources. Incorporate ecosystems, habitats and water resources considerations in spatial planning. Inform hinterland spatial planning to direct zoning to prevent downstream impacts on fisheries habitats.		Z-Fresh-05: Degradation in catchments from land uses Z-Fresh-06: Increasing demand form population and economic growth	Z-Fresh-02: Increased demand from tourism sector exceeding supply. Z-Fresh-03: Impacts from upstream river and land uses	Z-Fresh-07: Pesticide and waste water pollution of aquifers	
Shoreline Management Planning	Establish a systematic overview of coastal processes through a shoreline management investigation, considering the entire coast, and inform spatial planning accordingly. Sediment cell resolution national effort, management unit resolution regional/district effort.			Z-Fresh-03: Impacts from upstream river and land uses		
Solid and Liquid Waste Management	Review agrochemical management and inform land use accordingly. Pursue integrated solid and liquid waste management solutions considering: Waste water treatment systems: - collection - treatment technology - discharge Liquid Waste Management Systems: - collection - storage - processing - financing - minimisation - reuse? Green Infrastructure Storm Water Systems			Z-Fresh-03: Impacts from upstream river and land uses	Z-Fresh-07: Pesticide and waste water pollution of aquifers	
Sanitation	Pursue integrated solid and liquid waste management considering: Waste water treatment systems: - collection - treatment technology - discharge Liquid Waste Management Systems: - collection - storage - processing - financing - minimisation - reuse? Green Infrastructure Storm Water Systems			Z-Fresh-03: Impacts from upstream river and land uses	Z-Fresh-07: Pesticide and waste water pollution of aquifers	
Capacity Building	Accompany management interventions with appropriate capacity building components. Particular focus on spatial planning, shoreline management, conflict resolution, monitoring, law enforcement. Enhance information management systems to provide for better and systematically informed management decisions.		Z-Fresh-05: Degradation in catchments from land uses Z-Fresh-06: Increasing demand form population and economic growth Z-Fresh-08: Lack of information on climate change and its impacts on Zanzibar's aquifers. Z-Fresh-09: Lack of information on water resources	Z-Fresh-01: Inefficient management of piped water supply Z-Fresh-02: Increased demand from tourism sector exceeding supply. Z-Fresh-03: Impacts from upstream river and land uses	Z-Fresh-07: Pesticide and waste water pollution of aquifers	

Intervention Dimension	Statement	Threat pertinence at each RV				
		Major Problem (RV 5)	Very important problem (RV 4)	Important Problem (RV 3)	Problem (RV 2)	Light Problem (RV 1)
Technology	<p>Pursue opportunities through further technology development within:</p> <ul style="list-style-type: none"> • Offshore fisheries • Aquaculture • Value addition • Integrated solid and liquid waste management • Shoreline management 		<p>Z-Fresh-05: Degradation in catchments from land uses</p> <p>Z-Fresh-06: Increasing demand form population and economic growth</p> <p>Z-Fresh-08: Lack of information on climate change and its impacts on Zanzibar's aquifers.</p> <p>Z-Fresh-09: Lack of information on water resources</p>	<p>Z-Fresh-01: Inefficient management of piped water supply</p> <p>Z-Fresh-02: Increased demand from tourism sector exceeding supply.</p> <p>Z-Fresh-03: Impacts from upstream river and land uses</p>	<p>Z-Fresh-07: Pesticide and waste water pollution of aquifers</p>	
Law Enforcement	<p>1) Integrated review of laws, regulations and their enforcement within amongst others:</p> <ul style="list-style-type: none"> • Fisheries, • Mangrove exploitation • Coral mining • Agrochemicals • Industrial and domestic waste • Land use <p>2) Optimise enforcement through capacity building and coordination following recommendations from review.</p>		<p>Z-Fresh-05: Degradation in catchments from land uses</p> <p>Z-Fresh-06: Increasing demand form population and economic growth</p>	<p>Z-Fresh-03: Impacts from upstream river and land uses</p>	<p>Z-Fresh-07: Pesticide and waste water pollution of aquifers</p>	
Legal Review	<p>1) Integrated review of laws, regulations and their enforcement within amongst others:</p> <ul style="list-style-type: none"> • Fisheries, • Mangrove exploitation • Coral mining • Agrochemicals • Industrial and domestic waste • Land use <p>2) Initiate revision of existing and develop new laws, regulations according to recommendations from review</p>		<p>Z-Fresh-05: Degradation in catchments from land uses</p> <p>Z-Fresh-06: Increasing demand form population and economic growth</p>	<p>Z-Fresh-03: Impacts from upstream river and land uses</p>	<p>Z-Fresh-07: Pesticide and waste water pollution of aquifers</p>	
Alternative/ Improved Livelihood	<p>Develop and offer alternative livelihoods for households currently engaged in destructive resource exploitation practises. Particular efforts to provide alternatives for young generation.</p> <p>Improve current sustainable resource use livelihoods using technology advances and insights.</p>			<p>Z-Fresh-03: Impacts from upstream river and land uses</p>		
Awareness Raising	<p>Develop and launch awareness raising campaigns related to coastal management challenges directed to the public at large and to schools.</p> <p>Develop and launch issue specific awareness raising campaigns targeting stakeholders affected by or affecting the issue.</p>		<p>Z-Fresh-05: Degradation in catchments from land uses</p> <p>Z-Fresh-06: Increasing demand form population and economic growth</p> <p>Z-Fresh-08: Lack of information on climate change and its impacts on Zanzibar's aquifers.</p> <p>Z-Fresh-09: Lack of information on water resources</p>	<p>Z-Fresh-01: Inefficient management of piped water supply</p> <p>Z-Fresh-02: Increased demand from tourism sector exceeding supply.</p> <p>Z-Fresh-03: Impacts from upstream river and land uses</p>	<p>Z-Fresh-07: Pesticide and waste water pollution of aquifers</p>	

Intervention Dimension	Statement	Threat pertinence at each RV				
		Major Problem (RV 5)	Very important problem (RV 4)	Important Problem (RV 3)	Problem (RV 2)	Light Problem (RV 1)
Education	Engage in curricula review and development for primary and secondary schools to enhance the knowledge and understanding about coastal management issues- Issue of particular relevance from a fisheries perspective include: <ul style="list-style-type: none"> Fisheries ecology and sustainable fisheries Impact from catchment management on coastal fisheries Environmental management Coastal ecology Importance of beaches 		Z-Fresh-05: Degradation in catchments from land uses Z-Fresh-06: Increasing demand form population and economic growth Z-Fresh-08: Lack of information on climate change and its impacts on Zanzibar's aquifers. Z-Fresh-09: Lack of information on water resources	Z-Fresh-01: Inefficient management of piped water supply Z-Fresh-02: Increased demand from tourism sector exceeding supply. Z-Fresh-03: Impacts from upstream river and land uses	Z-Fresh-07: Pesticide and waste water pollution of aquifers	

Action areas

In Table 152 below an overview has been established on how strongly each intervention dimension responds to threats to local communities and ecosystems as perceived by local stakeholders.

For each intervention dimension and for each problem class the number of threats considered to benefit from the intervention have been multiplied by the range value (RV) for the given problem class. The total score for each management dimension has then been calculated by adding the values achieved. The table thus provides an indication of the importance of each intervention dimension in addressing identified and ranked threats. In the same manner Figure 42 gives a graphical presentation of the relevance of intervention dimensions in addressing the identified threats related to with freshwater resources.

Table 152: Assessment of the importance of broad management dimension in addressing threats to local communities and ecosystems associated with freshwater resources.

Intervention Dimension	Major Problem weight	Very important problem weight	Important Problem weight	Problem weight	Light Problem weight	Total Score
Integrated Coastal Zone Management (ICZM)	0	8	3	0	0	11
Integrated Water Resources Management (IWRM)	0	16	3	2	0	21
Land Use Management	0	8	6	2	0	16
Shoreline Management Planning	0	0	3	0	0	3
Solid and Liquid Waste Management	0	0	3	2	0	5
Sanitation	0	0	3	2	0	5
Capacity Building	0	16	9	2	0	27
Technology	0	16	9	2	0	27
Law Enforcement	0	8	3	2	0	13
Legal Review	0	8	3	2	0	13
Alternative/ Improved Livelihood	0	0	3	0	0	3
Awareness Raising	0	16	9	2	0	27
Education	0	16	9	2	0	27
Zanzibar			Freshwater Resources		Total	198

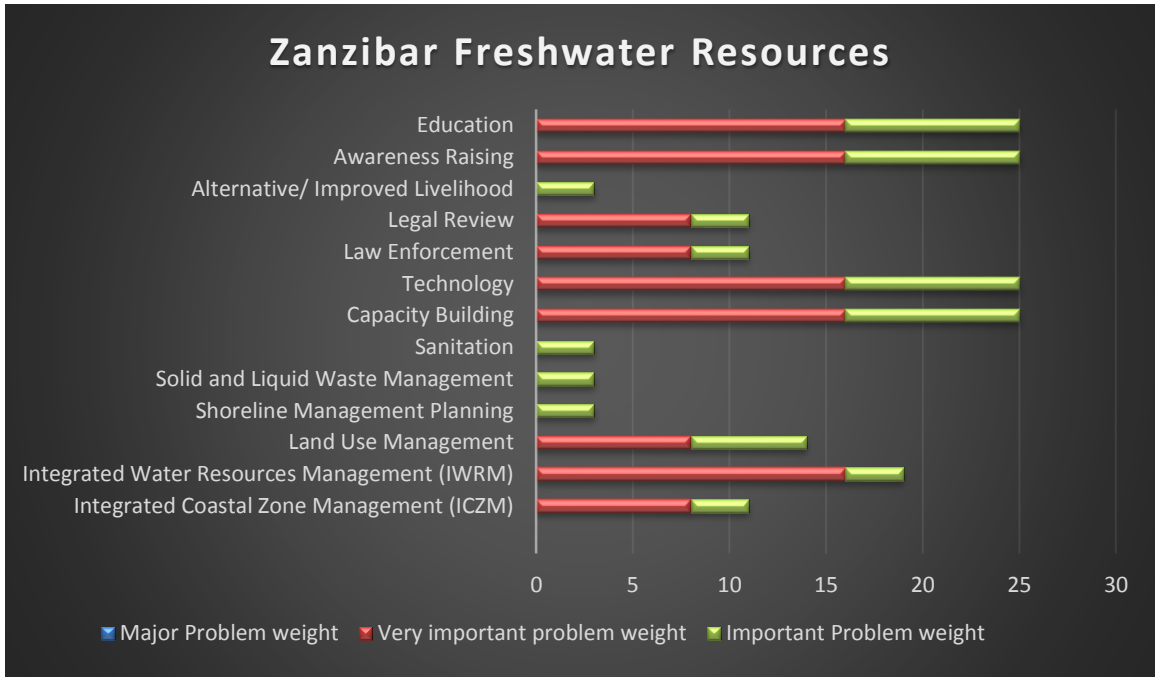


Figure 42: The importance of broad intervention dimension in responding to threats to local communities and ecosystems associated with freshwater resources.

Management Framework for Coastal Zone Management

Prioritized Threats

In Table 153 below the threats identified related to management framework for coastal zone management have been listed and ranked according to their severity as established using the CRIAM method discussed extensively in Volumes I and II of the Coastal Profile. A rapid assessment has been made on the susceptibility of each threat to impacts of climate change more specifically, changes in whether patterns, extreme events, sea level rise, temperature rise and acidification.

Table 153: Prioritised threats related to management framework for coastal zone management and a rapid assessment of threat susceptibility to climate change.

#	Threat as identified in Coastal Profile	Threat Level	Influence from Climate Change					
			Change in Patterns	Extreme events	Sea Level Rise	Temperature rise	Acidification	
Z-MFCZM-01	Poor coordination and monitoring between different sectors leading to ineffective governance and failing of enforcement in coastal and marine areas.	Very Important Problem	0	0	0	0	0	No impact from climate change on this threat. The threat needs to be addressed however to mitigate impacts of climate change in general.
Z-MFCZM-02	Poor capacity and motivation at local district authority level to implement legal mandates governing natural resource use, resulting in continued deterioration of productive resources.	Very Important Problem	0	0	0	0	0	No impact from climate change on this threat. The threat needs to be addressed however to mitigate impacts of climate change in general.
Z-MFCZM-03	Absence of financial capacity to address management issues related to coastal and marine resources.	Very Important Problem	0	0	0	0	0	No impact from climate change on this threat
Z-MFCZM-06	Increasing demand of freshwater for irrigation	Very Important Problem	+	++	+	0	0	Will be aggravated with changed weather patterns (drought)
Z-MFCZM-04	Poor coordination to address solid waste disposal leading to pollution of beaches and coastal waters.	Important Problem	+	++	+	0	0	Impacts will be more severe
Z-MFCZM-05	Lack of sewage treatment facilities in the Stone Town leading to pollution of beaches and coastal waters.	Important Problem	+	++	++	0	0	Impacts will be more severe
+++	Threat is severely aggravated from climate change dimension							
++	Threat is aggravated from climate change dimension							
+	Threat is slightly aggravated from climate change dimension							
0	No influence of threat from climate change dimension							
-	Remediating effect on threat from climate change dimension							

Recommendations for threat mitigation measures

Overall measures to mitigate each of the identified natural resources related threats to coastal local communities and ecosystems have been tabulated in Table 203 (page 374) arranged under broad management dimensions headings. Table 154 below provides an overview of the requirements/opportunities expressed within each of these management or intervention dimensions.

Table 154: Broad management intervention dimensions to address identified and prioritised threats to coastal communities and ecosystems associated with management framework for coastal zone management in Zanzibar

Intervention Dimension	Statement	Threat pertinence at each RV				
		Major Problem (RV 5)	Very important problem (RV 4)	Important Problem (RV 3)	Problem (RV 2)	Light Problem (RV 1)
Integrated Coastal Zone Management (ICZM)	<p>Ensure coordination and participation in management of coastal land, water and resources use currently under complex pressures.</p> <p>Facilitate dialogues required to alleviate social conflicts over resources use.</p> <p>Link with hinterland management to address catchment and riverbank deforestation, river flow changes and river pollution, all of which affect the coast in many ways (ICARM).</p>		<p>Z-MFCZM-01: Poor coordination and monitoring</p> <p>Z-MFCZM-02: Poor capacity at local authority</p> <p>Z-MFCZM-03: Low financial capacity</p>	<p>Z-MFCZM-04: Pollution of beaches and coastal waters</p> <p>Z-MFCZM-05: Lack of sewage treatment facilities in the Stone Town leading to pollution of beaches and coastal waters.</p>		

Intervention Dimension	Statement	Threat pertinence at each RV				
		Major Problem (RV 5)	Very important problem (RV 4)	Important Problem (RV 3)	Problem (RV 2)	Light Problem (RV 1)
Integrated Water Resources Management (IWRM)	Link IWRM to coastal integrated planning ensuring upstream/ downstream considerations (ICARM). Land use in catchments and its impacts on water resources included in IWRM planning.		Z-MFCZM-03: Low financial capacity Z-MFCZM-06: Increasing demand of freshwater for irrigation			
Land Use Management	Land use information management systems to include ecosystems, habitats and water resources. Incorporate ecosystems, habitats and water resources considerations in spatial planning. Inform hinterland spatial planning to direct zoning to prevent downstream impacts on fisheries habitats.		Z-MFCZM-02: Poor capacity at local authority Z-MFCZM-06: Increasing demand of freshwater for irrigation	Z-MFCZM-04: Pollution of beaches and coastal waters Z-MFCZM-05: Lack of sewage treatment facilities in the Stone Town leading to pollution of beaches and coastal waters.		
Shoreline Management Planning	Establish a systematic overview of coastal processes through a shoreline management investigation, considering the entire coast, and inform spatial planning accordingly. Sediment cell resolution national effort, management unit resolution regional/ district effort.		Z-MFCZM-01: Poor coordination and monitoring Z-MFCZM-02: Poor capacity at local authority Z-MFCZM-03: Low financial capacity	Z-MFCZM-04: Pollution of beaches and coastal waters Z-MFCZM-05: Lack of sewage treatment facilities in the Stone Town leading to pollution of beaches and coastal waters.		
Solid and Liquid Waste Management	Review agrochemical management and inform land use accordingly. Pursue integrated solid and liquid waste management solutions considering: Waste water treatment systems: - collection - treatment technology - discharge Liquid Waste Management Systems: - collection - storage - processing - financing - minimisation - reuse? Green Infrastructure Storm Water Systems			Z-MFCZM-04: Pollution of beaches and coastal waters Z-MFCZM-05: Lack of sewage treatment facilities in the Stone Town leading to pollution of beaches and coastal waters.		
Sanitation						
Capacity Building	Accompany management interventions with appropriate capacity building components. Particular focus on spatial planning, shoreline management, conflict resolution, monitoring, law enforcement. Enhance information management systems to provide for better and systematically informed management decisions.		Z-MFCZM-01: Poor coordination and monitoring Z-MFCZM-02: Poor capacity at local authority Z-MFCZM-03: Low financial capacity Z-MFCZM-06: Increasing demand of freshwater for irrigation	Z-MFCZM-04: Pollution of beaches and coastal waters Z-MFCZM-05: Lack of sewage treatment facilities in the Stone Town leading to pollution of beaches and coastal waters.		
Technology	Pursue opportunities through further technology development within: <ul style="list-style-type: none"> Offshore fisheries Aquaculture Value addition Integrated solid and liquid waste management Shoreline management 		Z-MFCZM-02: Poor capacity at local authority Z-MFCZM-06: Increasing demand of freshwater for irrigation	Z-MFCZM-04: Pollution of beaches and coastal waters Z-MFCZM-05: Lack of sewage treatment facilities in the Stone Town leading to pollution of beaches and coastal waters.		

Intervention Dimension	Statement	Threat pertinence at each RV				
		Major Problem (RV 5)	Very important problem (RV 4)	Important Problem (RV 3)	Problem (RV 2)	Light Problem (RV 1)
Law Enforcement	<p>1) Integrated review of laws, regulations and their enforcement within amongst others:</p> <ul style="list-style-type: none"> • Fisheries, • Mangrove exploitation • Coral mining • Agrochemicals • Industrial and domestic waste • Land use <p>2) Optimise enforcement through capacity building and coordination following recommendations from review.</p>		<p>Z-MFCZM-02: Poor capacity at local authority</p> <p>Z-MFCZM-06: Increasing demand of freshwater for irrigation</p>	<p>Z-MFCZM-05: Lack of sewage treatment facilities in the Stone Town leading to pollution of beaches and coastal waters.</p>		
Legal Review	<p>1) Integrated review of laws, regulations and their enforcement within amongst others:</p> <ul style="list-style-type: none"> • Fisheries, • Mangrove exploitation • Coral mining • Agrochemicals • Industrial and domestic waste • Land use <p>2) Initiate revision of existing and develop new laws, regulations according to recommendations from review</p>		<p>Z-MFCZM-02: Poor capacity at local authority</p> <p>Z-MFCZM-06: Increasing demand of freshwater for irrigation</p>	<p>Z-MFCZM-05: Lack of sewage treatment facilities in the Stone Town leading to pollution of beaches and coastal waters.</p>		
Alternative/ Improved Livelihood	<p>Develop and offer alternative livelihoods for households currently engaged in destructive resource exploitation practises. Particular efforts to provide alternatives for young generation.</p> <p>Improve current sustainable resource use livelihoods using technology advances and insights.</p>		<p>Z-MFCZM-01: Poor coordination and monitoring</p> <p>Z-MFCZM-02: Poor capacity at local authority</p> <p>Z-MFCZM-03: Low financial capacity</p>			
Awareness Raising	<p>Develop and launch awareness raising campaigns related to coastal management challenges directed to the public at large and to schools.</p> <p>Develop and launch issue specific awareness raising campaigns targeting stakeholders affected by or affecting the issue.</p>		<p>Z-MFCZM-01: Poor coordination and monitoring</p> <p>Z-MFCZM-02: Poor capacity at local authority</p> <p>Z-MFCZM-06: Increasing demand of freshwater for irrigation</p>	<p>Z-MFCZM-04: Pollution of beaches and coastal waters</p> <p>Z-MFCZM-05: Lack of sewage treatment facilities in the Stone Town leading to pollution of beaches and coastal waters.</p>		
Education	<p>Engage in curricula review and development for primary and secondary schools to enhance the knowledge and understanding about coastal management issues- Issue of particular relevance from a fisheries perspective include:</p> <ul style="list-style-type: none"> • Fisheries ecology and sustainable fisheries • Impact from catchment management on coastal fisheries • Environmental management • Coastal ecology • Importance of beaches 		<p>Z-MFCZM-01: Poor coordination and monitoring</p> <p>Z-MFCZM-02: Poor capacity at local authority</p> <p>Z-MFCZM-06: Increasing demand of freshwater for irrigation</p>	<p>Z-MFCZM-04: Pollution of beaches and coastal waters</p> <p>Z-MFCZM-05: Lack of sewage treatment facilities in the Stone Town leading to pollution of beaches and coastal waters.</p>		

Action areas

In Table 155 below an overview has been established on how strongly each intervention dimension responds to threats to local communities and ecosystems as perceived by local stakeholders.

For each intervention dimension and for each problem class the number of threats considered to benefit from the intervention have been multiplied by the range value (RV) for the given problem class. The total score for each management dimension has then been calculated by adding the values achieved. The table thus provides an indication of the importance of each intervention dimension in addressing

identified and ranked threats. In the same manner Figure 43 gives a graphical presentation of the relevance of intervention dimensions in addressing the identified threats related to with management framework for coastal zone management.

Table 155: Assessment of the importance of broad management dimension in addressing threats to local communities and ecosystems associated with management framework for coastal zone management

Intervention Dimension	Major Problem weight	Very important problem weight	Important Problem weight	Problem weight	Light Problem weight	Total Score
Integrated Coastal Zone Management (ICZM)	0	12	6	0	0	18
Integrated Water Resources Management (IWRM)	0	8	0	0	0	8
Land Use Management	0	8	6	0	0	14
Shoreline Management Planning	0	12	6	0	0	18
Solid and Liquid Waste Management	0	0	6	0	0	6
Sanitation	0	0	0	0	0	0
Capacity Building	0	16	6	0	0	22
Technology	0	8	6	0	0	14
Law Enforcement	0	8	3	0	0	11
Legal Review	0	8	3	0	0	11
Alternative/ Improved Livelihood	0	12	0	0	0	12
Awareness Raising	0	12	6	0	0	18
Education	0	12	6	0	0	18
Zanzibar	Management Framework				Total	170

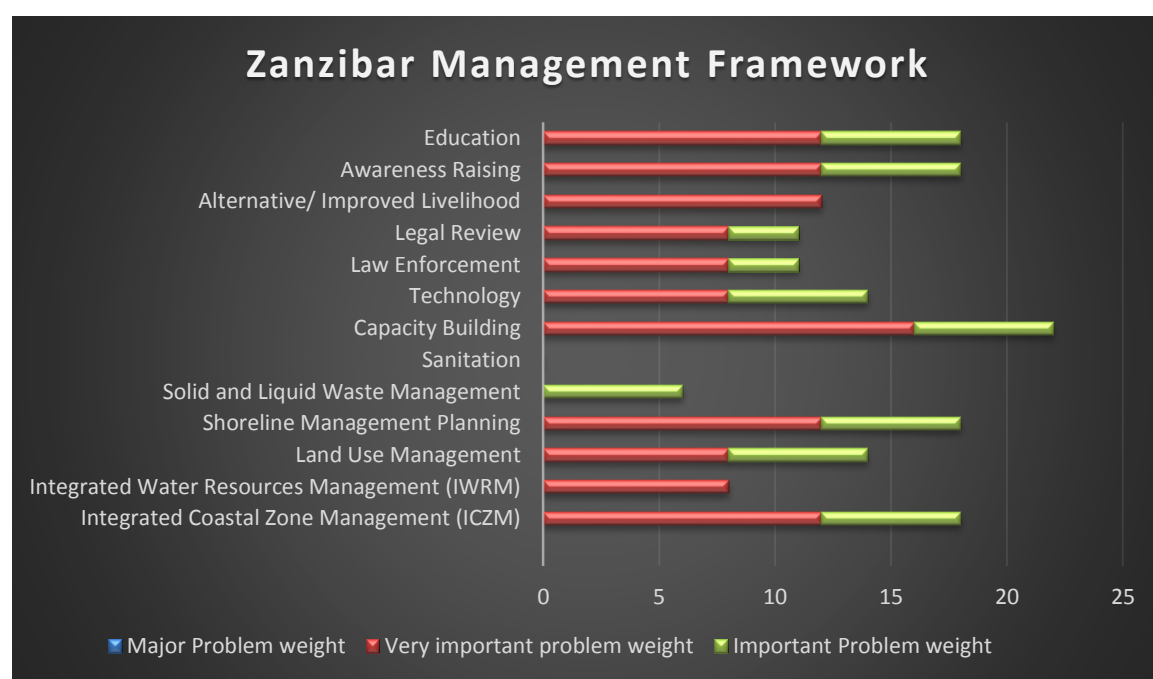


Figure 43: The importance of broad intervention dimension in responding to threats to local communities and ecosystems associated with management framework.

Zanzibar Regions

Pemba North Region

Prioritized Threats

In Table 156 below the threats identified for Pemba North Region have been listed and ranked according to their severity as established using the CRIAM method discussed extensively in Volumes I and II of the Coastal Profile. A rapid assessment has been made on the susceptibility of each threat to impacts of climate change more specifically, changes in weather patterns, extreme events, sea level rise, temperature rise and acidification.

Table 156: Prioritised threats for Pemba North Region, Zanzibar and a rapid assessment of threat susceptibility to climate change.

#	Threat as identified in Coastal Profile	Threat Level	Influence from Climate Change					
			Change in Patterns	Extreme events	Sea Level Rise	Temperature rise	Acidification	
PembaNorth-03	Fisheries decline	Very important problem	0	-	0	0	0	Changes in climate are not expected to impact per se on the practise of destructive and illegal fisheries. Extreme weather events may in periods have a preventive effect.
PembaNorth-05	Loss of habitat & agricultural area	Important problem	++	++	+	0	0	Impact from unsuitable resource use practises will be exacerbated notably from extreme events (storms and surges), stress from changed weather patterns and from sea level rise.
PembaNorth-04	Disease outbreaks	Problem	++	++	+	+	0	More frequent and severe weather events and sea level rise may increase flooding and standing water and sewage exacerbating disease outbreaks and higher temperatures increase disease propagation.
PembaNorth-06	Marine environmental pollution	Problem	++	++	0	0	0	More frequent and severe weather events may increase the leaching of pollutants into water resources and thereby exacerbate the levels reaching local marine ecosystems.
PembaNorth-02	Beach erosion	Light problem	+	+++	+++	0	+	Impact from unsuitable resource use practises leading to beach erosion will be exacerbated notably from extreme events (storms and surges) and sea level rise. Coral growth likely reduce by acidification, increasing wave action and erosion.
PembaNorth-01	Beach pollution	Light problem	0	0	0	0	0	Changes in climate are not expected to impact per se on the practise of poor waste disposal that affects beaches.
+++	Threat is severely aggravated from climate change dimension							
++	Threat is aggravated from climate change dimension							
+	Threat is slightly aggravated from climate change dimension							
0	No influence of threat from climate change dimension							
-	Remediating effect on threat from climate change dimension							

Table 157: Prioritised threats for Pemba North region, Zanzibar, their location and causes

#	Threat as identified in Coastal Profile	Threat Level	Location	Causes
PembaNorth-03	Fisheries decline	Very Important Problem	Along shallow waters in the region	Destruction of fish nurseries such as mangrove cutting, illegal fishing such as dynamite fishing and other poor fishing methods such as beach seine and kigumi
PembaNorth-05	Loss of habitat & agricultural areas	Important Problem	Mtambwe, Wete bay, Micheweni	Mangrove cutting, Influx of sea water to agricultural land. Limestone brick cutting
PembaNorth-04	Disease outbreaks	Problem	Micheweni town and villages	Inadequate sewerage control, poor solid waste management. Lack of latrines and toilets in some coastal dwellings.
PembaNorth-06	Marine environmental pollution	Problem	Wete and Micheweni towns and villages. Wete port	Uncontrolled solid waste dump sites, as well as untreated sewage from domestic uses in the area. Influx of pesticides, nutrients and fertilizers from nearby firms, especially in the undulations and valleys where sea water near the agricultural areas. Possible oil leak during loading and offloading of petroleum from ships at Wete port.
PembaNorth-02	Beach erosion	Light problem	Micheweni and Wete town and villages	Mangrove cutting, beach sand mining, unplanned construction along the coast, currents and waves
PembaNorth-01	Beach pollution	Light problem	Ras Kigomasha, Wete, Mtambwe	Uncontrolled solid and liquid waste disposal

Recommendations for threat mitigation measures

Overall measures to mitigate each if the identified natural resources related threats to coastal local communities and ecosystems have been tabulated in Table 220 (page405) arranged under broad management dimensions headings. Table 153 provides an overview of the requirements/opportunities expressed within each of these management or intervention dimensions.

Table 158: Broad management intervention dimensions to address identified and prioritised threats to coastal communities and ecosystems in Pemba North region, Zanzibar

Intervention Dimension	Statement	Threat pertinence at each RV				
		Major Problem (RV 5)	Very important problem (RV 4)	Important Problem (RV 3)	Problem (RV 2)	Light Problem (RV 1)
Integrated Coastal Zone Management (ICZM)	<p>Ensure coordination and participation in management of coastal land, water and resources use currently under complex pressures.</p> <p>Focus areas for integrated management to address include fisheries, and coastal land loss, waste and erosion at Mtambwe, Wete Bay and Micheweni</p>		PbaN-03: Fisheries decline	PbaN-05: Habitat & agricultural loss	PbaN-06: Marine pollution	<p>PbaN-02: Beach erosion</p> <p>PbaN-01: Beach pollution</p>
Integrated Water Resources Management (IWRM)	Link IWRM to coastal integrated planning to address impacts from upstream pollution, at Wete and Micheweni towns and villages and Wete port (ICARM).				PbaN-06: Marine pollution	PbaN-01: Beach pollution
Land Use Management	<p>Land use information management systems to include ecosystems, habitats and water resources.</p> <p>Incorporate ecosystems, habitats, shoreline processes and water resources considerations in spatial planning.</p> <p>Optimise land use through zoning to minimise conflicts and prevent anarchistic development.</p> <p>Develop and/or update regional spatial plan accordingly and within national spatial planning framework.</p>		PbaN-03: Fisheries decline	PbaN-05: Habitat & agricultural loss	<p>PbaN-04: Disease outbreaks</p> <p>PbaN-06: Marine pollution</p>	<p>PbaN-02: Beach erosion</p> <p>PbaN-01: Beach pollution</p>
Shoreline Management Planning	<p>Region's shorelines included in a national level overall shoreline management investigation.</p> <p>Shoreline management units (area of coast) identified for the region informing regional level spatial planning as a basis for local shoreline management regulation.</p>		PbaN-03: Fisheries decline	PbaN-05: Habitat & agricultural loss	PbaN-06: Marine pollution	<p>PbaN-02: Beach erosion</p> <p>PbaN-01: Beach pollution</p>
Solid and Liquid Waste Management	<p>Pursue integrated solid and liquid waste management solutions focusing on Wete and Micheweni towns and villages, and Wete port, Ras Kigomasha and Mtambwe considering:</p> <p>Waste water treatment systems:</p> <ul style="list-style-type: none"> - collection - treatment technology - discharge <p>Liquid and Solid Waste Management Systems:</p> <ul style="list-style-type: none"> - collection - storage - processing - financing - minimisation - reuse? <p>Green Infrastructure Storm Water Systems</p>				<p>PbaN-04: Disease outbreaks</p> <p>PbaN-06: Marine pollution</p>	PbaN-01: Beach pollution

Intervention Dimension	Statement	Threat pertinence at each RV				
		Major Problem (RV 5)	Very important problem (RV 4)	Important Problem (RV 3)	Problem (RV 2)	Light Problem (RV 1)
Sanitation	<p>Pursue integrated solid and liquid waste management focusing on Wete and Micheweni towns and villages, and Wete port, Ras Kigomasha and Mtambwe, considering:</p> <p>Waste water treatment systems:</p> <ul style="list-style-type: none"> - collection - treatment technology - discharge <p>Liquid and Solid Waste Management Systems:</p> <ul style="list-style-type: none"> - collection - storage - processing - financing - minimisation - reuse? <p>Green Infrastructure Storm Water Systems</p>				<p>PbaN-04:Disease outbreaks</p> <p>PbaN-06: Marine pollution</p>	PbaN-01: Beach pollution
Capacity Building	<p>Accompany management interventions with appropriate capacity building components at regional level. Particular focus on fisheries management, spatial planning, shoreline management, ecosystems and species management, monitoring, law enforcement.</p> <p>Enhance information management systems to provide for better and systematically informed management decisions.</p>		PbaN-03: Fisheries decline	PbaN-05: Habitat & agricultural loss	<p>PbaN-04:Disease outbreaks</p> <p>PbaN-06: Marine pollution</p>	<p>PbaN-02: Beach erosion</p> <p>PbaN-01: Beach pollution</p>
Technology	<p>Pursue opportunities through further technology development within:</p> <ul style="list-style-type: none"> • Offshore fisheries • Value added to existing fisheries • Aquaculture • Agriculture • Mangrove management • Water borne disease management • Integrated solid and liquid waste management 		PbaN-03: Fisheries decline	PbaN-05: Habitat & agricultural loss	<p>PbaN-04:Disease outbreaks</p> <p>PbaN-06: Marine pollution</p>	<p>PbaN-02: Beach erosion</p> <p>PbaN-01: Beach pollution</p>
Law Enforcement	<p>1) Enforce reviewed laws relevant to amongst others:</p> <ul style="list-style-type: none"> • Fisheries • Mangrove and coastal forest exploitation • Industrial and domestic waste • Agrochemicals • Coral (and sand) mining <p>2) Optimise enforcement through capacity building at regional level and aligned with recommendations from national review.</p>		PbaN-03: Fisheries decline	PbaN-05: Habitat & agricultural loss	<p>PbaN-04:Disease outbreaks</p> <p>PbaN-06: Marine pollution</p>	<p>PbaN-02: Beach erosion</p> <p>PbaN-01: Beach pollution</p>
Legal Review	<p>1) Guided by central integrated review of regional legislative and regulatory instruments, including amongst others:</p> <ul style="list-style-type: none"> • Coral (and sand) mining • Mangrove exploitation • Land use (especially shoreline and set-back uses). <p>2) Follow revision (above) and revise and develop new regional legislative and regulatory instruments.</p>					PbaN-02: Beach erosion
Alternative/Improved Livelihood	<p>Develop and offer alternative livelihoods for households currently engaged in destructive resource exploitation practises and those displaced and disadvantaged, focusing on on Wete and Micheweni towns and villages, and Wete port, Ras Kigomasha and Mtambwe. Particular efforts to provide alternatives for young generation.</p> <p>Improve current sustainable resource use livelihoods using technology advances and insights.</p>		PbaN-03: Fisheries decline	PbaN-05: Habitat & agricultural loss		PbaN-02: Beach erosion

Intervention Dimension	Statement	Threat pertinence at each RV				
		Major Problem (RV 5)	Very important problem (RV 4)	Important Problem (RV 3)	Problem (RV 2)	Light Problem (RV 1)
Awareness Raising	<p>Participate in national awareness raising campaigns related to coastal management challenges directed to the public at large and to schools.</p> <p>Develop and implement regional level awareness raising campaigns targeting local stakeholders affected by or affecting:</p> <ul style="list-style-type: none"> • Fisheries decline • Habitat and agricultural area loss • Water borne disease • Marine and beach pollution • Erosion 		PbaN-03: Fisheries decline	PbaN-05: Habitat & agricultural loss	PbaN-04: Disease outbreaks PbaN-06: Marine pollution	PbaN-02: Beach erosion PbaN-01: Beach pollution
Education	<p>Interact and participate in national curricula review for primary and secondary schools to enhance the knowledge and understanding about coastal management issues. Issues of particular relevance for the region are:</p> <ul style="list-style-type: none"> • Fisheries ecology and sustainable fisheries • Coastal ecology • Environmental management • Water borne disease • Climate change impacts 		PbaN-03: Fisheries decline	PbaN-05: Habitat & agricultural loss	PbaN-04: Disease outbreaks PbaN-06: Marine pollution	PbaN-02: Beach erosion PbaN-01: Beach pollution

Action areas

Table 159: Assessment of the importance of broad management dimension in addressing threats to local communities and ecosystems in Pemba North Region.

Intervention Dimension	Major Problem weight	Very important problem weight	Important Problem weight	Problem weight	Light Problem weight	Total Score
Integrated Coastal Zone Management (ICZM)	0	4	3	2	2	11
Integrated Water Resources Management (IWRM)	0	0	0	2	1	3
Land Use Management	0	4	3	4	2	13
Shoreline Management Planning	0	4	3	2	2	11
Solid and Liquid Waste Management	0	0	0	4	1	5
Sanitation	0	0	0	4	1	5
Capacity Building	0	4	3	4	2	13
Technology	0	4	3	4	2	13
Law Enforcement	0	4	3	4	2	13
Legal Review	0	0	0	0	1	1
Alternative/ Improved Livelihood	0	4	3	0	1	8
Awareness Raising	0	4	3	4	2	13
Education	0	4	3	4	2	13
Zanzibar	Pemba North Region				Total	122

The prioritised location-specific actions for Pemba North region relate to addressing the following:

- Responding to the decline in fisheries productivity due to numerous destructive activities, along the entire district's shoreline
- Loss of agricultural and natural habitat land, in Mtambwe, Wete Bay and Micheweni, from destructive practices and seawater intrusion, requiring urban planning
- Disease outbreaks in Micheweni town from inadequate sewage and waste management as well as unhygienic food vending, accompanied by marine pollution, also at Wete

Pemba South Region

Prioritized Threats

In Table 160 below the threats identified for Pemba South Region have been listed and ranked according to their severity as established using the CRIAM method discussed extensively in Volumes I and II of the Coastal Profile. A rapid assessment has been made on the susceptibility of each threat to impacts of climate change more specifically, changes in weather patterns, extreme events, sea level rise, temperature rise and acidification.

Table 160: Prioritised threats from Pemba South region, Zanzibar, and a rapid assessment of threat susceptibility to climate change.

#	Threat as identified in Coastal Profile	Threat Level	Influence from Climate Change					
			Change in Patterns	Extreme events	Sea Level Rise	Temperature rise	Acidification	
PembaSouth-03	Fisheries decline	Very important problem	0	-	0	0	0	Changes in climate are not expected to impact per se on the practise of destructive and illegal fisheries. Extreme weather events may in periods have a preventive effect.
PembaSouth-06	Marine environmental pollution	Very important problem	++	++	0	0	0	More frequent and severe weather events may increase the leaching of pollutants into water resources and thereby exacerbate the levels reaching local marine ecosystems.
PembaSouth-02	Beach erosion	Important problem	+	+++	+++	0	+	Impact from unsuitable resource use practises leading to beach erosion will be exacerbated notably from extreme events (storms and surges) and sea level rise. Coral growth likely reduce by acidification, increasing wave action and erosion.
PembaSouth-04	Disease outbreaks	Important problem	++	++	+	+	0	More frequent and severe weather events and sea level rise may increase flooding and standing water and sewage exacerbating disease outbreaks and higher temperatures increase disease propagation.
PembaSouth-01	Beach pollution	Important problem	0	0	0	0	0	Changes in climate are not expected to impact per se on the practise of poor waste disposal that affects beaches.
PembaSouth-05	Loss of habitat & agricultural area	Light problem	++	++	+	0	0	Impact from unsuitable resource use practises will be exacerbated notable from extreme events (storms and surges), stress from changed weather patterns and from sea level rise.
+++	Threat is severely aggravated from climate change dimension							
++	Threat is aggravated from climate change dimension							
+	Threat is slightly aggravated from climate change dimension							
0	No influence of threat from climate change dimension							
-	Remediating effect on threat from climate change dimension							

Table 161: Prioritised threats for Pemba South region, Zanzibar, their location and causes

#	Threat as identified in Coastal Profile	Threat Level	Location	Causes
PembaSouth-03	Fisheries decline	Very Important Problem	Along shallow waters in the region	Destruction of fish nurseries such as mangrove cutting, illegal fishing such as dynamite fishing and other poor fishing methods such as beach seine and kigumi
PembaSouth-06	Marine environmental pollution	Very Important Problem	Chake and Mkoani towns and villages. Weshu, Mkoani Port	Uncontrolled solid waste dump sites, as well as untreated sewage from domestic uses in the area. Influx of pesticides, nutrients and fertilizers from nearby farms, especially in the undulations and valleys where sea water near the agricultural areas. Possible oil leak during loading and offloading of petroleum from ships at Weshu depot and Mkoani Port.
PembaSouth-02	Beach erosion	Important Problem	Tandauwa, Wambaa, Mkoani, Kangani, etc.,	Mangrove cutting, beach sand mining, unplanned construction along the coast, currents and waves
PembaSouth-04	Disease outbreaks	Important Problem	Chake Chake and Mkoani town, some villages in the region	Inadequate sewerage control, poor solid waste management. Lack of latrines and toilets in some coastal dwellings.
PembaSouth-01	Beach pollution	Important problem	Mkoani and Chake Chake town and in some villages	Uncontrolled solid and liquid waste disposal
PembaSouth-05	Loss of habitat & agricultural areas	Light Problem	Along the coastal front. Kisiwa Panza	Mangrove cutting, Influx of sea water to agricultural land. Limestone brick cutting

Recommendations for threat mitigation measures

Overall measures to mitigate each if the identified natural resources related threats to coastal local communities and ecosystems have been tabulated in Table 221(page407) arranged under broad management dimensions headings. Table 162 provides an overview of the requirements/opportunities expressed within each of these management or intervention dimensions.

Table 162: Broad management intervention dimensions to address identified and prioritised threats to coastal communities and ecosystems in Pemba South region, Zanzibar

Intervention Dimension	Statement	Threat pertinence at each RV				
		Major Problem	Very important problem	Important Problem	Problem	Light Problem
Integrated Coastal Zone Management (ICZM)	<p>Ensure coordination and participation in management of coastal land, water and resources use currently under complex pressures.</p> <p>Focus areas for integrated management to address include fisheries and waste at Chake Chake and Mkoani towns and villages, Weshu and Mkoani Port, and coastal land loss and erosion at Tandauwa, Wambaa, Mkoani, Kangani.</p>		<p>PbaN03: Fisheries decline</p> <p>PbaN-06: Marine pollution</p>	<p>PbaN-02: Beach erosion</p> <p>PbaN-01: Beach pollution</p>		PbaN-05: Habitat & agric loss
Integrated Water Resources Management (IWRM)	<p>Link IWRM to coastal integrated planning to address impacts from upstream pollution, at Wete and Micheweni towns and villages and Wete port (ICARM).</p>		PbaN-06: Marine pollution	<p>PbaN-02: Beach erosion</p> <p>PbaN-01: Beach pollution</p>		
Land Use Management	<p>Land use information management systems to include ecosystems, habitats and water resources.</p> <p>Incorporate ecosystems, habitats, shoreline processes and water resources considerations in spatial planning.</p> <p>Develop and/or update regional spatial plan accordingly and within national spatial planning framework.</p>		<p>PbaN03: Fisheries decline</p> <p>PbaN-06: Marine pollution</p>	<p>PbaN-02: Beach erosion</p> <p>PbaN-04: Disease outbreaks</p> <p>PbaN-01: Beach pollution</p>		PbaN-05: Habitat & agric loss
Shoreline Management Planning	<p>Region's shorelines included in a national level overall shoreline management investigation.</p> <p>Shoreline management units (areas of coast) identified for the region informing regional level spatial planning as a basis for local shoreline management regulation.</p>		<p>PbaN03: Fisheries decline</p> <p>PbaN-06: Marine pollution</p>	<p>PbaN-02: Beach erosion</p> <p>PbaN-01: Beach pollution</p>		PbaN-05: Habitat & agric loss
Solid and Liquid Waste Management	<p>Pursue integrated solid and liquid waste management solutions overing Chake Chake and Mkoani towns and villages, Weshu and Mkoani Port considering:</p> <p>Waste water treatment systems:</p> <ul style="list-style-type: none"> - collection - treatment technology - discharge <p>Liquid and Solid Waste Management Systems:</p> <ul style="list-style-type: none"> - collection - storage - processing - financing - minimisation - reuse? <p>Green Infrastructure</p> <p>Storm Water Systems</p>		PbaN-06: Marine pollution	<p>PbaN-04: Disease outbreaks</p> <p>PbaN-01: Beach pollution</p>		

Intervention Dimension	Statement	Threat pertinence at each RV				
		Major Problem	Very important problem	Important Problem	Problem	Light Problem
Sanitation	<p>Pursue integrated solid and liquid waste management covering Chake Chake and Mkoani towns and villages, Wesha and Mkoani Port, considering:</p> <p>Waste water treatment systems:</p> <ul style="list-style-type: none"> - collection - treatment technology - discharge <p>Liquid and Solid Waste Management Systems:</p> <ul style="list-style-type: none"> - collection - storage - processing - financing - minimisation - reuse? <p>Green Infrastructure Storm Water Systems</p>		PbaN-06: Marine pollution	PbaN-04: Disease outbreaks PbaN-01: Beach pollution		
Capacity Building	<p>Accompany management interventions with appropriate capacity building components at regional level. Particular focus on fisheries management, spatial planning, shoreline management, ecosystems and species management, monitoring, law enforcement.</p> <p>Enhance information management systems to provide for better and systematically informed management decisions.</p>		PbaN03: Fisheries decline PbaN-06: Marine pollution	PbaN-02: Beach erosion PbaN-04: Disease outbreaks PbaN-01: Beach pollution		PbaN-05: Habitat & agric loss
Technology	<p>Pursue opportunities through further technology development within:</p> <ul style="list-style-type: none"> • Offshore fisheries • Value added to existing fisheries • Aquaculture • Agriculture • Integrated solid and liquid waste management • Mangrove management • Water borne disease management • Land use management 		PbaN03: Fisheries decline PbaN-06: Marine pollution	PbaN-02: Beach erosion PbaN-04: Disease outbreaks PbaN-01: Beach pollution		PbaN-05: Habitat & agric loss
Law Enforcement	<p>1) Enforce reviewed laws relevant to amongst others:</p> <ul style="list-style-type: none"> • Fisheries • Industrial and domestic waste • Coral (and sand) mining • Mangrove and coastal forest exploitation • Agrochemicals <p>2) Optimise enforcement through capacity building at regional level and aligned with recommendations from national review.</p>		PbaN03: Fisheries decline PbaN-06: Marine pollution	PbaN-02: Beach erosion PbaN-04: Disease outbreaks PbaN-01: Beach pollution		PbaN-05: Habitat & agric loss
Legal Review	<p>1) Guided by central integrated review of regional legislative and regulatory instruments, including amongst others:</p> <ul style="list-style-type: none"> • Coral (and sand) mining • Mangrove exploitation • Land use (especially shoreline and set-back uses). <p>2) Follow revision (above) and revise and develop new regional legislative and regulatory instruments.</p>			PbaN-02: Beach erosion		
Alternative/Improved Livelihood	<p>Develop and offer alternative livelihoods for households currently engaged in destructive resource exploitation practises and those displaced and disadvantaged, focusing on Tandauwa, Wambaa, Mkoani, Kangani. Particular efforts to provide alternatives for young generation.</p> <p>Improve current sustainable resource use livelihoods using technology advances and insights.</p>		PbaN03: Fisheries decline	PbaN-02: Beach erosion		PbaN-05: Habitat & agric loss

Intervention Dimension	Statement	Threat pertinence at each RV				
		Major Problem	Very important problem	Important Problem	Problem	Light Problem
Awareness Raising	<p>Participate in national awareness raising campaigns related to coastal management challenges directed to the public at large and to schools.</p> <p>Develop and implement regional level awareness raising campaigns targeting local stakeholders affected by or affecting:</p> <ul style="list-style-type: none"> Fisheries decline Marine and beach pollution Water borne disease Erosion Habitat and agricultural area loss 		<p>PbaN03: Fisheries decline</p> <p>PbaN-06: Marine pollution</p>	<p>PbaN-02: Beach erosion</p> <p>PbaN-04: Disease outbreaks</p> <p>PbaN-01: Beach pollution</p>		PbaN-05: Habitat & agric loss
Education	<p>Interact and participate in national curricula review for primary and secondary schools to enhance the knowledge and understanding about coastal management issues. Issues of particular relevance for the region are:</p> <ul style="list-style-type: none"> Fisheries ecology and sustainable fisheries Coastal ecology Environmental management Water borne disease Climate change impacts 		<p>PbaN03: Fisheries decline</p> <p>PbaN-06: Marine pollution</p>	<p>PbaN-02: Beach erosion</p> <p>PbaN-04: Disease outbreaks</p> <p>PbaN-01: Beach pollution</p>		PbaN-05: Habitat & agric loss

Action areas

Table 163: Assessment of the importance of broad management dimension in addressing threats to local communities and ecosystems in Pemba South Region.

Intervention Dimension	Major Problem weight	Very important problem weight	Important Problem weight	Problem weight	Light Problem weight	Total Score
Integrated Coastal Zone Management (ICZM)	0	8	6	0	1	15
Integrated Water Resources Management (IWRM)	0	4	6	0	0	10
Land Use Management	0	8	9	0	1	18
Shoreline Management Planning	0	8	6	0	1	15
Solid and Liquid Waste Management	0	4	6	0	0	10
Sanitation	0	4	6	0	0	10
Capacity Building	0	4	9	0	1	14
Technology	0	4	9	0	1	14
Law Enforcement	0	4	9	0	1	14
Legal Review	0	0	3	0	0	3
Alternative/ Improved Livelihood	0	4	3	0	1	8
Awareness Raising	0	8	9	0	1	18
Education	0	8	9	0	1	18
Zanzibar						
			Pemba South Region		Total	167

The prioritised location-specific actions for Pemba South region relate to addressing the following:

- Responding to the decline in fisheries productivity due to numerous destructive activities, along the entire district's shoreline
- Marine pollution at Chake Chake and Mkoani, Weshu and Mkoani Port, resulting from sewage and waste disposal, associated also with disease outbreaks

Unguja North Region

Prioritized Threats

In Table 164 below the threats identified for Unguja North Region have been listed and ranked according to their severity as established using the CRIAM method discussed extensively in Volumes I and II of the Coastal Profile. A rapid assessment has been made on the susceptibility of each threat to impacts of climate change more specifically, changes in whether patterns, extreme events, sea level rise, temperature rise and acidification.

Table 164: Prioritised threats for Unguja North region, Zanzibar and a rapid assessment of threat susceptibility to climate change.

#	Threat as identified in Coastal Profile	Threat Level	Influence from Climate Change					
			Change in Patterns	Extreme events	Sea Level Rise	Temperature rise	Acidification	
UngujaNorth-02	Beach erosion	Major problem	+	+++	+++	0	+	Impact from unsuitable resource use practises leading to beach erosion will be exacerbated notably from extreme events (storms and surges) and sea level rise. Coral growth likely reduce by acidification, increasing wave action and erosion.
UngujaNorth-01	Beach pollution	Very Important	0	0	0	0	0	Changes in climate are not expected to impact per se on the practise of poor waste disposal that affects beaches.
UngujaNorth-03	Fisheries decline	Very Important	0	-	0	0	0	Changes in climate are not expected to impact per se on the practise of destructive and illegal fisheries. Extreme weather events may in periods have a preventive effect.
UngujaNorth-08	Sea water intrusion in underground aquifers	Very Important	++	+	+++	+	0	Increase temperature will increase demand for freshwater, and evaporation rates; extreme events likely to slight aggravate the situation with sea level rise having a significant impact.
UngujaNorth-06	Land use conflict	Very Important	+	+	0	0	+	Climate change may impact on use of beach-intertidal areas. Reduced stocks (e.g. from acidification) or reduced access to marine resources from extreme events may increase conflicts to secure livelihood in the short term.
UngujaNorth-07	Loss of coral cover	Important problem	0	-	0	++	++	Changes in climate are not expected to impact per se on the practise of destructive and illegal fisheries. Extreme weather events may in periods have a preventive effect. Rises in temperature and acidification will reduce coral growth.
UngujaNorth-04	Disease outbreaks	Problem	++	++	+	+	0	More frequent and severe weather events and sea level rise may increase flooding and standing water and sewage exacerbating disease outbreaks and higher temperatures increase disease propagation
UngujaNorth-05	Marine environmental pollution	Problem	++	++	0	0	0	More frequent and severe weather events may increase the leaching of pollutants into water resources and thereby exacerbate the levels reaching local marine ecosystems.
+++ Threat is severely aggravated from climate change dimension ++ Threat is aggravated from climate change dimension + Threat is slightly aggravated from climate change dimension 0 No influence of threat from climate change dimension - Remediating effect on threat from climate change dimension								

Table 165: Prioritised threats for Unguja North region, Zanzibar, their location and causes

#	Threat as identified in Coastal Profile	Threat Level	Location	Causes
UjaN-02	Beach erosion	Major problem	Kiwengwa, Mnemba, Fukuchani, Nungwi	Beach sand mining, unplanned construction along the coast, currents and waves, clearing coastal vegetation.
UjaN-01	Beach pollution	Very important	Nungwi, Matemwe, Tumbatu	Uncontrolled solid and liquid waste disposal
UjaN-03	Fisheries decline	Very important	All along shallow waters of the region	Destruction of fish nurseries such as mangrove cutting, illegal fishing such as dynamite fishing and other poor fishing methods such as beach seine and kigumi
UjaN-08	Sea water intrusion in underground aquifers	Very important	All along the coast	Overuse of ground water by tourist hotel and increased population related to tourism (Gössling, 2001).
UjaN-06	Land use conflict	Very important	Pwani Mchangani, Nungwi, Matemwe and Mangapwani. Mnemba Island and Matemwe	Use of space, especially beaches and intertidals, between hoteliers and local community - seaweed farmers and fishers. Use of space and resources between fishers and Mnemba Island CA

#	Threat as identified in Coastal Profile	Threat Level	Location	Causes
UjaN-07	Loss of coral cover	Important problem	All along the regional coast	Crown of Thorn outbreak; over exploitation of habitat by fishers, gleaners and tourists
UjaN-04	Disease outbreaks	Problem	Nungwi, Matemwe, Tumbatu, Pwani Mchangani, Kiwengwa	Inadequate sewerage control, poor solid waste management. Lack of latrines and toilets in some coastal dwellings.
UjaN-05	Marine environmental pollution	Problem	All along north coast, especially Pwani Mchangani Kiwengwa on the east, and Muwanda - Makoba embayment on the west; Matemwe, Nungwi, Mkokotoni, Mangapwani	Uncontrolled solid waste dump sites, as well as untreated sewage from domestic uses and tourist hotels in the area. Influx of pesticides, nutrients and fertilizers from nearby farms, especially in valleys with agricultural areas close to the shore. Possible oil leak during loading/unloading fuels in landing sites and small local harbours

Recommendations for threat mitigation measures

Overall measures to mitigate each of the identified natural resources related threats to coastal local communities and ecosystems have been tabulated in Table 222 (page 409) arranged under broad management dimensions headings. Table 166 provides an overview of the requirements/opportunities expressed within each of these management or intervention dimensions.

Table 166: Broad management intervention dimensions to address identified and prioritised threats to coastal communities and ecosystems in Unguja North region, Zanzibar

Intervention Dimension	Statement	Threat pertinence at each RV				
		Major Problem	Very important problem	Important Problem	Problem	Light Problem
Integrated Coastal Zone Management (ICZM)	Ensure coordination and participation in management of coastal land, water and resources use currently under complex pressures. Focus areas for integrated management to address include shoreline (and riverbank) and mangrove deforestation, fisheries, beach changes from Makoba to Mto wa maji.	UjaN-02 Beach erosion	UjaN-01 Beach pollution UjaN-03 Fisheries decline UjaN-06 Land use conflict	UjaN-07 Loss of coral	UjaN-05 Marine pollution	
Integrated Water Resources Management (IWRM)	Link IWRM to coastal integrated planning to address impacts from upstream pollution, from Makoba to Mto wa maji (ICARM).	UjaN-02 Beach erosion	UjaN-01 Beach pollution UjaN-05 Marine pollution			
Land Use Management	Land use information management systems to include ecosystems, habitats and water resources. Incorporate ecosystems, habitats, shoreline processes and water resources considerations in spatial planning. Optimise land use through zoning to minimise conflicts and prevent anarchistic development. Develop and/or update regional spatial plan accordingly and within national spatial planning framework.	UjaN-02 Beach erosion	UjaN-01 Beach pollution UjaN-03 Fisheries decline UjaN-08 Sea water intrusion UjaN-06 Land use conflict	UjaN-07 Loss of coral	UjaN-04 Disease outbreaks UjaN-05 Marine pollution	
Shoreline Management Planning	Region's shorelines included in a national level overall shoreline management investigation. Shoreline management units (areas of coast) identified for the region informing regional level spatial planning as a basis for local shoreline management regulation.	UjaN-02 Beach erosion	UjaN-01 Beach pollution UjaN-03 Fisheries decline UjaN-06 Land use conflict	UjaN-07 Loss of coral	UjaN-05 Marine pollution	
Solid and Liquid Waste Management	Pursue integrated solid and liquid waste management solutions covering Nungwi, Matemwe, Tumbatu, Pwani Mchangani, Kiwengwa and all harbours, considering: Waste water treatment systems: - collection - treatment technology - discharge Liquid and Solid Waste Management Systems: - collection - storage - processing - financing - minimisation - reuse? Green Infrastructure Storm Water Systems		UjaN-01 Beach pollution		UjaN-04 Disease outbreaks UjaN-05 Marine pollution	

Intervention Dimension	Statement	Threat pertinence at each RV				
		Major Problem	Very important problem	Important Problem	Problem	Light Problem
Sanitation	<p>Pursue integrated solid and liquid waste management focusing on Nungwi, Matemwe, Tumbatu, Pwani Mchangani, Kiwengwa and all harbours, considering:</p> <p>Waste water treatment systems:</p> <ul style="list-style-type: none"> - collection - treatment technology - discharge <p>Liquid and Solid Waste Management Systems:</p> <ul style="list-style-type: none"> - collection - storage - processing - financing - minimisation - reuse? <p>Green Infrastructure Storm Water Systems</p>		UjaN-01 Beach pollution		UjaN-04 Disease outbreaks UjaN-05 Marine pollution	
Capacity Building	<p>Accompany management interventions with appropriate capacity building components at regional level. Particular focus on spatial planning, shoreline management, fisheries, cultural heritage management, conflict resolution, monitoring, law enforcement.</p> <p>Enhance information management systems to provide for better and systematically informed management decisions.</p> <p>Develop and diversify local skills at all levels to enhance local participation in tourism sector and encourage local client sector.</p>	UjaN-02 Beach erosion	UjaN-01 Beach pollution UjaN-03 Fisheries decline UjaN-08 Sea water intrusion UjaN-06 Land use conflict	UjaN-07 Loss of coral	UjaN-04 Disease outbreaks UjaN-05 Marine pollution	
Technology	<p>Pursue opportunities through further technology development within:</p> <p>Shoreline management Integrated solid and liquid waste management Mangrove forest management Offshore fisheries Aquaculture Value added to existing fisheries Water borne disease management</p>	UjaN-02 Beach erosion	UjaN-01 Beach pollution UjaN-03 Fisheries decline UjaN-08 Sea water intrusion UjaN-06 Land use conflict	UjaN-07 Loss of coral	UjaN-04 Disease outbreaks UjaN-05 Marine pollution	
Law Enforcement	<p>1) Enforce reviewed laws relevant to amongst others:</p> <ul style="list-style-type: none"> • Fisheries, • Mangrove and coastal forest exploitation • Coral (and sand) mining • Agrochemicals • Industrial and domestic waste • Land use (especially shoreline and set-back uses) and speculation. <p>2) Optimise enforcement through capacity building at regional level and aligned with recommendations from national review.</p>	UjaN-02 Beach erosion	UjaN-01 Beach pollution UjaN-03 Fisheries decline UjaN-06 Land use conflict	UjaN-07 Loss of coral	UjaN-04 Disease outbreaks UjaN-05 Marine pollution	
Legal Review	<p>1) Guided by central integrated review of regional legislative and regulatory instruments, including amongst others:</p> <ul style="list-style-type: none"> • Coral mining • Mangrove exploitation • Land use (especially shoreline and set-back uses) and speculation. <p>2) Follow revision (above) and revise and develop new regional legislative and regulatory instruments.</p>	UjaN-02 Beach erosion	UjaN-06 Land use conflict			
Alternative/Improved Livelihood	<p>Develop and offer alternative livelihoods for households currently engaged in destructive resource exploitation practises and those displaced and disadvantaged, focusing on Nungwi, Matemwe, Tumbatu, Pwani Mchangani and Kiwengwa. Particular efforts to provide alternatives for young generation.</p> <p>Improve current sustainable resource use livelihoods using technology advances and insights.</p>	UjaN-02 Beach erosion	UjaN-03 Fisheries decline	UjaN-07 Loss of coral		

Intervention Dimension	Statement	Threat pertinence at each RV				
		Major Problem	Very important problem	Important Problem	Problem	Light Problem
Awareness Raising	<p>Participate in national awareness raising campaigns related to coastal management challenges directed to the public at large and to schools.</p> <p>Develop and implement regional level awareness raising campaigns targeting local stakeholders affected by or affecting:</p> <ul style="list-style-type: none"> • Fisheries decline • Marine and beach Pollution • Erosion • Land use conflicts • Loss and degradation of coral • Sea water intrusion • Water borne disease 	UjaN-02 Beach erosion	UjaN-01 Beach pollution UjaN-03 Fisheries decline UjaN-08 Sea water intrusion UjaN-06 Land use conflict	UjaN-07 Loss of coral	UjaN-04 Disease outbreaks UjaN-05 Marine pollution	
Education	<p>Interact and participate in national curricula review for primary and secondary schools to enhance the knowledge and understanding about coastal management issues. Issues of particular relevance for the region are:</p> <ul style="list-style-type: none"> • Fisheries ecology and sustainable fisheries • Environmental management • Coastal ecology • Importance of beaches • Sustainable tourism • Climate change impacts • Water borne disease 	UjaN-02 Beach erosion	UjaN-03 Fisheries decline UjaN-01 Beach pollution UjaN-08 Sea water intrusion UjaN-06 Land use conflict	UjaN-07 Loss of coral	UjaN-04 Disease outbreaks UjaN-05 Marine pollution	

Action areas

Table 167: Assessment of the importance of broad management dimension in addressing threats to local communities and ecosystems in Unguja North Region.

Intervention Dimension	Major Problem weight	Very important problem weight	Important Problem weight	Problem weight	Light Problem weight	Total Score
Integrated Coastal Zone Management (ICZM)	5	12	3	2	0	22
Integrated Water Resources Management (IWRM)	5	8	0	0	0	13
Land Use Management	5	16	3	4	0	28
Shoreline Management Planning	5	12	3	2	0	22
Solid and Liquid Waste Management	0	4	0	4	0	8
Sanitation	0	4	0	4	0	8
Capacity Building	5	16	3	4	0	28
Technology	5	16	3	4	0	28
Law Enforcement	5	12	3	4	0	24
Legal Review	5	4	0	0	0	9
Alternative/ Improved Livelihood	5	4	3	0	0	12
Awareness Raising	5	16	3	4	0	28
Education	5	16	3	4	0	28
Zanzibar			Unguja North Region		Total	258

The prioritised location-specific actions for Unguja North region relate to addressing the following:

- Beach erosion at Kiwengwa, Mnemba, Fukuchani, Nungwi
- Beach pollution at Nungwi, Matemwe and Tumbatu, usually associated with poor sanitation and waste management associated with marine pollution
- Responding to the decline in fisheries productivity due to numerous destructive activities, along the entire district's shoreline
- Seawater intrusion into aquifer throughout the region
- Beach pollution at Mtwara Port area and Mikindani, usually associated with poor sanitation and waste management
- Marine pollution associated with Makoba River

Unguja West and Urban Region

Prioritized Threats

In Table 168 below the threats identified for Unguja West and Urban Region have been listed and ranked according to their severity as established using the CRIAM method discussed extensively in Volumes I and II of the Coastal Profile. A rapid assessment has been made on the susceptibility of each threat to impacts of climate change more specifically, changes in whether patterns, extreme events, sea level rise, temperature rise and acidification.

Table 168: Prioritised threats for Unguja West and Urban Region, Zanzibar and a rapid assessment of threat susceptibility to climate change.

#	Threat as identified in Coastal Profile	Threat Level	Influence from Climate Change					
			Change in Patterns	Extreme events	Sea Level Rise	Temperature rise	Acidification	
UngujaWest-03	Fisheries decline	Very Important Problem	0	-	0	0	0	Changes in climate are not expected to impact per se on the practise of destructive and illegal fisheries. Extreme weather events may in periods have a preventive effect.
UngujaWest-01	Beach pollution	Very Important Problem	0	0	0	0	0	Changes in climate are not expected to impact per se on the practise of poor waste disposal that affects beaches.
UngujaWest-05	Marine environmental pollution	Very Important Problem	++	++	0	0	0	More frequent and severe weather events may increase the leaching of pollutants into water resources and thereby exacerbate the levels reaching local marine ecosystems.
UngujaWest-02	Beach erosion	Very Important Problem	+	+++	+++	0	+	Impact from unsuitable resource use practises leading to beach erosion will be exacerbated notably from extreme events (storms and surges) and sea level rise. Coral growth likely reduce by acidification, increasing wave action and erosion.
UngujaWest-06	Land use conflict	Very Important Problem	+	+	0	0	+	Climate change may impact on use of beach-intertidal areas. Reduced stocks (e.g. from acidification) or reduced access to marine resources from extreme events may increase conflicts to secure livelihood in the short term.
UngujaWest-07	Loss of coral cover	Important Problem	0	-	0	++	++	Changes in climate are not expected to impact per se on the practise of destructive and illegal fisheries. Extreme weather events may in periods have a preventive effect. Rises in temperature and acidification will reduce coral growth.
UngujaWest-08	Sea water intrusion in underground aquifers	Important Problem	++	+	+++	+	0	Increase temperature will increase demand for freshwater, and evaporation rates; extreme events likely to slight aggravate the situation with sea level rise having a significant impact.
UngujaWest-04	Disease outbreaks	Problem	++	++	+	+	0	More frequent and severe weather events and sea level rise may increase flooding and standing water and sewage exacerbating disease outbreaks and higher temperatures increase disease propagation
+++ Threat is severely aggravated from climate change dimension ++ Threat is aggravated from climate change dimension + Threat is slightly aggravated from climate change dimension 0 No influence of threat from climate change dimension - Remediating effect on threat from climate change dimension								

Table 169: Prioritised threats for Unguja West region, Zanzibar, their location and causes

#	Threat as identified in Coastal Profile	Threat Level	Location	Causes
UngW-03	Fisheries decline	Very Important Problem	All around the region	Destruction of fish nurseries such as mangrove cutting, illegal fishing such as dynamite fishing and other poor fishing methods such as beach seine and kigumi
UngW-01	Beach pollution	Very Important Problem	All along the regional sea front	Uncontrolled solid and liquid waste disposal, lack of toilets in public gatherings
UngW-05	Marine environmental pollution	Very Important Problem	Zanzibar municipality, Zanzibar port, Maruhubi, Mtoni Deport, Kizingo	Uncontrolled solid waste dump sites, as well as untreated sewage from domestic uses and tourist hotels in the area. Possible oil leak during loading and offloading of fuels in landing sites and small local harbours
UngW-02	Beach erosion	Very Important Problem	Kilimani, Mazizini, Maruhubi, Mtoni, Mbwani	Beach sand mining, unplanned construction along the coast, currents and waves, clearing coastal vegetation.
UngW-06	Land use conflict	Very Important Problem	In some spots along the coast, Southeast of region where it borders with Menai Bay	Use of space, especially beaches and intertidals, between hoteliers and local community. Use of space and resources between fishers and Menai Bay Conservation Authority

#	Threat as identified in Coastal Profile	Threat Level	Location	Causes
UngW-07	Loss of coral cover	Important Problem	Stone town reefs and other western coral reef areas	Crown of Thorn outbreak. Over exploitation of habitat by fishers, gleaners and tourists
UngW-08	Sea water intrusion in underground aquifers	Important Problem	Stone Town constituency, Kilimani, Kisiwandui	Overuse of ground water by tourist hotel and increased population related to tourism (Gössling, 2001).
UngW-04	Disease outbreaks	Problem	Especially in Urban District	Inadequate sewerage control, poor solid waste management. Lack of latrines and toilets in some coastal dwellings.

Recommendations for threat mitigation measures

Overall measures to mitigate each of the identified natural resources related threats to coastal local communities and ecosystems have been tabulated in Table 223 (page 411) arranged under broad management dimensions headings. Table 170 provides an overview of the requirements/opportunities expressed within each of these management or intervention dimensions.

Table 170: Broad management intervention dimensions to address identified and prioritised threats to coastal communities and ecosystems in Unguja West region, Zanzibar

Intervention Dimension	Statement	Threat pertinence at each RV				
		Major Problem	Very important problem	Important Problem	Problem	Light Problem
Integrated Coastal Zone Management (ICZM)	Ensure coordination and participation in management of coastal land, water and resources use currently under complex pressures. Focus areas for integrated management to address include fisheries, shoreline (and riverbank) and mangrove deforestation, beach changes along Stone Town shores and northern Chwaka Bay.		UngW-03 Fisheries decline UngW-01 Beach pollution UngW-05 Marine pollution UngW-02 Beach erosion UngW-06 Land use conflict	UngW-07 Loss of coral cover		
Integrated Water Resources Management (IWRM)	Link IWRM to coastal integrated planning to address impacts from upstream pollution, along Stone Town shores and northern Chwaka Bay (ICARM).		UngW-01 Beach pollution UngW-05 Marine pollution UngW-02 Beach erosion	UngW-08 Sea water intrusion		
Land Use Management	Land use information management systems to include ecosystems, habitats and water resources. Incorporate ecosystems, habitats, shoreline processes and water resources considerations in spatial planning. Optimise land use through zoning to minimise conflicts and prevent anarchistic development. Develop and/or update regional spatial plan accordingly and within national spatial planning framework.		UngW-03 Fisheries decline UngW-01 Beach pollution UngW-05 Marine pollution UngW-02 Beach erosion UngW-06 Land use conflict	UngW-07 Loss of coral cover UngW-08 Sea water intrusion	UngW-04 Disease outbreaks	
Shoreline Management Planning	Region's shorelines included in a national level overall shoreline management investigation. Shoreline management units (areas of coast) identified for the region informing regional level spatial planning as a basis for local shoreline management regulation.		UngW-03 Fisheries decline UngW-01 Beach pollution UngW-05 Marine pollution UngW-02 Beach erosion UngW-06 Land use conflict	UngW-07 Loss of coral cover		

Intervention Dimension	Statement	Threat pertinence at each RV				
		Major Problem	Very important problem	Important Problem	Problem	Light Problem
Solid and Liquid Waste Management	<p>Pursue integrated solid and liquid waste management solutions focusing on Stone Town shores and northern Chwaka Bay, and all harbours, considering:</p> <p>Waste water treatment systems:</p> <ul style="list-style-type: none"> - collection - treatment technology - discharge <p>Liquid and Solid Waste Management Systems:</p> <ul style="list-style-type: none"> - collection - storage - processing - financing - minimisation - reuse? <p>Green Infrastructure Storm Water Systems</p>		<p>UngW-01 Beach pollution</p> <p>UngW-05 Marine pollution</p>		UngW-04 Disease outbreaks	
Sanitation	<p>Pursue integrated solid and liquid waste management focusing on along Stone Town shores and northern Chwaka Bay, considering:</p> <p>Waste water treatment systems:</p> <ul style="list-style-type: none"> - collection - treatment technology - discharge <p>Liquid and Solid Waste Management Systems:</p> <ul style="list-style-type: none"> - collection - storage - processing - financing - minimisation - reuse? <p>Green Infrastructure Storm Water Systems</p>		<p>UngW-01 Beach pollution</p> <p>UngW-05 Marine pollution</p>		UngW-04 Disease outbreaks	
Capacity Building	<p>Accompany management interventions with appropriate capacity building components at regional level. Particular focus on spatial planning, shoreline management, fisheries management, cultural heritage management, conflict resolution, monitoring, law enforcement.</p> <p>Enhance information management systems to provide for better and systematically informed management decisions.</p> <p>Develop and diversify local skills at all levels to enhance local participation in tourism sector and encourage local client sector.</p>		<p>UngW-03 Fisheries decline</p> <p>UngW-01 Beach pollution</p> <p>UngW-05 Marine pollution</p> <p>UngW-02 Beach erosion</p> <p>UngW-06 Land use conflict</p>	<p>UngW-07 Loss of coral cover</p> <p>UngW-08 Sea water intrusion</p>	UngW-04 Disease outbreaks	
Technology	<p>Pursue opportunities through further technology development within:</p> <p>Offshore fisheries Value added to existing fisheries Aquaculture Integrated solid and liquid waste management Shoreline management Mangrove management Water borne disease management</p>		<p>UngW-03 Fisheries decline</p> <p>UngW-01 Beach pollution</p> <p>UngW-05 Marine pollution</p> <p>UngW-02 Beach erosion</p> <p>UngW-06 Land use conflict</p>	<p>UngW-07 Loss of coral cover</p> <p>UngW-08 Sea water intrusion</p>	UngW-04 Disease outbreaks	
Law Enforcement	<p>1) Enforce reviewed laws relevant to amongst others:</p> <ul style="list-style-type: none"> • Fisheries • Industrial and domestic waste • Land use (especially shoreline and set-back uses) and speculation. • Coral (and sand) mining • Mangrove and coastal forest exploitation • Agrochemicals <p>2) Optimise enforcement through capacity building at regional level and aligned with recommendations from national review.</p>		<p>UngW-03 Fisheries decline</p> <p>UngW-01 Beach pollution</p> <p>UngW-05 Marine pollution</p> <p>UngW-02 Beach erosion</p> <p>UngW-06 Land use conflict</p>	UngW-07 Loss of coral cover	UngW-04 Disease outbreaks	

Intervention Dimension	Statement	Threat pertinence at each RV				
		Major Problem	Very important problem	Important Problem	Problem	Light Problem
Legal Review	<p>1) Guided by central integrated review of regional legislative and regulatory instruments, including amongst others:</p> <ul style="list-style-type: none"> • Coral (and sand) mining • Mangrove exploitation • Land use (especially shoreline and set-back uses) and speculation. <p>2) Follow revision (above) and revise and develop new regional legislative and regulatory instruments.</p>		<p>UngW-02 Beach erosion</p> <p>UngW-06 Land use conflict</p>			
Alternative/Improved Livelihood	<p>Develop and offer alternative livelihoods for households currently engaged in destructive resource exploitation practises and those displaced and disadvantaged, focusing on Stone Town and northern Chwaka Bay areas. Particular efforts to provide alternatives for young generation.</p> <p>Improve current sustainable resource use livelihoods using technology advances and insights.</p>		<p>UngW-03 Fisheries decline</p> <p>UngW-02 Beach erosion</p>	UngW-07 Loss of coral cover		
Awareness Raising	<p>Participate in national awareness raising campaigns related to coastal management challenges directed to the public at large and to schools.</p> <p>Develop and implement regional level awareness raising campaigns targeting stakeholders affected by or affecting:</p> <ul style="list-style-type: none"> • Fisheries decline • Marine and beach pollution • Erosion • Land use conflicts • Loss and degradation of coral • Sea water intrusion • Water borne disease 		<p>UngW-03 Fisheries decline</p> <p>UngW-01 Beach pollution</p> <p>UngW-05 Marine pollution</p> <p>UngW-02 Beach erosion</p> <p>UngW-06 Land use conflict</p>	<p>UngW-07 Loss of coral cover</p> <p>UngW-08 Sea water intrusion</p>	UngW-04 Disease outbreaks	
Education	<p>Interact and participate in national curricula review for primary and secondary schools to enhance the knowledge and understanding about coastal management issues. Issues of particular relevance for the region are:</p> <ul style="list-style-type: none"> • Fisheries ecology and sustainable fisheries • Environmental management • Coastal ecology • Importance of beaches • Sustainable tourism • Climate change impacts • Water borne disease 		<p>UngW-03 Fisheries decline</p> <p>UngW-01 Beach pollution</p> <p>UngW-05 Marine pollution</p> <p>UngW-02 Beach erosion</p> <p>UngW-06 Land use conflict</p>	<p>UngW-07 Loss of coral cover</p> <p>UngW-08 Sea water intrusion</p>	UngW-04 Disease outbreaks	

Action areas

Table 171: Assessment of the importance of broad management dimension in addressing threats to local communities and ecosystems Unguja West and Urban Region.

Intervention Dimension	Major Problem weight	Very important problem weight	Important Problem weight	Problem weight	Light Problem weight	Total Score
Integrated Coastal Zone Management (ICZM)	0	20	3	0	0	23
Integrated Water Resources Management (IWRM)	0	12	3	0	0	15
Land Use Management	0	20	6	2	0	28
Shoreline Management Planning	0	20	3	0	0	23
Solid and Liquid Waste Management	0	8	0	2	0	10
Sanitation	0	8	0	2	0	10
Capacity Building	0	20	6	2	0	28
Technology	0	20	6	2	0	28
Law Enforcement	0	20	3	2	0	25
Legal Review	0	8	0	0	0	8
Alternative/ Improved Livelihood	0	8	3	0	0	11
Awareness Raising	0	20	6	2	0	28
Education	0	20	6	2	0	28
Zanzibar			Unguja West and Urban Region		Total	265

The prioritised location-specific actions for Unguja West and Urban region relate to addressing the following:

- Responding to the decline in fisheries productivity due to numerous destructive activities, along the entire district's shoreline
- Beach and marine pollution at Zanzibar Stone Town, Port area, Maruhubi, Mtoni Depot and Kizingo, usually associated with poor sanitation and waste management, associated with marine pollution and disease outbreaks, in places transported to the coast by numerous small rivers north of the Stone Town
- Beach erosion around Stone Town and adjacent areas of coast
- Land use conflict, especially bordering with Menai Bay to the south
- Seawater intrusion into aquifer especially in Stone Town constituency, Kilimani, Kisiwandui

Unguja South Region

Prioritized Threats

In Table 172 below the threats identified for Unguja South Region have been listed and ranked according to their severity as established using the CRIAM method discussed extensively in Volumes I and II of the Coastal Profile. A rapid assessment has been made on the susceptibility of each threat to impacts of climate change more specifically, changes in whether patterns, extreme events, sea level rise, temperature rise and acidification.

Table 172: Prioritised threats for Unguja South region, Zanzibar and a rapid assessment of threat susceptibility to climate change.

#	Threat as identified in Coastal Profile	Threat Level	Influence from Climate Change					
			Change in Patterns	Extreme events	Sea Level Rise	Temperature rise	Acidification	
UngujaSouth-02	Beach erosion	Major problem	+	+++	+++	0	+	Impact from unsuitable resource use practises leading to beach erosion will be exacerbated notably from extreme events (storms and surges) and sea level rise. Coral growth likely reduce by acidification, increasing wave action and erosion.
UngujaSouth-03	Fisheries decline	Very Important	0	-	0	0	0	Changes in climate are not expected to impact per se on the practise of destructive and illegal fisheries. Extreme weather events may in periods have a preventive effect.
UngujaSouth-06	Land use conflict	Problem	+	+	0	0	+	Climate change may impact on use of beach-intertidal areas. Reduced stocks (e.g. from acidification) or reduced access to marine resources from extreme events may increase conflicts to secure livelihood in the short term.
UngujaSouth-07	Loss of coral cover	Problem	0	-	0	++	++	Changes in climate are not expected to impact per se on the practise of destructive and illegal fisheries. Extreme weather events may in periods have a preventive effect. Rises in temperature and acidification will reduce coral growth.
UngujaSouth-05	Marine environmental pollution	Problem	++	++	0	0	0	More frequent and severe weather events may increase the leaching of pollutants into water resources and thereby exacerbate the levels reaching local marine ecosystems.
UngujaSouth-08	Sea water intrusion in underground aquifers	Light problem	++	+	+++	+	0	Increase temperature will increase demand for freshwater, and evaporation rates; extreme events likely to slight aggravate the situation with sea level rise having a significant impact.
UngujaSouth-01	Beach pollution	Light problem	0	0	0	0	0	Changes in climate are not expected to impact per se on the practise of poor waste disposal that affects beaches.
UngujaSouth-04	Disease outbreaks	Light problem	++	++	+	+	0	More frequent and severe weather events and sea level rise may increase flooding and standing water and sewage exacerbating disease outbreaks and higher temperatures increase disease propagation
+++	Threat is severely aggravated from climate change dimension							
++	Threat is aggravated from climate change dimension							
+	Threat is slightly aggravated from climate change dimension							
0	No influence of threat from climate change dimension							
-	Remediating effect on threat from climate change dimension							

Table 173: Prioritised threats for Unguja South region, Zanzibar, their location and causes

#	Threat as identified in Coastal Profile	Threat Level	Location	Causes
UjaS-02	Beach erosion	Major problem	Many areas including Unguja Ujuu, Jambiani, Makunduchi, Uroa, Paje, Bwejuu and Michamvi	Beach sand mining, unplanned construction along the coast, currents and waves, clearing coastal vegetation.
UjaS-03	Fisheries decline	Very Important	All along the shallow water coastal areas	Destruction of fish nurseries such as mangrove cutting, illegal fishing and other poor fishing methods such as beach seine and kigumi
UjaS-06	Land use conflict	Problem	Chwaka Bay	Use of space, especially beaches and intertidal, between hoteliers and local community - seaweed farmers and fishers. Use of space and resources between fishers and MBCA
UjaS-07	Loss of coral cover	Problem	Jambiani, Bwejuu, Michamvi, Paje, Menai Bay	Crown of Thorn outbreak. Over exploitation of habitat by fishers, gleaners and tourists
UjaS-05	Marine environmental pollution	Problem	All most the entire coast from Makunduchi to Michamvi through Jambiani, Paje and Bwejuu	Uncontrolled solid waste dump sites, as well as untreated sewage from domestic uses and tourist hotels. Possible oil leak during loading and offloading of fuels in landing sites and small local harbours.

#	Threat as identified in Coastal Profile	Threat Level	Location	Causes
UjaS-08	Sea water intrusion in underground aquifers	Light problem	Menai Bay	Overuse of ground water by tourist hotel and increased population related to tourism
UjaS-01	Beach pollution	Light problem	All along coast	Uncontrolled solid and liquid waste disposal
UjaS-04	Disease outbreaks	Light problem	In all big villages of region	Inadequate sewerage control, poor solid waste management. Lack of latrines and toilets in some coastal dwellings

Recommendations for threat mitigation measures

Overall measures to mitigate each if the identified natural resources related threats to coastal local communities and ecosystems have been tabulated in Table 224 (page413) arranged under broad management dimensions headings. Table 174 provides an overview of the requirements/opportunities expressed within each of these management or intervention dimensions.

Table 174: Broad management intervention dimensions to address identified and prioritised threats to coastal communities and ecosystems in Unguja South region, Zanzibar

Intervention Dimension	Statement	Threat pertinence at each RV				
		Major Problem	Very important problem	Important Problem	Problem	Light Problem
Integrated Coastal Zone Management (ICZM)	<p>Ensure local (regional) coordination and participation in management of coastal land, water and resources use currently under complex pressures.</p> <p>Focus areas for integrated management to address include fisheries, shoreline (and riverbank) and mangrove deforestation, beach changes from Menai Bay to Chwaka Bay.</p>	UjaS-02 Beach erosion	UjaS-03 Fisheries decline		UjaS-06 Land use conflict UjaS-07 Loss of coral UjaS-05 Marine pollution	UjaS-01 Beach pollution
Integrated Water Resources Management (IWRM)	<p>Link IWRM to coastal integrated planning to address impacts from upstream pollution, including Unguja Ujuu, Jambiani, Makunduchi, Uroa, Paje, Bwejuu and Michamvi, Menai Bay to Chwaka Bay. (ICARM).</p>	UjaS-02 Beach erosion			UjaS-05 Marine pollution	UjaS-01 Beach pollution UjaS-08 Sea water intrusion
Land Use Management	<p>Land use information management systems to include ecosystems, habitats and water resources.</p> <p>Incorporate ecosystems, habitats, shoreline processes and water resources considerations in spatial planning.</p> <p>Optimise land use through zoning to minimise conflicts and prevent anarchistic development.</p> <p>Develop and/or update regional spatial plan accordingly and within national spatial planning framework.</p>	UjaS-02 Beach erosion	UjaS-03 Fisheries decline		UjaS-06 Land use conflict UjaS-07 Loss of coral UjaS-05 Marine pollution	UjaS-01 Beach pollution UjaS-04 Disease outbreaks UjaS-08 Sea water intrusion
Shoreline Management Planning	<p>Region's shorelines included in a national level overall shoreline management investigation.</p> <p>Shoreline management units (areas of coast) identified for the region informing regional level spatial planning as a basis for local shoreline management regulation.</p>	UjaS-02 Beach erosion	UjaS-03 Fisheries decline		UjaS-06 Land use conflict UjaS-07 Loss of coral UjaS-05 Marine pollution	UjaS-01 Beach pollution
Solid and Liquid Waste Management	<p>Pursue integrated solid and liquid waste management solutions covering entire region, from Menai Bay to Chwaka Bay and all harbours, considering:</p> <p>Waste water treatment systems: - collection - treatment technology - discharge</p> <p>Liquid and Solid Waste Management Systems: - collection - storage - processing - financing - minimisation - reuse?</p> <p>Green Infrastructure Storm Water Systems</p>				UjaS-05 Marine pollution	UjaS-01 Beach pollution UjaS-04 Disease outbreaks

Intervention Dimension	Statement	Threat pertinence at each RV				
		Major Problem	Very important problem	Important Problem	Problem	Light Problem
Sanitation	<p>Pursue integrated solid and liquid waste management covering entire region, from Menai Bay to Chwaka Bay, considering:</p> <p>Waste water treatment systems:</p> <ul style="list-style-type: none"> - collection - treatment technology - discharge <p>Liquid and Solid Waste Management Systems:</p> <ul style="list-style-type: none"> - collection - storage - processing - financing - minimisation - reuse? <p>Green Infrastructure Storm Water Systems</p>				UjaS-05 Marine pollution	UjaS-01 Beach pollution UjaS-04 Disease outbreaks
Capacity Building	<p>Accompany management interventions with appropriate capacity building components at regional level. Particular focus on spatial planning, shoreline management, fisheries management, conflict resolution, monitoring, law enforcement.</p> <p>Enhance information management systems to provide for better and systematically informed management decisions.</p>	UjaS-02 Beach erosion	UjaS-03 Fisheries decline		UjaS-06 Land use conflict UjaS-07 Loss of coral UjaS-05 Marine pollution	UjaS-01 Beach pollution UjaS-04 Disease outbreaks UjaS-08 Sea water intrusion
Technology	<p>Pursue opportunities through further technology development within:</p> <ul style="list-style-type: none"> • Shoreline management • Offshore fisheries • Integrated solid and liquid waste management • Aquaculture • Value added to existing fisheries • Mangrove management • Water borne disease management 	UjaS-02 Beach erosion	UjaS-03 Fisheries decline			UjaS-01 Beach pollution UjaS-04 Disease outbreaks UjaS-08 Sea water intrusion
Law Enforcement	<p>1) Enforce reviewed laws relevant to amongst others:</p> <ul style="list-style-type: none"> • Coral (and sand) mining • Fisheries • Mangrove and coastal forest exploitation • Agrochemicals • Industrial and domestic waste • Land use (especially shoreline and set-back uses) and speculation. <p>2) Optimise enforcement through capacity building at regional level and aligned with recommendations from national review.</p>	UjaS-02 Beach erosion	UjaS-03 Fisheries decline		UjaS-06 Land use conflict UjaS-07 Loss of coral UjaS-05 Marine pollution	UjaS-01 Beach pollution UjaS-04 Disease outbreaks
Legal Review	<p>1) Guided by central integrated review of regional legislative and regulatory instruments, including amongst others:</p> <ul style="list-style-type: none"> • Coral (and sand) mining • Mangrove exploitation • Land use (especially shoreline and set-back uses) and speculation. <p>2) Follow revision (above) and revise and develop new regional legislative and regulatory instruments.</p>	UjaS-02 Beach erosion			UjaS-06 Land use conflict	
Alternative/Improved Livelihood	<p>Develop and offer alternative livelihoods for households currently engaged in destructive resource exploitation practises and those displaced and disadvantaged, focusing on Unguja Ujuu, Jambiani, Makunduchi, Uroa, Paje, Bwejuu and Michamvi Menai Bay to Chwaka Bay, with particular efforts to provide alternatives for young generation.</p> <p>Improve current sustainable resource use livelihoods using technology advances and insights.</p>	UjaS-02 Beach erosion	UjaS-03 Fisheries decline		UjaS-07 Loss of coral	

Intervention Dimension	Statement	Threat pertinence at each RV				
		Major Problem	Very important problem	Important Problem	Problem	Light Problem
Awareness Raising	<p>Participate in national awareness raising campaigns related to coastal management challenges directed to the public at large and to schools.</p> <p>Develop and implement regional level awareness raising campaigns targeting local stakeholders affected by or affecting:</p> <ul style="list-style-type: none"> • Erosion • Fisheries decline • Land use conflicts • Loss and degradation of coral • Marine and beach pollution • Water borne disease • Sea water intrusion 	UjaS-02 Beach erosion	UjaS-03 Fisheries decline		UjaS-06 Land use conflict UjaS-07 Loss of coral UjaS-05 Marine pollution	UjaS-01 Beach pollution UjaS-04 Disease outbreaks UjaS-08 Sea water intrusion
Education	<p>Interact and participate in national curricula review for primary and secondary schools to enhance the knowledge and understanding about coastal management issues. Issues of particular relevance for the region are:</p> <ul style="list-style-type: none"> • Coastal ecology • Importance of beaches • Fisheries ecology and sustainable fisheries • Sustainable tourism • Environmental management • Water borne disease • Climate change impacts 	UjaS-02 Beach erosion	UjaS-03 Fisheries decline		UjaS-06 Land use conflict UjaS-07 Loss of coral UjaS-05 Marine pollution	UjaS-01 Beach pollution UjaS-04 Disease outbreaks UjaS-08 Sea water intrusion

Action areas

Table 175: Assessment of the importance of broad management dimension in addressing threats to local communities and ecosystems in Unguja South Region.

Intervention Dimension	Major Problem weight	Very important problem weight	Important Problem weight	Problem weight	Light Problem weight	Total Score
Integrated Coastal Zone Management (ICZM)	5	4	0	6	1	16
Integrated Water Resources Management (IWRM)	5	0	0	2	2	9
Land Use Management	5	4	0	6	3	18
Shoreline Management Planning	5	4	0	6	1	16
Solid and Liquid Waste Management	0	0	0	2	2	4
Sanitation	0	0	0	2	2	4
Capacity Building	5	4	0	6	3	18
Technology	5	4	0	0	3	12
Law Enforcement	5	4	0	6	2	17
Legal Review	5	0	0	2	0	7
Alternative/ Improved Livelihood	5	4	0	2	0	11
Awareness Raising	5	4	0	6	3	18
Education	5	4	0	6	3	18
Zanzibar				Unguja South Region	Total	168

The prioritised location-specific actions for Unguja South region relate to addressing the following:

- Beach erosion along east coast (Jambiani, Paje, Uroa) and adjacent areas of coast
- Responding to the decline in fisheries productivity due to numerous destructive activities, along the entire district's shoreline

Tables of Overall Threat Mitigation Measures

Mainland Tanzania Themes

Fisheries

Table 176: Broad assessment of measures to mitigate threats associated with fisheries to local coastal communities and ecosystems in mainland Tanzania.

#	RV	Threat	ICZM	IWRM	Land Use Management	Shoreline Management Planning	Solid and Liquid Waste Management	Sanitation	Capacity building	Technology	Law enforcement	Legal Review	Alternative/Improved Livelihood	Awareness raising	Education
03	5	Destructive and illegal fishing – causing decline in productivity due to habitat destruction through beach seine, spear guns and dragnets, and dynamite, adversely affecting the fisher community livelihoods.	Coordination among stakeholders in addressing fisheries decline. Guidelines for best practices in mangrove management. Guidelines for best practices in fisheries. Guidelines for best practices in coral reef management. Guidelines to be based on outcome of legal review.	Not applicable	Mangroves and other habitats of importance (including seagrass areas and coral reefs) for fisheries included in land use information management systems and incorporated into spatial planning.	Identifying management units requiring local management arrangements.	Not Applicable	Not Applicable	Information Management: - Monitoring occurrences of illegal fisheries - Monitoring fishing practices - Monitoring fisheries catches - Monitoring fisheries resources - Monitoring fisheries habitats (mangroves, coral reefs) Capacity among: - Relevant government departments at national and local levels - BMUs	Offshore fisheries Aquaculture; Add value to existing harvest.	Enforce existing laws related to fisheries. Enforce existing laws related to mangrove exploitation. Enforce existing laws related to coral mining.	Review appropriateness of fisheries regulations in relation to local conditions, environment, species and gears. Establish local zoning and fishing effort seasonality.	Provide alternatives to current destructive and unsustainable livelihood practices related to fisheries. - Emphasis on young generation	Awareness raising campaigns: - public at large - schools - stakeholders benefitting from fisheries (fishing communities, middlemen, hotels and restaurants)	Curricula development for relevant education in primary and secondary schools. - Sustainable Fisheries. - Fisheries ecology.
10	5	Poor mangrove resource management – allowing over harvesting of mangrove and wetland or riverine trees leading to erosion and estuarine siltation.	ICZM is an important tool in addressing the complex requirements to address unsustainable resources usage. Implications at and between all management levels. Catchment and coast management needs to be coordinated. IWRM is the appropriate tool such management in the catchment but needs to incorporate coastal concerns (ICZM).	Link IWRM to coastal integrated planning ensuring upstream/downstream considerations.	Forest reserves and forests included in land use information management systems and incorporated into spatial planning.	An understanding of processes and factors behind erosion and accretion along the Tanzanian coast is required. Such an understanding can be attained through a structural effort in Shoreline Management Planning which can then inform Spatial Planning at local level. First step is to identify sediment cells along the coast based on littoral drift considerations, next step to identify management units within these cells based on environment, economic and socio-economic considerations.	Not applicable	Not applicable	District level capacity building related to: - Shoreline management - Spatial Planning - Conflict resolution	Best forest management practices Alternative livelihood technologies Alternatives to coastal forest wood usage	Enforce existing laws related to mangrove forest exploitation.	Not Applicable	Provide alternatives to current destructive and unsustainable livelihood practices related to coastal forests, particularly fuel wood and other resources.	Awareness raising campaigns: - public at large - schools - stakeholders benefitting from mangrove and coastal forest services and products	Curricula development for relevant education in primary and secondary schools. - Coastal/mangrove forest ecology - Coastal forest management
11	5	Catchment deforestation in major basins – causing changes in freshwater river flows, leading to excessive run-off, flooding, erosion and siltation.	ICZM is an important tool in addressing the complex requirements to address unsustainable resources usage. Implications at and between all management levels. Catchment and coast management needs to be coordinated. IWRM is the appropriate tool such management in the catchment but needs to incorporate coastal concerns (ICZM).	Link IWRM to coastal integrated planning ensuring upstream/downstream considerations.	Forest reserves and forests included in land use information management systems and incorporated into spatial planning.	An understanding of processes and factors behind erosion and accretion along the Tanzanian coast is required. Such an understanding can be attained through a structural effort in Shoreline Management Planning which can then inform Spatial Planning at local level. First step is to identify sediment cells along the coast based on littoral drift considerations, next step to identify management units within these cells based on environment, economic and socio-economic considerations.	Not Applicable	Not Applicable	Information Management: - Monitoring forest reserves - Monitoring forest reserve exploitation Capacity among: - Relevant government departments at national and local levels - BMUs	Best forest management practices Alternative livelihood technologies Alternatives to coastal forest wood usage	Enforce existing laws related to coastal forest exploitation.	Not Applicable	Provide alternatives to current destructive and unsustainable livelihood practices related to coastal forests, particularly fuel wood and other resources.	Awareness raising campaigns: - public at large - schools - stakeholders benefitting from mangrove services and products	Curricula development for relevant education in primary and secondary schools. - Coastal forest ecology - Coastal forest management
01	4	Social conflicts over fishing gears - where local fishers use gears or methods (some of which are illegal) that are not acceptable by neighbouring villages. Destructive.	Coordinated and participatory land and resource use planning expressed in integrated spatial plans and regulations.	Not applicable	Mangroves and other habitats of importance (including seagrass areas and coral reefs) for fisheries included in land use information management systems and incorporated into spatial planning.	Identifying management units requiring local management arrangements.	Not applicable	Not applicable	Information Management: - Monitoring occurrences of illegal fisheries - Monitoring fishing practices - Monitoring fisheries catches - Monitoring fisheries resources - Monitoring fisheries habitats (mangroves, coral reefs) Capacity among: - District level capacity building related to: - Shoreline management - Spatial Planning - Conflict resolution; especially community. - BMUs	Offshore fisheries Aquaculture; Add value to existing harvest.	Enforce existing laws related to fisheries. Enforce existing laws related to mangrove exploitation. Enforce existing laws related to coral mining.	Review appropriateness of fisheries regulations in relation to local conditions, environment, species and gears. Establish local zoning and fishing effort seasonality.	Provide alternatives to current destructive and unsustainable livelihood practices related to fisheries. - Emphasis on young generation	Awareness raising campaigns: - public at large - schools - stakeholders benefitting from fisheries (fishing communities, middlemen, hotels and restaurants)	Curricula development for relevant education in primary and secondary schools. - Sustainable Fisheries. - Fisheries ecology.
04	4	Poor fishery resource management – allowing open access fishery, thus increasing fishing pressure and stock depletion is difficult to manage; leading to conflicts with tourists over coral reefs to dive and to snorkel, fish landing sites and tourist hotels; to seaweed farming conflict with boat users and tourists;	Coordinated and participatory land and resource use planning expressed in integrated spatial plans and regulations.	Link IWRM to coastal integrated planning ensuring upstream/downstream considerations.	Review and update of spatial plans including zoning to guide development planning and development control. Spatial plans to also consider marine spaces.	An understanding of processes and factors behind erosion and accretion along the Tanzanian coast is required. Such an understanding can be attained through a structural effort in Shoreline Management Planning which can then inform Spatial Planning at local level. First step is to identify sediment cells along the coast based on littoral drift considerations, next step to identify management units within these cells based on environment, economic and socio-economic considerations.	Not applicable	Not applicable	Information Management: - Monitoring occurrences of illegal fisheries - Monitoring fishing practices - Monitoring fisheries catches - Monitoring fisheries resources - Monitoring fisheries habitats (mangroves, coral reefs) Capacity among: - District level capacity building related to: - Shoreline management - Spatial Planning - Conflict resolution; especially community. - BMUs	Offshore fisheries Aquaculture; Add value to existing harvest.	Enforce existing laws related to fisheries. Enforce existing laws related to mangrove exploitation. Enforce existing laws related to coral mining.	Review appropriateness of fisheries regulations in relation to local conditions, environment, species and gears. Establish local zoning and fishing effort seasonality.	Provide alternatives to current destructive and unsustainable livelihood practices related to fisheries. - Emphasis on young generation	Awareness raising campaigns: - public at large - schools - stakeholders benefitting from fisheries (fishing communities, middlemen, hotels and restaurants)	Curricula development for relevant education in primary and secondary schools. - Sustainable Fisheries. - Fisheries ecology.

#	RV	Threat	ICZM	IWRM	Land Use Management	Shoreline Management Planning	Solid and Liquid Waste Management	Sanitation	Capacity building	Technology	Law enforcement	Legal Review	Alternative/Improved Livelihood	Awareness raising	Education
05	4	Destructive behaviour of fishers (Poverty and lack of education – combine with absence of alternatives or investment, are all attributed as the causes for the current behaviour of fishers).	Coordination among stakeholders in addressing fisheries decline. Guidelines for best practices in mangrove management. Guidelines for best practices in fisheries. Guidelines for best practices in coral reef management. Guidelines to be based on outcome of legal review.	Not applicable	Mangroves and other habitats of importance (including seagrass areas and coral reefs) for fisheries included in land use information management systems and incorporated into spatial planning.	Identifying management units requiring local management arrangements.	Not Applicable	Not Applicable	Information Management: - Monitoring occurrences of illegal fisheries - Monitoring fishing practices - Monitoring fisheries catches - Monitoring fisheries resources - Monitoring fisheries habitats (mangroves, coral reefs) Capacity among: - Relevant government departments at national and local levels - BMUs	Offshore fisheries Aquaculture; Add value to existing harvest.	Enforce existing laws related to fisheries. Enforce existing laws related to mangrove exploitation. Enforce existing laws related to coral mining.	Review appropriateness of fisheries regulations in relation to local conditions, environment, species and gears. Establish local zoning and fishing effort seasonality.	Provide alternatives to current destructive and unsustainable livelihood practices related to fisheries. - Emphasis on young generation	Awareness raising campaigns: - public at large - schools - stakeholders benefitting from fisheries (fishing communities, middlemen, hotels and restaurants)	Curricula development for relevant education in primary and secondary schools. - Sustainable Fisheries. - Fisheries ecology.
06	3	Pollution into catchments and coastal zone - by dumping or leaching of domestic, urban, mining and industrial wastes, sewage, solids, agricultural pesticides into catchments or direct disposal in wetlands, draining to estuaries and coastal zone, affecting marine productivity.	ICARM ensuring linkage between catchment management and coastal management. Coordination among stakeholders in addressing coastal and riverine industry pollution. Beach management guidelines.	Land uses in catchment and its impacts on water resources included in IWRM planning. To the extent that solid and liquid waste origin from upstream activities.	Agriculture zoning in catchments. Regulations for riverside vegetation. Lower portions of rivers included in zoning and development of associated regulations.	Not applicable	Review of management of agrochemicals upstream	Identify and quantify sources of liquid waste as basis for solution	Environmental authorities Agriculture extension services Land use planners. Information Management: - Monitoring waste generation, disposal and management - Monitoring sources of industrial waste, its disposal and impact in recipient environment Capacity among: - Relevant government departments at national and local levels - Guidelines	Waste water treatment systems: - collection - treatment technology - discharge Liquid Waste Management Systems: - collection - storage - processing - financing - minimization - reuse? Green Infrastructure Storm Water Systems	Enforce regulations for use of agrochemicals and disposal of domestic and industrial wastes.	Not Applicable	Not applicable	Awareness raising campaigns targeting agriculture	Curricula development for relevant education in primary and secondary schools. Importance of environmentally sound agriculture production. Importance of integrated management (upstream / downstream).
07	2	Drainage changes - re-claiming areas for agriculture, to build roads, houses and cities or mosquito control, or diversion or in-efficient use of freshwater for irrigation, mining, industry, livestock or domestic and urban needs alters flows, changes estuarine sediment loads (erosion).	ICARM ensuring linkage between catchment management and coastal management. Coordination among stakeholders in addressing coastal and riverine industry pollution. Beach management guidelines.	Land uses in catchment and its impacts on water resources included in IWRM planning. To the extent that solid and liquid waste origin from upstream activities.	Agriculture zoning in catchments. Regulations for riverside vegetation. Lower portions of rivers included in zoning and development of associated regulations.	Not applicable	Review of management of agrochemicals upstream	Identify and quantify sources of liquid waste as basis for solution	Environmental authorities Agriculture extension services Land use planners. Information Management: - Monitoring waste generation, disposal and management - Monitoring sources of industrial waste, its disposal and impact in recipient environment Capacity among: - Relevant government departments at national and local levels - Guidelines	Waste water treatment systems: - collection - treatment technology - discharge Liquid Waste Management Systems: - collection - storage - processing - financing - minimization - reuse? Green Infrastructure Storm Water Systems; PHE	Enforce regulations for use of agrochemicals and disposal of domestic and industrial wastes.	Not Applicable	Not applicable	Awareness raising campaigns targeting agriculture	Curricula development for relevant education in primary and secondary schools. Importance of environmentally sound agriculture production. Importance of integrated management (upstream / downstream).
08	2	Unsustainable mining - salt, sand, coral lime, fossil coral limestone, etc. mined with damage to physical properties of shorelines and river basins.	ICZM is an important tool in addressing the complex requirements to address unsustainable resources usage. Implications at and between all management levels. Catchment and coast management needs to be coordinated. IWRM is the appropriate tool such management in the catchment but needs to incorporate coastal concerns (ICZM).	Link IWRM to coastal integrated planning ensuring upstream/downstream considerations.	Zoning of beaches to be included in Land Use Plans, providing regulations and guidelines for land use. Ideally to be informed from Shoreline Management Planning efforts. Regulations may define types of use as well as set back arrangements. Guidelines may also cover coral reef, seagrass and mangrove management to the extent of importance to beach erosion.	An understanding of processes and factors behind erosion and accretion along the Tanzanian coast is required. Such an understanding can be attained through a structural effort in Shoreline Management Planning which can then inform Spatial Planning at local level. First step is to identify sediment cells along the coast based on littoral drift considerations, next step to identify management units within these cells based on environment, economic and socio-economic considerations.	Not Applicable	Not Applicable	Information Management: - Monitoring forest reserves - Monitoring forest reserve exploitation Capacity among: - Relevant government departments at national and local levels - BMUs	Beach protection technologies, from engineering (groynes, etc.) to soft (beach nourishment) solutions and green technologies (mangrove planting, other shoreline vegetation).	Enforce existing laws related to resources exploitation sand mining and construction near shore (set back provisions).	Establish required regulations, bylaws and guidelines to ensure sustainable and safe development along near the sea. Informed by shoreline management study.	Provide alternatives to current destructive and unsustainable livelihood practices related to mangrove exploitation and fisheries in particular.	The impact of unsustainable resources usage on beach erosion highlighted in awareness raising campaigns. Services of mangroves and corals in protecting against erosive forces (targeting resource users). Impact of physical structures along the coast on shorelines included in awareness raising campaigns (targeting developers and planners)	Curricula development for relevant education in primary and secondary schools. Importance of beaches.
09	2	River damming - for reservoirs for domestic freshwater, irrigation and/or hydro-electric power (HEP) changing sediment loads, affecting estuaries (erosion).	ICARM ensuring linkage between catchment management and coastal management. Coordination among stakeholders in addressing coastal and river flows. Beach management guidelines.	Land uses in catchment and its impacts on water resources included in IWRM planning.	Zoning in catchments and regulations for freshwater abstraction.	An understanding of processes and factors behind erosion and accretion along the Tanzanian coast is required. Such an understanding can be attained through a structural effort in Shoreline Management Planning which can then inform Spatial Planning at local level. First step is to identify sediment cells along the coast based on littoral drift considerations, next step to identify management units within these cells based on environment, economic and socio-economic considerations.	Not applicable	Not applicable	District level capacity building related to: - Shoreline management - Spatial Planning	Beach protection technologies, from engineering (groynes, etc.) to soft (beach nourishment) solutions and green technologies (mangrove planting, other shoreline vegetation).	Enforce existing laws related to freshwater abstraction, and evaluation of dams.	Establish required regulations and guidelines to ensure sustainable and safe development along near the sea. Informed by shoreline management study.	Provide alternatives to current destructive and unsustainable livelihood practices related to freshwater use.	The impact of unsustainable resources usage on beach erosion highlighted in awareness raising campaigns. Services of mangroves and corals in protecting against erosive forces (targeting resource users). Impact of reduced river flows and physical structures along the coast on shorelines included in awareness raising campaigns (targeting developers and planners)	Curricula development for relevant education in primary and secondary schools. Importance of environmentally sound catchment management. Importance of integrated management (upstream / downstream).
02	1	Social conflicts over access to resource – where cultural and historical rivalry over “traditional” fishing grounds increases as pressure on the resource increases; also includes increasing resentment of migratory fishing groups of “dago” fishers during seasonal visits, using gears considered destructive or conflict with local traditions.	Coordinated and participatory land and resource use planning expressed in integrated spatial plans and regulations.	Not applicable	Mangroves and other habitats of importance (including seagrass areas and coral reefs) for fisheries included in land use information management systems and incorporated into spatial planning.	Identifying management units requiring local management arrangements.	Not applicable	Not applicable	Information Management: - Monitoring occurrences of illegal fisheries - Monitoring fishing practices - Monitoring fisheries catches - Monitoring fisheries resources - Monitoring fisheries habitats (mangroves, coral reefs) Capacity among: - District level capacity building related to: - Shoreline management - Spatial Planning - Conflict resolution; especially community. - BMUs	Offshore fisheries Aquaculture; Add value to existing harvest.	Enforce existing laws related to fisheries. Enforce existing laws related to mangrove exploitation. Enforce existing laws related to coral mining.	Review appropriateness of fisheries regulations in relation to local conditions, environment, species and gears. Establish local zoning and fishing effort seasonality.	Provide alternatives to current destructive and unsustainable livelihood practices related to fisheries. - Emphasis on young generation	Awareness raising campaigns: - public at large - schools - stakeholders benefitting from fisheries (fishing communities, middlemen, hotels and restaurants)	Curricula development for relevant education in primary and secondary schools. - Sustainable Fisheries. - Fisheries ecology.

Tourism

Table 177: Broad assessment of measures to mitigate threats associated with tourism to local coastal communities and ecosystems in mainland Tanzania.

#	RV	Threat	ICZM	IWRM	Land Use Management	Shoreline Management Planning	Solid and Liquid Waste Management	Sanitation	Capacity building	Technology	Law enforcement	Legal Review	Alternative/Improved Livelihood	Awareness raising	Education
03	4	Profits not captured locally, thus not benefitting the local population (e.g. package tours sold overseas).	Not applicable	Not applicable	Not applicable	Not applicable	Not Applicable	Not Applicable	District and tax institutions capacity building related to: - tourism revenues - local community participation/benefits	Not Applicable	Ensure laws on taxes etc. for tourism are adhered to.	Review of tourism revenue sharing agreement.	Not applicable	Not applicable	Not applicable
04	4	Increased cost of living due to tourism industry where prices of fish and agricultural foodstuff have gone up, to the detriment of the local consumers who risk loss of valuable protein inputs to their diets.	Not applicable	Not applicable	Not applicable	Not applicable	Not Applicable	Not Applicable	District and tax institutions capacity building related to: - local community participation/benefits	Not Applicable	Not Applicable	Not Applicable	Provide alternatives to displaced and disadvantaged local communities.	Not applicable	Not applicable
06	4	Uncertainty of tourism jobs with most being ad-hoc, or 'as needed' basis and does not offer steady employment, or seasonal in nature.	Not applicable	Not applicable	Not applicable	Not applicable	Not Applicable	Not Applicable	District and tourism institutions capacity building related to: - local participation improvement of management; - boost local participation; encourage local tourism to extend the season	Promote tourism.	Not Applicable	Not Applicable	Provide alternatives to diversify economic activities for local staff.	Not applicable	Not applicable
08	4	Erosion of local traditions and culture due to influences from tourists and non-locals in the industry (e.g. from language, dress code, manners and habits); loss of village elder authority to preside over disputes; increases in prostitution, robbery and alcohol abuse; goods and services offered freely in the past (e.g. land, thatch (roofing materials) and assistance to the elderly or during times of hardship), are eroded by the 'money economy' of wage employment.	Not applicable	Not applicable	Not applicable	Not applicable	Not Applicable	Not Applicable	Improve capacity of local staff to participate in the tourism sector at all and at higher levels.	Not Applicable	Enforce existing laws related to anti-social behavior.	Review employment of non-local staff in the sector.	Provide alternatives to diversify economic activities for local staff.	not applicable	not applicable
12	4	Pollution of the coastal zone, from some developments illegally dumping waste and litter.	Coordination among stakeholders in addressing beach pollution. Beach management guidelines	To the extent that solid and liquid waste origin from upstream activities	Beaches included in zoning and development of associated regulations	Identifying management units requiring local management arrangements.	Waste collection, storage and processing system needs to be put in place.	- Identify and quantify sources of liquid waste as basis for solution	Information Management: - Monitoring waste generation, disposal and management - Monitoring sources of liquid waste, its disposal and impact in recipient environment Capacity among: - Relevant government departments at national and local levels - BMUs - Guidelines	Waste water treatment systems: - collection - treatment technology - discharge Solid Waste Management Systems: - collection - storage - processing - financing - minimization - reuse?	Enforce existing laws related to waste disposal	Not Applicable	Not applicable	Awareness raising campaigns: - public at large - schools - stakeholders benefitting from beaches (tourism operators, hotels, fishermen, etc.) - tourists	Curricula development for relevant education in primary and secondary schools. Importance of beaches.
02	3	Lack of trained personnel for conservation and management of cultural heritage (TCMP 2001).	Not applicable	Not applicable	Not applicable	Not applicable	Not Applicable	Not Applicable	District and antiquities institutions capacity building related to: - Spatial Planning - Conflict resolution - Monument management	Not Applicable	Not Applicable	Not Applicable	Provide alternatives to current destructive and unsustainable livelihood practices related to monuments.	Not applicable	Not applicable
05	3	Increasing cost of land in high tourism potential areas are targeted by speculators or developers and competition for land can drive prices high, such local populous cannot afford land.	Not applicable	Not applicable	Zoning in spatial plans providing guidance for land uses and for development control addressing tourism development and local communities.	Not applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Ensure laws on land speculation are enforced.	Not Applicable	Not applicable	Not applicable	Not applicable
10	3	Reduction in iconic marine life with illegal killing of whale sharks, dolphins, dugongs, turtles and other exotic marine animals that are tourist attractions degrading the value of the experience and creating a poor image of Tanzania as an eco-friendly destination.	ICZM is an important tool in addressing the complex requirements to address unsustainable resources usage. Implications at and between all management levels. Catchment and coast management needs to be coordinated. IWRM is the appropriate tool such management in the catchment but needs to incorporate coastal concerns (ICZM).	Not applicable	not applicable	Designated turtle nesting beaches to be integrated into SMP, with emphasis on beach condition, set-back distances, lighting and infrastructure, as well as human disturbance.	Waste management to reduce solid waste on beaches, and beach clean-up to assist turtle nesting.	Not Applicable	not applicable	not applicable	Enforce existing laws related to iconic species.	Review legal status of iconic marine life.	Not applicable	Awareness raising campaigns: - public at large - schools - stakeholders benefitting from iconic marine life.	not applicable
11	3	Ecosystem fragmentation due to encroachment of corridors and protected areas, is affecting migratory species, exacerbated by over utilization of forest resources and conflicts between agriculture and wildlife, due to failure of management to address encroachment and resource over-utilization, especially forests.	Coordination among stakeholders in addressing forest management. Forest reserve management plans.	Not applicable	Forest reserves and forests included in land use information management systems and incorporated into spatial planning.	Identifying management units requiring local management arrangements.	Not Applicable	Not Applicable	Information Management: - Monitoring forest reserves - Monitoring forest reserve exploitation Capacity among: - Relevant government departments at national and local levels.	Best forest management practices Alternative livelihood technologies Alternatives to coastal forest wood usage	Enforce existing laws related to coastal forest exploitation.	Not Applicable	Provide alternatives to current destructive and unsustainable livelihood practices related to coastal forests, particularly fuel wood and other resources.	Awareness raising campaigns: - public at large - schools - stakeholders benefitting from coastal forest services and products	Curricula development for relevant education in primary and secondary schools. - Coastal forest and ecology - Coastal forest management

#	RV	Threat	ICZM	IWRM	Land Use Management	Shoreline Management Planning	Solid and Liquid Waste Management	Sanitation	Capacity building	Technology	Law enforcement	Legal Review	Alternative/Improved Livelihood	Awareness raising	Education
01	2	Anarchistic tourist development destroying cultural heritage sites (TCMP 2001) where urban development planning and control fail to intervene.	Not applicable	Not applicable	Zoning in spatial plans providing guidance for land uses and for development control addressing monuments and unsustainable land uses.	Not applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Enforce existing laws (especially ESAs) related to construction around monuments.	Not Applicable	Not applicable	Not applicable	Not applicable
07	2	Loss of employment opportunities by locals to more qualified and better trained staff from other parts of mainland Tanzania and Kenya.	Not applicable	Not applicable	Not applicable	Not applicable	Not Applicable	Not Applicable	Improve capacity of local staff to participate in the tourism sector at all and at higher levels.	Not Applicable	Not Applicable	Review employment of non-local staff in the sector.	Not applicable	not applicable	Not applicable
09	2	Deterioration of marine environment resulting in loss of biodiversity and other marine tourist attractions from... also threatening the sport fishing industry.	Coordination among stakeholders in addressing fisheries decline. Guidelines for best practices in mangrove management. Guidelines for best practices in fisheries. Guidelines for best practices in coral reef management. Guidelines to be based on outcome of legal review.	Not applicable	Mangroves and other habitats of importance (including seagrass areas and coral reefs) for fisheries included in land use information management systems and incorporated into spatial planning.	Identifying management units requiring local management arrangements.	Not Applicable	Not Applicable	Information Management: - Monitoring occurrences of illegal fisheries - Monitoring fishing practices - Monitoring fisheries catches - Monitoring fisheries resources - Monitoring fisheries habitats (mangroves, coral reefs) Capacity among: - Relevant government departments at national and local levels - BMUs	Offshore fisheries Aquaculture; Add value to existing harvest.	Enforce existing laws related to fisheries. Enforce existing laws related to mangrove exploitation. Enforce existing laws related to coral mining.	Review appropriateness of fisheries regulations in relation to local conditions, environment, species and gears. Establish local zoning and fishing effort seasonality.	Provide alternatives to current destructive and unsustainable livelihood practices related to fisheries. - Emphasis on young generation	Awareness raising campaigns: - public at large - schools - stakeholders benefiting from fisheries (fishing communities, middlemen, hotels and restaurants)	Curricula development for relevant education in primary and secondary schools. - Sustainable Fisheries. - Fisheries ecology.
13	2	Increased beach erosion due to tourism alteration of the shoreline, with obstruction of sediment supply by modification of the beach hydrodynamics due to the construction of inappropriate engineering structures like sea walls, jetties and salt pans and removal of beach material for road or hotel or beach construction, and of protective mangroves enhancing aggressive wave action on the beach, leading to sand loss (e.g. northern Bagamoyo Beach Hotels have cleared their mangrove frontage, resulting in erosion rates of up to 3m/year.). Poor planning by beach hotels and residential houses built directly on or very close to the beach are threatened by erosion (e.g. in Dar es Salaam area Hotel Africana built on a dune lost more than 50% of its residential huts by the late 1980s.	ICZM is an important tool in addressing the complex requirements to address unsustainable resources usage. Implications at and between all management levels. Catchment and coast management needs to be coordinated. IWRM is the appropriate tool such management in the catchment but needs to incorporate coastal concerns (ICZM).	Link IWRM to coastal integrated planning ensuring upstream/downstream considerations.	Zoning of beaches to be included in Land Use Plans, providing regulations and guidelines for land use. Ideally to be informed from Shoreline Management Planning efforts. Regulations may define types of use as well as set back arrangements. Guidelines may also cover coral reef, seagrass and mangrove management to the extent of importance to beach erosion.	An understanding of processes and factors behind erosion and accretion along the Tanzanian coast is required. Such an understanding can be attained through a structural effort in Shoreline Management Planning which can then inform Spatial Planning at local level. First step is to identify sediment cells along the coast based on littoral drift considerations, next step to identify management units within these cells based on environment, economic and socio-economic considerations.	Not Applicable	Not Applicable	Information Management: - Monitoring forest reserves - Monitoring forest reserve exploitation Capacity among: - Relevant government departments at national and local levels - BMUs	Beach protection technologies, from engineering (groynes, etc.) to soft (beach nourishment) solutions and green technologies (mangrove planting, other shoreline vegetation).	Enforce existing laws related to resources exploitation sand mining and construction near shore (set back provisions).	Establish required regulations, bylaws and guidelines to ensure sustainable and safe development along near the sea. Informed by shoreline management study.	Provide alternatives to current destructive and unsustainable livelihood practices related to mangrove exploitation and sand extraction in particular.	The impact of unsustainable resources usage on beach erosion highlighted in awareness raising campaigns. Services of mangroves and corals in protecting against erosive forces (targeting resource users). Impact of physical structures along the coast on shorelines included in awareness raising campaigns (targeting developers and planners)	Curricula development for relevant education in primary and secondary schools. Importance of beaches.

Livestock and Agriculture

Table 178: Broad assessment of measures to mitigate threats associated with livestock and agriculture to local coastal communities and ecosystems in mainland Tanzania.

RV	Themes	Threat	ICZM	IWRM	Land Use Management	Shoreline Management Planning	Solid and Liquid Waste Management	Sanitation	Capacity building	Technology	Law enforcement	Legal Review	Alternative/Improved Livelihood	Awareness raising	Education
4	01	Poor land management leading to social conflicts over land between agriculture and livestock grazing.	Coordinated and participatory land and resource use planning expressed in integrated spatial plans and regulations.	Link IWRM to coastal integrated planning ensuring upstream/downstream considerations.	Review and update of spatial plans including zoning to guide development planning and development control. Spatial plans to also consider marine spaces.	An understanding of processes and factors behind erosion and accretion along the Tanzanian coast is required. Such an understanding can be attained through a structural effort in Shoreline Management Planning which can then inform Spatial Planning at local level. First step is to identify sediment cells along the coast based on littoral drift considerations, next step to identify management units within these cells based on environment, economic and socio-economic considerations.	Not applicable	Not applicable	District level capacity building related to: - Shoreline management - Spatial Planning - Conflict resolution	Beach protection technologies, from engineering (groynes, etc.) to soft (beach nourishment) solutions and green technologies (mangrove planting, other shoreline vegetation). More efficient use of land.	Enforce existing laws related to resources exploitation and sand mining and construction near shore (set back provisions). Enforce development control measures according to updated spatial plans.	Establish required regulations, bylaws and guidelines to ensure sustainable and safe development along near the sea. Local guidelines based on updated spatial plans informed by shoreline management study.	Not applicable	The impact of unsustainable resources usage on beach erosion highlighted in awareness raising campaigns. Including on safety/security financial.	Curricula development for relevant education in primary and secondary schools. Sustainable development in areas under high demographic and economic development pressure (coastal areas, urban areas). Importance of coasts and coastal habitats and resources.
4	02	Poor land tenure. Leading to inadequate and/or poor land development/use.	not applicable	Not applicable	Review and up-date spatial plans for development control clarifying district land uses.	Not applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Enforce existing laws related to land tenure.	Not Applicable	Not applicable	Awareness campaigns related to sustainable development planning and development control targeting: - farmers - district authorities - land-users	Not applicable
4	03	Inadequate Government support for continued or expanded production, e.g. with new seeds to resist new pest.	not applicable	Not applicable	Not applicable	Not applicable	Not Applicable	Not Applicable	District level capacity building related to: - agriculture. Planning - Conflict resolution	Agriculture / forestry technologies.	Not Applicable	Not Applicable	Not applicable	Awareness campaigns related to sustainable development planning and development control targeting: - farmers - district authorities - land-users	Not applicable
4	05	Reduction in soil fertility and structure.	not applicable	Not applicable	Not applicable	Not applicable	Not Applicable	Not Applicable	District level capacity building related to: supporting agriculture soil management; extension services.	Agriculture soil improvement technologies.	Not Applicable	Not Applicable	Not applicable	Awareness campaigns related to sustainable development planning and development control targeting: - farmers - district authorities - land-users	Not applicable
4	07	Scarcity and irregular supply.	Coordinated and participatory land and resource use planning expressed in integrated spatial plans and regulations.	Link IWRM to coastal integrated planning ensuring upstream/downstream considerations.	Review and update of spatial plans including zoning to guide development planning and development control.	Not applicable	Not Applicable	Not Applicable	District level capacity building related to: - Catchment management - Spatial Planning - Conflict resolution	Strengthen/modernise spatial planning tools (GIS, remote imageries); improved water source monitoring;	Enforce existing laws related to resources exploitation and water abstraction. Enforce development control measures according to updated spatial plans.	Establish required regulations, bylaws and guidelines to ensure sustainable and safe development in river catchments.	Not applicable	Awareness raising campaigns: - public at large - schools - stakeholders benefitting from beaches (tourism operators, hotels, fishermen, etc.) - tourists. Impact of pollution on environment and health Pollution pathways and waste management. Upstream/downstream.	Curricula development for relevant education in primary and secondary schools. Importance of environmentally sound agriculture production. Importance of integrated management (upstream / downstream). Importance of marine environment. Pollution, environment, health. Waste minimisation and recycling.
4	09	Dependence on rain-fed agriculture and insufficient freshwater for irrigation	ICARM ensuring linkage between catchment management and coastal management.	Forest management and catchment land uses addressed in integrated water resources management planning. Link IWRM to coastal integrated planning ensuring upstream/downstream considerations.	Zoning in spatial plans providing guidance for land uses and for development control addressing water resources problems arising from unsustainable land uses.	Not applicable	Not Applicable	Not Applicable	Environmental authorities Land use planners Agriculture extension Information Management: - Monitoring land uses	Agriculture / forestry technologies sustaining recharge of aquifers; rain harvest; Alternative technology replacing charcoal and fuel wood as energy source.	Enforce existing laws related to coastal forest exploitation.	Not Applicable	Provide alternatives to current destructive and unsustainable livelihood practises related to coastal forests, particularly fuel wood and other resources.	Awareness raising campaigns: - public at large - schools - stakeholders benefitting from mangrove services and products	Curricula development for relevant education in primary and secondary schools. - Coastal forest ecology - Coastal forest management; - Hydrologic cycle
4	12	Lack of early warning systems strengthening climate information and agro-meteorological services and seasonal forecasting, and strengthened early warning systems (including communication) and enhanced disaster risk management (VPO 2012).	ICARM ensuring linkage between catchment management and coastal management. Coordination among stakeholders in addressing climate change impacts on hydrology.	Land uses in catchment and its impacts on water resources included in IWRM planning.	Not applicable	Not applicable	Not Applicable	Not Applicable	District level capacity building related to: supporting agriculture early warning system; also at TMA and Dept. of Disaster Management (PMO).	Agriculture early warning system for climate and pests.	Not Applicable	Not Applicable	Not applicable	Awareness raising campaigns on early warning systems: - public at large - schools - farmers	Not applicable

RV	Themes	Threat	ICZM	IWRM	Land Use Management	Shoreline Management Planning	Solid and Liquid Waste Management	Sanitation	Capacity building	Technology	Law enforcement	Legal Review	Alternative/Improved Livelihood	Awareness raising	Education
3	06	Drying up and contamination of ground and surface waters, with periodic outbreak water borne diseases.	Coordinated and participatory land and resource use planning expressed in integrated spatial plans and regulations.	Link IWRM to coastal integrated planning ensuring upstream/downstream considerations.	Review and update of spatial plans including zoning to guide development planning and development control.	Not applicable	Waste collection, storage and processing system needs to be put in place.	Identify and quantify sources of liquid waste as basis for solution and develop sanitation systems accordingly	District level capacity building related to: - Catchment management - Spatial Planning - Conflict resolution	Strengthen/modernise spatial planning tools (GIS, remote imageries)	Enforce existing laws related to resources exploitation and water abstraction. Enforce development control measures according to updated spatial plans.	Establish required regulations, bylaws and guidelines to ensure sustainable and safe development in river catchments.	Not applicable	Awareness raising campaigns: - public at large - schools - stakeholders benefitting from beaches (tourism operators, hotels, fishermen, etc.) - tourists. Impact of pollution on environment and health Pollution pathways and waste management. Upstream/downstream.	Curricula development for relevant education in primary and secondary schools. Importance of environmentally sound agriculture production. Importance of integrated management (upstream / downstream). Importance of marine environment. Pollution, environment, health. Waste minimisation and recycling.
3	10	Limited success of timely product distribution.	not applicable	Not applicable	Not applicable	Not applicable	Not Applicable	Not Applicable	District level capacity building related to: supporting agriculture; post-harvest losses and marketing; business skills/training.	Agriculture post-harvest and marketing technologies.	Not Applicable	Not Applicable	Not applicable	Not applicable	Not applicable
2	04	Harvest quality deterioration and huge post-harvest losses.	not applicable	Not applicable	Not applicable	Not applicable	Not Applicable	Not Applicable	District level capacity building related to: supporting agriculture; post-harvest losses and marketing.	Agriculture post-harvest and marketing technologies.	Not Applicable	Not Applicable	Not applicable	Not applicable	Not applicable
2	11	Salt water intrusion seen in many of the coastal areas with good soils for agriculture (Rufiji, Mkuranga, Bagamoyo, Pangani, Lindi) which are now frequently flooded by sea water during spring tides.	not applicable	Forest management and catchment land uses addressed in integrated water resources management planning. Link IWRM to coastal integrated planning ensuring upstream/downstream considerations.	Zoning in spatial plans providing guidance for land uses and for development control addressing water resources problems arising from unsustainable land uses.	Not applicable	Not Applicable	Not Applicable	Environmental authorities Land use planners Agriculture extension Information Management: - Monitoring land uses	Agriculture / forestry technologies sustaining recharge of aquifers; rain harvest;	Not Applicable	Not Applicable	Provide alternatives to current destructive and unsustainable livelihood practises related to coastal forests, particularly fuel wood and other resources.	Awareness raising campaigns: - public at large - schools - stakeholders benefitting from mangrove services and products	Curricula development for relevant education in primary and secondary schools. - Coastal forest ecology - Coastal forest management; - Hydrologic cycle
1	08	Coral rag bush fallow system has been progressively reduced in extremes, to 1-2 years instead of the customary 10-15. Also, availability, timing, price, variety and quality of essential seed varieties and chemicals hinder optimal production, thus limiting output and returns. Also, loss of topsoil, erosion, structural deterioration and declining fertility.	not applicable	Not applicable	Review and update of spatial plans including zoning to guide development planning and development control.	Not applicable	Not Applicable	Not Applicable	District level capacity building related to: supporting agriculture soil management; extension services.	Strengthen/modernise farming; improve efficiency and yields/varieties.	Not Applicable	Establish required regulations, bylaws and guidelines to ensure sustainable and safe development in river catchments.	Not applicable	Awareness campaigns related to sustainable development planning and development control targeting: - farmers - district authorities - land-users	Curricula development for relevant education in primary and secondary schools. Importance of environmentally sound agriculture production. Importance of integrated management (upstream / downstream). Importance of marine environment. Pollution, environment, health. Waste minimisation and recycling.

Forestry

Table 179: Broad assessment of measures to mitigate threats associated with forestry to local coastal communities and ecosystems in mainland Tanzania.

RV	Themes	Threat	ICZM	IWRM	Land Use Management	Shoreline Management Planning	Solid and Liquid Waste Management	Sanitation	Capacity building	Technology	Law enforcement	Legal Review	Alternative/Improved Livelihood	Awareness raising	Education
5	06	Encroachment of expanding agriculture and settlements into coastal forest reserves e.g. South Ruvu forest reserve and widespread in Msubugwe and Gendagenda FRs in Tanga region, Vikindu FR near Dar es salaam and near major centres e.g. Bagamoyo.	Coordination among stakeholders in addressing forest management. Forest reserve management plans.	Not applicable	Forest reserves included in land use information management systems and incorporated into spatial planning.	Identifying management units requiring local management arrangements.	Not Applicable	Not Applicable	Information Management: - Monitoring forest reserves - Monitoring forest reserve exploitation Capacity among: - Relevant government departments at national and local levels - BMUs	Best forest management practises Alternative livelihood technologies Alternatives to coastal forest wood usage	Enforce existing laws related to coastal forest exploitation.	Not Applicable	Provide alternatives to current destructive and unsustainable livelihood practises related to coastal forests, particularly fuel wood and other resources.	Awareness raising campaigns: - public at large - schools - stakeholders benefitting from forest services and products	Curricula development for relevant education in primary and secondary schools. - Coastal forest ecology - Coastal forest management
5	10	Inefficient use of biomass fuel production (e.g. forest charcoal) and consumption is extremely inefficient, exacerbating the demand.	Coordination among stakeholders in addressing forest management. Forest reserve management plans.	Not applicable	Forest reserves and forests included in land use information management systems and incorporated into spatial planning.	Identifying management units requiring local management arrangements.	Not Applicable	Not Applicable	Information Management: - Monitoring forest reserves - Monitoring forest reserve exploitation Capacity among: - Relevant government departments at national and local levels.	Best forest management practises Alternative livelihood technologies Alternatives to coastal forest wood usage	Enforce existing laws related to coastal forest exploitation.	Not Applicable	Provide alternatives to current destructive and unsustainable livelihood practises related to coastal forests, particularly fuel wood and other resources.	Awareness raising campaigns: - public at large - schools - stakeholders benefitting from coastal forest services and products	Curricula development for relevant education in primary and secondary schools. - Coastal forest and ecology - Coastal forest management
4	01	Invasion of water catchments areas and upstream changes in river courses (springs, small seasonal streams, ponds and wetlands) by farmers (agriculture), leads to decreases in freshwater flows affecting coastal and mangrove forests (e.g. Pangani River estuary).	ICZM is an important tool in addressing the complex requirements to address unsustainable resources usage. Implications at and between all management levels. Catchment and coast management needs to be coordinated. IWRM is the appropriate tool such management in the catchment but needs to incorporate coastal concerns (ICZM).	Link IWRM to coastal integrated planning ensuring upstream/downstream considerations.	Forest included in land use information management systems and incorporated into spatial planning.	Not applicable	Not Applicable	Not Applicable	District level capacity building related to: - Catchment management - Spatial Planning - Conflict resolution	Strengthen/modernise spatial planning tools (GIS, remote imageries); improved water source monitoring;	Enforce existing laws related to resources exploitation and water abstraction. Enforce development control measures according to updated spatial plans.	Establish required regulations, bylaws and guidelines to ensure sustainable and safe development in river catchments.	Not applicable	Awareness raising campaigns: - public at large - schools - stakeholders benefitting from beaches (tourism operators, hotels, fishermen, etc.) - tourists. Impact of pollution on environment and health Pollution pathways and waste management. Upstream/downstream.	Curricula development for relevant education in primary and secondary schools. Importance of environmentally sound agriculture production. Importance of integrated management (upstream / downstream). Importance of marine environment. Pollution, environment, health. Waste minimisation and recycling.
4	02	Inadequate enforcement of forest management regulations resulting in illegal clearing and over-harvesting of mangrove forests and coastal forests for various reasons: charcoal (Bagamoyo and close to large urban areas) and domestic firewood (most districts), for lime burning (in Rufiji, Mafia and Lindi), conversion to agricultural land (Rufiji for rice), tourist developments (e.g. Bagamoyo) and salt farms. Lack of effective enforcement, low penalties, and a long and cumbersome procedure to pass by-laws, dilutes the process.	Coordination among stakeholders in addressing forest management. Mangrove forest reserve management plans.	Not applicable	Forest reserves and forests included in land use information management systems and incorporated into spatial planning.	Identifying management units requiring local management arrangements.	Not Applicable	Not Applicable	Information Management: - Monitoring forest reserves - Monitoring forest reserve exploitation Capacity among: - Relevant government departments at national and local levels Land use planning commission Local Government Authorities; particularly Forestry and Agriculture	Strengthen/modernise spatial planning tools (GIS, remote imageries); Best forest management practises Alternative livelihood technologies Alternatives to coastal forest wood usage	Enforce existing laws related to coastal forest exploitation.	Establish required regulations, bylaws and guidelines to ensure sustainable and safe development in farmland areas.	Provide alternatives to current destructive and unsustainable livelihood practises related to coastal forests, particularly fuel wood and other resources.	Awareness raising campaigns: - public at large - schools - stakeholders benefitting from mangrove services and products	Curricula development for relevant education in primary and secondary schools. - Coastal forest ecology - Coastal forest management
4	07	Uncontrolled fires escaping from plot clearing destroys forests, killing wildlife and other living organisms and are a long term threat to coastal forests, exacerbated by long dry seasons experienced over recent years have caused the coastal forests to dry up and prone to forest fires.	Coordination among stakeholders in addressing forest management. Mangrove forest reserve management plans.	Not applicable	Forest reserves and forests included in land use information management systems and incorporated into spatial planning.	not applicable	Not Applicable	Not Applicable	Land use planning commission Local Government Authorities; particularly Forestry and Agriculture	Strengthen/modernise spatial planning tools (GIS, remote imageries); Best forest management practises Alternative livelihood technologies Alternatives to coastal forest wood usage	Enforce existing laws related to resources exploitation and use of fire to clear bush. Enforce development control measures according to updated spatial plans.	Establish required regulations, bylaws and guidelines to ensure sustainable and safe development in farmland areas.	Provide alternatives to current destructive and unsustainable livelihood practises related to coastal forests, particularly fuel wood and other resources.	Awareness raising campaigns: - public at large - schools - stakeholders benefitting from mangrove services and products	Curricula development for relevant education in primary and secondary schools. - Coastal forest ecology - Coastal forest management

RV	Themes	Threat	ICZM	IWRM	Land Use Management	Shoreline Management Planning	Solid and Liquid Waste Management	Sanitation	Capacity building	Technology	Law enforcement	Legal Review	Alternative/Improved Livelihood	Awareness raising	Education
4	08	Ineffective implementation of land use planning resulting in destructive mining practices such as of limestone is widespread along coastal areas of Wazo Hill in Dar es Salaam and Amboni in Tanga, clearing forests while the Songo Songo gas project pipeline extending from Lindi to Dar es Salaam, with extensive damage to coastal forests, or over exploitation of coast forests for salt works or tourism.	Coordination among stakeholders in addressing forest and mining management. Mangrove forest reserve management plans.	Not applicable	Forest reserves, forests and mining areas included in land use information management systems and incorporated into spatial planning.	Identifying management units requiring local management arrangements.	Not Applicable	Not Applicable	Information Management: - Monitoring forest reserves - Monitoring forest reserve exploitation Capacity among: - Relevant government departments at national and local levels - BMUs	Best forest and mining management practises; Alternative livelihood technologies for mining and coastal forest wood usage	Enforce existing laws related to coastal forest exploitation, fisheries, mangrove exploitation and coastal mining.	Not Applicable	Provide alternatives to current destructive and unsustainable livelihood practises related to coastal forests, particularly fuel wood and mining.	Awareness raising campaigns: - public at large - schools - stakeholders benefitting from mangrove services and products	Curricula development for relevant education in primary and secondary schools. - Coastal forest ecology - Coastal forest management
4	11	Unreserved status in more than 60% of forest and woodlands leaving these areas with insufficient management instruments.	Coordination among stakeholders in addressing forest management.	Not applicable	Forest reserves and forests included in land use information management systems and incorporated into spatial planning.	Identifying management units requiring local management arrangements.	Not Applicable	Not Applicable	Information Management: - Monitoring forest reserves - Monitoring forest reserve exploitation Capacity among: - Relevant government departments at national and local levels - BMUs	Best forest management practises Alternative livelihood technologies Alternatives to coastal forest wood usage	Enforce existing laws related to coastal forest exploitation.	Not Applicable	Provide alternatives to current destructive and unsustainable livelihood practises related to coastal forests, particularly fuel wood and other resources.	Awareness raising campaigns: - public at large - schools - stakeholders benefitting from mangrove services and products	Curricula development for relevant education in primary and secondary schools. - Coastal forest ecology - Coastal forest management
3	09	Land tenure uncertainty discourages long-term investment in village land and protection of sensitive areas as water catchment areas and forests.	Coordination among stakeholders in addressing forest and catchment management.	Link IWRM to coastal integrated planning ensuring upstream/downstream considerations.	Forest reserves, forests and catchments included in land use information management systems and incorporated into spatial planning.	Identifying management units requiring local management arrangements.	Not Applicable	Not Applicable	Information Management: - Monitoring forest reserves - Monitoring forest reserve exploitation Capacity among: - Relevant government departments at national and local levels.	Best forest management practises Alternative livelihood technologies Alternatives to coastal forest wood usage	Enforce existing laws related to coastal forest exploitation and land tenure.	Establish required regulations, bylaws and guidelines to ensure sustainable and safe development in river catchments. Review land tenure issues.	Not applicable	Awareness raising campaigns: - public at large - schools - stakeholders benefitting from coastal forest services and products	Curricula development for relevant education in primary and secondary schools. - Coastal forest and ecology - Coastal forest management
2	03	Pollution from fertilizers, pesticides, and other toxic agrochemicals and solid wastes including from up-stream sources. DDT and Thiodan are widely used to control crabs in the rice farms in the Rufiji delta, can poison mangroves.	ICARM ensuring linkage between catchment management and coastal management. Coordination among stakeholders in addressing riverine agriculture pollution.	Land uses in catchment and its impacts on water resources included in IWRM planning	Agriculture zoning in catchments. Regulations for riverside vegetation.	Not applicable	Review of management of agrochemicals upstream	Not Applicable	Environmental authorities Agriculture extension services Land use planners	Agriculture technologies minimising impact for agrochemicals on water resources Technology for monitoring receiving environment.	Enforce regulations for use of agrochemicals.	Not Applicable	Not applicable	Awareness raising campaigns targeting agriculture	Curricula development for relevant education in primary and secondary schools. Importance of environmentally sound agriculture production. Importance of integrated management (upstream / downstream).
2	04	Erosion of mangrove stands from sea level changes and storms.	ICZM is an important tool in addressing the complex requirements to address unsustainable resources usage. Implications at and between all management levels. Catchment and coast management needs to be coordinated. IWRM is the appropriate tool such management in the catchment but needs to incorporate coastal concerns (ICZM).	Link IWRM to coastal integrated planning ensuring upstream/downstream considerations.	Forest reserves and forests included in land use information management systems and incorporated into spatial planning.	An understanding of processes and factors behind erosion and accretion along the Tanzanian coast is required. Such an understanding can be attained through a structural effort in Shoreline Management Planning which can then inform Spatial Planning at local level. First step is to identify sediment cells along the coast based on littoral drift considerations, next step to identify management units within these cells based on environment, economic and socio-economic considerations.	Not Applicable	Not Applicable	Information Management: - Monitoring forest reserves - Monitoring forest reserve exploitation Capacity among: - Relevant government departments at national and local levels - BMUs	Best forest management practises Alternative livelihood technologies Alternatives to coastal forest wood usage	Enforce existing laws related to coastal forest exploitation.	Not Applicable	Provide alternatives to current destructive and unsustainable livelihood practises related to coastal forests, particularly fuel wood and other resources.	Awareness raising campaigns: - public at large - schools - stakeholders benefitting from mangrove services and products	Curricula development for relevant education in primary and secondary schools. - Coastal forest ecology - Coastal forest management
2	05	Inadequate enforcement of hunting regulations resulting in loss of wildlife from many coastal forests (the demand for bush meat is ever increasing in coastal forest communities, notably Gendagenda forest reserve in Handeni district and Noto/Chitoo Plateau forests in Lindi region).	not applicable	Not applicable	Wildlife included in land use information management systems and incorporated into spatial planning.	Not applicable	Not Applicable	Not Applicable	Information Management: - Monitoring wildlife reserves - Monitoring forest reserve exploitation Capacity among: - Relevant government departments at national and local levels	Best wildlife management practises Alternative livelihood technologies Alternatives to coastal wildlife hunting.	Enforce existing laws related to wildlife exploitation.	Not Applicable	Provide alternatives to current destructive and unsustainable livelihood practises related to wildlife hunting.	Awareness raising campaigns: - public at large - schools - stakeholders benefitting from wildlife services and products	Curricula development for relevant education in primary and secondary schools. - Coastal forest and wildlife ecology - Wildlife management

Industry

Table 180: Broad assessment of measures to mitigate threats associated with industry to local coastal communities and ecosystems in mainland Tanzania.

RV	Themes	Threat	ICZM	IWRM	Land Use Management	Shoreline Management Planning	Solid and Liquid Waste Management	Sanitation	Capacity building	Technology	Law enforcement	Legal Review	Alternative/Improved Livelihood	Awareness raising	Education
4	01	Inadequate infrastructure management unable to maintain supply of services (electricity, transport, water supply) to coastal regions, resulting in a disincentive for industry to be attracted to the coast and develop.	Not applicable	Not applicable	Not applicable	Not applicable	Not Applicable	Not Applicable	Strengthen institutional capacity and financial management.	Improve investment efficiency and financial resources management.	Not Applicable	Not Applicable	Not applicable	Awareness raising campaigns targeting relevant industries/activities; improved transparency.	Not applicable
4	03	Industrial pollution of waterways and ground water.	ICARM ensuring linkage between catchment management and coastal management. Coordination among stakeholders in addressing riverine pollution.	Land uses in catchment and its impacts on water resources included in IWRM planning; To the extent that liquid waste origin from upstream activities.	Industry zoning in catchments.	Not applicable	Review of management of industrial wastes in upstream and ground waters.	Not Applicable	Information Management: - Monitoring waste generation, disposal and management - Monitoring sources of industrial waste, its disposal and impact in recipient environment Capacity among: - Relevant government departments at national and local levels - Guidelines	Waste water treatment systems: - collection - treatment technology - discharge Liquid Waste Management Systems: - collection - storage - processing - financing - minimisation - reuse? Green Infrastructure Storm Water Systems	Enforce regulations industrial waste disposal.	Not Applicable	Not applicable	Awareness raising campaigns targeting relevant industries/activities.	Curricula development for relevant education in primary and secondary schools. Importance of environmentally sound industrial production. Importance of integrated management (upstream / downstream).
4	04	Industrial pollution of waterways and open ground.	ICARM ensuring linkage between catchment management and coastal management. Coordination among stakeholders in addressing riverine pollution.	Land uses in catchment and its impacts on water resources included in IWRM planning; To the extent that solid waste origin from upstream activities.	Industry zoning in catchments.	Not applicable	Review of management of industrial wastes in upstream and ground waters.	Not Applicable	Information Management: - Monitoring waste generation, disposal and management - Monitoring sources of industrial waste, its disposal and impact in recipient environment Capacity among: - Relevant government departments at national and local levels - Guidelines	Waste water treatment systems: - collection - treatment technology - discharge Solid Waste Management Systems: - collection - storage - processing - financing - minimisation - reuse? Green Infrastructure Storm Water Systems	Enforce regulations industrial waste disposal.	Not Applicable	Not applicable	Awareness raising campaigns targeting relevant industries/activities.	Curricula development for relevant education in primary and secondary schools. Importance of environmentally sound industrial production. Importance of integrated management (upstream / downstream).
2	02	Lack of coordination of the choice of location of new industries (underlines the need for integrated planning).	Not applicable	Not applicable	Industry zoning included in coastal land use management plans.	Not applicable	Not Applicable	Not Applicable	Strengthen institutional capacity and financial management.	Develop coordination framework.	Not Applicable	Not Applicable	Not applicable	Not applicable	Not applicable
1	01	Air emission leading to air pollution.	not applicable	Not applicable	Industry zoning.	Not applicable	Emission treatment system needs to be put in place.	Not Applicable	Information Management: - Monitoring waste generation, disposal and management - Monitoring sources of industrial air emission and impact in recipient environment Capacity among: - Relevant government departments at national and local levels - Guidelines	Air emission treatment systems: technology	Enforce existing laws related to air pollution.	Not Applicable	Not applicable	Awareness raising campaigns targeting relevant industries/activities.	Curricula development for relevant education in primary and secondary schools. Importance of environmentally sound industrial production. Importance of integrated management (upstream / downstream).

Ports and Harbours

Table 181: Broad assessment of measures to mitigate threats associated with ports and harbours to local coastal communities and ecosystems in mainland Tanzania.

RV	Themes	Threat	ICZM	IWRM	Land Use Management	Shoreline Management Planning	Solid and Liquid Waste Management	Sanitation	Capacity building	Technology	Law enforcement	Legal Review	Alternative/Improved Livelihood	Awareness raising	Education
2	Ports and Harbours	Inefficient operation at Dar es Salaam port leading to loss of economic competitiveness (compared to other ports e.g. Mombasa) by increasing the costs of import/export to/from global markets.	Not applicable	Not applicable	Not applicable	Not applicable	Not Applicable	Not Applicable	Strengthen institutional capacity, TPA.	Improve efficiency.	Not Applicable	Not Applicable	Not applicable	Not applicable	Not applicable
2	Ports and Harbours	Inadequate compensation for land for port expansion at Dar es Salaam, Mtwara, Mwamabni (Tanga) and Bagamoyo.	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Enforce relevant national and regional laws and commitments with respect to land acquisition.	Review criteria for land valuation.	Not applicable	Not applicable	Not applicable
2	Ports and Harbours	Inadequate environmental mitigation during port expansion at Mtwara, Mwamabni (Tanga) and Bagamoyo, leading to environmental degradation e.g. siltation of reefs.	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Strengthen institutional capacity of regulators.	Not applicable	Enforce relevant national and regional laws and commitments with respect to land acquisition and ESIA process.	Not applicable	Not applicable	Not applicable	Not applicable
1	Ports and Harbours	Erosion of shorelines adjacent to some secondary ports: Kilindoni (Mafia), Lindi, Rushungi, Kilwa Kivinje and Kilwa Masoko ports.	ICZM is an important tool in addressing the complex requirements to address unsustainable resources usage. Implications at and between all management levels.	Upstream catchment management influences hydrology and sediment flow and may thus interfere with erosion accretion patterns along the coast. Catchment and coast management needs to be coordinated. IWRM is the appropriate tool such management in the catchment but needs to incorporate coastal concerns (ICZM)	Zoning of beaches to be included in Land Use Plans, providing regulations and guidelines for land use. Ideally to be informed from Shoreline Management Planning efforts. Regulations may define types of use as well as set back arrangements. Guidelines may also cover coral reef, seagrass and mangrove management to the extent of importance to beach erosion.	An understanding of processes and factors behind erosion and accretion along the Tanzanian coast is required. Such an understanding can be attained through a structural effort in Shoreline Management Planning which can then inform Spatial Planning at local level. First step is to identify sediment cells along the coast based on littoral drift considerations, next step to identify management units within these cells based on environment, economic and socio-economic consideration.	Not Applicable	Not Applicable	District level capacity building related to ICZM and in particular shoreline management.	Beach protection technologies, from engineering (groynes, etc.) to soft (beach nourishment) solutions and green technologies (mangrove planting, other shoreline vegetation).	Enforce existing laws related to resources exploitation sand mining and construction near shore (set back provisions).	Establish required regulations, bylaws and guidelines to ensure sustainable and safe development along near the sea. Informed by shoreline management study.	Provide alternatives to current destructive and unsustainable livelihood practises related to mangrove exploitation and fisheries in particular.	The impact of unsustainable resources usage on beach erosion highlighted in awareness raising campaigns. Services of mangroves and corals in protecting against erosive forces (targeting resource users). Impact of physical structures along the coast on shorelines included in awareness raising campaigns (targeting developers and planners)	Curricula development for relevant education in primary and secondary schools. Importance of beaches.
1	Ports and Harbours	Pollution arising from port activities and traffic.	Coordination among stakeholders in addressing harbour industry pollution.	Not applicable	Harbour included in zoning and development of associated regulations	Identifying management units requiring local management arrangements.	Waste collection, storage and processing system needs to be put in place.	Not Applicable	Information Management: - Monitoring waste generation, disposal and management - Monitoring sources of industrial waste, its disposal and impact in recipient environment Capacity among: - Relevant government departments at national and local levels - Guidelines	Waste water treatment systems: - collection - treatment technology - discharge Solid Waste Management Systems: - collection - storage - processing - financing - minimisation - reuse? Green Infrastructure Storm Water Systems	Enforce existing laws related to waste disposal	Not Applicable	Not Applicable	Awareness raising campaigns: - public at large - schools - industry Impact of pollution on environment and health Pollution pathways and waste management. Upstream/downstream.	Curricula development for relevant education in primary and secondary schools. Importance of beaches. Pollution, environment, health. Waste minimisation and recycling.

Infrastructure

Table 182: Broad assessment of measures to mitigate threats associated with infrastructure to local coastal communities and ecosystems in mainland Tanzania.

RV	Themes	Threat	ICZM	IWRM	Land Use Management	Shoreline Management Planning	Solid and Liquid Waste Management	Sanitation	Capacity building	Technology	Law enforcement	Legal Review	Alternative/Improved Livelihood	Awareness raising	Education
4	1	Poor infrastructure management leading to poor or biased choices for development, for example, promoting road transport at the expenses of developing railways.	Not applicable	Not applicable	Develop infrastructure plans.	Not applicable	Not Applicable	Not Applicable	Strengthen institutional capacity for land use planning at ministry and LGA levels.	Develop coordination framework.	Not Applicable	Strengthen legal framework.	Not applicable	Not applicable	Not applicable
4	2	Inadequate infrastructure management unable to maintain supply of services (electricity, transport, water supply, health and education services and ICT) to coastal regions, resulting in a deterioration of living standards, business development and prosperity.	Not applicable	Not applicable	Not applicable	Not applicable	Not Applicable	Not Applicable	Strengthen institutional capacity for land use planning at ministry and LGA levels.	Develop coordination framework.	Not Applicable	Strengthen legal framework.	Not applicable	Not applicable	Not applicable
4	3	Weak Implementation of Environmental Legislation (Inception Meeting Addition)							Strengthen institutional capacity for land use planning at ministry and LGA levels.		Enforce existing laws related to environmental legislation.			Awareness raising campaigns targeting relevant industries/activities.	Not applicable

Urbanisation

Table 183: Broad assessment of measures to mitigate threats associated with urbanisation to local coastal communities and ecosystems in mainland Tanzania.

RV	#	Threat	ICZM	IWRM	Land Use Management	Shoreline Management Planning	Solid and Liquid Waste Management	Sanitation	Capacity building	Technology	Law enforcement	Legal Review	Alternative/Improved Livelihood	Awareness raising	Education
4	1	Inadequate solid waste management causing pollution of the landscape, watersheds and the coast.	ICZM is an important tool in addressing the complex requirements to address unsustainable resources usage. Implications at and between all management levels. Catchment and coast management needs to be coordinated. IWRM is the appropriate tool such management in the catchment but needs to incorporate coastal concerns (ICZM).	not applicable	Zoning of beaches to be included in Land Use Plans, providing regulations and guidelines for land use. Ideally to be informed from Shoreline Management Planning efforts. Regulations may define types of use as well as set back arrangements. Guidelines may also cover coral reef, seagrass and mangrove management to the extent of importance to beach erosion.	An understanding of processes and factors behind erosion and accretion along the Tanzanian coast is required. Such an understanding can be attained through a structural effort in Shoreline Management Planning which can then inform Spatial Planning at local level. First step is to identify sediment cells along the coast based on littoral drift considerations, next step to identify management units within these cells based on environment, economic and socio-economic considerations.	Waste collection, storage and processing system needs to be put in place.	- Identify and quantify sources of liquid waste as basis for solution	Information Management: - Monitoring forest reserves - Monitoring forest reserve exploitation Capacity among: - Relevant government departments at national and local levels - BMUs	Waste water treatment systems: - collection - treatment technology - discharge Solid Waste Management Systems: - collection - storage - processing - financing - minimisation - reuse?	Enforce existing laws related to waste disposal	Not Applicable	Not applicable	Awareness raising campaigns: - public at large - schools - stakeholders benefitting from beaches (tourism operators, hotels, fishermen, etc.) - tourists	not applicable
4	2	Youth Unemployment (Inception Meeting Addition)	Not applicable	Not applicable	Not applicable	Not applicable	Not Applicable	Not Applicable	District level capacity building related to youth employment in particular.	Vocational training for youth.	Not Applicable	Not Applicable	Provide alternatives to current destructive and unsustainable livelihood practises related to mangrove exploitation and fisheries in particular. Promote private sector investment to create jobs.	Not applicable	Curricula development for relevant education in primary and secondary schools. Sustainable development in areas under high demographic and economic development pressure (coastal areas, urban areas). Importance of coasts and coastal habitats and resources.
3	3	Poor urban management leading to overcrowding informal settlements that lack clean water and adequate sanitation, leading to increase health and well-being problems from contaminated water and from mosquitos and other pests that thrive in unsanitary environments.	ICZM is an important tool in addressing the complex requirements to address unsustainable resources usage. Implications at and between all management levels. Catchment and coast management needs to be coordinated. IWRM is the appropriate tool such management in the catchment but needs to incorporate coastal concerns (ICZM).	not applicable	Zoning of beaches to be included in Land Use Plans, providing regulations and guidelines for land use. Ideally to be informed from Shoreline Management Planning efforts. Regulations may define types of use as well as set back arrangements. Guidelines may also cover coral reef, seagrass and mangrove management to the extent of importance to beach erosion.	An understanding of processes and factors behind erosion and accretion along the Tanzanian coast is required. Such an understanding can be attained through a structural effort in Shoreline Management Planning which can then inform Spatial Planning at local level. First step is to identify sediment cells along the coast based on littoral drift considerations, next step to identify management units within these cells based on environment, economic and socio-economic considerations.	Waste collection, storage and processing system needs to be put in place.	- Identify and quantify sources of liquid waste as basis for solution	Information Management: - Monitoring forest reserves - Monitoring forest reserve exploitation Capacity among: - Relevant government departments at national and local levels - BMUs	Waste water treatment systems: - collection - treatment technology - discharge Solid Waste Management Systems: - collection - storage - processing - financing - minimisation - reuse?	Enforce existing laws related to waste disposal	Not Applicable	Not applicable	Awareness raising campaigns: - public at large - schools - stakeholders benefitting from beaches (tourism operators, hotels, fishermen, etc.) - tourists	not applicable
3	4	Encroachment into coastal habitats from urban expansion	ICZM is an important tool in addressing the complex requirements to address unsustainable resources usage. Implications at and between all management levels. Catchment and coast management needs to be coordinated. IWRM is the appropriate tool such management in the catchment but needs to incorporate coastal concerns (ICZM).	Not applicable	Zoning of beaches to be included in Land Use Plans, providing regulations and guidelines for land use. Ideally to be informed from Shoreline Management Planning efforts. Regulations may define types of use as well as set back arrangements. Guidelines may also cover coral reef, seagrass and mangrove management to the extent of importance to beach erosion.	An understanding of processes and factors behind erosion and accretion along the Tanzanian coast is required. Such an understanding can be attained through a structural effort in Shoreline Management Planning which can then inform Spatial Planning at local level. First step is to identify sediment cells along the coast based on littoral drift considerations, next step to identify management units within these cells based on environment, economic and socio-economic considerations.	Not Applicable	Not Applicable	Information Management: - Monitoring forest reserves - Monitoring forest reserve exploitation Capacity among: - Relevant government departments at national and local levels - BMUs	Not Applicable	Enforce existing laws related to resources exploitation sand mining and construction near shore (set back provisions).	Not Applicable	Not applicable	Not applicable	Not applicable
3	5	Increasing vehicular/pedestrian congestion, conflicts and air pollution.	Not applicable	Not applicable	Review and update of spatial plans including vehicle transport zoning to guide development planning and development control.	Not applicable	Not applicable	Not applicable	District level capacity building related to: - Spatial Planning - Traffic flow.	Strengthen enforcement of traffic laws and vehicle behaviour.	Enforce existing laws related to traffic.	Not Applicable	Not applicable	Awareness raising campaigns: - public at large - schools - road users.	Curricula development for relevant education in primary and secondary schools. Sustainable development in areas under high demographic and economic development pressure (coastal areas, urban areas). Importance of coasts and coastal habitats and resources.
2	6	Failure of housing for the youth and children exposing them to human predators, violence, abuse and sexual assault that increase their risk of HIV infection.	not applicable	not applicable	not applicable	not applicable	not applicable	not applicable	Capacity among: - Relevant government departments at national and local levels to support child care.	not applicable	Enforce existing laws related to child welfare.	not applicable	not applicable	Awareness raising campaigns: - public at large - schools - staon human rights.	not applicable

Non-Renewable Extractive Industry – Hydrocarbons

Table 184: Broad assessment of measures to mitigate threats associated with hydrocarbons to local coastal communities and ecosystems in mainland Tanzania.

RV	#	Threat	ICZM	IWRM	Land Use Management	Shoreline Management Planning	Solid and Liquid Waste Management	Sanitation	Capacity building	Technology	Law enforcement	Legal Review	Alternative/Improved Livelihood	Awareness raising	Education
4	1	Degradation of the natural marine and coastal environment and thus impact on livelihoods, from failure of exploration companies to adhere to environmental and socio-economic safeguards, partly due to weakness in the oversight provided by The National Environment management Council (NEMC) is responsible for issuing licences and monitoring the operations that have been subjected to EIAs.	Coordination among stakeholders (including TPDC, exploration companies, NEMC, NGOS, etc.) in addressing coastal environmental issues.	Not applicable	Not applicable	Identifying management units requiring local management arrangements.	Not Applicable	Not Applicable	Strengthen regulator NEMC capacity;	Use of remote sensing technology to monitor offshore operations and tracks developments.	Enforce existing laws and international agreements (e.g. Ramsar) related to exploration and development.	Not Applicable	Not applicable	Maintain public and other stakeholders informed of developments and risks.	Not applicable
4	2	Piracy attacks against offshore operations.	not applicable	Not applicable	Not applicable	Not applicable	Not Applicable	Not Applicable	Strengthen maritime security forces, information sharing and monitoring;	Use of remote sensing technology to track pirate movements.	Not Applicable	Strengthen courts handling piracy cases.	Not applicable	Not applicable	Not applicable
3	3	Social and/or political unrest related to behaviour of the Government and stakeholders.	not applicable	Not applicable	Not applicable	Not applicable	Not Applicable	Not Applicable	Not Applicable	Information sharing;	Enforce relevant existing laws.	Not Applicable	Not applicable	Awareness raising campaigns targeting relevant industries/activities; improved transparency.	Not applicable
2	4	Damage to infrastructure and environment from engineering design failure.	not applicable	Not applicable	Not applicable	Not applicable	Not Applicable	Not Applicable	Strengthen regulator capacity;	Not Applicable	Enforce design standards are met.	Not Applicable	Not applicable	Not applicable	Not applicable

Non-Renewable Extractive Industry – Coastal Sand and Rock Mining

Table 185: Broad assessment of measures to mitigate threats associated with sand and rock mining to local coastal communities and ecosystems in mainland Tanzania.

RV	Themes	Threat	ICZM	IWRM	Land Use Management	Shoreline Management Planning	Solid and Liquid Waste Management	Sanitation	Capacity building	Technology	Law enforcement	Legal Review	Alternative/Improved Livelihood	Awareness raising	Education
4	1	Poor management of shores (e.g. coastal developments) and river basins, lack of understanding of coastal erosion causative factors and sustainable mitigation/adaptation measures leading to loss of shoreline due to coastal erosion.	ICZM is an important tool in addressing the complex requirements to address unsustainable resources usage. Implications at and between all management levels. Catchment and coast management needs to be coordinated. IWRM is the appropriate tool such management in the catchment but needs to incorporate coastal concerns (ICZM).	Link IWRM to coastal integrated planning ensuring upstream/downstream considerations.	Zoning of beaches to be included in Land Use Plans, providing regulations and guidelines for land use. Ideally to be informed from Shoreline Management Planning efforts. Regulations may define types of use as well as set back arrangements. Guidelines may also cover coral reef, seagrass and mangrove management to the extent of importance to beach erosion.	An understanding of processes and factors behind erosion and accretion along the Tanzanian coast is required. Such an understanding can be attained through a structural effort in Shoreline Management Planning which can then inform Spatial Planning at local level. First step is to identify sediment cells along the coast based on littoral drift considerations, next step to identify management units within these cells based on environment, economic and socio-economic considerations.	Not Applicable	Not Applicable	Information Management: - Monitoring forest reserves - Monitoring forest reserve exploitation Capacity among: - Relevant government departments at national and local levels - BMUs	Beach protection technologies, from engineering (groynes, etc.) to soft (beach nourishment) solutions and green technologies (mangrove planting, other shoreline vegetation).	Enforce existing laws related to resources exploitation sand mining and construction near shore (set back provisions).	Establish required regulations, bylaws and guidelines to ensure sustainable and safe development along near the sea. Informed by shoreline management study.	Provide alternatives to current destructive and unsustainable livelihood practises related to mangrove exploitation and fisheries in particular.	The impact of unsustainable resources usage on beach erosion highlighted in awareness raising campaigns. Services of mangroves and corals in protecting against erosive forces (targeting resource users). Impact of physical structures along the coast on shorelines included in awareness raising campaigns (targeting developers and planners)	Curricula development for relevant education in primary and secondary schools. Importance of beaches.
3	2	Corrupt and uncoordinated institutional enforcement of mining policy to protect the natural environment, particularly rivers and coastline.	ICZM is an important tool in addressing the complex requirements to address unsustainable resources usage. Implications at and between all management levels. Catchment and coast management needs to be coordinated. IWRM is the appropriate tool such management in the catchment but needs to incorporate coastal concerns (ICZM).	Link IWRM to coastal integrated planning ensuring upstream/downstream considerations.	Zoning of beaches to be included in Land Use Plans, providing regulations and guidelines for land use. Ideally to be informed from Shoreline Management Planning efforts. Regulations may define types of use as well as set back arrangements. Guidelines may also cover coral reef, seagrass and mangrove management to the extent of importance to beach erosion.	An understanding of processes and factors behind erosion and accretion along the Tanzanian coast is required. Such an understanding can be attained through a structural effort in Shoreline Management Planning which can then inform Spatial Planning at local level. First step is to identify sediment cells along the coast based on littoral drift considerations, next step to identify management units within these cells based on environment, economic and socio-economic considerations.	Not Applicable	Not Applicable	Not Applicable	not Applicable	Enforce existing laws related to resources exploitation sand mining and construction near shore (set back provisions).	Establish required regulations, bylaws and guidelines to ensure sustainable and safe development along near the sea. Informed by shoreline management study.	Provide alternatives to current destructive and unsustainable livelihood practises related to mangrove exploitation and fisheries in particular.	The impact of unsustainable resources usage on beach erosion highlighted in awareness raising campaigns. Services of mangroves and corals in protecting against erosive forces (targeting resource users). Impact of physical structures along the coast on shorelines included in awareness raising campaigns (targeting developers and planners)	Curricula development for relevant education in primary and secondary schools. Importance of beaches.
3	3	Anarchistic sand and rock extraction from coastal zone resulting in increased erosion.	ICZM is an important tool in addressing the complex requirements to address unsustainable resources usage. Implications at and between all management levels. Catchment and coast management needs to be coordinated. IWRM is the appropriate tool such management in the catchment but needs to incorporate coastal concerns (ICZM).	Link IWRM to coastal integrated planning ensuring upstream/downstream considerations.	Zoning of beaches to be included in Land Use Plans, providing regulations and guidelines for land use. Ideally to be informed from Shoreline Management Planning efforts. Regulations may define types of use as well as set back arrangements. Guidelines may also cover coral reef, seagrass and mangrove management to the extent of importance to beach erosion.	An understanding of processes and factors behind erosion and accretion along the Tanzanian coast is required. Such an understanding can be attained through a structural effort in Shoreline Management Planning which can then inform Spatial Planning at local level. First step is to identify sediment cells along the coast based on littoral drift considerations, next step to identify management units within these cells based on environment, economic and socio-economic considerations.	Not Applicable	Not Applicable	Information Management: - Monitoring forest reserves - Monitoring forest reserve exploitation Capacity among: - Relevant government departments at national and local levels - BMUs	Beach protection technologies, from engineering (groynes, etc.) to soft (beach nourishment) solutions and green technologies (mangrove planting, other shoreline vegetation).	Enforce existing laws related to resources exploitation sand mining and construction near shore (set back provisions).	Establish required regulations, bylaws and guidelines to ensure sustainable and safe development along near the sea. Informed by shoreline management study.	Provide alternatives to current destructive and unsustainable livelihood practises related to sand extraction in particular.	The impact of unsustainable resources usage on beach erosion highlighted in awareness raising campaigns. Services of mangroves and corals in protecting against erosive forces (targeting resource users). Impact of physical structures along the coast on shorelines included in awareness raising campaigns (targeting developers and planners)	Curricula development for relevant education in primary and secondary schools. Importance of beaches.
3	4	Loss of river basin habitat from un-regulated sand extraction.	ICZM is an important tool in addressing the complex requirements to address unsustainable resources usage. Implications at and between all management levels. Catchment and coast management needs to be coordinated. IWRM is the appropriate tool such management in the catchment but needs to incorporate coastal concerns (ICZM).	Link IWRM to coastal integrated planning ensuring upstream/downstream considerations.	Zoning of beaches to be included in Land Use Plans, providing regulations and guidelines for land use. Ideally to be informed from Shoreline Management Planning efforts. Regulations may define types of use as well as set back arrangements. Guidelines may also cover coral reef, seagrass and mangrove management to the extent of importance to beach erosion.	An understanding of processes and factors behind erosion and accretion along the Tanzanian coast is required. Such an understanding can be attained through a structural effort in Shoreline Management Planning which can then inform Spatial Planning at local level. First step is to identify sediment cells along the coast based on littoral drift considerations, next step to identify management units within these cells based on environment, economic and socio-economic considerations.	Not Applicable	Not Applicable	Information Management: - Monitoring forest reserves - Monitoring forest reserve exploitation Capacity among: - Relevant government departments at national and local levels - BMUs	Beach protection technologies, from engineering (groynes, etc.) to soft (beach nourishment) solutions and green technologies (mangrove planting, other shoreline vegetation).	Enforce existing laws related to resources exploitation sand mining and construction near shore (set back provisions).	Establish required regulations, bylaws and guidelines to ensure sustainable and safe development along near the sea. Informed by shoreline management study.	Provide alternatives to current destructive and unsustainable livelihood practises related to sand extraction in particular.	The impact of unsustainable resources usage on beach erosion highlighted in awareness raising campaigns. Services of mangroves and corals in protecting against erosive forces (targeting resource users). Impact of physical structures along the coast on shorelines included in awareness raising campaigns (targeting developers and planners)	Curricula development for relevant education in primary and secondary schools. Importance of beaches.
3	5	Loss of beach habitats for turtle nesting.	ICZM is an important tool in addressing the complex requirements to address unsustainable resources usage. Implications at and between all management levels. Catchment and coast management needs to be coordinated. IWRM is the appropriate tool such management in the catchment but needs to incorporate coastal concerns (ICZM).	Not applicable	Not applicable	Designated turtle nesting beaches to be integrated into SMP, with emphasis on beach condition, set-back distances, lighting and infrastructure, as well as human disturbance.	Not Applicable	Not Applicable	Not Applicable	Track turtle movements/nesting season/sites to improve avoidance.	Enforce existing laws related to turtle protection.	Not Applicable	Not applicable	Improve awareness about turtle protection status.	Curricula development for relevant education in primary and secondary schools. Importance of beaches for turtles.

RV	Themes	Threat	ICZM	IWRM	Land Use Management	Shoreline Management Planning	Solid and Liquid Waste Management	Sanitation	Capacity building	Technology	Law enforcement	Legal Review	Alternative/Improved Livelihood	Awareness raising	Education
2	6	Destruction of reef protection services from removal of live coral, threatening coastal infrastructure, farmland, villages and fisheries resources.	Coordination among stakeholders in addressing fisheries decline. Guidelines for best practices in mangrove management. Guidelines for best practises in fisheries. Guidelines for best practises in coral reef management. Guidelines to be based on outcome of legal review.	Not applicable	Mangroves and other habitats of importance (including seagrass areas and coral reefs) for fisheries included in land use information management systems and incorporated into spatial planning.	Identifying management units requiring local management arrangements.	Not Applicable	Not Applicable	Information Management: - Monitoring occurrences of illegal fisheries - Monitoring fishing practises - Monitoring fisheries catches - Monitoring fisheries resources - Monitoring fisheries habitats (mangroves, coral reefs) Capacity among: - Relevant government departments at national and local levels - BMUs	Offshore fisheries Aquaculture; Add value to existing harvest.	Enforce existing laws related to fisheries. Enforce existing laws related to mangrove exploitation. Enforce existing laws related to coral mining.	Review appropriateness of fisheries regulations in relation to local conditions, environment, species and gears. Establish local zoning and fishing effort seasonality.	Provide alternatives to current destructive and unsustainable livelihood practises related to fisheries. - Emphasis on young generation	Awareness raising campaigns: - public at large - schools - stakeholders benefitting from fisheries (fishing communities, middlemen, hotels and restaurants)	Curricula development for relevant education in primary and secondary schools. - Sustainable Fisheries. - Fisheries ecology.
2	7	Reduced coastal sand recharge from rivers due to over-extraction of river sand.	ICZM is an important tool in addressing the complex requirements to address unsustainable resources usage. Implications at and between all management levels. Catchment and coast management needs to be coordinated. IWRM is the appropriate tool such management in the catchment but needs to incorporate coastal concerns (ICZM).	Link IWRM to coastal integrated planning ensuring upstream/downstream considerations.	Zoning of beaches to be included in Land Use Plans, providing regulations and guidelines for land use. Ideally to be informed from Shoreline Management Planning efforts. Regulations may define types of use as well as set back arrangements. Guidelines may also cover coral reef, seagrass and mangrove management to the extent of importance to beach erosion.	An understanding of processes and factors behind erosion and accretion along the Tanzanian coast is required. Such an understanding can be attained through a structural effort in Shoreline Management Planning which can then inform Spatial Planning at local level. First step is to identify sediment cells along the coast based on littoral drift considerations, next step to identify management units within these cells based on environment, economic and socio-economic considerations.	Not Applicable	Not Applicable	Information Management: - Monitoring forest reserves - Monitoring forest reserve exploitation Capacity among: - Relevant government departments at national and local levels - BMUs	Beach protection technologies, from engineering (groynes, etc.) to soft (beach nourishment) solutions and green technologies (mangrove planting, other shoreline vegetation).	Enforce existing laws related to resources exploitation sand mining and construction near shore (set back provisions).	Establish required regulations, bylaws and guidelines to ensure sustainable and safe development along near the sea. Informed by shoreline management study.	Provide alternatives to current destructive and unsustainable livelihood practises related to mangrove exploitation and fisheries in particular.	The impact of unsustainable resources usage on beach erosion highlighted in awareness raising campaigns. Services of mangroves and corals in protecting against erosive forces (targeting resource users). Impact of physical structures along the coast on shorelines included in awareness raising campaigns (targeting developers and planners)	Curricula development for relevant education in primary and secondary schools. Importance of beaches.
2	8	Increase in water born diseases from quarries that fill with rainwater.	ICZM is an important tool in addressing the complex requirements to address unsustainable resources usage. Implications at and between all management levels. Catchment and coast management needs to be coordinated. IWRM is the appropriate tool such management in the catchment but needs to incorporate coastal concerns (ICZM).	Land uses in catchment and its impacts on water resources included in IWRM planning; to the extent that disease vectors origin from upstream activities	Infrastructure development. Supply of sanitation and health services.	Not applicable	Waste collection, storage and processing system needs to be put in place.	Identify and quantify sources of liquid waste as basis for solution and develop sanitation systems accordingly	Environmental authorities Land use planners Information Management: - Monitoring waste generation, disposal and management - Monitoring sources of liquid waste, its disposal and impact in recipient environment Capacity among: - Relevant government departments at national and local levels - BMUs - Guidelines	Waste water treatment systems: - collection - treatment technology - discharge Solid Waste Management Systems: - collection - storage - processing - financing - minimisation - reuse? Green Infrastructure Storm Water Systems Technology for monitoring receiving environment.	Enforce existing laws related to waste disposal	Not Applicable	Not applicable	Awareness raising campaigns: - public at large - schools - stakeholders benefitting from beaches (tourism operators, hotels, fishermen, etc.) - tourists. Impact of pollution on environment and health Pollution pathways and waste management. Upstream/downstream.	Curricula development for relevant education in primary and secondary schools. Importance of environmentally sound agriculture production. Importance of integrated management (upstream / downstream). Importance of marine environment. Pollution, environment, health. Waste minimisation and recycling.
1	9	Economic losses through tourist abandonment	Not applicable	Not applicable	Not applicable	Not applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Enforce existing laws related to marine resources exploitation.	Not Applicable	Not applicable	Awareness raising campaigns: - public at large - schools - stakeholders benefitting from beaches (tourism operators, hotels, fishermen, etc.) - tourists.	Curricula development for relevant education in primary and secondary schools. Importance of environmentally sound agriculture production. Importance of integrated management (upstream / downstream). Importance of marine environment. Pollution, environment, health. Waste minimisation and recycling.

RV	Themes	Threat	ICZM	IWRM	Land Use Management	Shoreline Management Planning	Solid and Liquid Waste Management	Sanitation	Capacity building	Technology	Law enforcement	Legal Review	Alternative/Improved Livelihood	Awareness raising	Education
1	10	Loss of coastal aesthetics	ICZM is an important tool in addressing the complex requirements to address unsustainable resources usage. Implications at and between all management levels. Catchment and coast management needs to be coordinated. IWRM is the appropriate tool such management in the catchment but needs to incorporate coastal concerns (ICZM).	Not applicable	Not applicable	Not applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Enforce existing laws related to marine resources exploitation.	Not Applicable	Not applicable	Awareness raising campaigns: - public at large - schools - stakeholders benefitting from beaches (tourism operators, hotels, fishermen, etc.) - tourists. Impact of pollution on environment and health Pollution pathways and waste management.	Curricula development for relevant education in primary and secondary schools. Importance of environmentally sound agriculture production. Importance of integrated management (upstream / downstream). Importance of marine environment. Pollution, environment, health. Waste minimisation and recycling.
1	11	Shallow freshwater table contamination from poor citing of rock quarries.	ICARM ensuring linkage between catchment management and coastal management.	Rock quarrying management and catchment land uses addressed in integrated water resources management planning. Link IWRM to coastal integrated planning ensuring upstream/downstream considerations.	Zoning in spatial plans providing guidance for land uses and for development control addressing water resources problems arising from unsustainable land uses.	Not applicable	Not Applicable	Not Applicable	Environmental authorities Land use planners Agriculture extension Information Management: - Monitoring land uses	Agriculture / forestry technologies sustaining recharge of aquifers; rain harvest.	Enforce existing laws (especially ESIA's) related to mining and freshwater.	Not Applicable	Not applicable	Awareness raising campaigns: - public at large - schools on water management and need to conserve water and avoid waste/leaks.	Curricula development for relevant education in primary and secondary schools. - Coastal forest ecology - Coastal forest management; - Hydrologic cycle

Non-Renewable Extractive Industry – Salt Production from Evaporation of Sea Water

Table 186: Broad assessment of measures to mitigate threats associated with salt production to local coastal communities and ecosystems in mainland Tanzania.

RV	#	Threat	ICZM	IWRM	Land Use Management	Shoreline Management Planning	Solid and Liquid Waste Management	Sanitation	Capacity building	Technology	Law enforcement	Legal Review	Alternative/Improved Livelihood	Awareness raising	Education
3	1	Lack of government support with infrastructure (e.g. roads) and land ownership, and corruption.	Coordination among stakeholders in addressing salt pan management. Mangrove forest reserve management plans.	Not applicable	Salt pans included in zoning and development of associated regulations	Identifying management units requiring local management arrangements.	Not Applicable	Not Applicable	Information Management: - Monitoring forest reserves - Monitoring forest reserve exploitation Capacity among: - Relevant government departments at national and local levels - BMUs	Not Applicable	Enforce existing laws related to coastal forest exploitation.	Revise applicable legislation and streamline salt production laws.	Not Applicable	not applicable	Not applicable
3	2	Unsustainable practices resulting in degradation of mangrove forests for ponds and timber (for boiling salt water), causing losses to the wider environment with respect to shelter from wave action (erosion) to fisheries production.	Coordination among stakeholders in addressing salt pan management. Mangrove forest reserve management plans.	Not applicable	Forest reserves and forests included in land use information management systems and incorporated into spatial planning.	Identifying management units requiring local management arrangements.	Not Applicable	Not Applicable	Information Management: - Monitoring forest reserves - Monitoring forest reserve exploitation Capacity among: - Relevant government departments at national and local levels	Best forest management practises Alternative livelihood technologies Alternatives to coastal forest wood usage for salt.	Enforce existing laws related to coastal forest exploitation.	Not Applicable	Provide alternatives to current destructive and unsustainable livelihood practises related to coastal forests, particularly fuel wood and other resources.	Awareness raising campaigns: - public at large - schools - stakeholders benefiting from mangrove services and products	Curricula development for relevant education in primary and secondary schools. - Coastal forest ecology - Coastal forest management
3	3	Sea level rise threatening infrastructure (dykes and buildings, etc.).	Coordination among stakeholders in addressing salt pan management. Mangrove forest reserve management plans.	Not applicable	Salt pans included in zoning and development of associated regulations	Identifying management units requiring local management arrangements.	Not Applicable	Not Applicable	Not Applicable	Beach protection technologies, from engineering (groynes, etc.) to soft (beach nourishment) solutions and green technologies (mangrove planting, other shoreline vegetation).	Not Applicable	Not Applicable	Not applicable	Not applicable	Not applicable
2	4	Unplanned urbanization and land availability into which to expand (in some areas).	Coordination among stakeholders in addressing salt pan management and coastal development in suitable sat pan areas. Mangrove forest reserve management plans.	Not applicable	Salt pans included in zoning and development of associated regulations	Identifying management units requiring local management arrangements.	Not Applicable	Not Applicable	Information Management: - Monitoring forest reserves - Monitoring forest reserve exploitation Capacity among: - Relevant government departments at national and local levels	Strengthen/modernise spatial planning tools (GIS, remote imageries); add value to existing salt harvest.	Enforce existing laws related to coastal forest exploitation, land development.	Not Applicable	Not Applicable	not applicable	Not applicable
1	5	Loss of suitable habitat for artisanal (non-pump) and industrial systems into which to expand/adapt, particularly with respect to land and availability of clay to construct dykes.	Coordination among stakeholders in addressing mangrove forest and salt pan management. Mangrove forest reserve management plans.	Not applicable	Salt pans included in zoning and development of associated regulations	Identifying management units requiring local management arrangements.	Not Applicable	Not Applicable	Information Management: - Monitoring forest reserves - Monitoring forest reserve exploitation Capacity among: - Relevant government departments at national and local levels - BMUs	Not Applicable	Not Applicable	Revise applicable legislation and streamline salt production laws	Not Applicable	not applicable	Not applicable
1	6	Local population IDD hazard from low iodisation of salt from small-scale producers in Mtwara and Lindi.	Not applicable	Not applicable	Not applicable	Not applicable	Not Applicable	Not Applicable	Not Applicable	Iodization.	Enforce existing laws related to addition of salt (if exists)	Review existing laws related to addition of salt.	Not applicable	Awareness raising campaigns: - public at large - schools - stakeholders benefiting from local salt - of the need for iodine.	Curricula development for relevant education in primary and secondary schools. Importance of iodized salt.

Natural Resources

Table 187: Broad assessment of measures to mitigate threats associated with natural resources to local coastal communities and ecosystems in mainland Tanzania.

RV	#	Threat	ICZM	IWRM	Land Use Management	Shoreline Management Planning	Solid and Liquid Waste Management	Sanitation	Capacity building	Technology	Law enforcement	Legal Review	Alternative/Improved Livelihood	Awareness raising	Education
4	1	Poor management of the shores (e.g. coastal developments) and lack of understanding of coastal erosion causative factors and sustainable mitigation/adaptation measures leading to loss of shoreline due to coastal erosion.	ICZM is an important tool in addressing the complex requirements to address unsustainable resources usage. Implications at and between all management levels. Catchment and coast management needs to be coordinated. IWRM is the appropriate tool such management in the catchment but needs to incorporate coastal concerns (ICZM).	Link IWRM to coastal integrated planning ensuring upstream/downstream considerations.	Zoning of beaches to be included in Land Use Plans, providing regulations and guidelines for land use. Ideally to be informed from Shoreline Management Planning efforts. Regulations may define types of use as well as set back arrangements. Guidelines may also cover coral reef, seagrass and mangrove management to the extent of importance to beach erosion.	An understanding of processes and factors behind erosion and accretion along the Tanzanian coast is required. Such an understanding can be attained through a structural effort in Shoreline Management Planning which can then inform Spatial Planning at local level. First step is to identify sediment cells along the coast based on littoral drift considerations, next step to identify management units within these cells based on environment, economic and socio-economic considerations.	Not Applicable	Not Applicable	Information Management: - Monitoring forest reserves - Monitoring forest reserve exploitation Capacity among: - Relevant government departments at national and local levels - BMUs	Beach protection technologies, from engineering (groynes, etc.) to soft (beach nourishment) solutions and green technologies (mangrove planting, other shoreline vegetation).	Enforce existing laws related to resources exploitation sand mining and construction near shore (set back provisions).	Establish required regulations, bylaws and guidelines to ensure sustainable and safe development along near the sea. Informed by shoreline management study.	Provide alternatives to current destructive and unsustainable livelihood practises related to mangrove exploitation and fisheries in particular.	The impact of unsustainable resources usage on beach erosion highlighted in awareness raising campaigns. Services of mangroves and corals in protecting against erosive forces (targeting resource users). Impact of physical structures along the coast on shorelines included in awareness raising campaigns (targeting developers and planners)	Curricula development for relevant education in primary and secondary schools. Importance of beaches.
4	2	Illegal (destructive) fishing (shallow water prawn trawling, beach seining and dynamite fishing), damaging seaweed, seagrass beds and coral reefs.	Coordination among stakeholders in addressing fisheries decline. Guidelines for best practises in mangrove management. Guidelines for best practises in fisheries. Guidelines for best practises in coral reef management. Guidelines to be based on outcome of legal review.	Not applicable	Mangroves and other habitats of importance (including seagrass areas and coral reefs) for fisheries included in land use information management systems and incorporated into spatial planning.	Identifying management units requiring local management arrangements.	Not Applicable	Not Applicable	Information Management: - Monitoring occurrences of illegal fisheries - Monitoring fishing practises - Monitoring fisheries catches - Monitoring fisheries resources - Monitoring fisheries habitats (mangroves, coral reefs) Capacity among: - Relevant government departments at national and local levels - BMUs	Offshore fisheries Aquaculture; Add value to existing harvest.	Enforce existing laws related to fisheries. Enforce existing laws related to mangrove exploitation. Enforce existing laws related to coral mining.	Review appropriateness of fisheries regulations in relation to local conditions, environment, species and gears. Establish local zoning and fishing effort seasonality.	Provide alternatives to current destructive and unsustainable livelihood practises related to fisheries. - Emphasis on young generation	Awareness raising campaigns: - public at large - schools - stakeholders benefiting from fisheries (fishing communities, middlemen, hotels and restaurants)	Curricula development for relevant education in primary and secondary schools. - Sustainable Fisheries. - Fisheries ecology.
3	3	Poor upstream agriculture increases sediment loads, increased turbidity and reduced photosynthesis, affecting seaweed and seagrass productivity.	ICZM is an important tool in addressing the complex requirements to address unsustainable resources usage. Implications at and between all management levels. Catchment and coast management needs to be coordinated. IWRM is the appropriate tool such management in the catchment but needs to incorporate coastal concerns (ICZM).	Link IWRM to coastal integrated planning ensuring upstream/downstream considerations.	Forest included in land use information management systems and incorporated into spatial planning.	Not applicable	Not Applicable	Not Applicable	District level capacity building related to: - Catchment management - Spatial Planning - Conflict resolution	Strengthen/modernise spatial planning tools (GIS, remote imageries); improved water source monitoring and agricultural techniques;	Enforce existing laws related to resources exploitation and water abstraction. Enforce development control measures according to updated spatial plans.	Establish required regulations, bylaws and guidelines to ensure sustainable and safe development in river catchments.	Not applicable	Awareness raising campaigns: - public at large - schools - stakeholders benefiting from beaches (tourism operators, hotels, fishermen, etc.) - tourists. Impact of pollution on environment and health Pollution pathways and waste management. Upstream/downstream.	Curricula development for relevant education in primary and secondary schools. Importance of environmentally sound agriculture production. Importance of integrated management (upstream / downstream). Importance of marine environment. Pollution, environment, health. Waste minimisation and recycling.
3	4	Coral bleaching from El Nino sea surface temperature rise damaging coral reefs	not applicable	not applicable	not applicable	not applicable	not applicable	not applicable	not applicable	not applicable	not applicable	not applicable	not applicable	not applicable	not applicable
2	5	Waste disposal, in solid and liquid form (pollution) causing harm to seagrass beds and estuaries where marine debris enters from storm sewers, or especially after heavy rains. Debris comes from many sources, including improper disposal of trash on land, storm water runoff and combined sewer overflows to rivers and streams, ships and other vessels.	Coordination among stakeholders in addressing beach pollution. Beach management guidelines	To the extent that solid and liquid waste origin from upstream activities	Beaches included in zoning and development of associated regulations	Identifying management units requiring local management arrangements.	Waste collection, storage and processing system needs to be put in place.	Identify and quantify sources of liquid waste as basis for solution	Information Management: - Monitoring waste generation, disposal and management - Monitoring sources of liquid waste, its disposal and impact in recipient environment Capacity among: - Relevant government departments at national and local levels - BMUs - Guidelines	Waste water treatment systems: - collection - treatment technology - discharge Solid Waste Management Systems: - collection - storage - processing - financing - minimisation - reuse?	Enforce existing laws related to waste disposal	Not Applicable	Not applicable	Awareness raising campaigns: - public at large - schools - stakeholders benefiting from beaches (tourism operators, hotels, fishermen, etc.) - tourists	Curricula development for relevant education in primary and secondary schools. Importance of environmentally sound industrial production. Importance of integrated management (upstream / downstream).

RV	#	Threat	ICZM	IWRM	Land Use Management	Shoreline Management Planning	Solid and Liquid Waste Management	Sanitation	Capacity building	Technology	Law enforcement	Legal Review	Alternative/Improved Livelihood	Awareness raising	Education
2	6	Coral mining for the lime industry significantly destructive to reef ecosystems, especially in Kilwa, Lindi and Mtwara districts.	Coordination among stakeholders in addressing fisheries decline. Guidelines for best practises in coral reef management.	Not applicable	Not applicable	Identifying management units requiring local management arrangements.	Not Applicable	Not Applicable	Capacity among: - Relevant government departments at national and local levels - BMUs	Offshore fisheries Aquaculture; Add value to existing harvest.	Enforce existing laws related to fisheries. Enforce existing laws related to coral mining.	Review appropriateness of fisheries regulations in relation to local conditions, environment, species and gears. Establish local zoning and fishing effort seasonality.	Provide alternatives to current destructive and unsustainable livelihood practises related to fisheries. - Emphasis on young generation	Awareness raising campaigns: - public at large - schools - stakeholders benefiting from fisheries (fishing communities, middlemen, hotels and restaurants)	Curricula development for relevant education in primary and secondary schools. - Sustainable Fisheries. - Fisheries ecology.
2	7	Habitat alteration such as the filling of marshes and tidal flats, and reconstruction of shorelines to accommodate the needs of development, transportation, and agriculture, can degrade estuaries.	ICZM is an important tool in addressing the complex requirements to address unsustainable resources usage. Implications at and between all management levels. Catchment and coast management needs to be coordinated. IWRM is the appropriate tool such management in the catchment but needs to incorporate coastal concerns (ICZM).	Link IWRM to coastal integrated planning ensuring upstream/downstream considerations.	Forest included in land use information management systems and incorporated into spatial planning.	Identifying management units requiring local management arrangements.	Not Applicable	Not Applicable	District level capacity building related to: - Catchment management - Spatial Planning - Conflict resolution	Strengthen/modernise spatial planning tools (GIS, remote imageries); improved water source monitoring;	Enforce existing laws related to resources exploitation, agrochemicals and water abstraction, and building codes. Enforce development control measures according to updated spatial plans.	Establish required regulations, bylaws and guidelines to ensure sustainable and safe development in river catchments.	Not applicable	Awareness raising campaigns: - public at large - schools - stakeholders benefiting from beaches (tourism operators, hotels, fishermen, etc.) - tourists. Impact of pollution on environment and health Pollution pathways and waste management. Upstream/downstream.	Curricula development for relevant education in primary and secondary schools. Importance of environmentally sound agriculture production. Importance of integrated management (upstream / downstream). Importance of marine environment. Pollution, environment, health. Waste minimisation and recycling.
2	8	Invasive Indian house crow causing loss of bird diversity through ferocious predation on eggs of local bird species thus threatening indigenous populations.	not applicable	not applicable	not applicable	not applicable	Waste collection, storage and processing system needs to be put in place.	not applicable	not applicable	Eradication program.	Not Applicable	Not Applicable	Not applicable	Awareness raising campaigns: - public at large - schools - tourists. on impacts and means to eradicate pest.	Not applicable
2	9	Seismic surveys by oil and gas companies deterring whales, especially migrating Humpback whales with calves.	Not applicable	Not applicable	Not applicable	Not applicable	Not Applicable	Not Applicable	Strengthen institutional capacity of regulators.	Track whale movements to improve avoidance.	Enforce relevant national and regional laws and commitments with respect to whales.	Review seismic survey permitting legislation on site specific basis, where whales occur.	Not applicable	Awareness raising campaigns: - oil and gas companies.	Not applicable
1	10	Tourist activities destroying seagrass beds and coral reefs (e.g. trampling when wading, boat anchorage).	Coordination among stakeholders in addressing fisheries decline. Guidelines for best practices in mangrove management. Guidelines for best practises in fisheries. Guidelines for best practises in coral reef management. Guidelines to be based on outcome of legal review.	Not applicable	Mangroves and other habitats of importance (including seagrass areas and coral reefs) for fisheries included in land use information management systems and incorporated into spatial planning.	Identifying management units requiring local management arrangements.	Not Applicable	Not Applicable	Information Management: - Monitoring occurrences of illegal fisheries - Monitoring fishing practises - Monitoring fisheries catches - Monitoring fisheries resources - Monitoring fisheries habitats (mangroves, coral reefs) Capacity among: - Relevant government departments at national and local levels - BMUs	Offshore fisheries Aquaculture; Add value to existing harvest.	Not Applicable	Establish local zoning.	Provide alternatives to current destructive and unsustainable tourism practises.	Awareness raising campaigns: - public at large - schools - stakeholders benefiting from marine resources (fishing communities, middlemen, hotels and restaurants)	Curricula development for relevant education in primary and secondary schools. - Sustainable Fisheries. - Fisheries ecology.
1	11	Pollution of coastal watersheds poses a threat to estuaries, entering waterways through storm drains, industrial discharges, runoff from farmlands, discharges from sewage treatment plants, being toxic or harmful to biological systems with long lasting effects, as well as having a negative visual impacts on estuarine environment.	ICARM ensuring linkage between catchment management and coastal management. Coordination among stakeholders in addressing riverine and beach pollution. Beach management guidelines	To the extent that solid and liquid waste origin from upstream activities	Beaches included in zoning and development of associated regulations	Identifying management units requiring local management arrangements.	Waste collection, storage and processing system needs to be put in place.	Identify and quantify sources of liquid waste as basis for solution	Information Management: - Monitoring waste generation, disposal and management - Monitoring sources of liquid waste, its disposal and impact in recipient environment Capacity among: - Relevant government departments at national and local levels - BMUs - Guidelines	Waste water treatment systems: - collection - treatment technology - discharge Solid Waste Management Systems: - collection - storage - processing - financing - minimisation - reuse?	Enforce existing laws related to waste disposal	Not Applicable	Not applicable	Awareness raising campaigns: - public at large - schools - stakeholders benefiting from beaches (tourism operators, hotels, fishermen, etc.) - tourists	Curricula development for relevant education in primary and secondary schools. Importance of beaches.

RV	#	Threat	ICZM	IWRM	Land Use Management	Shoreline Management Planning	Solid and Liquid Waste Management	Sanitation	Capacity building	Technology	Law enforcement	Legal Review	Alternative/Improved Livelihood	Awareness raising	Education
1	12	Marine pollution.	Coordination among stakeholders in addressing beach pollution. Beach management guidelines	To the extent that solid and liquid waste origin from upstream activities	Beaches included in zoning and development of associated regulations	Identifying management units requiring local management arrangements.	Waste collection, storage and processing system needs to be put in place.	- Identify and quantify sources of liquid waste as basis for solution	Information Management: - Monitoring waste generation, disposal and management - Monitoring sources of liquid waste, its disposal and impact in recipient environment Capacity among: - Relevant government departments at national and local levels - BMUs - Guidelines	Waste water treatment systems: - collection - treatment technology - discharge Solid Waste Management Systems: - collection - storage - processing - financing - minimisation - reuse?	Enforce existing laws related to waste disposal	Not Applicable	Not applicable	Awareness raising campaigns: - public at large - schools - stakeholders benefiting from beaches (tourism operators, hotels, fishermen, etc.) - tourists	Curricula development for relevant education in primary and secondary schools. Importance of beaches.
1	13	Sedimentation of coral reefs from river discharges, sewage discharges (pollution) and dredging.	ICZM is an important tool in addressing the complex requirements to address unsustainable resources usage. Implications at and between all management levels. Catchment and coast management needs to be coordinated. IWRM is the appropriate tool such management in the catchment but needs to incorporate coastal concerns (ICZM).	Not applicable	Forest included in land use information management systems and incorporated into spatial planning.	Identifying management units requiring local management arrangements.	Not applicable	Not applicable	Not Applicable	Not Applicable	Enforce existing laws related to water abstraction and pollution.	Not Applicable	Not applicable	Awareness raising campaigns: - public at large - schools - stakeholders benefiting from beaches (tourism operators, hotels, fishermen, etc.) - tourists. Impact of pollution on environment and health Pollution pathways and waste management. Upstream/downstream.	Not applicable
1	14	Intentional or accidental introduction of invasive species can often result in unexpected ecological, economic, and social impacts on the estuarine environment.	not applicable	not applicable	not applicable	not applicable	not applicable	not applicable	not applicable	not Applicable	Not Applicable	Not Applicable	Not applicable	Awareness raising campaigns: - public at large - schools - tourists - investors - developers on impacts of alien introductions.	Not applicable
1	15	Gillnetting possess the greatest threat to dugongs.	Not applicable	Not applicable	Not applicable	Not applicable	Not Applicable	Not Applicable	Not Applicable	Track dugong movements to improve avoidance.	Enforce fishing regulations.	Review fishing legislation on site specific basis, where dugong occur.	Not applicable	Awareness raising campaigns: - public at large - schools - tourists. on impacts and means to eradicate pest.	Not applicable
1	16	Shrimp trawling threatening turtles.	Not applicable	Not applicable	Not applicable	Not applicable	Not Applicable	Not Applicable	Not Applicable	Mandatory turtle exclusion devices for trawl nets.	Not Applicable	Review fishing legislation on site specific basis, where turtles occur.	Not applicable	Awareness raising campaigns: - trawlers.	Not applicable
1	17	Gillnetting threatening turtles (adults and sub adults).	Not applicable	Not applicable	Not applicable	Not applicable	Not Applicable	Not Applicable	Not Applicable	Track turtle movements to improve avoidance.	Not Applicable	Review fishing legislation on site specific basis, where turtles occur.	Not applicable	Awareness raising campaigns: - gill-netters	Not applicable
1	18	Gillnetting threatening whales, especially migrating Humpback whales.	Not applicable	Not applicable	Not applicable	Not applicable	Not Applicable	Not Applicable	Not Applicable	Track whale movements to improve avoidance.	Not Applicable	Not Applicable	Not applicable	Awareness raising campaigns: - gill-netters	Not applicable

Freshwater Resources

Table 188: Broad assessment of measures to mitigate threats associated with freshwater resources to local coastal communities and ecosystems in mainland Tanzania.

RV	#	Threat	ICZM	IWRM	Land Use Management	Shoreline Management Planning	Solid and Liquid Waste Management	Sanitation	Capacity building	Technology	Law enforcement	Legal Review	Alternative/Improved Livelihood	Awareness raising	Education
5	1	Population and economic growth leading to ever increasing need for freshwater.	ICARM ensuring between catchment linkage management and coastal management.	Forest management and catchment land uses addressed in integrated water resources management planning. Link IWRM to coastal integrated planning ensuring upstream/downstream considerations.	Zoning in spatial plans providing guidance for land uses and for development control addressing water resources problems arising from unsustainable land uses.	Not applicable	Not Applicable	Not Applicable	Environmental authorities Land use planners Agriculture extension Information Management: - Monitoring land uses	Agriculture / forestry technologies sustaining recharge of aquifers; rain harvest; Alternative technology replacing charcoal and fuel wood as energy source. PHE.	Enforce existing laws related to coastal forest exploitation.	Not Applicable	Provide alternatives to current destructive and unsustainable livelihood practises related to coastal forests, particularly fuel wood and other resources.	Awareness raising campaigns: - public at large - schools - stakeholders benefitting from mangrove services and products	Curricula development for relevant education in primary and secondary schools. - Coastal forest ecology - Coastal forest management; - Hydrologic cycle
4	2	Removal of riverine vegetation, erosion of riverbanks, pollution of water bodies from municipal waste dumping, agricultural practices or mining (minerals and river sand), abstraction for water for agriculture (or livestock) or hydropower generation.	ICARM ensuring linkage between catchment management and coastal management. Coordination among stakeholders in addressing riverine agriculture pollution.	Land uses in catchment and its impacts on water resources included in IWRM planning	Agriculture zoning in catchments. Regulations for riverside vegetation.	Not applicable	Review of management of agrochemicals upstream	Not Applicable	Environmental authorities Agriculture extension services Land use planners	Agriculture technologies minimising impact for agrochemicals on water resources Technology for monitoring receiving environment.	Enforce regulations for use of agrochemicals; and on river bank set-back distances; river sand excavation, water abstraction and mining and waterways.	Not Applicable	Not applicable	Awareness raising campaigns targeting agriculture and river health.	Curricula development for relevant education in primary and secondary schools. Importance of environmentally sound agriculture production. Importance of integrated management (upstream / downstream).
4	3	Degradation of catchments due to land use changes and livestock keeping.	Coordination among stakeholders in addressing forest management.	Land uses in catchment and its impacts on water resources included in IWRM planning.	Forest reserves and forests included in land use information management systems and incorporated into spatial planning.	Identifying management units requiring local management arrangements.	Not Applicable	Not Applicable	Information Management: - Monitoring forest reserves - Monitoring forest reserve exploitation Capacity among: - Relevant government departments at national and local levels Land use planning commission Local Government Authorities; particularly Forestry and Agriculture	Strengthen/modernise spatial planning tools (GIS, remote imageries); Best forest management practises Alternative livelihood technologies Alternatives to coastal forest wood usage	Enforce existing laws related to coastal forest exploitation.	Establish required regulations, bylaws and guidelines to ensure sustainable and safe development in farmland areas.	Provide alternatives to current destructive and unsustainable livelihood practises related to coastal forests, particularly fuel wood and other resources.	Awareness raising campaigns: - public at large - schools - stakeholders benefitting from mangrove services and products	Curricula development for relevant education in primary and secondary schools. - Coastal forest ecology - Coastal forest management
4	4	General lack of information on the patterns of climate change and their impacts on the hydrology of the Tanzanian river systems draining into the coast.	ICARM ensuring linkage between catchment management and coastal management. Coordination among stakeholders in addressing climate change impacts on hydrology.	Land uses in catchment and its impacts on water resources included in IWRM planning.	Not applicable	Not applicable	Not Applicable	Not Applicable	District level capacity building related to: supporting agriculture early warning system; also at TMA and Dept. of Disaster Management (PMO). Institutional re-structuring.	Technology for monitoring receiving environment and for forecasting weather changes.	Not Applicable	Not Applicable	Not applicable	Awareness raising campaigns targeting and other freshwater users.	Curricula development for relevant education in primary and secondary schools. Importance of environmentally sound agriculture production. Importance of integrated management (upstream / downstream).Hydrologic cycle.
3	5	Deterioration of river flows leading to reduced estuarine and marine productivity, especially of delta prawn and small pelagic species (e.g. sardines).	ICARM ensuring linkage between catchment management and coastal management. Coordination among stakeholders in addressing river water abstraction.	Land uses in catchment and its impacts on water resources included in IWRM planning.	Freshwater abstraction zoning in catchments.	Not applicable	Review of management of upstream water abstraction.	Not Applicable	Environmental authorities Agriculture extension services Land use planners	Rain harvesting and other technologies minimising need to abstract river water. Technology for monitoring receiving environment.	Enforce regulations for use of river waters.	Not Applicable	Not applicable	Awareness raising campaigns targeting agriculture	Curricula development for relevant education in primary and secondary schools. - Hydrologic cycle. Complex requirements in coastal areas (high population and economic pressure). Sustainable development. Spatial Planning to service Population requirements.
3	6	Absence of updated data on current river discharges leading to failure to comprehensively monitor river discharges.	ICARM ensuring linkage between catchment management and coastal management. Coordination among stakeholders in addressing climate change impacts on hydrology.	Land uses in catchment and its impacts on water resources included in IWRM planning.	Not applicable	Not applicable	Not Applicable	Not Applicable	Environmental authorities Agriculture extension services Land use planners	Technology for monitoring receiving environment and for forecasting weather changes and consequently hydrological systems. EFA (Environmental Flow Assessment). Information Management System Infrastructure.	Not Applicable	Not Applicable	Not applicable	Awareness raising campaigns targeting and other freshwater users.	Curricula development for relevant education in primary and secondary schools. Importance of environmentally sound agriculture production. Importance of integrated management (upstream / downstream).Hydrologic cycle.
1	7	Corruption with the management sectors leading to waste of water or revenues from water usage.	Not applicable	Not applicable	Zoning in spatial plans providing guidance for land uses and for development control addressing water resources problems arising from unsustainable land uses.	Not applicable	Not Applicable	Not Applicable	District level capacity building related to: - Catchment management - Spatial Planning - Conflict resolution	Strengthen/modernise spatial planning tools (GIS, remote imageries); improved water source monitoring; Agriculture / forestry technologies sustaining recharge of aquifers; rain harvest;	Enforce existing laws related to resources exploitation and water abstraction. Enforce development control measures according to updated spatial plans.	Establish required regulations, bylaws and guidelines to ensure sustainable and safe development in river catchments.	Not applicable	Awareness raising campaigns: - public at large - schools on water management and need to conserve water and avoid waste/leaks.	Curricula development for relevant education in primary and secondary schools. - Coastal forest ecology - Coastal forest management; - Hydrologic cycle
1	8	Pesticide pollution of river deltas from poor agricultural practices resulting in reduced crustacean and fisheries productivity and poisoning of edible marine life.	ICARM ensuring linkage between catchment management and coastal management. Coordination among stakeholders in addressing riverine agriculture pollution.	Land uses in catchment and its impacts on water resources included in IWRM planning; To the extent that solid and liquid waste origin from upstream activities.	Agriculture zoning in catchments. Regulations for riverside vegetation.	Not applicable	Review of management of agrochemicals upstream	Not Applicable	Environmental authorities Agriculture extension services Land use planners	Agriculture technologies minimising impact for agrochemicals on water resources Technology for monitoring receiving environment.	Enforce regulations for use of agrochemicals.	Not Applicable	Not applicable	Awareness raising campaigns targeting agriculture	Curricula development for relevant education in primary and secondary schools. Importance of environmentally sound agriculture production. Importance of integrated management (upstream / downstream).

Management Framework for Coastal Zone Management

Table 189: Broad assessment of measures to mitigate threats associated with management framework for coastal zone management to local coastal communities and ecosystems in mainland Tanzania.

RV	#	Threat	ICZM	IWRM	Land Use Management	Shoreline Management Planning	Solid and Liquid Waste Management	Sanitation	Capacity building	Technology	Law enforcement	Legal Review	Alternative/Improved Livelihood	Awareness raising	Education
4	1	Poor coordination and monitoring between different sectors leading to ineffective governance and failing of enforcement in coastal and marine areas.	Coordination among stakeholders in addressing fisheries decline. Guidelines for best practices in mangrove management. Guidelines for best practises in fisheries. Guidelines for best practises in coral reef management. Guidelines to be based on outcome of legal review.	Not applicable	Not applicable	Not applicable	Not Applicable	Not Applicable	Information Management: - Monitoring occurrences of illegal fisheries - Monitoring fishing practises - Monitoring fisheries catches - Monitoring fisheries resources - Monitoring fisheries habitats (mangroves, coral reefs) Capacity among: - Relevant government departments at national and local levels - BMUs	Not Applicable	Not Applicable	Review of legal and policy framework.	Not applicable	Not applicable	Not applicable
4	2	Poor capacity and motivation at local district authority level to implement legal mandates governing natural resource use, resulting in continued deterioration of productivity.	not applicable	Not applicable	Not applicable	Not applicable	Not Applicable	Not Applicable	Information Management: - Monitoring occurrences of illegal fisheries - Monitoring fishing practises - Monitoring fisheries catches - Monitoring fisheries resources - Monitoring fisheries habitats (mangroves, coral reefs) Capacity among: - Relevant government departments at national and local levels - BMUs	Not Applicable	Not Applicable	Institutional reforms.	Not applicable	Not applicable	Not applicable
4	3	Absence of financial capacity to address management issues related to coastal and marine resources.	Integrated efforts hold the potential of financial resource use optimization (sharing, coordination)	Integrated efforts hold the potential of financial resource use optimization (sharing, coordination)	Not applicable	Not applicable	Not Applicable	Not Applicable	Revenue planning; increased government effort into financing this problem.	Not Applicable	Not Applicable	Institutional reforms.	Private Public Partnerships (PPP).	Not applicable	Not applicable
4	4	Corruption at diverse management levels associated with extractive activity related to marine resources, particularly in the fisheries sector, leading to deterioration of the productivity of the resource.	Not applicable	Not applicable	Not applicable	Not applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Enforce existing laws related to marine and coastal resources.	Institutional reforms.	Not applicable	Awareness raising campaigns: - public at large - schools - stakeholders benefitting from marine and coastal resources.	Not applicable
4	5	Continued inability to stop "dynamite" fishing, threatening the productive quality of coastal marine habitats.	not applicable	Not applicable	Not applicable	Not applicable	Not Applicable	Not Applicable	Information Management: - Monitoring occurrences of illegal fisheries - Monitoring fishing practises - Monitoring fisheries catches - Monitoring fisheries resources - Monitoring fisheries habitats (mangroves, coral reefs) Capacity among: - Relevant government departments at national and local levels - BMUs	Offshore fisheries Aquaculture; Add value to existing harvest.	Enforce existing laws related to fisheries. Enforce existing laws related to mangrove exploitation. Enforce existing laws related to coral mining.	Institutional reforms; Review appropriateness of fisheries regulations in relation to local conditions, environment, species and gears. Establish local zoning and fishing effort seasonality.	Provide alternatives to current destructive and unsustainable livelihood practises related to fisheries. - Emphasis on young generation	Awareness raising campaigns: - public at large - schools - stakeholders benefitting from fisheries (fishing communities, middlemen, hotels and restaurants)	Curricula development for relevant education in primary and secondary schools. - Sustainable Fisheries. - Fisheries ecology.
3	6	Poor coordination to combat river basin and catchment degradation, resulting in loss of productivity in the coastal zone through reduced seasonal freshwater and nutrient inputs, as well as reduced river sand contribution to the coast; and/or overload of the sediments and freshwater from flash floods.	ICZM is an important tool in addressing the complex requirements to address unsustainable resources usage. Implications at and between all management levels. Catchment and coast management needs to be coordinated. IWRM is the appropriate tool such management in the catchment but needs to incorporate coastal concerns (ICZM).	Link IWRM to coastal integrated planning ensuring upstream/downstream considerations.	Zoning of beaches to be included in Land Use Plans, providing regulations and guidelines for land use. Ideally to be informed from Shoreline Management Planning efforts. Regulations may define types of use as well as set back arrangements. Guidelines may also cover coral reef, seagrass and mangrove management to the extent of importance to beach erosion.	An understanding of processes and factors behind erosion and accretion along the Tanzanian coast is required. Such an understanding can be attained through a structural effort in Shoreline Management Planning which can then inform Spatial Planning at local level. First step is to identify sediment cells along the coast based on littoral drift considerations, next step to identify management units within these cells based on environment, economic and socio-economic considerations.	Not Applicable	Not Applicable	Information Management: - Monitoring forest reserves - Monitoring forest reserve exploitation Capacity among: - Relevant government departments at national and local levels - BMUs	Beach protection technologies, from engineering (groynes, etc.) to soft (beach nourishment) solutions and green technologies (mangrove planting, other shoreline vegetation).	Enforce existing laws related to resources exploitation sand mining and construction near shore (set back provisions).	Establish required regulations, bylaws and guidelines to ensure sustainable and safe development along near the sea. Informed by shoreline management study.	Provide alternatives to current destructive and unsustainable livelihood practises related to mangrove exploitation and fisheries in particular.	The impact of unsustainable resources usage on beach erosion highlighted in awareness raising campaigns. Services of mangroves and corals in protecting against erosive forces (targeting resource users). Impact of physical structures along the coast on shorelines included in awareness raising campaigns (targeting developers and planners)	Curricula development for relevant education in primary and secondary schools. Importance of beaches.
2	7	Pollution of beaches and coastal waters.	not applicable	Not applicable	Not applicable	Not applicable	Not Applicable	Not Applicable	Capacity among: - Relevant government departments at national and local levels - BMUs - Guidelines	Not Applicable	Enforce existing laws related to waste disposal	Institutional reforms; Review appropriateness of fisheries regulations in relation to local conditions, environment, species and gears. Establish local zoning and fishing effort seasonality.	Not applicable	Awareness raising campaigns: - public at large - schools - stakeholders benefitting from beaches (tourism operators, hotels, fishermen, etc.) - tourists	Curricula development for relevant education in primary and secondary schools. Importance of beaches.

Zanzibar Themes

Fisheries

Table 190: Broad assessment of measures to mitigate threats associated with fisheries to local coastal communities and ecosystems in Zanzibar.

RV	#	Threat	ICZM	IWRM	Land Use Management	Shoreline Management Planning	Solid and Liquid Waste Management	Sanitation	Capacity building	Technology	Law enforcement	Legal Review	Alternative/Improved Livelihood	Awareness raising	Education
5	1	Destructive and illegal fishing - causing decline in productivity due to habitat destruction through beach seine, spear guns and dragnets, adversely affecting the fisher community livelihoods.	Coordination among stakeholders in addressing fisheries decline. Guidelines for best practices in mangrove management. Guidelines for best practises in coral reef management. Guidelines to be based on outcome of legal review.	Not applicable	Mangroves and other habitats of importance (including seagrass areas and coral reefs) for fisheries included in land use information management systems and incorporated into spatial planning.	Identifying management units requiring local management arrangements.	Not Applicable	Not Applicable	Information Management: - Monitoring occurrences of illegal fisheries - Monitoring fishing practises - Monitoring fisheries catches - Monitoring fisheries resources - Monitoring fisheries habitats (mangroves, coral reefs) Capacity among: - Relevant government departments at national and local levels - BMUs	Offshore fisheries Aquaculture; Add value to existing harvest.	Enforce existing laws related to fisheries. Enforce existing laws related to mangrove exploitation.	Review appropriateness of fisheries regulations in relation to local conditions, environment, species and gears. Establish local zoning and fishing effort seasonality.	Provide alternatives to current destructive and unsustainable livelihood practises related to fisheries. - Emphasis on young generation	Awareness raising campaigns: - public at large - schools - stakeholders benefitting from fisheries (fishing communities, middlemen, hotels and restaurants)	Curricula development for relevant education in primary and secondary schools. - Sustainable Fisheries. - Fisheries ecology.
4	2	Social conflicts over access to resource – where cultural and historical rivalry over “traditional” fishing grounds increases as pressure on the resource increases; also includes increasing resentment of migratory fishing groups of “dago” fishers during seasonal visits, using gears considered destructive or conflict with local traditions.	Coordinated and participatory land and resource use planning expressed in integrated spatial plans and regulations.	Not applicable	Review and update of spatial plans including zoning to guide development planning and development control. Spatial plans to also consider marine spaces.	Identifying management units requiring local management arrangements.	Not applicable	Not applicable	District level capacity building related to: - Shoreline management - Spatial Planning - Conflict resolution - Community empowerment.	Offshore fisheries Aquaculture; Add value to existing harvest.	Enforce existing laws related to resources exploitation sand mining and construction near shore (set back provisions). Enforce development control measures according to updated spatial plans.	Establish required regulations, bylaws and guidelines to ensure sustainable and safe development along near the sea. Local guidelines based on updated spatial plans informed by shoreline management study.	Provide alternatives to current destructive and unsustainable livelihood practises related to fisheries. - Emphasis on young generation	The impact of unsustainable resources usage on beach erosion highlighted in awareness raising campaigns. Services of mangroves and corals in protecting against erosive forces (targeting resource users). Impact of physical structures along the coast on shorelines included in awareness raising campaigns (targeting developers and planners)	Curricula development for relevant education in primary and secondary schools. Sustainable development in areas under high demographic and economic development pressure (coastal areas, urban areas). Importance of coasts and coastal habitats and resources.
4	3	Weaknesses in management leading to conflicts with tourists over coral reefs to dive and to snorkel, fish landing sites and tourist hotels; to seaweed farming conflict with boat users and tourists; allowing open access fishery, thus increasing fishing pressure and stock depletion is difficult to manage.	Coordinated and participatory land and resource use planning expressed in integrated spatial plans and regulations.	Not applicable	Review and update of spatial plans including zoning to guide development planning and development control. Spatial plans to also consider marine spaces.	An understanding of processes and factors behind erosion and accretion along the Tanzanian coast is required. Such an understanding can be attained through a structural effort in Shoreline Management Planning which can then inform Spatial Planning at local level. First step is to identify sediment cells along the coast based on littoral drift considerations, next step to identify management units within these cells based on environment, economic and socio-economic considerations.	Not applicable	Not applicable	Regional level capacity building related to: - Spatial Planning - Conflict resolution	not applicable	Enforce existing laws related to resources exploitation. Enforce development control measures according to updated spatial plans.	Review appropriateness of fisheries regulations in relation to local conditions, environment, species and gears. Establish local zoning and fishing effort seasonality.	Not applicable	The impact of unsustainable resources usage on beach erosion highlighted in awareness raising campaigns. Services of mangroves and corals in protecting against erosive forces (targeting resource users).	Curricula development for relevant education in primary and secondary schools. Sustainable development in areas under high demographic and economic development pressure (coastal areas, urban areas). Importance of coasts and coastal habitats and resources.
4	4	Limited alternatives or investment, are all attributed as causes for the current behaviour of fishers.	Not applicable	Not applicable	Not applicable	Not applicable	Not Applicable	Not Applicable	not applicable	Offshore fisheries Aquaculture; Add value to existing harvest.	Not Applicable	Not Applicable	Provide alternatives to current destructive and unsustainable livelihood practises related to fisheries. - Emphasis on young generation. Capital investment/micro-finance.	Awareness raising campaigns: - public at large - schools - stakeholders benefitting from fisheries (fishing communities, middlemen, hotels and restaurants)	Curricula development for relevant education in primary and secondary schools. - Sustainable Fisheries. - Fisheries ecology.
4	5	Absence of weather (climate) forecasting resulting in losses of drying seaweed.	Not applicable	Not applicable	Not applicable	Not applicable	Not Applicable	Not Applicable	Regional level capacity building related to: supporting agriculture early warning system; also at TMA and Dept. of Disaster Management (PMO).	Technology for monitoring receiving environment and for forecasting weather changes.	Not Applicable	Not Applicable	Not applicable	Awareness raising campaigns targeting seaweed farmers.	Not applicable
4	6	Inadequate understanding of fisheries resources biology in support of management	Not applicable	Not applicable	Not applicable	Not applicable	Not Applicable	Not Applicable	Capacity among: - Relevant government departments at national and local levels - BMUs	Research fish biology.	Not Applicable	Not Applicable	Not applicable	Awareness raising campaigns: - fishing communities	Curricula development for relevant education in primary and secondary schools. - Sustainable Fisheries. - Fisheries ecology.
4	7	Weak dissemination of aquaculture techniques	Not applicable	Not applicable	Not applicable	Not applicable	Not Applicable	Not Applicable	Regional level capacity building related to: - fish farming, training, distribution and extension services.	Research fish biology, fingerling availability.	Not Applicable	Not Applicable	Not applicable	Not applicable	Not applicable

RV	#	Threat	ICZM	IWRM	Land Use Management	Shoreline Management Planning	Solid and Liquid Waste Management	Sanitation	Capacity building	Technology	Law enforcement	Legal Review	Alternative/Improved Livelihood	Awareness raising	Education
3	8	Social conflicts over fishing gears - where local fishers use gears or methods (some of which are illegal) that are not acceptable by neighbouring villages.	Coordinated and participatory land and resource use planning expressed in integrated spatial plans and regulations.	Not applicable	Review and update of spatial plans including zoning to guide development planning and development control. Spatial plans to also consider marine spaces.	An understanding of processes and factors behind erosion and accretion along the Tanzanian coast is required. Such an understanding can be attained through a structural effort in Shoreline Management Planning which can then inform Spatial Planning at local level. First step is to identify sediment cells along the coast based on littoral drift considerations, next step to identify management units within these cells based on environment, economic and socio-economic considerations.	Not applicable	Not applicable	District level capacity building related to: - Shoreline management - Spatial Planning - Conflict resolution	Beach protection technologies, from engineering (groynes, etc.) to soft (beach nourishment) solutions and green technologies (mangrove planting, other shoreline vegetation). More efficient use of land.	Enforce existing laws related to resources exploitation and mining and construction near shore (set back provisions). Enforce development control measures according to updated spatial plans.	Establish required regulations, bylaws and guidelines to ensure sustainable and safe development along near the sea. Local guidelines based on updated spatial plans informed by shoreline management study.	Provide alternatives to current destructive and unsustainable livelihood practises related to fisheries. - Emphasis on young generation	The impact of unsustainable resources usage on beach erosion highlighted in awareness raising campaigns. Services of mangroves and corals in protecting against erosive forces (targeting resource users). Impact of physical structures along the coast on shorelines included in awareness raising campaigns (targeting developers and planners)	Curricula development for relevant education in primary and secondary schools. Sustainable development in areas under high demographic and economic development pressure (coastal areas, urban areas). Importance of coasts and coastal habitats and resources.

Tourism

Table 191: Broad assessment of measures to mitigate threats associated with tourism to local coastal communities and ecosystems in Zanzibar.

RV	#	Threat	ICZM	IWRM	Land Use Management	Shoreline Management Planning	Solid and Liquid Waste Management	Sanitation	Capacity building	Technology	Law enforcement	Legal Review	Alternative/Improved Livelihood	Awareness raising	Education
5	1	Inadequate sewage infrastructure and waste management causing pollution of the coastal zone, further exacerbated by the illegal dumping of waste and litter from some developments.	Coordination among stakeholders in addressing beach pollution. Beach management guidelines	Not applicable	Beaches included in zoning and development of associated regulations	Identifying management units requiring local management arrangements.	Waste collection, storage and processing system needs to be put in place.	Identify and quantify sources of liquid waste as basis for solution and develop sanitation systems accordingly	Information Management: - Monitoring waste generation, disposal and management - Monitoring sources of industrial waste, its disposal and impact in recipient environment Capacity among: - Relevant government departments at national and local levels - Guidelines	Waste water treatment systems: - collection - treatment technology - discharge Solid Waste Management Systems: - collection - storage - processing - minimisation - reuse? Green Infrastructure Storm Water Systems	Enforce existing laws related to waste disposal	Not Applicable	Not Applicable	Awareness raising campaigns: - public at large - schools Impact of pollution on environment and health Pollution pathways and waste management. Upstream/downstream.	Curricula development for relevant education in primary and secondary schools. Importance of beaches. Pollution, environment, health. Waste minimisation and recycling.
5	2	Reduced freshwater supply now estimated to meet only 51% of the demand (from a rising population and expanding industries and tourism).	not applicable	Not applicable	not applicable	Not applicable	Not Applicable	Not Applicable	Regional level capacity building related to: - Catchment management - Spatial Planning	Strengthen/modernise spatial planning tools (GIS, remote imageries); improved water source monitoring; Agriculture / forestry technologies sustaining recharge of aquifers; rain harvest; re-cycle water.	Not Applicable	Not Applicable	Not applicable	Awareness raising campaigns: - public at large - schools on water management and need to conserve water and avoid waste/leaks.	Curricula development for relevant education in primary and secondary schools. - Coastal forest ecology - Coastal forest management; - Hydrologic cycle
4	3	Worsening personal security due to increased crime and violence.	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Regional level capacity building related to security in general and especially tourists.	Surveillance, anti-corruption.	Enforce existing laws related to security.				
4	4	Deterioration of conservation areas due to failure of management to address encroachment and resource over-utilisation, especially forests.	Coordination among stakeholders in addressing forest management. Mangrove forest reserve management plans.	Not applicable	Forest reserves and forests included in land use information management systems and incorporated into spatial planning.	Identifying management units requiring local management arrangements.	Not Applicable	Not Applicable	Information Management: - Monitoring forest reserves - Monitoring forest reserve exploitation Capacity among: - Relevant government departments at national and local levels - BMUs	Best forest management practises Alternative livelihood technologies Alternatives to coastal forest wood usage	Enforce existing laws related to coastal forest exploitation.	Not Applicable	Provide alternatives to current destructive and unsustainable livelihood practises related to coastal forests, particularly fuel wood and other resources.	Awareness raising campaigns: - public at large - schools - stakeholders benefitting from mangrove services and products	Curricula development for relevant education in primary and secondary schools. - Coastal forest ecology - Coastal forest management
4	5	Deterioration of marine environment from destructive fishing practices.	Coordination among stakeholders in addressing fisheries decline. Guidelines for best practises in mangrove management. Guidelines for best practises in fisheries. Guidelines for best practises in coral reef management. Guidelines to be based on outcome of legal review.	Not applicable	Mangroves and other habitats of importance (including seagrass areas and coral reefs) for fisheries included in land use information management systems and incorporated into spatial planning.	Identifying management units requiring local management arrangements.	Not Applicable	Not Applicable	Information Management: - Monitoring occurrences of illegal fisheries - Monitoring fishing practises - Monitoring fisheries catches - Monitoring fisheries resources - Monitoring fisheries habitats (mangroves, coral reefs) Capacity among: - Relevant government departments at national and local levels - BMUs	Offshore fisheries Aquaculture; Add value to existing harvest. No take zones.	Enforce existing laws related to fisheries. Enforce existing laws related to mangrove exploitation. Enforce existing laws related to coral mining.	Review appropriateness of fisheries regulations in relation to local conditions, environment, species and gears. Establish local zoning and fishing effort seasonality.	Provide alternatives to current destructive and unsustainable livelihood practises related to fisheries. - Emphasis on young generation	Awareness raising campaigns: - public at large - schools - stakeholders benefitting from fisheries (fishing communities, middlemen, hotels and restaurants)	Curricula development for relevant education in primary and secondary schools. - Sustainable Fisheries. - Fisheries ecology.
4	6	Increased beach erosion from unchecked sand mining for hotel construction or for road construction in Zanzibar.	ICZM is an important tool in addressing the complex requirements to address unsustainable resources usage. Implications at and between all management levels. Catchment and coast management needs to be coordinated. IWRM is the appropriate tool such management in the catchment but needs to incorporate coastal concerns (ICZM).	Link IWRM to coastal integrated planning ensuring upstream/downstream considerations.	Zoning of beaches to be included in Land Use Plans, providing regulations and guidelines for land use. Ideally to be informed from Shoreline Management Planning efforts. Regulations may define types of use as well as set back arrangements. Guidelines may also cover coral reef, seagrass and mangrove management to the extent of importance to beach erosion.	An understanding of processes and factors behind erosion and accretion along the Tanzanian coast is required. Such an understanding can be attained through a structural effort in Shoreline Management Planning which can then inform Spatial Planning at local level. First step is to identify sediment cells along the coast based on littoral drift considerations, next step to identify management units within these cells based on environment, economic and socio-economic considerations.	Not Applicable	Not Applicable	Information Management: - Monitoring forest reserves - Monitoring forest reserve exploitation Capacity among: - Relevant government departments at national and local levels - BMUs	Beach protection technologies, from engineering (groynes, etc.) to soft (beach nourishment) solutions and green technologies (mangrove planting, other shoreline vegetation).	Enforce existing laws related to resources exploitation sand mining and construction near shore (set back provisions).	Establish required regulations, bylaws and guidelines to ensure sustainable and safe development along near the sea. Informed by shoreline management study.	Provide alternatives to current destructive and unsustainable livelihood practises related to sand extraction in particular.	The impact of unsustainable resources usage on beach erosion highlighted in awareness raising campaigns. Services of mangroves and corals in protecting against erosive forces (targeting resource users). Impact of physical structures along the coast on shorelines included in awareness raising campaigns (targeting developers and planners)	Curricula development for relevant education in primary and secondary schools. Importance of beaches.
4	7	Conflicts between local communities and tourism developers over natural resources.	Coordinated and participatory land and resource use planning expressed in integrated spatial plans and regulations.	Link IWRM to coastal integrated planning ensuring upstream/downstream considerations.	Review and update of spatial plans including zoning to guide development planning and development control. Spatial plans to also consider marine spaces.	An understanding of processes and factors behind erosion and accretion along the Tanzanian coast is required. Such an understanding can be attained through a structural effort in Shoreline Management Planning which can then inform Spatial Planning at local level. First step is to identify sediment cells along the coast based on littoral drift considerations, next step to identify management units within these cells based on environment, economic and socio-economic considerations.	Not applicable	Not applicable	Regional level capacity building related to: - Shoreline management - Spatial Planning - Conflict resolution	not applicable	Enforce existing laws related to access and use of natural resources exploitation. Enforce development control measures according to updated spatial plans.	Establish required regulations, bylaws and guidelines to ensure sustainable and safe development along near the sea. Local guidelines based on updated spatial plans informed by shoreline management study.	Not applicable	The impact of unsustainable resources usage on beach erosion highlighted in awareness raising campaigns. Services of mangroves and corals in protecting against erosive forces (targeting resource users). Impact of physical structures along the coast on shorelines included in awareness raising campaigns (targeting developers and planners)	Curricula development for relevant education in primary and secondary schools. Sustainable development in areas under high demographic and economic development pressure (coastal areas, urban areas). Importance of coasts and coastal habitats and resources.

RV	#	Threat	ICZM	IWRM	Land Use Management	Shoreline Management Planning	Solid and Liquid Waste Management	Sanitation	Capacity building	Technology	Law enforcement	Legal Review	Alternative/Improved Livelihood	Awareness raising	Education
3	8	Increased beach erosion from anarchistic tourism development constructed too close to or below the high water mark, due to inadequate management and enforcement tools.	ICZM is an important tool in addressing the complex requirements to address unsustainable resources usage. Implications at and between all management levels. Catchment and coast management needs to be coordinated. IWRM is the appropriate tool such management in the catchment but needs to incorporate coastal concerns (ICZM).	Link IWRM to coastal integrated planning ensuring upstream/downstream considerations.	Zoning of beaches to be included in Land Use Plans, providing regulations and guidelines for land use. Ideally to be informed from Shoreline Management Planning efforts. Regulations may define types of use as well as set back arrangements. Guidelines may also cover coral reef, seagrass and mangrove management to the extent of importance to beach erosion.	An understanding of processes and factors behind erosion and accretion along the Tanzanian coast is required. Such an understanding can be attained through a structural effort in Shoreline Management Planning which can then inform Spatial Planning at local level. First step is to identify sediment cells along the coast based on littoral drift considerations, next step to identify management units within these cells based on environment, economic and socio-economic considerations.	Not Applicable	Not Applicable	Information Management: - Monitoring forest reserves - Monitoring forest reserve exploitation Capacity among: - Relevant government departments at national and local levels - BMUs	Beach protection technologies, from engineering (groynes, etc.) to soft (beach nourishment) solutions and green technologies (mangrove planting, other shoreline vegetation).	Enforce existing laws related to construction near shore (set back provisions).	Not Applicable	Not applicable	The impact of unsustainable resources usage on beach erosion highlighted in awareness raising campaigns. Impact of physical structures along the coast on shorelines included in awareness raising campaigns (targeting developers and planners)	Curricula development for relevant education in primary and secondary schools. Importance of beaches.
3	9	Loss of employment opportunities by locals to more qualified and better trained staff from mainland Tanzania and Kenya.	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Regional level capacity building related to: - Needs and skills of the tourism industry.	Improved teaching of future local staff.	Enforce existing laws related to employment of non-nationals;	Policy regarding employees. Incentives.	Not applicable	Awareness raising campaigns: - public at large - schools on job opportunities in tourism; - tourism companies on importance of employing locals;	Training of locals for jobs/careers in the tourism sector.
1	10	Increase in water-borne disease such as malaria, dengue fever, typhoid and dysentery.	Not applicable	Not applicable	Infrastructure development. Supply of sanitation and health services.	Not applicable	Waste collection, storage and processing system needs to be put in place.	Identify and quantify sources of liquid waste as basis for solution and develop sanitation systems accordingly	Environmental authorities Land use planners Information Management: - Monitoring waste generation, disposal and management - Monitoring sources of liquid waste, its disposal and impact in recipient environment Capacity among: - Relevant government departments at national and local levels - BMUs - Guidelines	Waste water treatment systems: - collection - treatment technology - discharge Solid Waste Management Systems: - collection - storage - processing - financing - minimisation - reuse? Green Infrastructure Storm Water Systems Technology for monitoring receiving environment.	Enforce existing laws related to waste disposal	Not Applicable	Not applicable	Awareness raising campaigns: - public at large - schools - stakeholders benefitting from beaches (tourism operators, hotels, fishermen, etc.) - tourists. Impact of pollution on environment and health Pollution pathways and waste management. Upstream/downstream.	Curricula development for relevant education in primary and secondary schools. Importance of environmentally sound agriculture production. Importance of integrated management (upstream / downstream). Importance of marine environment. Pollution, environment, health. Waste minimisation and recycling.

Agriculture

Table 192: Broad assessment of measures to mitigate threats associated with livestock and agriculture to local coastal communities and ecosystems in Zanzibar.

RV	#	Threat	ICZM	IWRM	Land Use Management	Shoreline Management Planning	Solid and Liquid Waste Management	Sanitation	Capacity building	Technology	Law enforcement	Legal Review	Alternative/Improved Livelihood	Awareness raising	Education
5	1	Loss of public land (coral rag) to agriculture.	ICZM is an important tool in preventing land use conflicts through coordinated and participatory development planning.	Not applicable	Review and up-date spatial plans for development control clarifying agriculture land uses.	Shoreline Management Planning informs Spatial Planning at local level. First step is to identify sediment cells along the coast based on littoral drift considerations, next step to identify management units within these cells based on environment, economic and socio-economic considerations.	Not Applicable	Not Applicable	Land use planning commission Local Government Authorities	Strengthen/modernise spatial planning tools (GIS, remote imageries)	Enforce land use and building regulations.	Not Applicable	Provide alternatives for people losing traditional livelihoods in rural areas planned for other uses.	Awareness campaigns related to sustainable development planning and development control targeting: - public at large - district authorities - developers/entrepreneurs	Curricula development for relevant education in primary and secondary schools. Complex requirements in coastal areas (high population and economic pressure). Sustainable development. Spatial Planning to service Population requirements.
5	2	Reduced land for agriculture on Unguja due to intense competition (Coles et al. 2007).	ICZM is an important tool in preventing land use conflicts through coordinated and participatory development planning.	Not applicable	Review and up-date spatial plans for development control clarifying agriculture land uses.	Not applicable	Not Applicable	Not Applicable	Land use planning commission Local Government Authorities;	Strengthen/modernise land use spatial planning tools (GIS, remote imageries); reclamation...	Enforce land use and building regulations.	Not Applicable	Provide alternatives for people losing traditional livelihoods in rural areas planned for other uses.	Awareness campaigns related to sustainable development planning and development control targeting: - public at large - district authorities - developers/entrepreneurs	Curricula development for relevant education in primary and secondary schools. Complex requirements in coastal areas (high population and economic pressure). Sustainable development. Spatial Planning to service Population requirements.
4	3	Social conflicts over land use	Coordinated and participatory land and resource use planning expressed in integrated spatial plans and regulations.	Not applicable	Review and update of spatial plans including zoning to guide development planning and development control. Spatial plans to also consider coastal farm/grazing land and seaweed farming and marine spaces.	Identifying management units requiring local management arrangements.	Not applicable	Not applicable	Regional level capacity building related to: - Shoreline management - Spatial Planning - Conflict resolution	Technology for defining most appropriate agricultural land-use (farming or grazing) and coastal land use (beach hotels, seaweed farming or fishing).	Enforce existing laws related to resources exploitation fishing/seaweed farming. Enforce development control measures according to updated spatial plans.	Establish required regulations, bylaws and guidelines to ensure sustainable and safe development along near the sea, and agricultural land. Local guidelines based on updated spatial plans informed by shoreline management study. Land court.	Not applicable	Awareness raising campaigns: - public at large - schools - stakeholders benefitting from beaches (tourism operators, hotels, fishermen, etc.)	Curricula development for relevant education in primary and secondary schools. Sustainable development in areas under high demographic and economic development pressure (coastal areas, urban areas). Importance of coasts and coastal habitats and resources.
4	4	Invasion of freshwater sources	not applicable	Not applicable	Zoning in spatial plans providing guidance for land uses and for development control addressing water resources problems arising from unsustainable land uses.	Not applicable	Not Applicable	Not Applicable	Regional level capacity building related to: - Catchment management - Spatial Planning - Conflict resolution	Agriculture / forestry technologies sustaining recharge of aquifers; rain harvest;	Enforce land use and water sources regulations.	Review legislation.	Not applicable	Awareness raising campaigns: - public at large - schools on water management and need to conserve water and avoid waste/leaks.	Curricula development for relevant education in primary and secondary schools. - Coastal forest ecology - Coastal forest management; - Hydrologic cycle
4	5	High production cost	Not applicable	Not applicable	Not applicable	Not applicable	Not Applicable	Not Applicable	Training farmers; extension services.	Diversify crops/strains and markets;	Not Applicable	Fiscal review.	Not applicable	Not applicable	Not applicable
4	6	Insufficient freshwater for irrigation	not applicable	Forest management and catchment land uses addressed in integrated water resources management planning. Link IWRM to coastal integrated planning ensuring upstream/downstream considerations.	Zoning in spatial plans providing guidance for land uses and for development control addressing water resources problems arising from unsustainable land uses.	Not applicable	Not Applicable	Not Applicable	Regional level capacity building related to: - Catchment management - Spatial Planning - Conflict resolution	Strengthen/modernise spatial planning tools (GIS, remote imageries); improved water source monitoring; Agriculture / forestry technologies, research, adaptation, sustaining recharge of aquifers; rain harvest; infrastructure.	Enforce existing laws related to resources exploitation and water abstraction. Enforce development control measures according to updated spatial plans.	Establish required regulations, bylaws and guidelines to ensure sustainable and safe development in river catchments.	Not applicable	Awareness raising campaigns: - public at large - schools on water management and need to conserve water and avoid waste/leaks.	Curricula development for relevant education in primary and secondary schools. - Coastal forest ecology - Coastal forest management; - Hydrologic cycle
4	7	Limited business/financial management skills among producers and suppliers, limits the success of agribusiness.	Not applicable	Not applicable	Not applicable	Not applicable	Not Applicable	Not Applicable	Regional level capacity building related to training farmers; extension services.	Financial empowerment (credit)...	Not Applicable	Not Applicable	Not applicable	Not applicable	Not applicable
4	8	Salt water inundation	not applicable	Forest management and catchment land uses addressed in integrated water resources management planning. Link IWRM to coastal integrated planning ensuring upstream/downstream considerations.	Zoning in spatial plans providing guidance for land uses and for development control addressing water resources problems arising from unsustainable land uses.	Not applicable	Not Applicable	Not Applicable	Environmental authorities Land use planners Agriculture extension Information; tree-planting; Management: - Monitoring land uses	Agriculture / forestry technologies sustaining recharge of aquifers; rain harvest; coastal restoration.	Enforce existing laws related to coastal farming and freshwater resources. Enforce development control measures according to updated spatial plans.	Not Applicable	Provide alternatives to current destructive and unsustainable livelihood practises related to coastal forests, particularly fuel wood and other resources.	Awareness raising campaigns: - public at large - schools - stakeholders benefitting from mangrove services and products	Curricula development for relevant education in primary and secondary schools. - Coastal forest ecology - Coastal forest management; - Hydrologic cycle
4	9	Insufficient climate information forecasting and early warning systems	ICARM ensuring linkage between catchment management and coastal management. Coordination among stakeholders in addressing climate change impacts on hydrology.	Land uses in catchment and its impacts on water resources included in IWRM planning.	Not applicable	Not applicable	Not Applicable	Not Applicable	Regional level capacity building related to: supporting agriculture early warning system; also at TMA and Dept. of Disaster Management (PMO).	Technology for monitoring receiving environment and for forecasting weather changes. Indigenous knowledge (IK).	Not Applicable	Not Applicable	Not applicable	Awareness raising campaigns targeting and other freshwater users.	Curricula development for relevant education in primary and secondary schools. Importance of environmentally sound agriculture production. Importance of integrated management (upstream / downstream).Hydrologic cycle.

RV	#	Threat	ICZM	IWRM	Land Use Management	Shoreline Management Planning	Solid and Liquid Waste Management	Sanitation	Capacity building	Technology	Law enforcement	Legal Review	Alternative/Improved Livelihood	Awareness raising	Education
4	10	Social conflicts over land due to poor land management	Coordinated and participatory land and resource use planning expressed in integrated spatial plans and regulations.	Not applicable	Review and update of spatial plans including zoning to guide development planning and development control. Spatial plans to also consider coastal farm/grazing land and seaweed farming and marine spaces.	Identifying management units requiring local management arrangements.	Not applicable	Not applicable	Regional level capacity building related to: - Shoreline management - Spatial Planning - Conflict resolution	Technology for defining most appropriate agricultural land-use (farming or grazing) and coastal land use (beach hotels, seaweed farming or fishing).	Enforce existing laws related to resources exploitation fishing/seaweed farming. Enforce development control measures according to updated spatial plans.	Establish required regulations, bylaws and guidelines to ensure sustainable and safe development along near the sea, and agricultural land. Local guidelines based on updated spatial plans informed by shoreline management study.	Not applicable	Awareness raising campaigns: - public at large - schools - stakeholders benefitting from beaches (tourism operators, hotels, fishermen, etc.)	Curricula development for relevant education in primary and secondary schools. Sustainable development in areas under high demographic and economic development pressure (coastal areas, urban areas). Importance of coasts and coastal habitats and resources.
3	11	Inadequate agricultural product supply leading to tourism operators seeking suppliers elsewhere.	Not applicable	Not applicable	Not applicable	Not applicable	Not Applicable	Not Applicable	Training farmers; extension services.	Reduce post-harvest losses; value adding; improved logistics;	Not Applicable	Not Applicable	Not applicable	Not applicable	Not applicable
3	12	Freshwater scarcity and irregular supply	not applicable	Forest management and catchment land uses addressed in integrated water resources management planning. Link IWRM to coastal integrated planning ensuring upstream/downstream considerations.	Zoning in spatial plans providing guidance for land uses and for development control addressing water resources problems arising from unsustainable land uses.	Not applicable	Not Applicable	Not Applicable	Regional level capacity building related to: - Catchment management - Spatial Planning - Conflict resolution	Agriculture / forestry technologies sustaining recharge of aquifers; rain harvest; infrastructure.	Enforce existing laws related to resources exploitation and water abstraction. Enforce development control measures according to updated spatial plans.	Establish required regulations, bylaws and guidelines to ensure sustainable and safe development in river catchments.	Not applicable	Awareness raising campaigns: - public at large - schools on water management and need to conserve water and avoid waste/leaks.	Curricula development for relevant education in primary and secondary schools. - Coastal forest ecology - Coastal forest management; - Hydrologic cycle
3	13	Poor farming practice	Not applicable	Not applicable	Review and update of spatial plans including zoning to guide development planning and development control. Spatial plans to also consider coastal farm/grazing land and seaweed farming and marine spaces.	Not applicable	Not applicable	Not applicable	Regional level capacity building related to training farmers; extension services.	Technology for defining most appropriate agricultural land-use (farming or grazing).	Enforce existing laws related to resources exploitation fishing/seaweed farming. Enforce development control measures according to updated spatial plans.	Not Applicable	Not applicable	Awareness raising campaigns: - public at large - schools - stakeholders benefitting from beaches (tourism operators, hotels, fishermen, etc.)	Curricula development for relevant education in primary and secondary schools. Sustainable development in areas under high demographic and economic development pressure (coastal areas, urban areas). Importance of coasts and coastal habitats and resources.
2	14	Unpredictable demand by tourism operators due to uncertain occupancy rates mean hotels cannot guarantee long term orders.	Not applicable	Not applicable	Not applicable	Not applicable	Not Applicable	Not Applicable	Training farmers; extension services.	Diversify products and markets; coordinate market information; value adding; refrigeration.	Not Applicable	Not Applicable	Not applicable	Not applicable	Not applicable

Forestry

Table 193: Broad assessment of measures to mitigate threats associated with forestry to local coastal communities and ecosystems in Zanzibar.

RV	#	Threat	ICZM	IWRM	Land Use Management	Shoreline Management Planning	Solid and Liquid Waste Management	Sanitation	Capacity building	Technology	Law enforcement	Legal Review	Alternative/Improved Livelihood	Awareness raising	Education
5	1	Forest degradation due to over-exploitation or poor harvest methods (e.g. slash and burn).	Coordination among stakeholders in addressing forest management.	Not applicable	Forest reserves and forests included in land use information management systems and incorporated into spatial planning.	Identifying management units requiring local management arrangements.	Not Applicable	Not Applicable	Information Management: - Monitoring forest reserves - Monitoring forest reserve exploitation Capacity among: - Relevant government departments at national and local levels.	Best forest management practises Alternative livelihood technologies Alternatives to coastal forest wood usage; conservation agriculture; re-planting; alternative to timber; alternatives energy sources (avoiding charcoal and firewood) to reduce demand.	Enforce existing laws related to coastal forest exploitation.	Not Applicable	Provide alternatives to current destructive and unsustainable livelihood practises related to coastal forests, particularly fuel wood and other resources.	Awareness raising campaigns: - public at large - schools - stakeholders benefitting from mangrove services and products	Curricula development for relevant education in primary and secondary schools. - Coastal forest ecology - Coastal forest management
4	2	Inadequate enforcement of forest management regulations resulting in illegal clearing and over-harvesting of mangrove forests and coastal forests	Coordination among stakeholders in addressing forest management. Mangrove forest reserve management plans.	Not applicable	Forest reserves and forests included in land use information management systems and incorporated into spatial planning.	Identifying management units requiring local management arrangements.	Not Applicable	Not Applicable	Information Management: - Monitoring forest reserves - Monitoring forest reserve exploitation Capacity among: - Relevant government departments at national and local levels - BMUs	Best forest management practises Alternative livelihood technologies Alternatives to coastal forest wood usage	Enforce existing laws related to coastal forest exploitation; strengthen enforcement...	Not Applicable	Provide alternatives to current destructive and unsustainable livelihood practises related to coastal forests, particularly fuel wood and other resources.	Awareness raising campaigns: - public at large - schools - stakeholders benefitting from mangrove services and products	Curricula development for relevant education in primary and secondary schools. - Coastal forest ecology - Coastal forest management
4	3	Conflict over illegal mangrove cutting.	Coordinated and participatory land and resource use planning expressed in integrated spatial plans and regulations.	Not applicable	Review and update of spatial plans including zoning to guide development planning and development control. Spatial plans to also consider marine spaces.	Not applicable	Not applicable	Not applicable	Regional level capacity building related to: - Shoreline management - Spatial Planning - Conflict resolution	not applicable	Enforce existing laws related to fisheries. Enforce existing laws related to mangrove exploitation.	Establish required regulations, bylaws and guidelines to ensure sustainable and safe development along near the sea. Informed by shoreline management study.	Provide alternatives to current destructive and unsustainable livelihood practises related to mangrove exploitation and fisheries in particular.	The impact of unsustainable resources usage on beach erosion highlighted in awareness raising campaigns. Services of mangroves and corals in protecting against erosive forces (targeting resource users). Impact of physical structures along the coast on shorelines included in awareness raising campaigns (targeting developers and planners)	Curricula development for relevant education in primary and secondary schools. Sustainable development in areas under high demographic and economic development pressure (coastal areas, urban areas). Importance of coasts and coastal habitats and resources.
4	4	Ineffective land use management resulting in encroachment of expanding agriculture and settlements into forests or clearance for salt works, aquaculture (on Pemba) or tourism.	ICZM is an important tool in addressing the complex requirements to address unsustainable resources usage. Implications at and between all management levels. Catchment and coast management needs to be coordinated. IWRM is the appropriate tool such management in the catchment but needs to incorporate coastal concerns (ICZM).	Not applicable	Forest included in land use information management systems and incorporated into spatial planning.	Identifying management units requiring local management arrangements.	Not Applicable	Not Applicable	Regional level capacity building related to: - Catchment management - Spatial Planning - Conflict resolution - Improved integration and coordination between departments.	Strengthen/modernise spatial planning tools (GIS, remote imageries); improved water source monitoring;	Enforce existing laws related to resources exploitation and water abstraction. Enforce development control measures according to updated spatial plans.	Establish required regulations, bylaws and guidelines to ensure sustainable and safe development in river catchments.	Not applicable	Awareness raising campaigns: - public at large - schools - stakeholders benefitting from beaches (tourism operators, hotels, fishermen, etc.) - tourists. Impact of pollution on environment and health Pollution pathways and waste management. Upstream/downstream.	Curricula development for relevant education in primary and secondary schools. Importance of environmentally sound agriculture production. Importance of integrated management (upstream / downstream). Importance of marine environment. Pollution, environment, health. Waste minimisation and recycling.
4	5	Declining ground water (freshwater) quality.	not applicable	Forest management and catchment land uses addressed in integrated water resources management planning. Link IWRM to coastal integrated planning ensuring upstream/downstream considerations.	Zoning in spatial plans providing guidance for land uses and for development control addressing water resources problems arising from unsustainable land uses.	Not applicable	Not Applicable	Not Applicable	Regional level capacity building related to: - Catchment management - Spatial Planning - Conflict resolution	Strengthen/modernise spatial planning tools (GIS, remote imageries); improved water source monitoring; Agriculture / forestry technologies sustaining recharge of aquifers; rain harvest; re-planting.	Enforce existing laws related to resources exploitation and water abstraction. Enforce development control measures according to updated spatial plans.	Establish required regulations, bylaws and guidelines to ensure sustainable and safe development in river catchments.	Not applicable	Awareness raising campaigns: - public at large - schools on water management and need to conserve water and avoid waste/leaks.	Curricula development for relevant education in primary and secondary schools. - Coastal forest ecology - Coastal forest management; - Hydrologic cycle

RV	#	Threat	ICZM	IWRM	Land Use Management	Shoreline Management Planning	Solid and Liquid Waste Management	Sanitation	Capacity building	Technology	Law enforcement	Legal Review	Alternative/Improved Livelihood	Awareness raising	Education
4	6	Fire	Not applicable	Not applicable	Forest/bush areas included in land use information management systems and incorporated into spatial planning.	not applicable	Not Applicable	Not Applicable	Regional level capacity building related to: - Agriculture management - Spatial Planning - Fire management planning	Strengthen/modernise spatial planning tools (GIS, remote imageries); Best forest management practises Alternative livelihood technologies Alternatives to coastal forest wood usage	Enforce existing laws related to resources exploitation and use of fire to clear bush. Enforce development control measures according to updated spatial plans.	Establish required regulations, bylaws and guidelines to ensure sustainable and safe development in farmland areas.	Provide alternatives to current destructive and unsustainable livelihood practises related to grazing/farming in particular.	Awareness raising campaigns: - public at large - schools - stakeholders benefitting from agricultural land.	Curricula development for relevant education in primary and secondary schools. Importance of environmentally sound agriculture production.
1	7	Pests and grazing damage	Not applicable	Not applicable	Review and update of spatial plans including zoning to guide development planning and development control. Spatial plans to also consider coastal farm/grazing land and seaweed farming and marine spaces.	Identifying management units requiring local management arrangements.	Not applicable	Not applicable	Regional level capacity building related to: - Grazing - Spatial Planning - Pest control - Livestock management.	Technology for defining most appropriate agricultural land-use (farming or grazing).	Enforce existing laws related to farming. Enforce development control measures according to updated spatial plans.	Establish required regulations, bylaws and guidelines to ensure sustainable and safe development along near the sea, and agricultural land.	Provide alternatives to current destructive and unsustainable livelihood practises related to grazing/farming in particular.	Awareness raising campaigns: - public at large - schools - stakeholders benefitting from agricultural land.	Curricula development for relevant education in primary and secondary schools. Sustainable development in areas under high demographic and economic development pressure (coastal areas, urban areas). Importance of coasts and coastal habitats and resources.
1	8	Erosion of mangrove stands.	ICZM is an important tool in addressing the complex requirements to address unsustainable resources usage. Implications at and between all management levels.	Upstream catchment management influences hydrology and sediment flow and may thus interfere with erosion accretion patterns along the coast. Catchment and coast management needs to be coordinated. IWRM is the appropriate tool such management in the catchment but needs to incorporate coastal concerns (ICZM)	Zoning of beaches to be included in Land Use Plans, providing regulations and guidelines for land use. Ideally to be informed from Shoreline Management Planning efforts. Regulations may define types of use as well as set back arrangements. Guidelines may also cover coral reef, seagrass and mangrove management to the extent of importance to beach erosion.	Not applicable	Not Applicable	Not Applicable	Regional level capacity building related to ICZM and in particular shoreline management. Information management - Monitoring occurrences of illegal mangrove cutting. - Re-planting.	Beach protection technologies, from engineering (groynes, etc.) to soft (beach nourishment) solutions and green technologies (mangrove planting, other shoreline vegetation).	Enforce existing laws related to fisheries. Enforce existing laws related to mangrove exploitation.	Establish required regulations, bylaws and guidelines to ensure sustainable and safe development along near the sea. Informed by shoreline management study.	Provide alternatives to current destructive and unsustainable livelihood practises related to mangrove exploitation and fisheries in particular.	The impact of unsustainable resources usage on beach erosion highlighted in awareness raising campaigns. Services of mangroves and corals in protecting against erosive forces (targeting resource users). Impact of physical structures along the coast on shorelines included in awareness raising campaigns (targeting developers and planners)	Curricula development for relevant education in primary and secondary schools. Importance of beaches.

Industry

Table 194: Broad assessment of measures to mitigate threats associated with industry to local coastal communities and ecosystems in Zanzibar.

RV	#	Threat	ICZM	IWRM	Land Use Management	Shoreline Management Planning	Solid and Liquid Waste Management	Sanitation	Capacity building	Technology	Law enforcement	Legal Review	Alternative/Improved Livelihood	Awareness raising	Education
4	1	Inadequate infrastructure management unable to maintain supply of services (electricity, transport, freshwater supply), resulting in a disincentive for industry to be attracted to Zanzibar and develop.	not applicable	Not applicable	Industry included in zoning and development of associated regulations	Not applicable	Not Applicable	Not Applicable	Regional level capacity building related to: supporting infrastructure planning.	Technology for alternative energy sources. Investment.	Not Applicable	Not Applicable	Not applicable	Not applicable	Not applicable
4	2	Lack of coordination of the choice of location of new industries underlines the need for integrated planning.	not applicable	Not applicable	Industry included in zoning and development of associated regulations	Not applicable	Not Applicable	Not Applicable	Regional level capacity building related to: supporting infrastructure planning.	not applicable	Not Applicable	Not Applicable	Not applicable	Not applicable	Not applicable
4	3	Failure to monitor industry liquid waste leading to pollution of waterways and ground water.	Coordination among stakeholders in addressing industry pollution.	Not applicable	Industry included in zoning and development of associated regulations	Not applicable	Waste collection, storage and processing system needs to be put in place.	Not Applicable	Information Management: - Monitoring waste generation, disposal and management - Monitoring sources of industrial waste, its disposal and impact in recipient environment Capacity among: - Relevant government departments at national and local levels - Guidelines	Waste water treatment systems: - collection - treatment technology - discharge Solid Waste Management Systems: - collection - storage - processing - financing - minimisation - reuse? Green Infrastructure Storm Water Systems	Enforce existing laws related to waste disposal	Not Applicable	Not Applicable	Awareness raising campaigns: - public at large - schools - industry Impact of pollution on environment and health Pollution pathways and waste management. Upstream/downstream.	Curricula development for relevant education in primary and secondary schools. Importance of beaches. Pollution, environment, health. Waste minimisation and recycling.
4	4	Failure to monitor industry solid waste leading to pollution of waterways and open ground.	Coordination among stakeholders in addressing industry pollution.	Not applicable	Industry included in zoning and development of associated regulations	Not applicable	Waste collection, storage and processing system needs to be put in place.	Not Applicable	Information Management: - Monitoring waste generation, disposal and management - Monitoring sources of industrial waste, its disposal and impact in recipient environment Capacity among: - Relevant government departments at national and local levels - Guidelines	Waste water treatment systems: - collection - treatment technology - discharge Solid Waste Management Systems: - collection - storage - processing - financing - minimisation - reuse? Green Infrastructure Storm Water Systems	Enforce existing laws related to waste disposal	Not Applicable	Not Applicable	Awareness raising campaigns: - public at large - schools - industry Impact of pollution on environment and health Pollution pathways and waste management. Upstream/downstream.	Curricula development for relevant education in primary and secondary schools. Importance of beaches. Pollution, environment, health. Waste minimisation and recycling.
4	5	Air emission leading to air pollution.	not applicable	Not applicable	Industry zoning.	Not applicable	Emission treatment system needs to be put in place.	Not Applicable	Information Management: - Monitoring waste generation, disposal and management - Monitoring sources of industrial air emission and impact in recipient environment Capacity among: - Relevant government departments at national and local levels - Guidelines	Air emission treatment systems: technology	Enforce existing laws related to air pollution.	Not Applicable	Not applicable	Awareness raising campaigns targeting relevant industries/activities.	Curricula development for relevant education in primary and secondary schools. Importance of environmentally sound industrial production. Importance of integrated management (upstream / downstream).
4	6	Lack of raw materials leading to less adequate investment potentials	not applicable	Not applicable	Industry zoning.	Not applicable	Not applicable	Not applicable	not applicable	Subsidies, incentives.	Not Applicable	Not Applicable	Not applicable	Not applicable	Not applicable
3	7	Inadequate prioritisation in the industrial sector	not applicable	Not applicable	Industry included in zoning and development of associated regulations	Not applicable	Not applicable	Not applicable	not applicable	not applicable	Not Applicable	Not Applicable	Not applicable	Not applicable	Not applicable

Ports and Harbours

Table 195: Broad assessment of measures to mitigate threats associated with ports and harbours to local coastal communities and ecosystems in Zanzibar.

RV	#	Threat	ICZM	IWRM	Land Use Management	Shoreline Management Planning	Solid and Liquid Waste Management	Sanitation	Capacity building	Technology	Law enforcement	Legal Review	Alternative/Improved Livelihood	Awareness raising	Education
4	1	Inefficient operation at Malindi port leading to greater costs of imported and exported goods.	Not applicable	Not applicable	Not applicable	Not applicable	Not Applicable	Not Applicable	Strengthen institutional capacity, ZNZ ports authority	Improve efficiency.	Not Applicable	Not Applicable	Not applicable	Not applicable	Not applicable
3	2	Erosion of shorelines adjacent to some secondary ports: Mkoani and Wete (Pemba), and Mkokotoni (Unguja).	ICZM is an important tool in addressing the complex requirements to address unsustainable resources usage. Implications at and between all management levels. Catchment and coast management needs to be coordinated. IWRM is the appropriate tool such management in the catchment but needs to incorporate coastal concerns (ICZM).	Not applicable	Zoning of beaches to be included in Land Use Plans, providing regulations and guidelines for land use. Ideally to be informed from Shoreline Management Planning efforts. Regulations may define types of use as well as set back arrangements. Guidelines may also cover coral reef, seagrass and mangrove management to the extent of importance to beach erosion.	An understanding of processes and factors behind erosion and accretion along the Tanzanian coast is required. Such an understanding can be attained through a structural effort in Shoreline Management Planning which can then inform Spatial Planning at local level. First step is to identify sediment cells along the coast based on littoral drift considerations, next step to identify management units within these cells based on environment, economic and socio-economic considerations.	Not Applicable	Not Applicable	Capacity among: - Relevant government departments at national and local levels; Strengthen institutional capacity, ZNZ ports authority	Beach protection technologies, from engineering (groynes, etc.) to soft (beach nourishment) solutions and green technologies (mangrove planting, other shoreline vegetation).	Enforce existing laws related to construction near shore (set back provisions).	Establish required regulations, bylaws and guidelines to ensure sustainable and safe development along near the sea. Informed by shoreline management study.	Not applicable	Included in awareness raising campaigns (targeting developers and planners)	Not applicable
2	3	Inadequate environmental mitigation during new port construction leading to environmental degradation e.g. siltation of reefs.	Coordination among stakeholders in addressing proposed port shoreline.	Not applicable	Not applicable	An understanding of processes and factors behind erosion and accretion along the Zanzibar coast is required. Such an understanding can be attained through a structural effort in Shoreline Management Planning which can then inform Spatial Planning at local level. First step is to identify sediment cells along the coast based on littoral drift considerations, next step to identify management units within these cells based on environment, economic and socio-economic considerations.	Not Applicable	Not Applicable	Capacity among: - Relevant government departments at national and local levels	Investment;	Not Applicable	Not Applicable	Not Applicable	not applicable	Not applicable
2	4	Pollution arising from port activities and traffic.	Coordination among stakeholders in addressing harbour industry pollution.	Not applicable	Harbour included in zoning and development of associated regulations	Identifying management units requiring local management arrangements.	Waste collection, storage and processing system needs to be put in place.	Not Applicable	Information Management: - Monitoring waste generation, disposal and management - Monitoring sources of industrial waste, its disposal and impact in recipient environment Capacity among: - Relevant government departments at national and local levels - Guidelines	Waste water treatment systems: - collection - treatment technology - discharge Solid Waste Management Systems: - collection - storage - processing - financing - minimisation - reuse? Green Infrastructure Storm Water Systems	Enforce existing laws related to waste disposal	Not Applicable	Not Applicable	Awareness raising campaigns: - public at large - schools - industry Impact of pollution on environment and health Pollution pathways and waste management. Upstream/downstream.	Curricula development for relevant education in primary and secondary schools. Importance of beaches. Pollution, environment, health. Waste minimisation and recycling.

Infrastructure

Table 196: Broad assessment of measures to mitigate threats associated with infrastructure to local coastal communities and ecosystems in Zanzibar.

RV	#	Threat	ICZM	IWRM	Land Use Management	Shoreline Management Planning	Solid and Liquid Waste Management	Sanitation	Capacity building	Technology	Law enforcement	Legal Review	Alternative/Improved Livelihood	Awareness raising	Education
4	1	Poor land use and infrastructure management leading to poor or biased choices for development, for example.	Coordination among stakeholders in addressing fisheries decline. Guidelines for best practices in mangrove management. Guidelines for best practises in fisheries. Guidelines for best practises in coral reef management. Guidelines to be based on outcome of legal review.	Not applicable	Industry included in zoning and development of associated regulations	Not applicable	Not applicable	Not applicable	Capacity among: - Relevant government departments at national and local levels - Guidelines	not applicable	Enforce existing laws related to land use plans.	Not Applicable	Not applicable	Awareness raising campaigns targeting relevant industries/activities.	Not applicable
4	2	Inadequate infrastructure management unable to maintain supply of services (electricity, transport, freshwater supply, health and education services and ICT) to coastal regions, resulting in a deterioration of living standards, business development and prosperity.	Coordination among stakeholders in addressing fisheries decline. Guidelines for best practices in mangrove management. Guidelines for best practises in fisheries. Guidelines for best practises in coral reef management. Guidelines to be based on outcome of legal review.	Not applicable	Industry included in zoning and development of associated regulations	Not applicable	Not applicable	Not applicable	Capacity among: - Relevant government departments at national and local levels - Guidelines	Investment; Waste water treatment systems: - collection - treatment technology - discharge Solid Waste Management Systems: - collection - storage - processing - financing - minimisation - reuse? Green Infrastructure Storm Water Systems; rain harvest; improved health service delivery; energy.	Not Applicable	Not Applicable	Not applicable	Not applicable	Not applicable

Urbanisation

Table 197: Broad assessment of measures to mitigate threats associated with urbanisation to local coastal communities and ecosystems in Zanzibar.

RV	#	Threat	ICZM	IWRM	Land Use Management	Shoreline Management Planning	Solid and Liquid Waste Management	Sanitation	Capacity building	Technology	Law enforcement	Legal Review	Alternative/Improved Livelihood	Awareness raising	Education
4	1	Poor urban management leading to overcrowding informal settlements that lack clean water and adequate sanitation, leading to increase health and well-being problems from contaminated water and from mosquitos and other pests that thrive in unsanitary environments.	Not applicable	To the extent that solid and liquid waste origin from upstream activities in local river basins.	Review and update of spatial plans including zoning to guide development planning and development control. Spatial plans to also consider marine spaces.	Not applicable	Waste collection, storage and processing system needs to be put in place.	Identify and quantify sources of liquid waste as basis for solution and develop sanitation systems accordingly	Regional level capacity building related to: - Shoreline management - Spatial Planning - Conflict resolution	Waste water treatment systems: - collection - treatment technology - discharge Solid Waste Management Systems: - collection - storage - processing - financing - minimisation - reuse? Green Infrastructure Storm Water Systems	Enforce existing laws related to waste disposal	Not Applicable	Not applicable	Awareness raising campaigns: - public at large - schools. Impact of pollution on environment and health Pollution pathways and waste management.	Curricula development for relevant education in primary and secondary schools. Pollution, environment, health. Waste minimisation and recycling.
4	2	Inadequate solid waste management causing pollution of the landscape, watersheds and the coast.	Coordination among stakeholders in addressing beach pollution. Beach management guidelines	To the extent that solid and liquid waste origin from upstream activities in local river basins.	Beaches included in zoning and development of associated regulations	Identifying management units requiring local management arrangements.	Waste collection, storage and processing system needs to be put in place.	Identify and quantify sources of liquid waste as basis for solution and develop sanitation systems accordingly	Information Management: - Monitoring waste generation, disposal and management - Monitoring sources of liquid waste, its disposal and impact in recipient environment Capacity among: - Relevant government departments at national and local levels - BMUs - Guidelines	Waste water treatment systems: - collection - treatment technology - discharge Solid Waste Management Systems: - collection - storage - processing - financing - minimisation - reuse? Green Infrastructure Storm Water Systems	Enforce existing laws related to waste disposal	Not Applicable	Not applicable	Awareness raising campaigns: - public at large - schools - stakeholders benefitting from beaches (tourism operators, hotels, fishermen, etc.) - tourists. Impact of pollution on environment and health Pollution pathways and waste management. Upstream/downstream.	Curricula development for relevant education in primary and secondary schools. Importance of beaches. Pollution, environment, health. Waste minimisation and recycling.
4	3	Inadequate sanitation causing pollution and health issues.	Not applicable	Not applicable	Not applicable	Not applicable	Waste collection, storage and processing system needs to be put in place.	Identify and quantify sources of liquid waste as basis for solution and develop sanitation systems accordingly	Information Management: - Monitoring waste generation, disposal and management - Monitoring sources of liquid waste, its disposal and impact in recipient environment Capacity among: - Relevant government departments at national and local levels - Guidelines	Waste water treatment systems: - collection - treatment technology - discharge Solid Waste Management Systems: - collection - storage - processing - financing - minimisation - reuse? Green Infrastructure Storm Water Systems; Investments	Enforce existing laws related to waste disposal	Not Applicable	Not applicable	Awareness raising campaigns: - public at large - schools. Impact of pollution on environment and health Pollution pathways and waste management.	Curricula development for relevant education in primary and secondary schools. Pollution, environment, health. Waste minimisation and recycling.
4	4	Failure of housing for the youth and children exposing them to human predators, violence, abuse and sexual assault that increase their risk of HIV infection.	not applicable	not applicable	not applicable	not applicable	not applicable	not applicable	Capacity among: - Relevant government departments at national and local levels to support child care.	not applicable	Enforce existing laws related to child welfare.	not applicable	not applicable	Awareness raising campaigns: - public at large - schools -sustain human rights.	not applicable
4	5	Increasing vehicular/pedestrian congestion, conflicts and air pollution.	Not applicable	Not applicable	Review and update of spatial plans including vehicle transport zoning to guide development planning and development control.	Not applicable	Not applicable	Not applicable	Regional level capacity building related to: - Spatial Planning - Traffic flow.	Strengthen enforcement of traffic laws and vehicle behaviour. Infrastructure.	Enforce existing laws related to traffic.	Not Applicable	Not applicable	Awareness raising campaigns: - public at large - schools - road users.	Curricula development for relevant education in primary and secondary schools. Sustainable development in areas under high demographic and economic development pressure (coastal areas, urban areas). Importance of coasts and coastal habitats and resources.
3	6	Poor urban management threatening the status of the Stone Town World Heritage Site and thus the tourism industry on Zanzibar.	Not applicable	Not applicable	Review and update of spatial plans including construction zoning to guide development planning and development control.	Not applicable	Not applicable	Not applicable	Regional level capacity building related to: - Spatial Planning - Construction in Stone Town.	not applicable	Enforce existing laws related to construction, anti-corruption, transparency and good governance.	Not Applicable	Not applicable	Awareness raising campaigns: - public at large - schools - residents.	Curricula development for relevant education in primary and secondary schools. Sustainable development in areas under high demographic and economic development pressure (coastal areas, urban areas). Importance of World Heritage status.
1	7	Poor vehicular management leading to increasing vehicular congestion resulting in loss of working hours and fatigue among the workforce.	Not applicable	Not applicable	Review and update of spatial plans including vehicle transport zoning to guide development planning and development control.	Not applicable	Not applicable	Not applicable	Regional level capacity building related to: - Spatial Planning - Traffic flow.	Strengthen enforcement of traffic laws and vehicle behaviour. Infrastructure.	Enforce existing laws related to traffic.	Not Applicable	Not applicable	Awareness raising campaigns: - public at large - schools - road users.	Curricula development for relevant education in primary and secondary schools. Sustainable development in areas under high demographic and economic development pressure (coastal areas, urban areas). Importance of coasts and coastal habitats and resources.

Non-Renewable Extractive Industry – Hydrocarbons

Table 198: Broad assessment of measures to mitigate threats associated with hydrocarbons to local coastal communities and ecosystems in Zanzibar.

RV	#	Threat	ICZM	IWRM	Land Use Management	Shoreline Management Planning	Solid and Liquid Waste Management	Sanitation	Capacity building	Technology	Law enforcement	Legal Review	Alternative/Improved Livelihood	Awareness raising	Education
4	1	Degradation of the natural marine and coastal environment and thus impact on livelihoods, from failure of exploration companies to adhere to environmental and socio-economic safeguards, partly due to weakness in the oversight provided by the Department of Environment, responsible for issuing licences and monitoring the operations that have been subjected to EIAs.	Not applicable	Not applicable	Not applicable	Coordination among stakeholders (including Min Energy exploration companies, Dept. Environment NGOs, etc.) in addressing coastal environmental issues.	Not Applicable	Not Applicable	Strengthen Dept. Environment NGOs, etc.) in addressing coastal environmental issues; coast guard.	Use of remote sensing technology to monitor offshore operations and track developments.	Enforce existing laws and international agreements (e.g. Ramsar) related to exploration and development.	Strengthen regulator capacity;	Not applicable	Maintain public and other stakeholders informed of developments and risks.	Not Applicable
2	2	Piracy attacks against offshore operations.	not applicable	Not applicable	Not applicable	Not applicable	Not Applicable	Not Applicable	Strengthen maritime security forces, information sharing and monitoring;	Use of remote sensing technology to track pirate movements.	Not Applicable	Strengthen courts handling piracy cases.	Not applicable	Not applicable	Not applicable
1	3	Social and/or political unrest related to behaviour of the Government and stakeholders.	not applicable	Not applicable	Not applicable	Not applicable	Not Applicable	Not Applicable	Not Applicable	Information sharing;	Enforce relevant existing laws. Fair compensation for losses;	Not Applicable	Not applicable	Awareness raising campaigns targeting relevant industries/activities; improved transparency.	Training for job opportunities (CHECK)

Non-Renewable Extractive Industry – Coastal Sand and Rock Mining

Table 199: Broad assessment of measures to mitigate threats associated with sand and rock mining to local coastal communities and ecosystems in Zanzibar.

RV	#	Threat	ICZM	IWRM	Land Use Management	Shoreline Management Planning	Solid and Liquid Waste Management	Sanitation	Capacity building	Technology	Law enforcement	Legal Review	Alternative/Improved Livelihood	Awareness raising	Education
4	1	Poor management of shores (e.g. coastal developments), lack of understanding of coastal erosion causative factors leading to loss of shoreline.	ICZM is an important tool in addressing the complex requirements to address unsustainable resources usage. Implications at and between all management levels. Catchment and coast management needs to be coordinated. IWRM is the appropriate tool such management in the catchment but needs to incorporate coastal concerns (ICZM).	Link IWRM to coastal integrated planning ensuring upstream/downstream considerations.	Zoning of beaches to be included in Land Use Plans, providing regulations and guidelines for land use. Ideally to be informed from Shoreline Management Planning efforts. Regulations may define types of use as well as set back arrangements. Guidelines may also cover coral reef, seagrass and mangrove management to the extent of importance to beach erosion.	An understanding of processes and factors behind erosion and accretion along the Tanzanian coast is required. Such an understanding can be attained through a structural effort in Shoreline Management Planning which can then inform Spatial Planning at local level. First step is to identify sediment cells along the coast based on littoral drift considerations, next step to identify management units within these cells based on environment, economic and socio-economic considerations.	Not Applicable	Not Applicable	Information Management: - Monitoring forest reserves - Monitoring forest reserve exploitation Capacity among: - Relevant government departments at national and local levels - BMUs	Beach protection technologies, from engineering (groynes, etc.) to soft (beach nourishment) solutions and green technologies (mangrove planting, other shoreline vegetation).	Enforce existing laws related to resources exploitation sand mining and construction near shore (set back provisions).	Establish required regulations, bylaws and guidelines to ensure sustainable and safe development along near the sea. Informed by shoreline management study.	Provide alternatives to current destructive and unsustainable livelihood practises related to mangrove exploitation and fisheries in particular.	The impact of unsustainable resources usage on beach erosion highlighted in awareness raising campaigns. Services of mangroves and corals in protecting against erosive forces (targeting resource users). Impact of physical structures along the coast on shorelines included in awareness raising campaigns (targeting developers and planners)	Curricula development for relevant education in primary and secondary schools. Importance of beaches.
4	2	Corrupt and uncoordinated institutional enforcement of mining policy to protect the natural environment, particularly the coastline.	ICZM is an important tool in addressing the complex requirements to address unsustainable resources usage. Implications at and between all management levels. Catchment and coast management needs to be coordinated. IWRM is the appropriate tool such management in the catchment but needs to incorporate coastal concerns (ICZM).	Not applicable	Zoning of beaches to be included in Land Use Plans, providing regulations and guidelines for land use. Ideally to be informed from Shoreline Management Planning efforts. Regulations may define types of use as well as set back arrangements. Guidelines may also cover coral reef, seagrass and mangrove management to the extent of importance to beach erosion.	An understanding of processes and factors behind erosion and accretion along the Tanzanian coast is required. Such an understanding can be attained through a structural effort in Shoreline Management Planning which can then inform Spatial Planning at local level. First step is to identify sediment cells along the coast based on littoral drift considerations, next step to identify management units within these cells based on environment, economic and socio-economic considerations.	Not Applicable	Not Applicable	Information Management: - Monitoring forest reserves - Monitoring forest reserve exploitation Capacity among: - Relevant government departments at national and local levels - BMUs	Best forest and mining management practises; Alternative livelihood technologies for mining and coastal forest wood usage	Enforce existing laws related to coastal forest exploitation, fisheries, mangrove exploitation and coastal mining.	Not Applicable	Provide alternatives to current destructive and unsustainable livelihood practises related to coastal forests, particularly fuel wood and mining.	Awareness raising campaigns: - public at large - schools - stakeholders benefitting from mangrove services and products	Curricula development for relevant education in primary and secondary schools. - Coastal forest ecology - Coastal forest management
2	3	Loss of beach habitats for turtle nesting.	Coordination among stakeholders in addressing turtle decline. Guidelines for best practices in beach management. Guidelines to be based on outcome of legal review.	Not applicable	Not applicable	Designated turtle nesting beaches to be integrated into SMP, with emphasis on beach condition, set-back distances, lighting and infrastructure, as well as human disturbance.	Waste management to reduce solid waste on beaches, and beach clean-up to assist turtle nesting.	Not Applicable	Information Management: - Monitoring occurrences of illegal turtle's harvest. Capacity among: - Relevant government departments at national and local levels - MPAs	Track turtle movements to improve avoidance.	Enforce existing laws related to turtle protection.	Review fishing legislation on site specific basis, where turtles occur.	Not applicable	Awareness raising campaigns: - public at large - schools - stakeholders benefitting from turtles (fishing communities, middlemen, hotels and restaurants)	Curricula development for relevant education in primary and secondary schools. - Sustainable Fisheries. - Fisheries ecology. - Conservation and protected species.
1	4	Anarchistic sand and rock extraction from coastal zone resulting in increased erosion.	ICZM is an important tool in addressing the complex requirements to address unsustainable resources usage. Implications at and between all management levels.	Upstream catchment management influences hydrology and sediment flow and may thus interfere with erosion accretion patterns along the coast. Catchment and coast management needs to be coordinated. IWRM is the appropriate tool such management in the catchment but needs to incorporate coastal concerns (ICZM)	Zoning of beaches to be included in Land Use Plans, providing regulations and guidelines for land use. Ideally to be informed from Shoreline Management Planning efforts. Regulations may define types of use as well as set back arrangements. Guidelines may also cover coral reef, seagrass and mangrove management to the extent of importance to beach erosion.	An understanding of processes and factors behind erosion and accretion along the Tanzanian coast is required. Such an understanding can be attained through a structural effort in Shoreline Management Planning which can then inform Spatial Planning at local level. First step is to identify sediment cells along the coast based on littoral drift considerations, next step to identify management units within these cells based on environment, economic and socio-economic consideration.	Not Applicable	Not Applicable	Regional level capacity building related to ICZM and in particular shoreline management. Information management - Monitoring occurrences of illegal fisheries - Monitoring fishing practises - Monitoring land uses - Monitoring beach sand mining	Beach protection technologies, from engineering (groynes, etc.) to soft (beach nourishment) solutions and green technologies (mangrove planting, other shoreline vegetation).	Enforce existing laws related to resources exploitation sand mining and construction near shore (set back provisions).	Establish required regulations, bylaws and guidelines to ensure sustainable and safe development along near the sea. Informed by shoreline management study.	Provide alternatives to current destructive and unsustainable livelihood practises related to sand extraction in particular.	The impact of unsustainable resources usage on beach erosion highlighted in awareness raising campaigns. Services of mangroves and corals in protecting against erosive forces (targeting resource users). Impact of physical structures along the coast on shorelines included in awareness raising campaigns (targeting developers and planners)	Curricula development for relevant education in primary and secondary schools. Importance of beaches.
1	5	Loss of river basin habitat from un-regulated sand extraction.	ICZM is an important tool in addressing the complex requirements to address unsustainable resources usage. Implications at and between all management levels. Catchment and coast management needs to be coordinated. IWRM is the appropriate tool such management in the catchment but needs to incorporate coastal concerns (ICZM).	Link IWRM to coastal integrated planning ensuring upstream/downstream considerations.	Zoning of beaches to be included in Land Use Plans, providing regulations and guidelines for land use. Ideally to be informed from Shoreline Management Planning efforts. Regulations may define types of use as well as set back arrangements. Guidelines may also cover coral reef, seagrass and mangrove management to the extent of importance to beach erosion.	An understanding of processes and factors behind erosion and accretion along the Tanzanian coast is required. Such an understanding can be attained through a structural effort in Shoreline Management Planning which can then inform Spatial Planning at local level. First step is to identify sediment cells along the coast based on littoral drift considerations, next step to identify management units within these cells based on environment, economic and socio-economic considerations.	Not Applicable	Not Applicable	Information Management: - Monitoring forest reserves - Monitoring forest reserve exploitation Capacity among: - Relevant government departments at national and local levels - BMUs	Beach protection technologies, from engineering (groynes, etc.) to soft (beach nourishment) solutions and green technologies (mangrove planting, other shoreline vegetation).	Enforce existing laws related to resources exploitation sand mining and construction near shore (set back provisions).	Establish required regulations, bylaws and guidelines to ensure sustainable and safe development along near the sea. Informed by shoreline management study.	Provide alternatives to current destructive and unsustainable livelihood practises related to sand extraction in particular.	The impact of unsustainable resources usage on beach erosion highlighted in awareness raising campaigns. Services of mangroves and corals in protecting against erosive forces (targeting resource users). Impact of physical structures along the coast on shorelines included in awareness raising campaigns (targeting developers and planners)	Curricula development for relevant education in primary and secondary schools. Importance of beaches.
1	6	Economic losses through tourist abandonment	Not applicable	Not applicable	Not applicable	Designated tourism beaches to be integrated into SMP.	Not applicable	Not applicable	Environmental authorities Land use planners Information Management: - Monitoring beach sand extraction. Capacity among: - Relevant government departments at national and local levels - BMUs - Guidelines	not applicable	Enforce existing laws related to resources exploitation sand mining and construction near shore (set back provisions).	Not Applicable	Provide alternatives to current destructive and unsustainable livelihood practises related to sand extraction in particular.	The impact of unsustainable resources usage on beach erosion highlighted in awareness raising campaigns. Services of mangroves and corals in protecting against erosive forces (targeting resource users). Impact of physical structures along the coast on shorelines included in awareness raising campaigns (targeting developers and planners)	Curricula development for relevant education in primary and secondary schools. Importance of beaches.

RV	#	Threat	ICZM	IWRM	Land Use Management	Shoreline Management Planning	Solid and Liquid Waste Management	Sanitation	Capacity building	Technology	Law enforcement	Legal Review	Alternative/Improved Livelihood	Awareness raising	Education
1	7	Loss of coastal aesthetics	Not applicable	Not applicable	Not applicable	Designated tourism beaches to be integrated into SMP.	Not applicable	Not applicable	Environmental authorities Land use planners Information Management: - Monitoring beach sand extraction. Capacity among: - Relevant government departments at national and local levels - BMUs - Guidelines	not applicable	Enforce existing laws related to resources exploitation sand mining and construction near shore (set back provisions).	Not Applicable	Provide alternatives to current destructive and unsustainable livelihood practises related to sand extraction in particular.	The impact of unsustainable resources usage on beach erosion highlighted in awareness raising campaigns. Services of mangroves and corals in protecting against erosive forces (targeting resource users). Impact of physical structures along the coast on shorelines included in awareness raising campaigns (targeting developers and planners)	Curricula development for relevant education in primary and secondary schools. Importance of beaches.
1	8	Increase in water borne diseases from quarries that fill with rainwater.	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Environmental authorities Land use planners Information Management: - Monitoring mining and management Capacity among: - Relevant government departments at national and local levels. - Guidelines	not applicable	Enforce existing laws related to mining.	Not Applicable	Not applicable	Awareness raising campaigns: - mining stakeholders; Impact of stagnant water on environment and health.	Curricula development for relevant education in primary and secondary schools. Importance of environmentally sound mining; Pollution, environment, health.
1	9	Shallow freshwater table contamination from poor citing of rock quarries.	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Environmental authorities Land use planners Information Management: - Monitoring mining and management Capacity among: - Relevant government departments at national and local levels. - Guidelines	not applicable	Enforce existing laws related to mining.	Not Applicable	Not applicable	Awareness raising campaigns: - mining stakeholders; Impact of stagnant water on environment and health.	Curricula development for relevant education in primary and secondary schools. Importance of environmentally sound mining; Pollution, environment, health.

Non-Renewable Extractive Industry – Salt Production from Evaporation of Sea Water

Table 200: Broad assessment of measures to mitigate threats associated with salt production to local coastal communities and ecosystems in Zanzibar.

RV	#	Threat	ICZM	IWRM	Land Use Management	Shoreline Management Planning	Solid and Liquid Waste Management	Sanitation	Capacity building	Technology	Law enforcement	Legal Review	Alternative/Improved Livelihood	Awareness raising	Education
4	1	Unplanned urbanization in some areas reduces land availability into which to expand.	Coordination among stakeholders in addressing salt pan management and coastal development in suitable sat pan areas. Mangrove forest reserve management plans.	Not applicable	Salt pans included in zoning and development of associated regulations	Identifying management units requiring local management arrangements.	Not Applicable	Not Applicable	Information Management: - Monitoring forest reserves - Monitoring forest reserve exploitation Capacity among: - Relevant government departments at national and local levels	Strengthen/modernise spatial planning tools (GIS, remote imageries); add value to existing salt harvest.	Enforce existing laws related to coastal forest exploitation, land development.	Revise applicable legislation and streamline salt production laws.	Not Applicable	not applicable	Not applicable
4	2	Unsustainable practices resulting in degradation of mangrove forests for ponds and timber (for boiling salt water), causing losses to the wider environment with respect to shelter from wave action to fisheries production.	Coordination among stakeholders in addressing forest management. Mangrove forest reserve management plans.	Not applicable	Forest reserves and forests included in land use information management systems and incorporated into spatial planning.	Identifying management units requiring local management arrangements.	Not Applicable	Not Applicable	Information Management: - Monitoring forest reserves - Monitoring forest reserve exploitation Capacity among: - Relevant government departments at national and local levels - BMUs	Best forest management practises Alternative livelihood technologies Alternatives to coastal forest wood usage; re-planting mangrove.	Enforce existing laws related to coastal forest exploitation.	Not Applicable	Provide alternatives to current destructive and unsustainable livelihood practises related to coastal forests, particularly fuel wood and other resources.	Awareness raising campaigns: - public at large - schools - stakeholders benefitting from mangrove services and products	Curricula development for relevant education in primary and secondary schools. - Coastal forest ecology - Coastal forest management
4	3	Solid and liquid wastes from improper disposal	Not applicable	Not applicable	Not applicable	Not applicable	Waste collection, storage and processing system needs to be put in place.	Not applicable	not applicable	not applicable	"Don't produce salt"	Not Applicable	Not applicable	Not applicable	Not applicable
2	4	Sea level rise threatening infrastructure (dykes and buildings, etc.).	Coordination among stakeholders in addressing salt pan management. Mangrove forest reserve management plans.	Not applicable	Salt pans included in zoning and development of associated regulations	Identifying management units requiring local management arrangements.	Not Applicable	Not Applicable	Not Applicable	Beach protection technologies, from engineering (groynes, etc.) to soft (beach nourishment) solutions and green technologies (mangrove planting, other shoreline vegetation).	Not Applicable	Not Applicable	Not applicable	Not applicable	Not applicable
1	5	Lack of suitable habitat for artisanal (non-pump) and industrial systems into which to expand/adapt, particularly with respect to land and availability of clay to construct dykes.	"NO NEED"												
1	6	Local population hazard from low iodisation of salt from small-scale producers in Zanzibar (iodine deficiency disorders).	Not applicable	Not applicable	Not applicable	Not applicable	Not Applicable	Not Applicable	Not Applicable	Iodization.	Enforce existing laws related to addition of salt (if exists)	Review existing laws related to addition of salt.	Not applicable	Awareness raising campaigns: - public at large - schools - stakeholders benefitting from local salt - of the need for iodine.	Curricula development for relevant education in primary and secondary schools. Importance of iodized salt.

Natural Resources

Table 201: Broad assessment of measures to mitigate threats associated with natural resources to local coastal communities and ecosystems in Zanzibar.

RV	#	Threat	ICZM	IWRM	Land Use Management	Shoreline Management Planning	Solid and Liquid Waste Management	Sanitation	Capacity building	Technology	Law enforcement	Legal Review	Alternative/Improved Livelihood	Awareness raising	Education
5	1	Illegal (destructive) fishing damaging seaweed, seagrass beds and coral reefs [1].	Coordination among stakeholders in addressing fisheries decline. Guidelines for best practices in mangrove management. Guidelines for best practises in fisheries. Guidelines for best practises in coral reef management. Guidelines to be based on outcome of legal review.	Not applicable	Mangroves and other habitats of importance (including seagrass areas and coral reefs) for fisheries included in land use information management systems and incorporated into spatial planning.	Identifying management units requiring local management arrangements.	Not Applicable	Not Applicable	Information Management: - Monitoring occurrences of illegal fisheries - Monitoring fishing practises - Monitoring fisheries catches - Monitoring fisheries resources - Monitoring fisheries habitats (mangroves, coral reefs) Capacity among: - Relevant government departments at national and local levels - BMUs	Offshore fisheries Aquaculture; Add value to existing harvest.	Enforce existing laws related to fisheries. Enforce existing laws related to mangrove exploitation. Enforce existing laws related to coral mining.	Review appropriateness of fisheries regulations in relation to local conditions, environment, species and gears. Establish local zoning and fishing effort seasonality.	Provide alternatives to current destructive and unsustainable livelihood practises related to fisheries. - Emphasis on young generation	Awareness raising campaigns: - public at large - schools - stakeholders benefitting from fisheries (fishing communities, middlemen, hotels and restaurants)	Curricula development for relevant education in primary and secondary schools. - Sustainable Fisheries. - Fisheries ecology.
5	2	Invasive Indian house crow causing loss of bird diversity through ferocious predation on eggs of local bird species thus threatening indigenous populations.	not applicable	not applicable	not applicable	not applicable	Waste collection, storage and processing system needs to be put in place.	not applicable	not applicable	Eradication program.	Not Applicable	Not Applicable	Not applicable	Awareness raising campaigns: - public at large - schools - tourists. on impacts and means to eradicate pest.	Not applicable
4	3	Poor management of the shores (e.g. coastal developments) and lack of understanding of coastal erosion leading to loss of shoreline.	ICZM is an important tool in addressing the complex requirements to address unsustainable resources usage. Implications at and between all management levels. Catchment and coast management needs to be coordinated. IWRM is the appropriate tool such management in the catchment but needs to incorporate coastal concerns (ICZM).	Not applicable	Zoning of beaches to be included in Land Use Plans, providing regulations and guidelines for land use. Ideally to be informed from Shoreline Management Planning efforts. Regulations may define types of use as well as set back arrangements. Guidelines may also cover coral reef, seagrass and mangrove management to the extent of importance to beach erosion.	An understanding of processes and factors behind erosion and accretion along the Tanzanian coast is required. Such an understanding can be attained through a structural effort in Shoreline Management Planning which can then inform Spatial Planning at local level. First step is to identify sediment cells along the coast based on littoral drift considerations, next step to identify management units within these cells based on environment, economic and socio-economic considerations.	Not Applicable	Not Applicable	Information Management: - Monitoring forest reserves - Monitoring forest reserve exploitation Capacity among: - Relevant government departments at national and local levels - BMUs	Beach protection technologies, from engineering (groynes, etc.) to soft (beach nourishment) solutions and green technologies (mangrove planting, other shoreline vegetation).	Enforce existing laws related to resources exploitation sand mining and construction near shore (set back provisions).	Establish required regulations, bylaws and guidelines to ensure sustainable and safe development along near the sea. Informed by shoreline management study. Review relevant institutional structure ("packaging! S)	Provide alternatives to current destructive and unsustainable livelihood practises related to mangrove exploitation and fisheries in particular.	The impact of unsustainable resources usage on beach erosion highlighted in awareness raising campaigns. Services of mangroves and corals in protecting against erosive forces (targeting resource users). Impact of physical structures along the coast on shorelines included in awareness raising campaigns (targeting developers and planners)	Curricula development for relevant education in primary and secondary schools. Importance of beaches.
4	4	Coral bleaching from El Nino sea surface temperature rise damaging coral reefs.	not applicable	not applicable	not applicable	not applicable	not applicable	not applicable	not applicable	not applicable	Enforce existing laws related to fisheries. Enforce existing laws related to coral reef exploitation.	not applicable	not applicable	not applicable	not applicable
4	5	Pollution through nutrient enrichment, particularly from sewage disposal impacting the structure of coral reef ecosystems.	Coordination among stakeholders in addressing beach pollution. Beach management guidelines	To the extent that solid and liquid waste origin from upstream activities in local river basins.	Beaches included in zoning and development of associated regulations	Identifying management units requiring local management arrangements.	Waste collection, storage and processing system needs to be put in place.	Identify and quantify sources of liquid waste as basis for solution and develop sanitation systems accordingly	Information Management: - Monitoring waste generation, disposal and management - Monitoring sources of liquid waste, its disposal and impact in recipient environment Capacity among: - Relevant government departments at national and local levels - BMUs - Guidelines	Waste water treatment systems: - collection - treatment technology - discharge Solid Waste Management Systems: - collection - storage - processing - financing - minimisation - reuse? Green Infrastructure Storm Water Systems; infrastructure.	Enforce existing laws related to waste disposal	Not Applicable	Not applicable	Awareness raising campaigns: - public at large - schools - stakeholders benefitting from beaches (tourism operators, hotels, fishermen, etc.) - tourists. Impact of pollution on environment and health Pollution pathways and waste management. Upstream/downstream.	Curricula development for relevant education in primary and secondary schools. Importance of beaches. Pollution, environment, health. Waste minimisation and recycling.
4	6	Habitat alteration from land use changes (salt pans in mangrove areas, shoreline alterations and inundation).	Coordination among stakeholders in addressing forest management. Mangrove forest reserve management plans.	Not applicable	Forest reserves and forests included in land use information management systems and incorporated into spatial planning.	Identifying management units requiring local management arrangements.	Not Applicable	Not Applicable	Information Management: - Monitoring forest reserves - Monitoring forest reserve exploitation Capacity among: - Relevant government departments at national and local levels - BMUs	Best forest management practises Alternative livelihood technologies Alternatives to coastal forest wood usage	Enforce existing laws related to coastal forest exploitation.	Review of applicable laws and devise new legislation.	Provide alternatives to current destructive and unsustainable livelihood practises related to coastal forests, particularly fuel wood and other resources.	Awareness raising campaigns: - public at large - schools - stakeholders benefitting from mangrove services and products	Curricula development for relevant education in primary and secondary schools. - Coastal forest ecology - Coastal forest management
4	7	Gillnetting threatening turtles (adults and sub-adults). Gillnetting threatening whales, especially migrating Humpback whales and dolphins.	Not applicable	Not applicable	Not applicable	Not applicable	Not Applicable	Not Applicable	Not Applicable	Track whale movements to improve avoidance.	Not Applicable	Review fishing legislation on site specific basis, where turtles occur.	Not applicable	Awareness raising campaigns: - gill-netters	Not applicable

RV	#	Threat	ICZM	IWRM	Land Use Management	Shoreline Management Planning	Solid and Liquid Waste Management	Sanitation	Capacity building	Technology	Law enforcement	Legal Review	Alternative/Improved Livelihood	Awareness raising	Education
4	8	Predation and disturbance of turtle nesting sites	ICZM is an important tool in addressing the complex requirements to address unsustainable resources usage. Implications at and between all management levels. Catchment and coast management needs to be coordinated. IWRM is the appropriate tool such management in the catchment but needs to incorporate coastal concerns (ICZM).	Not applicable	not applicable	Designated turtle nesting beaches to be integrated into SMP, with emphasis on beach condition, set-back distances, lighting and infrastructure, as well as human disturbance.	Not Applicable	Not Applicable	Not Applicable	Track turtle movements to improve avoidance.	Enforce relevant national and regional laws and commitments with respect to turtles.	Review fishing legislation on site specific basis, where turtles occur.	Not applicable	Awareness raising campaigns: - public at large - schools - stakeholders benefitting from turtles (fishing communities, middlemen, hotels and restaurants)	Curricula development for relevant education in primary and secondary schools. - Sustainable Fisheries. - Fisheries ecology. - Conservation and protected species.
3	9	Waste disposal, in solid and liquid form causing harm to seagrass beds and estuaries and lagoons.	Coordination among stakeholders in addressing lagoon pollution.	To the extent that solid and liquid waste origin from upstream activities in local river basins.	Beaches included in zoning and development of associated regulations	Identifying management units requiring local management arrangements.	Review of management of agrochemicals upstream; Waste collection, storage and processing system needs to be put in place.	Identify and quantify sources of liquid waste as basis for solution and develop sanitation systems accordingly	Information Management: - Monitoring waste generation, disposal and management - Monitoring sources of liquid waste, its disposal and impact in recipient environment Capacity among: - Relevant government departments at national and local levels - Guidelines	Waste water treatment systems: - collection - treatment technology - discharge Solid Waste Management Systems: - collection - storage - processing - financing - minimisation - reuse? Technology for monitoring receiving environment. Green Infrastructure Storm Water Systems	Enforce existing laws related to waste disposal.	Not Applicable	Not applicable	Awareness raising campaigns: - public at large - schools Impact of pollution on environment and health Pollution pathways and waste management. Upstream/downstream.	Curricula development for relevant education in primary and secondary schools. Importance of beaches. Pollution, environment, health. Waste minimisation and recycling.
2	10	Tourist activities damaging seagrass beds and coral reefs [2].	Coordination among stakeholders in addressing habitat degradation by tourists. Guidelines for best practises in coral reef management. Guidelines to be based on outcome of legal review.	Not applicable	Habitats of importance (including seagrass areas and coral reefs) for fisheries included in land use information management systems and incorporated into spatial planning.	Identifying management units requiring local management arrangements.	Not Applicable	Not Applicable	Capacity among: - Relevant tourism guides and operators.	not applicable	Enforce existing laws related to natural resource protection.	Not Applicable	Not applicable	Awareness raising campaigns: - tourist industry.	not applicable
2	11	Overharvest of invertebrate marine life negatively affecting sea grass meadows.	Coordination among stakeholders in addressing fisheries decline. Guidelines for best practices in mangrove management. Guidelines for best practises in fisheries. Guidelines for best practises in coral reef management. Guidelines to be based on outcome of legal review.	Not applicable	Mangroves and other habitats of importance (including seagrass areas and coral reefs) for fisheries included in land use information management systems and incorporated into spatial planning.	Identifying management units requiring local management arrangements.	Not Applicable	Not Applicable	Information Management: - Monitoring occurrences of illegal fisheries - Monitoring fishing practises - Monitoring fisheries catches - Monitoring fisheries resources - Monitoring fisheries habitats (mangroves, coral reefs) Capacity among: - Relevant government departments at national and local levels - BMUs	Offshore fisheries Aquaculture; Add value to existing harvest.	Enforce existing laws related to fisheries. Enforce existing laws related to mangrove exploitation. Enforce existing laws related to coral mining.	Review appropriateness of fisheries regulations in relation to local conditions, environment, species and gears. Establish local zoning and fishing effort seasonality. Devise by-laws.	Provide alternatives to current destructive and unsustainable livelihood practises related to fisheries. - Emphasis on young generation	Awareness raising campaigns: - public at large - schools - stakeholders benefitting from fisheries (fishing communities, middlemen, hotels and restaurants)	Curricula development for relevant education in primary and secondary schools. - Sustainable Fisheries. - Fisheries ecology.
2	12	Sedimentation of coral reefs from river discharges, sewage discharges and dredging.	Coordination among stakeholders in addressing beach pollution. Beach management guidelines	To the extent that solid and liquid waste origin from upstream activities in local river basins.	Beaches included in zoning and development of associated regulations	Identifying management units requiring local management arrangements.	Waste collection, storage and processing system needs to be put in place.	Identify and quantify sources of liquid waste as basis for solution and develop sanitation systems accordingly	Information Management: - Monitoring waste generation, disposal and management - Monitoring sources of liquid waste, its disposal and impact in recipient environment Capacity among: - Relevant government departments at national and local levels - BMUs - Guidelines	Waste water treatment systems: - collection - treatment technology - discharge Solid Waste Management Systems: - collection - storage - processing - financing - minimisation - reuse? Green Infrastructure Storm Water Systems	Enforce existing laws related to waste disposal	Review of applicable laws and devise new legislation.	Not applicable	Awareness raising campaigns: - public at large - schools - stakeholders benefitting from beaches (tourism operators, hotels, fishermen, etc.) - tourists. Impact of pollution on environment and health Pollution pathways and waste management. Upstream/downstream.	Curricula development for relevant education in primary and secondary schools. Importance of beaches. Pollution, environment, health. Waste minimisation and recycling.
2	13	Seismic surveys by oil and gas companies deterring whales, especially migrating Humpback whales with calves.	Not applicable	Not applicable	Not applicable	Not applicable	Not Applicable	Not Applicable	Strengthen institutional capacity of regulators.	Track whale movements to improve avoidance.	Enforce relevant national and regional laws and commitments with respect to whales.	Review seismic survey permitting legislation on site specific basis, where whales occur.	Not applicable	Awareness raising campaigns: - oil and gas companies.	Not applicable
1	14	Poor upstream land use affecting seaweed and seagrass productivity [3].	Not applicable	Forest management and catchment land uses addressed in integrated water resources management planning. Link IWRM to coastal integrated planning ensuring upstream/downstream considerations.	Habitats of importance (including seagrass areas and coral reefs) for fisheries included in land use information management systems and incorporated into spatial planning.	Identifying management units requiring local management arrangements.	Not applicable	Not applicable	Information Management: - Monitoring land use in catchment. Capacity building among: - Relevant government departments at national and local levels - BMUs - Local communities upstream.	Strengthen/modernise spatial planning tools (GIS, remote imageries); improved water source monitoring; Agriculture / forestry technologies sustaining recharge of aquifers; rain harvest;	Enforce existing laws related to wetlands protection.	Not Applicable	Not applicable	Not applicable	Not applicable

Freshwater Resources

Table 202: Broad assessment of measures to mitigate threats associated with freshwater resources to local coastal communities and ecosystems in Zanzibar.

RV	#	Threat	ICZM	IWRM	Land Use Management	Shoreline Management Planning	Solid and Liquid Waste Management	Sanitation	Capacity building	Technology	Law enforcement	Legal Review	Alternative/Improved Livelihood	Awareness raising	Education
4	1	Degradation of catchments due to land use changes and livestock keeping.	Not applicable	Land uses in catchment and its impacts on water resources included in IWRM planning	Zoning in spatial plans providing guidance for land uses and for development control addressing water resources problems arising from unsustainable land uses.	Not applicable	Not Applicable	Not Applicable	Regional level capacity building related to: - Catchment management - Spatial Planning	Strengthen/modernise spatial planning tools (GIS, remote imageries); improved water source monitoring; sustaining recharge of aquifers; rain harvest;	Enforce existing laws related to water abstraction and waterways; appropriate farming practices.	Not Applicable	Not applicable	Awareness raising campaigns: - public at large - tourism sector, on water management and need to conserve water and avoid waste/leaks.	Curricula development for relevant education in primary and secondary schools. - Coastal forest ecology - Coastal forest management; - Hydrologic cycle
4	2	Population and economic growth leading to increasing demand for freshwater.	not applicable	Land uses in catchment and its impacts on water resources included in IWRM planning	Zoning in spatial plans providing guidance for land uses and for development control addressing water resources problems arising from unsustainable land uses.	Not applicable	Not Applicable	Not Applicable	Regional level capacity building related to: - Catchment management - Spatial Planning	Strengthen/modernise spatial planning tools (GIS, remote imageries); improved water source monitoring; sustaining recharge of aquifers; rain harvest;	Enforce existing laws related to resources exploitation and water abstraction. Enforce development control measures according to updated spatial plans.	Establish required regulations, bylaws and guidelines to ensure sustainable and safe development in river catchments.	Not applicable	Awareness raising campaigns: - public at large - schools on water management and need to conserve water and avoid waste/leaks.	Curricula development for relevant education in primary and secondary schools. - Coastal forest ecology - Coastal forest management; - Hydrologic cycle
4	3	Lack of information on climate change and its impacts on Zanzibar's aquifers.	ICARM ensuring linkage between catchment management and coastal management. Coordination among stakeholders in addressing climate change impacts on hydrology.	Land uses in catchment and its impacts on water resources included in IWRM planning.	Not applicable	Not applicable	Not Applicable	Not Applicable	Regional level capacity building related to: supporting agriculture early warning system; also at TMA and Dept. of Disaster Management (PMO).	Technology for monitoring receiving environment and for forecasting weather changes. Indigenous knowledge (IK).	Not Applicable	Not Applicable	Not applicable	Awareness raising campaigns targeting and other freshwater users.	Curricula development for relevant education in primary and secondary schools. Importance of environmentally sound agriculture production. Importance of integrated management (upstream / downstream).Hydrologic cycle.
4	4	Lack of updated data on current river discharges on Pemba and Unguja leading to failure to comprehensively control water supplies.	ICARM ensuring linkage between catchment management and coastal management. Coordination among stakeholders in addressing climate change impacts on hydrology.	Land uses in catchment and its impacts on water resources included in IWRM planning.	Not applicable	Not applicable	Not Applicable	Not Applicable	Regional level capacity building related to: supporting agriculture early warning system; also at TMA and Dept. of Disaster Management (PMO).	Technology for monitoring receiving environment and for forecasting weather changes.	Not Applicable	Not Applicable	Not applicable	Awareness raising campaigns targeting and other freshwater users.	Curricula development for relevant education in primary and secondary schools. Importance of environmentally sound agriculture production. Importance of integrated management (upstream / downstream).Hydrologic cycle.
3	5	Inefficient management of piped freshwater supply leading to leaks and loss of water.	Not applicable	Not applicable	Not applicable	Not applicable	Not Applicable	Not Applicable	Regional level capacity building related to: - Water management	Strengthen/modernise water distribution and monitoring tools; improved water delivery monitoring; improve finances of sector.	Not Applicable	Not Applicable	Not applicable	Awareness raising campaigns: - public at large - schools on water management and need to conserve water and avoid waste/leaks.	Curricula development for relevant education in primary and secondary schools. - Coastal forest ecology - Coastal forest management; - Hydrologic cycle
3	6	Increased demand from tourism sector exceeding supply.	Not applicable	Not applicable	Zoning in spatial plans providing guidance for land uses and for development control addressing water resources problems arising from unsustainable land uses.	Not applicable	Not Applicable	Not Applicable	Regional level capacity building related to: - Water management	Strengthen/modernise spatial planning tools (GIS, remote imageries); improved water source monitoring; sustaining recharge of aquifers; rain harvest; infrastructure; improve finances of sector.	Not Applicable	Not Applicable	Not applicable	Awareness raising campaigns: - public at large - tourism sector, on water management and need to conserve water and avoid waste/leaks.	Curricula development for relevant education in primary and secondary schools. - Coastal forest ecology - Coastal forest management; - Hydrologic cycle
3	7	Removal of riverine vegetation, erosion of riverbanks, pollution of water bodies from municipal waste dumping, agricultural practices or mining (minerals and river sand) or abstraction for water for agriculture (or livestock).	ICARM ensuring linkage between catchment management and coastal management. Coordination among stakeholders in addressing riverine agriculture pollution.	Land uses in catchment and its impacts on water resources included in IWRM planning	Agriculture zoning in catchments. Regulations for riverside vegetation.	Identifying management units requiring local management arrangements.	Waste collection, storage and processing system needs to be put in place.	Identify and quantify sources of liquid waste as basis for solution and develop sanitation systems accordingly	Information Management: - Monitoring waste generation, disposal and management - Monitoring sources of liquid waste, its disposal and impact in recipient environment Capacity among: - Relevant government departments at national and local levels - BMUs - Guidelines	Waste water treatment systems: - collection - treatment technology - discharge Solid Waste Management Systems: - collection - storage - processing - financing - minimisation - reuse? Green Infrastructure Storm Water Systems	Enforce existing laws related to waste disposal and river sand excavation, water abstraction and mining and waterways.	Establish required regulations, bylaws and guidelines to ensure sustainable and safe development along near the sea. Informed by shoreline management study.	Provide alternatives to current destructive and unsustainable livelihood practises related to sand extraction in particular.	Awareness raising campaigns: - public at large - schools - stakeholders benefitting from beaches (tourism operators, hotels, fishermen, etc.) - tourists. Impact of pollution on environment and health Pollution pathways and waste management. Upstream/downstream.	Curricula development for relevant education in primary and secondary schools. Importance of beaches. Pollution, environment, health. Waste minimisation and recycling.
2	8	Pesticide and waste water pollution of aquifers on Pemba and Unguja from poor agricultural practices, or pollution from municipal waste dumping or inadequate sewage systems.	Not applicable	Land uses in catchment and its impacts on water resources included in IWRM planning	Agriculture zoning in catchments. Regulations for riverside vegetation.	Not applicable	Review of management of agrochemicals upstream; Waste collection, storage and processing system needs to be put in place.	Identify and quantify sources of liquid waste as basis for solution and develop sanitation systems accordingly	Information Management: - Monitoring waste generation, disposal and management - Monitoring sources of liquid waste, its disposal and impact in recipient environment Capacity among: - Relevant government departments at national and local levels - Guidelines	Waste water treatment systems: - collection - treatment technology - discharge Solid Waste Management Systems: - collection - storage - processing - financing - minimisation - reuse? Agriculture technologies minimising impact for agrochemicals on water resources; Technology for monitoring receiving environment. Green Infrastructure Storm Water Systems	Enforce existing laws related to waste disposal and use of agrochemicals.	Establish required regulations, bylaws and guidelines to ensure sustainable and safe development in river catchments.	Not applicable	Awareness raising campaigns targeting agriculture; Pollution pathways and waste management. Upstream/downstream.	Curricula development for relevant education in primary and secondary schools. Importance of environmentally sound agriculture production. Importance of integrated management (upstream / downstream).

Management Framework for Coastal Zone Management

Table 203: Broad assessment of measures to mitigate threats associated with management framework for coastal zone management to local coastal communities and ecosystems in Zanzibar.

RV	#	Threat	ICZM	IWRM	Land Use Management	Shoreline Management Planning	Solid and Liquid Waste Management	Sanitation	Capacity building	Technology	Law enforcement	Legal Review	Alternative/Improved Livelihood	Awareness raising	Education
4	1	Poor coordination and monitoring between different sectors leading to ineffective governance and failing of enforcement in coastal and marine areas.	Coordination among stakeholders in addressing fisheries decline. Guidelines for best practices in mangrove management. Guidelines for best practises in fisheries. Guidelines for best practises in coral reef management. Guidelines to be based on outcome of legal review.	Not applicable	Not applicable	Identifying management units requiring local management arrangements.	Not Applicable	Not Applicable	Information Management: - Monitoring occurrences of illegal fisheries - Monitoring fishing practises - Monitoring fisheries catches - Monitoring fisheries resources - Monitoring fisheries habitats (mangroves, coral reefs) Capacity among: - Relevant government departments at national and local levels - BMUs	not applicable	Not Applicable	Institutional reform;	Provide alternatives to current destructive and unsustainable livelihood practises related to fisheries. - Emphasis on young generation	Awareness raising campaigns: - public at large - schools - stakeholders benefitting from fisheries (fishing communities, middlemen, hotels and restaurants)	Curricula development for relevant education in primary and secondary schools. - Sustainable Fisheries. - Fisheries ecology.
4	2	Poor capacity and motivation at local district authority level to implement legal mandates governing natural resource use, resulting in continued deterioration of productive resources.	Coordination among stakeholders in addressing fisheries decline. Guidelines for best practices in mangrove management. Guidelines for best practises in fisheries. Guidelines for best practises in coral reef management. Guidelines to be based on outcome of legal review.	Not applicable	Mangroves and other habitats of importance (including seagrass areas and coral reefs) for fisheries included in land use information management systems and incorporated into spatial planning.	Identifying management units requiring local management arrangements.	Not Applicable	Not Applicable	Information Management: - Monitoring occurrences of illegal fisheries - Monitoring fishing practises - Monitoring fisheries catches - Monitoring fisheries resources - Monitoring fisheries habitats (mangroves, coral reefs) Capacity among: - Relevant government departments at national and local levels - BMUs	Offshore fisheries Aquaculture; Add value to existing harvest.	Enforce existing laws related to fisheries. Enforce existing laws related to mangrove exploitation. Enforce existing laws related to coral mining. Anti-corruption.	Review appropriateness of fisheries regulations in relation to local conditions, environment, species and gears. Establish local zoning and fishing effort seasonality. Decentralisation.	Provide alternatives to current destructive and unsustainable livelihood practises related to fisheries. - Emphasis on young generation	Awareness raising campaigns: - public at large - schools - stakeholders benefitting from fisheries (fishing communities, middlemen, hotels and restaurants)	Curricula development for relevant education in primary and secondary schools. - Sustainable Fisheries. - Fisheries ecology.
4	3	Absence of financial capacity to address management issues related to coastal and marine resources.	Integrated efforts hold the potential of financial resource use optimization (sharing, coordination)	Integrated efforts hold the potential of financial resource use optimization (sharing, coordination)	Not applicable	Not applicable	Not Applicable	Not Applicable	Revenue planning; increased government effort into financing this problem.	not applicable	Not Applicable	Institutional reforms.	Private Public Partnerships (PPP).	Not applicable	Not applicable
4	4	Increasing demand of freshwater for irrigation	not applicable	Forest management and catchment land uses addressed in integrated water resources management planning. Link IWRM to coastal integrated planning ensuring upstream/downstream considerations.	Zoning in spatial plans providing guidance for land uses and for development control addressing water resources problems arising from unsustainable land uses.	Not applicable	Not Applicable	Not Applicable	Regional level capacity building related to: - Catchment management - Spatial Planning	Strengthen/modernise spatial planning tools (GIS, remote imageries); improved water source monitoring; Agriculture / forestry technologies sustaining recharge of aquifers; rain harvest;	Enforce existing laws related to resources exploitation and water abstraction. Enforce development control measures according to updated spatial plans.	Establish required regulations, bylaws and guidelines to ensure sustainable and safe development in river catchments.	Not applicable	Awareness raising campaigns: - public at large - schools on water management and need to conserve water and avoid waste/leaks.	Curricula development for relevant education in primary and secondary schools. - Coastal forest ecology - Coastal forest management; - Hydrologic cycle
3	5	Poor coordination to address solid waste disposal leading to pollution of beaches and coastal waters.	Coordination among stakeholders in addressing beach pollution. Beach management guidelines	Not applicable	Beaches included in zoning and development of associated regulations	Identifying management units requiring local management arrangements.	Waste collection, storage and processing system needs to be put in place.	Not Applicable	Information Management: - Monitoring waste generation, disposal and management - Monitoring sources of industrial waste, its disposal and impact in recipient environment Capacity among: - Relevant government departments at national and local levels - Guidelines	Waste water treatment systems: - collection - treatment technology - discharge Solid Waste Management Systems: - collection - storage - processing - financing - minimisation - reuse? Green Infrastructure Storm Water Systems; "Blue Flag" type incentives/competitions.	Not Applicable	Not Applicable	Not Applicable	Awareness raising campaigns: - public at large - schools Impact of pollution on environment and health Pollution pathways and waste management. Upstream/downstream.	Curricula development for relevant education in primary and secondary schools. Importance of beaches. Pollution, environment, health. Waste minimisation and recycling.
3	6	Lack of sewage treatment facilities in the Stone Town leading to pollution of beaches and coastal waters.	Coordination among stakeholders in addressing beach pollution. Beach management guidelines	Not applicable	Beaches included in zoning and development of associated regulations	Identifying management units requiring local management arrangements.	Waste collection, storage and processing system needs to be put in place.	Not Applicable	Information Management: - Monitoring waste generation, disposal and management - Monitoring sources of industrial waste, its disposal and impact in recipient environment Capacity among: - Relevant government departments at national and local levels - Guidelines	Waste water treatment systems: - collection - treatment technology - discharge Solid Waste Management Systems: - collection - storage - processing - financing - minimisation - reuse? Green Infrastructure Storm Water Systems	Enforce existing laws related to waste disposal	Payment of treatment through water bill...	Not Applicable	Awareness raising campaigns: - public at large - schools Impact of pollution on environment and health Pollution pathways and waste management. Upstream/downstream.	Curricula development for relevant education in primary and secondary schools. Importance of beaches. Pollution, environment, health. Waste minimisation and recycling.

Mainland Tanzania Districts

Muheza District

Table 204: Broad assessment of measures to mitigate identified threats to local coastal communities and ecosystems in Muheza District in Mainland Tanzania.

RV	Threat	Location	Causes	ICZM	IWRM	Land Use Management	Shoreline Management Planning	Solid and Liquid Waste Management	Sanitation	Capacity building	Technology	Law enforcement	Legal Review	Alternative/Improved Livelihood	Awareness raising	Education
5	Fisheries decline	At the near shore coastal area	Destruction of fish nurseries such as mangrove cutting, illegal fishing such as dynamite fishing and other poor fishing methods as well as coral mining for lime production	Coordination among stakeholders in addressing fisheries decline. Guidelines for best practices in mangrove management. Guidelines for best practices in coral reef management. Guidelines to be based on outcome of legal review.	Not applicable	Mangroves and other habitats of importance (including seagrass areas and coral reefs) for fisheries included in land use information management systems and incorporated into spatial planning.	Identifying management units requiring local management arrangements.	Not Applicable	Not Applicable	Information Management: - Monitoring occurrences of illegal fisheries - Monitoring fishing practises - Monitoring fisheries catches - Monitoring fisheries resources - Monitoring fisheries habitats (mangroves, coral reefs) Capacity among: - Relevant government departments at national and local levels, including MPAs - BMUs	Offshore fisheries Aquaculture; Add value to existing harvest.	Enforce existing laws related to fisheries. Enforce existing laws related to mangrove exploitation. Enforce existing laws related to coral mining.	Review appropriateness of fisheries regulations in relation to local conditions, environment, species and gears. Establish local zoning and fishing effort seasonality.	Provide alternatives to current destructive and unsustainable livelihood practises related to fisheries. - Emphasis on young generation	Awareness raising campaigns: - public at large - schools - stakeholders benefitting from fisheries (fishing communities, middlemen, hotels and restaurants)	Curricula development for relevant education in primary and secondary schools. - Sustainable Fisheries. - Fisheries ecology.
4	Beach erosion	Kigombe, Msakangoto	Beach sand and gravel excavation, mangrove cutting, dynamite fishing, unplanned construction along the coast.	ICZM is an important tool in addressing the complex requirements to address unsustainable resources usage. Implications at and between all management levels. Catchment and coast management needs to be coordinated. IWRM is the appropriate tool such management in the catchment but needs to incorporate coastal concerns (ICZM).	Upstream catchment management influences hydrology and sediment flow and may thus interfere with erosion accretion patterns along the coast (Pangani, Zigi, Mkulumuzi, Koreni).	Zoning of beaches to be included in Land Use Plans, providing regulations and guidelines for land use. Ideally to be informed from Shoreline Management Planning efforts. Regulations may define types of use as well as set back arrangements. Guidelines may also cover coral reef, seagrass and mangrove management to the extent of importance to beach erosion.	An understanding of processes and factors behind erosion and accretion along the Tanzanian coast is required. Such an understanding can be attained through a structural effort in Shoreline Management Planning which can then inform Spatial Planning at local level. First step is to identify sediment cells along the coast based on littoral drift considerations, next step to identify management units within these cells based on environment, economic and socio-economic consideration.	Not Applicable	Not Applicable	District level capacity building related to ICZM and in particular shoreline management. Information management - Monitoring occurrences of illegal fisheries - Monitoring fishing practises - Monitoring land uses - Monitoring beach sand mining	Beach protection technologies, from engineering (groynes, etc.) to soft (beach nourishment) solutions and green technologies (mangrove planting, other shoreline vegetation).	Enforce existing laws related to resources exploitation sand mining and construction near shore (set back provisions).	Establish required regulations, bylaws and guidelines to ensure sustainable and safe development along near the sea. Informed by shoreline management study.	Provide alternatives to current destructive and unsustainable livelihood practises related to mangrove exploitation and fisheries in particular.	The impact of unsustainable resources usage on beach erosion highlighted in awareness raising campaigns. Services of mangroves and corals in protecting against erosive forces (targeting resource users). Impact of physical structures along the coast on shorelines included in awareness raising campaigns (targeting developers and planners)	Curricula development for relevant education in primary and secondary schools. Importance of beaches and sustainable coastal resources use.
4	Land use conflicts	Kigombe and Msakangoto	Between sisal plantation and community (large land area owned by sisal plantation the fact that deprive community of for their various needs), construction of hotels vs beach access by local community. Conflict on the use of marine resources which emanates to misunderstanding between Immigrants fishers and resident fishing areas without following regulation	Coordinated and participatory land and resource use planning expressed in integrated spatial plans and regulations.	Link IWRM to coastal integrated planning ensuring upstream/downstream considerations.	Review and update of spatial plans including zoning to guide development planning and development control.	An understanding of processes and factors behind erosion and accretion along the Tanzanian coast is required. Such an understanding can be attained through a structural effort in Shoreline Management Planning which can then inform Spatial Planning at local level. First step is to identify sediment cells along the coast based on littoral drift considerations, next step to identify management units within these cells based on environment, economic and socio-economic considerations.	Not applicable	Not applicable	District level capacity building related to: - Shoreline management - Spatial Planning - Conflict resolution	Beach protection technologies, from engineering (groynes, etc.) to soft (beach nourishment) solutions and green technologies (mangrove planting, other shoreline vegetation).	Enforce existing laws related to resources exploitation sand mining and construction near shore (set back provisions). Enforce development control measures according to updated spatial plans.	Establish required regulations, bylaws and guidelines to ensure sustainable and safe development along near the sea. Local guidelines based on updated spatial plans informed by shoreline management study.	Not applicable	The impact of unsustainable resources usage on beach erosion highlighted in awareness raising campaigns. Services of mangroves and corals in protecting against erosive forces (targeting resource users). Impact of physical structures along the coast on shorelines included in awareness raising campaigns (targeting developers and planners)	Curricula development for relevant education in primary and secondary schools. Sustainable development in areas under high demographic and economic development pressure (coastal areas, urban areas). Importance of coasts and coastal habitats and resources.
3	Beach pollution	Kigombe, Msakangoto	Uncontrolled solid and liquid waste disposal, lack of latrines in many households and public areas. Discharge from industrial wastes	Coordination among stakeholders in addressing beach pollution. Beach management guidelines	To the extent that solid and liquid waste origin from upstream activities	Beaches included in zoning and development of associated regulations	Identifying management units requiring local management arrangements.	Waste collection, storage and processing system needs to be put in place.	- Identify and quantify sources of liquid waste as basis for solution	Information Management: - Monitoring waste generation, disposal and management - Monitoring sources of liquid waste, its disposal and impact in recipient environment Capacity among: - Relevant government departments at national and local levels - BMUs - Guidelines	Waste water treatment systems: - collection - treatment technology - discharge Solid Waste Management Systems: - collection - storage - processing - financing - minimisation - reuse? - EMS environmental monitoring system	Enforce existing laws related to waste disposal	Not Applicable	Not applicable	Awareness raising campaigns: - public at large - schools - stakeholders benefitting from beaches (tourism operators, hotels, fishermen, etc.) - tourists	Curricula development for relevant education in primary and secondary schools. Importance of beaches.

RV	Threat	Location	Causes	ICZM	IWRM	Land Use Management	Shoreline Management Planning	Solid and Liquid Waste Management	Sanitation	Capacity building	Technology	Law enforcement	Legal Review	Alternative/Improved Livelihood	Awareness raising	Education
3	Diseases outbreaks	Kigombe and Msakangoto	Inadequate sewerage control, flooding, poor solid waste management, uncontrolled food vending.	ICARM ensuring linkage between catchment management and coastal management.	Land uses in catchment and its impacts on water resources included in IWRM planning; to the extent that disease vectors origin from upstream activities	Infrastructure development. Supply of sanitation and health services.	Not applicable	Waste collection, storage and processing system needs to be put in place.	Identify and quantify sources of liquid waste as basis for solution and develop sanitation systems accordingly	Environmental authorities Land use planners Information Management: - Monitoring waste generation, disposal and management - Monitoring sources of liquid waste, its disposal and impact in recipient environment Capacity among: - Relevant government departments at national and local levels - BMUs - Guidelines	Waste water treatment systems: - collection - treatment technology - discharge Solid Waste Management Systems: - collection - storage - processing - financing - minimisation - reuse? Green Infrastructure Storm Water Systems Technology for monitoring receiving environment.	Enforce existing laws related to waste disposal	Not Applicable	Not applicable	Awareness raising campaigns: - public at large - schools - stakeholders benefitting from beaches (tourism operators, hotels, fishermen, etc.) - tourists. Impact of pollution on environment and health Pollution pathways and waste management. Upstream/downstream.	Curricula development for relevant education in primary and secondary schools. Importance of environmentally sound agriculture production. Importance of integrated management (upstream / downstream). Importance of marine environment. Pollution, environment, health. Waste minimisation and recycling.
1	Flooding	Kigombe	Poor drainage in the settlement area	ICARM ensuring linkage between catchment management and coastal management.	Land uses in catchment and its impacts on water resources included in IWRM planning	Review and update of spatial plans including zoning to guide development planning and development control. Storm water drainage infrastructure aligned to climate variability and change predictions. Consider and integrate green infrastructure measures.	Not applicable	Not Applicable	Not Applicable	Environmental authorities Land use planners Information Management: - Monitoring waste generation, disposal and management - Monitoring sources of liquid waste, its disposal and impact in recipient environment Capacity among: - Relevant government departments at national and local levels - BMUs - Guidelines Balance between green and grey infrastructure solutions	Waste water treatment systems: - collection - treatment technology - discharge Solid Waste Management Systems: - collection - storage - processing - financing - minimisation - reuse? Green Infrastructure Storm Water Systems and Early Warning System Technology for monitoring receiving environment.	Enforce existing laws related to waste disposal	Not Applicable	Not applicable	Not applicable	Curricula development for relevant education in primary and secondary schools. Importance of integrated management (upstream / downstream). Pollution, environment, health.
1	Reduced citrus yields	Across farming sectors of district	Lack of technical support to farmers	Not applicable	Not applicable	Not applicable	Not applicable	Not Applicable	Not Applicable	Training citrus farmers.	Improved techniques/strains to cope with pests/reduced soil fertility.	Not Applicable	Not Applicable	Not applicable	Not applicable	Not applicable

Mkinga District

Table 205: Broad assessment of measures to mitigate identified threats to local coastal communities and ecosystems in Mkinga District in Mainland Tanzania.

RV	#	Threat	Location	Causes	ICZM	IWRM	Land Use Management	Shoreline Management Planning	Solid and Liquid Waste Management	Sanitation	Capacity building	Technology	Law enforcement	Legal Review	Alternative/Improved Livelihood	Awareness raising	Education
4	1	Fisheries decline	Along Mkinga coastal water and habitats (Kwale, Mkinga, Mtibwani, Manza, Moa)	Destruction of fish nurseries such as mangrove cutting, illegal fishing such as dynamite fishing and other poor fishing methods as well as coral mining for lime production	Coordination among stakeholders in addressing fisheries decline. Guidelines for best practices in mangrove management. Guidelines for best practices in fisheries. Guidelines for best practices in coral reef management. Guidelines to be based on outcome of legal review.	Not applicable	Mangroves and other habitats of importance (including seagrass areas and coral reefs) for fisheries included in land use information management systems and incorporated into spatial planning.	Identifying management units requiring local management arrangements.	Not Applicable	Not Applicable	Information Management: - Monitoring occurrences of illegal fisheries - Monitoring fishing practises - Monitoring fisheries catches - Monitoring fisheries resources - Monitoring fisheries habitats (mangroves, coral reefs) Capacity among: - Relevant government departments at national and local levels - BMUs	Offshore fisheries Aquaculture; Add value to existing harvest.	Enforce existing laws related to fisheries. Enforce existing laws related to mangrove exploitation. Enforce existing laws related to coral mining.	Review appropriateness of fisheries regulations in relation to local conditions, environment, species and gears. Establish local zoning and fishing effort seasonality.	Provide alternatives to current destructive and unsustainable livelihood practises related to fisheries. - Emphasis on young generation	Awareness raising campaigns: - public at large - schools - stakeholders benefiting from fisheries (fishing communities, middlemen, hotels and restaurants)	Curricula development for relevant education in primary and secondary schools. - Sustainable Fisheries. - Fisheries ecology.
4	2	Land use conflicts	All along the sandy beach fringed coastal Mkinga	Unplanned selling of beach plots to investors may create big conflict between the community land use interests with investors. Conflict between seaweed farmers and fishermen due to destruction of seaweed farms by fishing vessels. Conflict between bordering villages of Kenya and Mkinga on marine resources use.	Coordinated and participatory land and resource use planning expressed in integrated spatial plans and regulations.	Link IWRM to coastal integrated planning ensuring upstream/downstream considerations.	Review and update of spatial plans including zoning to guide development planning and development control. Spatial plans to also consider marine spaces.	An understanding of processes and factors behind erosion and accretion along the Tanzanian coast is required. Such an understanding can be attained through a structural effort in Shoreline Management Planning which can then inform Spatial Planning at local level. First step is to identify sediment cells along the coast based on littoral drift considerations, next step to identify management units within these cells based on environment, economic and socio-economic considerations.	Not Applicable	Not Applicable	District level capacity building related to: - Shoreline management - Spatial Planning - Conflict resolution	Beach protection technologies, from engineering (groynes, etc.) to soft (beach nourishment) solutions and green technologies (mangrove planting, other shoreline vegetation).	Enforce existing laws related to resources exploitation sand mining and construction near shore (set back provisions). Enforce development control measures according to updated spatial plans.	Establish required regulations, bylaws and guidelines to ensure sustainable and safe development along near the sea. Local guidelines based on updated spatial plans informed by shoreline management study.	Not applicable	The impact of unsustainable resources usage on beach erosion highlighted in awareness raising campaigns. Services of mangroves and corals in protecting against erosive forces (targeting resource users). Impact of physical structures along the coast on shorelines included in awareness raising campaigns (targeting developers and planners)	Curricula development for relevant education in primary and secondary schools. Sustainable development in areas under high demographic and economic development pressure (coastal areas, urban areas). Importance of coasts and coastal habitats and resources.
3	3	Beach pollution	All along the coast	Uncontrolled solid and liquid waste disposal, often in creeks; lack of toilets for public as well as residential houses. For instance in Kwale 2002 there was only 48 latrines among 808 households.	Coordination among stakeholders in addressing beach pollution. Beach management guidelines	To the extent that solid and liquid waste origin from upstream activities	Beaches included in zoning and development of associated regulations	Identifying management units requiring local management arrangements.	Waste collection, storage and processing system needs to be put in place.	- Identify and quantify sources of liquid waste as basis for solution	Information Management: - Monitoring waste generation, disposal and management - Monitoring sources of liquid waste, its disposal and impact in recipient environment Capacity among: - Relevant government departments at national and local levels - BMUs - Guidelines	Waste water treatment systems: - collection - treatment technology - discharge Solid Waste Management Systems: - collection - storage - processing - financing - minimisation - reuse?	Enforce existing laws related to waste disposal	Not Applicable	Not applicable	Awareness raising campaigns: - public at large - schools - stakeholders benefiting from beaches (tourism operators, hotels, fishermen, etc.) - tourists	Curricula development for relevant education in primary and secondary schools. Importance of beaches.
3	4	Diseases outbreaks	Kwale, Moa, Manza, Mtibwani	Lack of latrines, poor solid waste management, uncontrolled food vending.	Not applicable	To the extent that disease vectors origin from upstream activities	Not applicable	Not applicable	Waste collection, storage and processing system needs to be put in place.	- Identify and quantify sources of pathogens as basis for solution	Information Management: - Monitoring waste generation, disposal and management - Monitoring sources of liquid waste, its disposal and impact in recipient environment Capacity among: - Relevant government departments at national and local levels - BMUs - Guidelines	Waste water treatment systems: - collection - treatment technology - discharge Solid Waste Management Systems: - collection - storage - processing - financing - minimisation - reuse?	Enforce existing laws related to waste disposal	Not Applicable	Not applicable	Awareness raising campaigns: - public at large - schools - stakeholders benefiting from beaches (tourism operators, hotels, fishermen, etc.) - tourists	Curricula development for relevant education in primary and secondary schools. Importance of disease vector control.
2	5	Marine pollution	River mouths and vicinity	Use of fertilizers and chemicals for agricultural purposes from upstream river flow.	ICARM ensuring linkage between catchment management and coastal management.	Land uses in catchment and its impacts on water resources included in IWRM planning	Agriculture zoning in catchments. Regulations for riverside vegetation.	Not applicable	Review of management of agrochemicals upstream	Not Applicable	Environmental authorities Agriculture extension services Land use planners	Agriculture technologies minimising impact for agrochemicals on water resources Technology for monitoring receiving environment.	Enforce regulations for use of agrochemicals.	Not Applicable	Not applicable	Awareness raising campaigns targeting agriculture	Curricula development for relevant education in primary and secondary schools. Importance of environmentally sound agriculture production. Importance of integrated management (upstream / downstream).
1	6	Heavy metal pollution	River mouths and vicinity	Wastes from tourist hotels, construction sites, workshops, garages and industries located upstream.	Coordination among stakeholders in addressing beach pollution. Beach management guidelines	To the extent that solid and liquid waste origin from upstream activities	Beaches included in zoning and development of associated regulations	Identifying management units requiring local management arrangements.	Waste collection, storage and processing system needs to be put in place.	Not Applicable	Information Management: - Monitoring waste generation, disposal and management - Monitoring sources of liquid waste, its disposal and impact in recipient environment Capacity among: - Relevant government departments at national and local levels - BMUs - Guidelines	Waste water treatment systems: - collection - treatment technology - discharge Solid Waste Management Systems: - collection - storage - processing - financing - minimisation - reuse?	Enforce existing laws related to waste disposal	Not Applicable	Not applicable	Awareness raising campaigns: - public at large - schools - stakeholders benefiting from beaches (tourism operators, hotels, fishermen, etc.) - tourists	Curricula development for relevant education in primary and secondary schools. Importance of beaches.

Tanga Urban District

Table 206: Broad assessment of measures to mitigate identified threats to local coastal communities and ecosystems in Tanga Urban District in Mainland Tanzania.

RV	Threat	Location	Causes	ICZM	IWRM	Land Use Management	Shoreline Management Planning	Solid and Liquid Waste Management	Sanitation	Capacity building	Technology	Law enforcement	Legal Review	Alternative/Improved Livelihood	Awareness raising	Education
5	Fisheries decline	In the near shore waters including: Kisosora, Chumvini, Msakangoto, Sahare	Destruction of fish nurseries such as mangrove cutting, illegal fishing such as dynamite fishing and other poor fishing methods as well as coral mining for lime production and constructions	Coordination among stakeholders in addressing fisheries decline. Guidelines for best practices in mangrove management. Guidelines for best practises in coral reef management. Guidelines to be based on outcome of legal review.	Not applicable	Mangroves and other habitats of importance (including seagrass areas and coral reefs) for fisheries included in land use information management systems and incorporated into spatial planning.	Identifying management units requiring local management arrangements.	Not Applicable	Not Applicable	Information Management: - Monitoring occurrences of illegal fisheries - Monitoring fishing practises - Monitoring fisheries catches - Monitoring fisheries resources - Monitoring fisheries habitats (mangroves, coral reefs) Capacity among: - Relevant government departments at national and local levels - BMUs	Offshore fisheries Aquaculture; Add value to existing harvest.	Enforce existing laws related to fisheries. Enforce existing laws related to mangrove exploitation. Enforce existing laws related to coral mining.	Review appropriateness of fisheries regulations in relation to local conditions, environment, species and gears. Establish local zoning and fishing effort seasonality.	Provide alternatives to current destructive and unsustainable livelihood practises related to fisheries. - Emphasis on young generation	Awareness raising campaigns: - public at large - schools - stakeholders benefitting from fisheries (fishing communities, middlemen, hotels and restaurants)	Curricula development for relevant education in primary and secondary schools. - Sustainable Fisheries. - Fisheries ecology.
4	Beach pollution	All along district sea front	Uncontrolled solid waste disposal.	Coordination among stakeholders in addressing beach pollution. Beach management guidelines	To the extent that solid and liquid waste origin from upstream activities in Zigi and Mkulumuzi river basins.	Beaches included in zoning and development of associated regulations	Identifying management units requiring local management arrangements.	Waste collection, storage and processing system needs to be put in place.	Identify and quantify sources of liquid waste as basis for solution and develop sanitation systems accordingly	Information Management: - Monitoring waste generation, disposal and management - Monitoring sources of liquid waste, its disposal and impact in recipient environment Capacity among: - Relevant government departments at national and local levels - BMUs - Guidelines	Waste water treatment systems: - collection - treatment technology - discharge Solid Waste Management Systems: - collection - storage - processing - financing - minimisation - reuse? Green Infrastructure Storm Water Systems	Enforce existing laws related to waste disposal	Not Applicable	Not applicable	Awareness raising campaigns: - public at large - schools - stakeholders benefitting from beaches (tourism operators, hotels, fishermen, etc.) - tourists. Impact of pollution on environment and health Pollution pathways and waste management. Upstream/downstream.	Curricula development for relevant education in primary and secondary schools. Importance of beaches. Pollution, environment, health. Waste minimisation and recycling.
4	Beach erosion	All along district sea front	Mangrove cutting, dynamite fishing, beach sand mining, unplanned construction along the coast.	ICZM is an important tool in addressing the complex requirements to address unsustainable resources usage. Implications at and between all management levels. Catchment and coast management needs to be coordinated. IWRM is the appropriate tool such management in the catchment but needs to incorporate coastal concerns (ICZM).	Upstream catchment management influences hydrology and sediment flow and may thus interfere with erosion accretion patterns along the coast (Zigi and Mkulumuzi rivers).	Zoning of beaches to be included in Land Use Plans, providing regulations and guidelines for land use. Ideally to be informed from Shoreline Management Planning efforts. Regulations may define types of use as well as set back arrangements. Guidelines may also cover coral reef, seagrass and mangrove management to the extent of importance to beach erosion.	An understanding of processes and factors behind erosion and accretion along the Tanzanian coast is required. Such an understanding can be attained through a structural effort in Shoreline Management Planning which can then inform Spatial Planning at local level. First step is to identify sediment cells along the coast based on littoral drift considerations, next step to identify management units within these cells based on environment, economic and socio-economic consideration.	Not Applicable	Not Applicable	District level capacity building related to ICZM and in particular shoreline management. Information management - Monitoring occurrences of illegal fisheries - Monitoring fishing practises - Monitoring land uses - Monitoring beach sand mining	Beach protection technologies, from engineering (groynes, etc.) to soft (beach nourishment) solutions and green technologies (mangrove planting, other shoreline vegetation).	Enforce existing laws related to resources exploitation sand mining and construction near shore (set back provisions).	Establish required regulations, bylaws and guidelines to ensure sustainable and safe development along near the sea. Informed by shoreline management study.	Provide alternatives to current destructive and unsustainable livelihood practises related to mangrove exploitation and fisheries in particular.	The impact of unsustainable resources usage on beach erosion highlighted in awareness raising campaigns. Services of mangroves and corals in protecting against erosive forces (targeting resource users). Impact of physical structures along the coast on shorelines included in awareness raising campaigns (targeting developers and planners)	Curricula development for relevant education in primary and secondary schools. Importance of beaches and sustainable coastal resources use.
4	Marine pollution	Shores around Tanga city	Inadequate sewerage control and direct disposal to the sea of untreated municipal sewerage, poor quality of sewerage construction, poor solid waste management. 84 % of the population use on site sanitation. The sewerage system is located at central business district only where the effluent is ultimately discharged into Indian ocean.	Not applicable	Land uses in catchment and its impacts on water resources included in IWRM planning	Pollution, environment, health. Waste minimisation and recycling.	Identifying management units requiring local management arrangements.	Waste collection, storage and processing system needs to be put in place.	Identify and quantify sources of liquid waste as basis for solution and develop sanitation systems accordingly	Information Management: - Monitoring waste generation, disposal and management - Monitoring sources of liquid waste, its disposal and impact in recipient environment Capacity among: - Relevant government departments at national and local levels - BMUs - Guidelines	Waste water treatment systems: - collection - treatment technology - discharge Solid Waste Management Systems: - collection - storage - processing - financing - minimisation - reuse? Green Infrastructure Storm Water Systems	Enforce existing laws related to waste disposal	Not Applicable	Not applicable	Awareness raising campaigns: - public at large - schools - stakeholders benefitting from beaches (tourism operators, hotels, fishermen, etc.) - tourists. Impact of pollution on environment and health Pollution pathways and waste management. Upstream/downstream.	Curricula development for relevant education in primary and secondary schools. Importance of marine environment. Pollution, environment, health. Waste minimisation and recycling.
2	Freshwater supply reduction	Zigi River	Muheza town needing more freshwater than presently supplied by the Mkulumuzi River.	ICARM ensuring linkage between catchment management and coastal management.	Forest management and catchment land uses addressed in integrated water resources management planning. Link IWRM to coastal integrated planning ensuring upstream/downstream considerations.	Zoning in spatial plans providing guidance for land uses and for development control addressing water resources problems arising from unsustainable land uses.	Not applicable	Not Applicable	Not Applicable	Environmental authorities Land use planners Agriculture extension Information Management: - Monitoring land uses	Agriculture / forestry technologies sustaining recharge of aquifers; rain harvest; Alternative technology replacing charcoal and fuel wood as energy source.	Enforce existing laws	Not Applicable	Not applicable	Awareness raising campaigns: - public at large - schools on water management and need to conserve water and avoid waste/leaks.	Curricula development for relevant education in primary and secondary schools. - Coastal forest ecology - Coastal forest management; - Hydrologic cycle

RV	Threat	Location	Causes	ICZM	IWRM	Land Use Management	Shoreline Management Planning	Solid and Liquid Waste Management	Sanitation	Capacity building	Technology	Law enforcement	Legal Review	Alternative/Improved Livelihood	Awareness raising	Education
2	Loss of land and environmental damage	Mwambani port project	Mwambani port project developed without due procedures on impact assessment and local livelihood analysis	Coordinated and participatory land and resource use planning expressed in integrated spatial plans and regulations.	Not applicable	Review and update of spatial plans including zoning to guide development planning and development control. Spatial plans to also consider marine spaces.	An understanding of processes and factors behind erosion and accretion along the Tanzanian coast is required. Such an understanding can be attained through a structural effort in Shoreline Management Planning which can then inform Spatial Planning at local level. First step is to identify sediment cells along the coast based on littoral drift considerations, next step to identify management units within these cells based on environment, economic and socio-economic considerations.	Not Applicable	Not Applicable	District level capacity building related to: - Shoreline management - Spatial Planning - Conflict resolution	Not Applicable	Enforce existing laws related to ESIA process.	Not Applicable	Not applicable	Ensure wider public aware of and participating in ESIA process.	Not applicable
2	Loss of habitat and agricultural area	Surrounding suburbs of Tanga city	Rapid urbanization, high increase of immigration into the city.	Coordinated and participatory land and resource use planning expressed in integrated spatial plans and regulations.	Not applicable	Review and update of spatial plans including zoning to guide development planning and development control. Spatial plans to also consider marine spaces.	Not applicable	Not Applicable	Not Applicable	District level capacity building related to: - Spatial Planning - Conflict resolution	Not Applicable	Enforce development control measures according to updated spatial plans.	Not Applicable	Provide alternatives to current agriculture/rural stakeholders. - Emphasis on young generation	Not applicable	Not applicable
1	Heavy metal pollution	Near shore waters along the coast	Wastes from tourist hotels, construction sites, workshops, garages and industries located upstream.	Coordination among stakeholders in addressing near shore water pollution. Guidelines for best practices in waste management.	Land uses in catchment and its impacts on water resources included in IWRM planning	Pollution, environment, health. Waste minimisation and recycling.	Identifying management units requiring local management arrangements.	Waste collection, storage and processing system needs to be put in place.	Not Applicable	Information Management: - Monitoring waste generation, disposal and management - Monitoring sources of liquid waste, its disposal and impact in recipient environment Capacity among: - Relevant government departments at national and local levels - BMUs - Guidelines	Waste water treatment systems: - collection - treatment technology - discharge Solid Waste Management Systems: - collection - storage - processing - financing - minimisation - reuse? Green Infrastructure Storm Water Systems	Enforce existing laws related to waste disposal	Not Applicable	Not applicable	Awareness raising campaigns: - public at large - schools - stakeholders benefitting from beaches (tourism operators, hotels, fishermen, etc.) - tourists. Impact of pollution on environment and health Pollution pathways and waste management. Upstream/downstream.	Curricula development for relevant education in primary and secondary schools. Importance of marine environment. Pollution, environment, health. Waste minimisation and recycling.
1	Marine pollution	Shores around Tanga city	Large plantations in the highlands drain into Tanga Urban basin and hence fertilizers, pesticides, herbicides and fungicides may pose as threat to marine environment.	ICARM ensuring linkage between catchment management and coastal management.	Land uses in catchment and its impacts on water resources included in IWRM planning	Agriculture zoning in catchments. Regulations for riverside vegetation.	Not applicable	Review of management of agrochemicals upstream	Not Applicable	Environmental authorities Agriculture extension services Land use planners	Agriculture technologies minimising impact for agrochemicals on water resources Technology for monitoring receiving environment.	Enforce regulations for use of agrochemicals.	Not Applicable	Not applicable	Awareness raising campaigns targeting agriculture	Curricula development for relevant education in primary and secondary schools. Importance of environmentally sound agriculture production. Importance of integrated management (upstream / downstream).
1	Land use conflicts	Shores around Tanga city	Conflict between seaweed farmers and fishers on marine land use; conflict between grazers and farmers	Coordinated and participatory land and resource use planning expressed in integrated spatial plans and regulations.	Not applicable	Review and update of spatial plans including zoning to guide development planning and development control. Spatial plans to also consider coastal farm/grazing land and seaweed farming and marine spaces.	An understanding of processes and factors behind erosion and accretion along the Tanzanian coast is required. Such an understanding can be attained through a structural effort in Shoreline Management Planning which can then inform Spatial Planning at local level. First step is to identify sediment cells along the coast based on littoral drift considerations, next step to identify management units within these cells based on environment, economic and socio-economic considerations.	Not Applicable	Not Applicable	District level capacity building related to: - Shoreline management - Spatial Planning - Conflict resolution	Technology for defining most appropriate agricultural land-use (farming or grazing) and coastal land use (seaweed farming or fishing).	Enforce existing laws related to resources exploitation fishing/seaweed farming, and farming/grazing. Enforce development control measures according to updated spatial plans.	Establish required regulations, bylaws and guidelines to ensure sustainable and safe development along near the sea, and agricultural land. Local guidelines based on updated spatial plans informed by shoreline management study.	Not applicable	Awareness raising campaigns: - public at large - schools - stakeholders benefitting from beaches (tourism operators, hotels, fishermen, etc.)	Curricula development for relevant education in primary and secondary schools. Sustainable development in areas under high demographic and economic development pressure (coastal areas, urban areas). Importance of coasts and coastal habitats and resources.

Pangani District

Table 207: Broad assessment of measures to mitigate identified threats to local coastal communities and ecosystems in Pangani District in Mainland Tanzania.

RV	Threat	Location	Causes	ICZM	IWRM	Land Use Management	Shoreline Management Planning	Solid and Liquid Waste Management	Sanitation	Capacity building	Technology	Law enforcement	Legal Review	Alternative/Improved Livelihood	Awareness raising	Education
4	Beach pollution	Pangani Town, Pangani River valley	Uncontrolled solid and liquid waste disposal, human excreta due to lack of latrines, coconut husk disposal on the beach. Large plantations in the highland drain into Pangani basin and hence fertilizers, pesticides, herbicides and fungicides from up land far to Kilimanjaro highlands may pose as threat.	Coordination among stakeholders in addressing beach pollution. Beach management guidelines	To the extent that solid and liquid waste origin from upstream activities in Pangani and Msangasi river basins.	Beaches included in zoning and development of associated regulations	Identifying management units requiring local management arrangements.	Waste collection, storage and processing system needs to be put in place.	Identify and quantify sources of liquid waste as basis for solution and develop sanitation systems accordingly	Information Management: - Monitoring waste generation, disposal and management - Monitoring sources of liquid waste, its disposal and impact in recipient environment Capacity among: - Relevant government departments at national and local levels - BMUs - Guidelines	Waste water treatment systems: - collection - treatment technology - discharge Solid Waste Management Systems: - collection - storage - processing - financing - minimisation - reuse? Green Infrastructure Storm Water Systems	Enforce existing laws related to waste disposal	Not Applicable	Not applicable	Awareness raising campaigns: - public at large - schools - stakeholders benefitting from beaches (tourism operators, hotels, fishermen, etc.) - tourists. Impact of pollution on environment and health Pollution pathways and waste management. Upstream/downstream.	Curricula development for relevant education in primary and secondary schools. Importance of beaches. Pollution, environment, health. Waste minimisation and recycling.
4	Beach erosion	Along entire coast and in particular at Pangani Town, Ushongo	Mangrove cutting, dynamite fishing, beach sand mining, climate changes, Pangani beach wall degradation	ICZM is an important tool in addressing the complex requirements to address unsustainable resources usage. Implications at and between all management levels. Catchment and coast management needs to be coordinated. IWRM is the appropriate tool such management in the catchment but needs to incorporate coastal concerns (ICZM).	Upstream catchment management influences hydrology and sediment flow and may thus interfere with erosion accretion patterns along the coast (Pangani and Msangasi rivers).	Zoning of beaches to be included in Land Use Plans, providing regulations and guidelines for land use. Ideally to be informed from Shoreline Management Planning efforts. Regulations may define types of use as well as set back arrangements. Guidelines may also cover coral reef, seagrass and mangrove management to the extent of importance to beach erosion.	An understanding of processes and factors behind erosion and accretion along the Tanzanian coast is required. Such an understanding can be attained through a structural effort in Shoreline Management Planning which can then inform Spatial Planning at local level. First step is to identify sediment cells along the coast based on littoral drift considerations, next step to identify management units within these cells based on environment, economic and socio-economic consideration.	Not Applicable	Not Applicable	District level capacity building related to ICZM and in particular shoreline management. Information management - Monitoring occurrences of illegal fisheries - Monitoring fishing practises - Monitoring land uses - Monitoring beach sand mining	Beach protection technologies, from engineering (groynes, etc.) to soft (beach nourishment) solutions and green technologies (mangrove planting, other shoreline vegetation).	Enforce existing laws related to resources exploitation sand mining and construction near shore (set back provisions).	Establish required regulations, bylaws and guidelines to ensure sustainable and safe development along near the sea. Informed by shoreline management study.	Provide alternatives to current destructive and unsustainable livelihood practises related to mangrove exploitation and fisheries in particular.	The impact of unsustainable resources usage on beach erosion highlighted in awareness raising campaigns. Services of mangroves and corals in protecting against erosive forces (targeting resource users). Impact of physical structures along the coast on shorelines included in awareness raising campaigns (targeting developers and planners)	Curricula development for relevant education in primary and secondary schools. Importance of beaches and sustainable coastal resources use.
4	Fisheries decline	All along the coastal shore water and especially Matakani	Destruction of fish nurseries such as mangrove cutting, illegal fishing such as dynamite fishing and other poor fishing methods as well as coral mining for lime production, SCUBA fishing	Coordination among stakeholders in addressing fisheries decline. Guidelines for best practices in mangrove management. Guidelines for best practises in coral reef management. Guidelines to be based on outcome of legal review.	Not applicable	Mangroves and other habitats of importance (including seagrass areas and coral reefs) for fisheries included in land use information management systems and incorporated into spatial planning.	Identifying management units requiring local management arrangements.	Not Applicable	Not Applicable	Information Management: - Monitoring occurrences of illegal fisheries - Monitoring fishing practises - Monitoring fisheries catches - Monitoring fisheries resources - Monitoring fisheries habitats (mangroves, coral reefs) Capacity among: - Relevant government departments at national and local levels - BMUs	Offshore fisheries Aquaculture; Add value to existing harvest.	Enforce existing laws related to fisheries. Enforce existing laws related to mangrove exploitation. Enforce existing laws related to coral mining.	Review appropriateness of fisheries regulations in relation to local conditions, environment, species and gears. Establish local zoning and fishing effort seasonality.	Provide alternatives to current destructive and unsustainable livelihood practises related to fisheries. - Emphasis on young generation	Awareness raising campaigns: - public at large - schools - stakeholders benefitting from fisheries (fishing communities, middlemen, hotels and restaurants)	Curricula development for relevant education in primary and secondary schools. - Sustainable Fisheries. - Fisheries ecology.
4	Decline in sea turtle population	Along Ushongo beaches and other sandy beaches and dunes	Deforestation of old Maziwe Island (now is just a sand bank), destruction of turtle nesting areas, turtle catching and killing for meat.	Coordination among stakeholders in addressing turtle decline. Guidelines for best practices in beach management. Guidelines to be based on outcome of legal review.	Not applicable	Not applicable	Designated turtle nesting beaches to be integrated into SMP, with emphasis on beach condition, set-back distances, lighting and infrastructure, as well as human disturbance.	Waste management to reduce solid waste on beaches, and beach clean-up to assist turtle nesting.	Not Applicable	Information Management: - Monitoring occurrences of illegal turtles harvest. Capacity among: - Relevant government departments at national and local levels - MPAs	Not Applicable	Enforce existing laws related to turtle protection.	Not Applicable	Not applicable	Awareness raising campaigns: - public at large - schools - stakeholders benefitting from turtles (fishing communities, middlemen, hotels and restaurants)	Curricula development for relevant education in primary and secondary schools. - Sustainable Fisheries. - Fisheries ecology. - Conservation and protected species.
3	Land use conflicts	Saadani and Buyuni border. Ushongo and vicinity. Various district areas	Between Sadani NP and Buyuni Village Community. Hotelier vs village communities on beach access. Land use conflict between livestock keeper and farmer on the grazing vs cultivation land	Coordinated and participatory land and resource use planning expressed in integrated spatial plans and regulations.	Not applicable	Review and update of spatial plans including zoning to guide farming/grazing, development planning and development control.	Not applicable	Not applicable	Not applicable	District level capacity building related to: - Shoreline management - Spatial Planning - Conflict resolution	Beach protection technologies, from engineering (groynes, etc.) to soft (beach nourishment) solutions and green technologies (mangrove planting, other shoreline vegetation).	Enforce existing laws related to resources exploitation (fishing/farming). Enforce development control measures according to updated spatial plans.	Establish required regulations, bylaws and guidelines to ensure sustainable and safe development along near the sea. Local guidelines based on updated spatial plans informed by shoreline management study.	Not applicable	The impact of unsustainable resources usage on beach erosion highlighted in awareness raising campaigns. Services of mangroves and corals in protecting against erosive forces (targeting resource users). Impact of physical structures along the coast on shorelines included in awareness raising campaigns (targeting developers and planners)	Curricula development for relevant education in primary and secondary schools. Sustainable development in areas under high demographic and economic development pressure (coastal areas, urban areas). Importance of coasts and coastal habitats and resources.

RV	Threat	Location	Causes	ICZM	IWRM	Land Use Management	Shoreline Management Planning	Solid and Liquid Waste Management	Sanitation	Capacity building	Technology	Law enforcement	Legal Review	Alternative/Improved Livelihood	Awareness raising	Education
3	Loss of habitat and agricultural area	Various district areas	Mangrove cutting, forest clearing for firewood collection, agricultural and animal rearing purposes, use of fire in cultivation,	ICZM is an important tool in preventing land use conflicts through coordinated and participatory development planning.	Not applicable	Review and up-date spatial plans for development control clarifying district land uses.	Shoreline Management Planning informs Spatial Planning at local level. First step is to identify sediment cells along the coast based on littoral drift considerations, next step to identify management units within these cells based on environment, economic and socio-economic considerations.	Not Applicable	Not Applicable	Land use planning commission Local Government Authorities	Strengthen/modernise spatial planning tools (GIS, remote imageries)	Enforce land use and building regulations.	Not Applicable	Provide alternatives for people losing traditional livelihoods in rural areas planned for other uses.	Awareness campaigns related to sustainable development planning and development control targeting: - public at large - district authorities - developers/entrepreneurs	Curricula development for relevant education in primary and secondary schools. Complex requirements in coastal areas (high population and economic pressure). Sustainable development. Spatial Planning to service Population requirements.
2	River erosion	along Pangani River Bank	Dams upstream, plantation along the river, cutting of mangroves in estuaries, SLR/CC.	ICARM ensuring linkage between catchment management and coastal management.	Upstream catchment management influences hydrology and sediment flow and may thus interfere with erosion accretion patterns along the coast (Pangani River).	Review and update of spatial plans including zoning to guide development planning and development control. Storm water drainage infrastructure aligned to climate variability and change predictions. Consider and integrate green infrastructure measures.	Not applicable	Not Applicable	Not Applicable	Environmental authorities Land use planners Capacity among: - Relevant government departments at national and local levels Balance between green and grey infrastructure solutions	Not Applicable	Enforce existing laws related to river margin land use and mangrove forest resources.	Not Applicable	Not applicable	Awareness raising campaigns: - public at large - schools - stakeholders benefitting from beaches (tourism operators, hotels, fishermen, etc.) - tourists. Upstream/downstream.	Curricula development for relevant education in primary and secondary schools. Importance of integrated management (upstream / downstream). Pollution, environment, health.
2	Marine pollution	Pangani River valley, Pangani Town	Uncontrolled solid and liquid waste disposal, human excreta due to lack of latrines, coconut husk disposal on the beach. Large plantations in the highland drain into Pangani basin and hence fertilizers, pesticides, herbicides and fungicides from up land far to Kilimanjaro highlands may pose as threat	ICARM ensuring linkage between catchment management and coastal management.	Land uses in catchment and its impacts on water resources included in IWRM planning	Agriculture zoning in catchments. Regulations for riverside vegetation.	Not applicable	Review of management of agrochemicals upstream. Waste collection, storage and processing system needs to be put in place.	Identify and quantify sources of liquid waste as basis for solution and develop sanitation systems accordingly	Environmental authorities Agriculture extension services Land use planners Information Management: - Monitoring waste generation, disposal and management - Monitoring sources of liquid waste, its disposal and impact in recipient environment Capacity among: - Relevant government departments at national and local levels - BMUs - Guidelines	Waste water treatment systems: - collection - treatment technology - discharge Solid Waste Management Systems: - collection - storage - processing - financing - minimisation - reuse? Green Infrastructure Storm Water Systems Agriculture technologies minimising impact for agrochemicals on water resources Technology for monitoring receiving environment.	Enforce regulations for use of agrochemicals. Enforce existing laws related to waste disposal	Not Applicable	Not applicable	Awareness raising campaigns targeting agriculture Awareness raising campaigns: - public at large - schools - stakeholders benefitting from beaches (tourism operators, hotels, fishermen, etc.) - tourists. Impact of pollution on environment and health Pollution pathways and waste management. Upstream/downstream.	Curricula development for relevant education in primary and secondary schools. Importance of environmentally sound agriculture production. Importance of integrated management (upstream / downstream). Importance of marine environment. Pollution, environment, health. Waste minimisation and recycling.
2	Increase of HIV infection	All along the district	Unsafe sex, alcoholism and drug abuse, early age sex engagement	Not applicable	Not applicable	Not applicable	Not applicable	Not Applicable	Not Applicable	Health and education authorities Capacity among: - Relevant government departments at national and local levels.	Not Applicable	Enforce existing laws related to drug use, early age sex among girls.	Not Applicable	Not applicable	STD awareness raising campaigns: - public at large - schools Awareness raising campaigns on impact of drugs and early age sex and pregnancy.	Curricula development for relevant education in primary and secondary schools. Importance of sexual education, HIV, drugs. Population health and environment.

Bagamoyo District

Table 208: Broad assessment of measures to mitigate identified threats to local coastal communities and ecosystems in Bagamoyo District in Mainland Tanzania.

RV	Threat	Location	Causes	ICZM	IWRM	Land Use Management	Shoreline Management Planning	Solid and Liquid Waste Management	Sanitation	Capacity building	Technology	Law enforcement	Legal Review	Alternative/Improved Livelihood	Awareness raising	Education
5	Beach erosion	Kaole, generally along the coast	Mangrove cutting, dynamite fishing, beach sand mining, unplanned construction along the coast.	ICZM is an important tool in addressing the complex requirements to address unsustainable resources usage. Implications at and between all management levels. Catchment and coast management needs to be coordinated. IWRM is the appropriate tool such management in the catchment but needs to incorporate coastal concerns (ICZM).	Upstream catchment management influences hydrology and sediment flow and may thus interfere with erosion accretion patterns along the coast (Ruvu River).	Zoning of beaches to be included in Land Use Plans, providing regulations and guidelines for land use. Ideally to be informed from Shoreline Management Planning efforts. Regulations may define types of use as well as set back arrangements. Guidelines may also cover coral reef, seagrass and mangrove management to the extent of importance to beach erosion.	An understanding of processes and factors behind erosion and accretion along the Tanzanian coast is required. Such an understanding can be attained through a structural effort in Shoreline Management Planning which can then inform Spatial Planning at local level. First step is to identify sediment cells along the coast based on littoral drift considerations, next step to identify management units within these cells based on environment, economic and socio-economic considerations.	Not Applicable	Not Applicable	District level capacity building related to ICZM and in particular shoreline management. Information management - Monitoring occurrences of illegal fisheries - Monitoring fishing practises - Monitoring land uses - Monitoring beach sand mining	Beach protection technologies, from engineering (groynes, etc.) to soft (beach nourishment) solutions and green technologies (mangrove planting, other shoreline vegetation).	Enforce existing laws related to resources exploitation sand mining and construction near shore (set back provisions).	Establish required regulations, bylaws and guidelines to ensure sustainable and safe development along near the sea. Informed by shoreline management study.	Provide alternatives to current destructive and unsustainable livelihood practises related to mangrove exploitation and fisheries in particular.	The impact of unsustainable resources usage on beach erosion highlighted in awareness raising campaigns. Services of mangroves and corals in protecting against erosive forces (targeting resource users). Impact of physical structures along the coast on shorelines included in awareness raising campaigns (targeting developers and planners).	Curricula development for relevant education in primary and secondary schools. Importance of beaches and sustainable coastal resources use.
5	Loss of habitat and agricultural area		Rapid urbanization, high increase of people immigration in the city.	ICZM is an important tool in preventing land use conflicts through coordinated and participatory development planning.	Not applicable	Review and up-date spatial plans for development control clarifying district land uses.	Shoreline Management Planning informs Spatial Planning at local level. First step is to identify sediment cells along the coast based on littoral drift considerations, next step to identify management units within these cells based on environment, economic and socio-economic considerations.	Not Applicable	Not Applicable	Land use planning commission Local Government Authorities	Strengthen/modernise spatial planning tools (GIS, remote imageries)	Enforce land use and building regulations.	Not Applicable	Provide alternatives for people losing traditional livelihoods in rural areas planned for other uses.	Awareness campaigns related to sustainable development planning and development control targeting: - public at large - district authorities - developers/entrepreneurs	Curricula development for relevant education in primary and secondary schools. Complex requirements in coastal areas (high population and economic pressure). Sustainable development. Spatial Planning to service Population requirements.
4	Fisheries decline	Bagamoyo Town, Mbegani, Mlingotini, Kaole and Kondo, generally along the coastal estuaries	Destruction of fish nurseries for action such as Mangrove cutting, illegal fishing such as Dynamite fishing and other poor fishing methods such as beach seine and arrow fishing as well as coral mining for lime production. Use of small mesh size reduces shrimp population. Community denied access and use of beaches which front some tourist hotels. Destruction of fish nurseries such as mangrove cutting, illegal fishing such as dynamite fishing and other poor fishing methods as well as coral mining for lime production	Coordination among stakeholders in addressing fisheries decline. Guidelines for best practices in mangrove management. Guidelines for best practises in fisheries. Guidelines for best practises in coral reef management. Guidelines to be based on outcome of legal review.	Not applicable	Mangroves and other habitats of importance (including seagrass areas and coral reefs) for fisheries included in land use information management systems and incorporated into spatial planning.	Identifying management units requiring local management arrangements.	Not Applicable	Not Applicable	Information Management: - Monitoring occurrences of illegal fisheries - Monitoring fishing practises - Monitoring fisheries catches - Monitoring fisheries resources - Monitoring fisheries habitats (mangroves, coral reefs) Capacity among: - Relevant government departments at national and local levels - BMUs	Offshore fisheries Aquaculture; Add value to existing harvest.	Enforce existing laws related to fisheries. Enforce existing laws related to mangrove exploitation. Enforce existing laws related to coral mining.	Review appropriateness of fisheries regulations in relation to local conditions, environment, species and gears. Establish local zoning and fishing effort seasonality.	Provide alternatives to current destructive and unsustainable livelihood practises related to fisheries. - Emphasis on young generation	Awareness raising campaigns: - public at large - schools - stakeholders benefitting from fisheries (fishing communities, middlemen, hotels and restaurants)	Curricula development for relevant education in primary and secondary schools. - Sustainable Fisheries. - Fisheries ecology.
3	Beach pollution	Beach front Bagamoyo harbour and vicinity. Coastal villages.	Uncontrolled solid and liquid waste disposal, often in creeks. lack of easily accessible public toilets	Coordination among stakeholders in addressing beach pollution. Beach management guidelines	To the extent that solid and liquid waste origin from upstream activities	Beaches included in zoning and development of associated regulations	Identifying management units requiring local management arrangements.	Waste collection, storage and processing system needs to be put in place.	- Identify and quantify sources of liquid waste as basis for solution	Information Management: - Monitoring waste generation, disposal and management - Monitoring sources of liquid waste, its disposal and impact in recipient environment Capacity among: - Relevant government departments at national and local levels - BMUs - Guidelines	Waste Water Management systems: - collection - treatment technology - discharge Solid Waste Management Systems: - collection - storage - processing - financing - minimisation - reuse?	Enforce existing laws related to waste disposal	Not Applicable	Not applicable	Awareness raising campaigns: - public at large - schools - stakeholders benefitting from beaches (tourism operators, hotels, fishermen, etc.) - tourists	Curricula development for relevant education in primary and secondary schools. Importance of beaches.
3	Mangrove decline	Uondwe creek, Wami and Ruvu River Mouth, Bagamoyo Town to Mpiji River Mouth	Illegal and un controlled cutting of mangroves, salt production	Coordination among stakeholders in addressing mangrove decline. Guidelines for best practices in mangrove management.	Not applicable	Mangroves included in land use information management systems and incorporated into spatial planning.	Identifying management units requiring local management arrangements.	Not Applicable	Not Applicable	Information Management: - Monitoring Salt production - Monitoring mangroves - Monitoring mangrove exploitation Capacity among: - Relevant government departments at national and local levels - BMUs	Best mangrove management practises Alternative livelihood technologies Alternatives to mangrove wood usage	Enforce existing laws related to mangrove exploitation. Enforce salt production regulations	Not Applicable	Provide alternatives to current destructive and unsustainable livelihood practises related to mangroves.	Awareness raising campaigns: - public at large - schools - stakeholders benefitting from mangrove services and products	Curricula development for relevant education in primary and secondary schools. - Mangrove ecology - Mangrove management
3	Forest habitat destruction	Makurunge Forest Reserve	Fuel wood collection, logging, pole cutting, forest fires and hunting, due to lack of proper management of the reserve.	Coordination among stakeholders in addressing forest management. Forest reserve management plans.	Not applicable	Forest reserves and forests included in land use information management systems and incorporated into spatial planning.	Identifying management units requiring local management arrangements.	Not Applicable	Not Applicable	Information Management: - Monitoring forest reserves - Monitoring forest reserve exploitation Capacity among: - Relevant government departments at national and local levels - BMUs	Best forest management practises Alternative livelihood technologies Alternatives to coastal forest wood usage	Enforce existing laws related to coastal forest exploitation.	Not Applicable	Provide alternatives to current destructive and unsustainable livelihood practises related to coastal forests, particularly fuel wood and other resources.	Awareness raising campaigns: - public at large - schools - stakeholders benefitting from mangrove services and products	Curricula development for relevant education in primary and secondary schools. - Coastal forest ecology - Coastal forest management

RV	Threat	Location	Causes	ICZM	IWRM	Land Use Management	Shoreline Management Planning	Solid and Liquid Waste Management	Sanitation	Capacity building	Technology	Law enforcement	Legal Review	Alternative/Improved Livelihood	Awareness raising	Education
2	Beach erosion	Coastal stretch towards Mbegani.	Wave erosion due to physiographic setting or mangrove coverage (Shagude, 2011).	Catchment and coast management need to be coordinated. IWRM is the appropriate tool for such management in the catchment but needs to incorporate coastal concerns (ICZM).	Upstream catchment management influences hydrology and sediment flow and may thus interfere with erosion accretion patterns along the coast.	Zoning of beaches to be included in Land Use Plans, providing regulations and guidelines for land use. Ideally to be informed from Shoreline Management Planning efforts. Regulations may define types of use as well as set back arrangements	An understanding of processes and factors behind erosion and accretion along the Tanzanian coast is required. Such an understanding can be attained through a structural effort in Shoreline Management Planning which can then inform Spatial Planning at local level. First step is to identify sediment cells along the coast based on littoral drift considerations, next step to identify management units within these cells based on environment, economic and socio-economic considerations.	Not Applicable	Not Applicable	District level capacity building related to ICZM and in particular shoreline management.	Beach protection technologies, from engineering (groynes, etc.) to soft (beach nourishment) solutions and green technologies (mangrove planting, other shoreline vegetation).	Enforce existing laws related to mangrove exploitation and beach and river sand extraction.	Establish required regulations, bylaws and guidelines to ensure sustainable and safe development along the shore. Informed by shoreline management study.	Provide alternatives to current destructive and unsustainable livelihood practises related to mangrove exploitation.	Awareness raising campaigns: <ul style="list-style-type: none"> - public at large - schools - stakeholders benefitting from beaches (tourism operators, hotels, fishermen, etc.) - tourists 	Curricula development for relevant education in primary and secondary schools. Importance of beaches.
2	Loss of land and environmental damage	Near shore waters	Mwambani port project developed without due procedures on impact assessment and local livelihood analysis (EIA was done)	ICZM is an important tool in preventing land use conflicts through coordinated and participatory development planning.	Not applicable	Review and up-date spatial plans for development control clarifying district land uses.	Shoreline Management Planning informs Spatial Planning at local level. First step is to identify sediment cells along the coast based on littoral drift considerations, next step to identify management units within these cells based on environment, economic and socio-economic considerations.	Not Applicable	Not Applicable	Land use planning commission Local Government Authorities	Strengthen/modernise spatial planning tools (GIS, remote imageries)	Enforce land use and building regulations.	Not Applicable	Provide alternatives for people losing traditional livelihoods in rural areas planned for other uses.	Awareness campaigns related to sustainable development planning and development control targeting: <ul style="list-style-type: none"> - public at large - district authorities - developers/entrepreneurs 	Curricula development for relevant education in primary and secondary schools. Complex requirements in coastal areas (high population and economic pressure). Sustainable development. Spatial Planning to service Population requirements.
0	Land use conflicts	Inshore shallow waters	Trawlers trawling in the areas where artisanal fishers use, leading to destruction of artisanal fishers traps. All fisher types fishing in seaweed farms.													

Kinondoni District

Table 209: Broad assessment of measures to mitigate identified threats to local coastal communities and ecosystems in Kinondoni District in Mainland Tanzania.

RV	Threat	Location	Causes	ICZM	IWRM	Land Use Management	Shoreline Management Planning	Solid and Liquid Waste Management	Sanitation	Capacity building	Technology	Law enforcement	Legal Review	Alternative/Improved Livelihood	Awareness raising	Education
4	Beach pollution	Entire coast and particularly at Kunduchi, Ununio, and Mbweni	Uncontrolled solid and liquid waste disposal, often in creeks.	Coordination among stakeholders in addressing beach pollution. Beach management guidelines	To the extent that solid and liquid waste origin from upstream activities in Msimbazi River basin.	Beaches included in zoning and development of associated regulations	Identifying management units requiring local management arrangements.	Waste collection, storage and processing system needs to be put in place.	Identify and quantify sources of liquid waste as basis for solution and develop sanitation systems accordingly	Information Management: - Monitoring waste generation, disposal and management - Monitoring sources of liquid waste, its disposal and impact in recipient environment Capacity among: - Relevant government departments at national and local levels - BMUs - Guidelines	Waste water treatment systems: - collection - treatment technology - discharge Solid Waste Management Systems: - collection - storage - processing - financing - minimisation - reuse? Green Infrastructure Storm Water Systems	Enforce existing laws related to waste disposal	Not Applicable	Not Applicable	Awareness raising campaigns: - public at large - schools - stakeholders benefitting from beaches (tourism operators, hotels, fishermen, etc.) - tourists. Impact of pollution on environment and health Pollution pathways and waste management. Upstream/downstream.	Curricula development for relevant education in primary and secondary schools. Importance of beaches. Pollution, environment, health. Waste minimisation and recycling.
4	Beach erosion	Entire Coast and particularly at Kunduchi area, Ununio and Mbweni	Mangrove cutting, dynamite fishing, beach sand mining, unplanned construction along the coast.	ICZM is an important tool in addressing the complex requirements to address unsustainable resources usage. Implications at and between all management levels. Catchment and coast management needs to be coordinated. IWRM is the appropriate tool such management in the catchment but needs to incorporate coastal concerns (ICZM).	Upstream catchment management influences hydrology and sediment flow and may thus interfere with erosion accretion patterns along the coast (Msimbazi River).	Zoning of beaches to be included in Land Use Plans, providing regulations and guidelines for land use. Ideally to be informed from Shoreline Management Planning efforts. Regulations may define types of use as well as set back arrangements. Guidelines may also cover coral reef, seagrass and mangrove management to the extent of importance to beach erosion.	An understanding of processes and factors behind erosion and accretion along the Tanzanian coast is required. Such an understanding can be attained through a structural effort in Shoreline Management Planning which can then inform Spatial Planning at local level. First step is to identify sediment cells along the coast based on littoral drift considerations, next step to identify management units within these cells based on environment, economic and socio-economic consideration.	Not Applicable	Not Applicable	District level capacity building related to ICZM and in particular shoreline management. Information management - Monitoring occurrences of illegal fisheries - Monitoring fishing practises - Monitoring land uses - Monitoring beach sand mining	Beach protection technologies, from engineering (groyne, etc.) to soft (beach nourishment) solutions and green technologies (mangrove planting, other shoreline vegetation).	Enforce existing laws related to resources exploitation sand mining and construction near shore (set back provisions).	Establish required regulations, bylaws and guidelines to ensure sustainable and safe development along near the sea. Informed by shoreline management study.	Provide alternatives to current destructive and unsustainable livelihood practises related to mangrove exploitation and fisheries in particular.	The impact of unsustainable resources usage on beach erosion highlighted in awareness raising campaigns. Services of mangroves and corals in protecting against erosive forces (targeting resource users). Impact of physical structures along the coast on shorelines included in awareness raising campaigns (targeting developers and planners)	Curricula development for relevant education in primary and secondary schools. Importance of beaches and sustainable coastal resources use.
4	Fisheries decline	Entire district coastal are including Ununio, Mbweni and Kunduchi	Destruction of fish nurseries such as mangrove cutting, illegal fishing such as dynamite fishing and other poor fishing methods as well as coral mining for lime production	Coordination among stakeholders in addressing fisheries decline. Guidelines for best practices in mangrove management. Guidelines for best practises in fisheries. Guidelines for best practises in coral reef management. Guidelines to be based on outcome of legal review.	Not applicable	Mangroves and other habitats of importance (including seagrass areas and coral reefs) for fisheries included in land use information management systems and incorporated into spatial planning.	Identifying management units requiring local management arrangements.	Not Applicable	Not Applicable	Information Management: - Monitoring occurrences of illegal fisheries - Monitoring fishing practises - Monitoring fisheries catches - Monitoring fisheries resources - Monitoring fisheries habitats (mangroves, coral reefs) Capacity among: - Relevant government departments at national and local levels - BMUs	Offshore fisheries Aquaculture; Add value to existing harvest.	Enforce existing laws related to fisheries. Enforce existing laws related to mangrove exploitation. Enforce existing laws related to coral mining.	Review appropriateness of fisheries regulations in relation to local conditions, environment, species and gears. Establish local zoning and fishing effort seasonality.	Provide alternatives to current destructive and unsustainable livelihood practises related to fisheries. - Emphasis on young generation	Awareness raising campaigns: - public at large - schools - stakeholders benefitting from fisheries (fishing communities, middlemen, hotels and restaurants)	Curricula development for relevant education in primary and secondary schools. - Sustainable Fisheries. - Fisheries ecology.
4	Flooding	Suna and Makuti B in Magomeni ward, Mkunguni A, Mkunguni B and Hanna-Nassif in Hanna-Nassif ward	Construction in vulnerable river valleys, absence of sieves in drainage channels, disposing solid wastes in drainage system, poor drainage system, and blockage of drainage channels and unplanned constructions and developments.	ICARM ensuring linkage between catchment management and coastal management.	Land uses in catchment and its impacts on water resources included in IWRM planning	Review and update of spatial plans including zoning to guide development planning and development control. Storm water drainage infrastructure aligned to climate variability and change predictions. Consider and integrate greeninfrastructure measures.	Not applicable	Waste collection, storage and processing system needs to be put in place.	Identify and quantify sources of liquid waste as basis for solution and develop sanitation systems accordingly	Environmental authorities Land use planners Information Management: - Monitoring waste generation, disposal and management - Monitoring sources of liquid waste, its disposal and impact in recipient environment Capacity among: - Relevant government departments at national and local levels - BMUs - Guidelines Balance between green and grey infrastructure solutions	Waste water treatment systems: - collection - treatment technology - discharge Solid Waste Management Systems: - collection - storage - processing - financing - minimisation - reuse? Green Infrastructure Storm Water Systems Technology for monitoring receiving environment.	Enforce existing laws related to waste disposal	Not Applicable	Not applicable	Awareness raising campaigns: - public at large - schools - stakeholders benefitting from beaches (tourism operators, hotels, fishermen, etc.) - tourists. Impact of pollution on environment and health Pollution pathways and waste management. Upstream/downstream.	Curricula development for relevant education in primary and secondary schools. Importance of integrated management (upstream / downstream). Pollution, environment, health. Waste minimisation and recycling.

RV	Threat	Location	Causes	ICZM	IWRM	Land Use Management	Shoreline Management Planning	Solid and Liquid Waste Management	Sanitation	Capacity building	Technology	Law enforcement	Legal Review	Alternative/Improved Livelihood	Awareness raising	Education
4	Land use conflicts	Along the coastal front.	Conflict between environmental conservation groups and investors; conflicting interests between sectors e.g. Forestry (mangrove) and mining (salt pans), forestry (mangrove) and lands; conflict between hotel owners and communities on addressing the issue of erosion at Kunduchi Beach areas.	Coordinated and participatory land and resource use planning expressed in integrated spatial plans and regulations.	Link IWRM to coastal integrated planning ensuring upstream/downstream considerations.	Review and update of spatial plans including zoning to guide development planning and development control. Spatial plans to also consider marine spaces.	An understanding of processes and factors behind erosion and accretion along the Tanzanian coast is required. Such an understanding can be attained through a structural effort in Shoreline Management Planning which can then inform Spatial Planning at local level. First step is to identify sediment cells along the coast based on littoral drift considerations, next step to identify management units within these cells based on environment, economic and socio-economic considerations.	Not applicable	Not applicable	District level capacity building related to: - Shoreline management - Spatial Planning - Conflict resolution	Beach protection technologies, from engineering (groynes, etc.) to soft (beach nourishment) solutions and green technologies (mangrove planting, other shoreline vegetation). More efficient use of land.	Enforce existing laws related to resources exploitation and sand mining and construction near shore (set back provisions). Enforce development control measures according to updated spatial plans.	Establish required regulations, bylaws and guidelines to ensure sustainable and safe development along near the sea. Local guidelines based on updated spatial plans informed by shoreline management study.	Not applicable	The impact of unsustainable resources usage on beach erosion highlighted in awareness raising campaigns. Services of mangroves and corals in protecting against erosive forces (targeting resource users). Impact of physical structures along the coast on shorelines included in awareness raising campaigns (targeting developers and planners)	Curricula development for relevant education in primary and secondary schools. Sustainable development in areas under high demographic and economic development pressure (coastal areas, urban areas). Importance of coasts and coastal habitats and resources.
3	Heavy metal pollution	Msimbazi river valley, Kunduchi, Mweni and Ununio	Wastes from tourist hotels, construction sites, workshops, garages and industries located upstream.	Coordination among stakeholders in addressing coastal and riverine industry pollution. Beach management guidelines.	To the extent that solid and liquid waste origin from upstream activities in Msimbazi River basin.	Beaches included in zoning and development of associated regulations	Identifying management units requiring local management arrangements.	Waste collection, storage and processing system needs to be put in place.	Identify and quantify sources of liquid waste as basis for solution and develop sanitation systems accordingly	Information Management: - Monitoring waste generation, disposal and management - Monitoring sources of liquid waste, its disposal and impact in recipient environment Capacity among: - Relevant government departments at national and local levels - BMUs - Guidelines	Waste water treatment systems: - collection - treatment technology - discharge Solid Waste Management Systems: - collection - storage - processing - financing - minimisation - reuse? Green Infrastructure Storm Water Systems	Enforce existing laws related to waste disposal	Not Applicable	Not Applicable	Awareness raising campaigns: - public at large - schools - stakeholders benefitting from beaches (tourism operators, hotels, fishermen, etc.) - tourists. Impact of pollution on environment and health Pollution pathways and waste management. Upstream/downstream.	Curricula development for relevant education in primary and secondary schools. Importance of beaches. Pollution, environment, health. Waste minimisation and recycling.
3	Diseases outbreaks	Throughout the coastal and urban areas of the district	Inadequate sewerage control, flooding, poor quality of sewerage construction, poor solid waste management, uncontrolled food vending.	ICARM ensuring linkage between catchment management and coastal management.	Land uses in catchment and its impacts on water resources included in IWRM planning; to the extent that disease vectors origin from upstream activities	Infrastructure development. Supply of sanitation and health services.	Not applicable	Waste collection, storage and processing system needs to be put in place.	Identify and quantify sources of liquid waste as basis for solution and develop sanitation systems accordingly	Environmental authorities Land use planners Information Management: - Monitoring waste generation, disposal and management - Monitoring sources of liquid waste, its disposal and impact in recipient environment Capacity among: - Relevant government departments at national and local levels - BMUs - Guidelines	Waste water treatment systems: - collection - treatment technology - discharge Solid Waste Management Systems: - collection - storage - processing - financing - minimisation - reuse? Green Infrastructure Storm Water Systems Technology for monitoring receiving environment.	Enforce existing laws related to waste disposal	Not Applicable	Not applicable	Awareness raising campaigns: - public at large - schools - stakeholders benefitting from beaches (tourism operators, hotels, fishermen, etc.) - tourists. Impact of pollution on environment and health Pollution pathways and waste management. Upstream/downstream.	Curricula development for relevant education in primary and secondary schools. Importance of environmentally sound agriculture production. Importance of integrated management (upstream / downstream). Importance of marine environment. Pollution, environment, health. Waste minimisation and recycling.
3	Loss of habitat and agricultural area	Mabwe Pande Forest, Mpji River Valley	Rapid urbanization, high increase of people immigration in the city.	ICZM is an important tool in preventing land use conflicts through coordinated and participatory development planning.	Link IWRM to coastal integrated planning ensuring upstream/downstream considerations.	Review and up-date spatial plans for development control clarifying district land uses.	Shoreline Management Planning informs Spatial Planning at local level. First step is to identify sediment cells along the coast based on littoral drift considerations, next step to identify management units within these cells based on environment, economic and socio-economic considerations.	Not Applicable	Not Applicable	Land use planning commission Local Government Authorities	Strengthen/modernise spatial planning tools (GIS, remote imageries)	Enforce land use and building regulations.	Not Applicable	Provide alternatives for people losing traditional livelihoods in rural areas planned for other uses.	Awareness campaigns related to sustainable development planning and development control targeting: - public at large - district authorities - developers/entrepreneurs	Curricula development for relevant education in primary and secondary schools. Complex requirements in coastal areas (high population and economic pressure). Sustainable development. Spatial Planning to service Population requirements.

Ilala District

Table 210: Broad assessment of measures to mitigate identified threats to local coastal communities and ecosystems in Ilala District in Mainland Tanzania.

RV	Threat	Location	Causes	ICZM	IWRM	Land Use Management	Shoreline Management Planning	Solid and Liquid Waste Management	Sanitation	Capacity building	Technology	Law enforcement	Legal Review	Alternative/Improved Livelihood	Awareness raising	Education
4	Fisheries decline	Msimbazi Bay, district marine waters.	Destruction of fish nurseries due to beach seining and dynamite fishing.	Coordination among stakeholders in addressing fisheries decline. Guidelines for best practices in mangrove management. Guidelines for best practises in fisheries. Guidelines for best practises in coral reef management. Guidelines to be based on outcome of legal review.	Not applicable	Mangroves and other habitats of importance (including seagrass areas and coral reefs) for fisheries included in land use information management systems and incorporated into spatial planning.	Identifying management units requiring local management arrangements.	Not Applicable	Not Applicable	Information Management: - Monitoring occurrences of illegal fisheries - Monitoring fishing practises - Monitoring fisheries catches - Monitoring fisheries resources - Monitoring fisheries habitats (mangroves, coral reefs) Capacity among: - Relevant government departments at national and local levels - BMUs	Offshore fisheries Aquaculture; Add value to existing harvest.	Enforce existing laws related to fisheries. Enforce existing laws related to mangrove exploitation. Enforce existing laws related to coral mining.	Review appropriateness of fisheries regulations in relation to local conditions, environment, species and gears. Establish local zoning and fishing effort seasonality.	Provide alternatives to current destructive and unsustainable livelihood practises related to fisheries. - Emphasis on young generation	Awareness raising campaigns: - public at large - schools - stakeholders benefitting from fisheries (fishing communities, middlemen, hotels and restaurants)	Curricula development for relevant education in primary and secondary schools. - Sustainable Fisheries. - Fisheries ecology.
4	Oil pollution	Dar es Salaam Harbour and vicinity	Waste products from Kigamboni oil terminal, loading and offloading of fuel at Dar es Salaam port, disposal of untreated liquid wastes from some industries and garages.	Coordination among stakeholders in addressing oil pollution. Coordinated development and implementation of oil spill contingency plans.	Not applicable	Not applicable	Shoreline sensitivity to oil spills included in shoreline management planning.	Waste collection, storage and processing system needs to be reviewed and improved.	Not Applicable	Port Authorities Industry Shipping Environmental authorities	Best available technology use for waste handling and disposal. Technology for monitoring receiving environment.	Enforce existing regulations for waste product handling and disposal.	Not Applicable	Not applicable	Awareness raising campaigns targeting relevant industries. Awareness raising related to oil spill contingency plans.	Not applicable
4	Diseases outbreaks	Throughout urban areas of the district	In adequate sewerage control, flooding, poor quality of sewerage construction, poor solid waste management.	ICARM ensuring linkage between catchment management and coastal management.	Land uses in catchment and its impacts on water resources included in IWRM planning; to the extent that disease vectors origin from upstream activities	Infrastructure development. Supply of sanitation and health services.	Not applicable	Waste collection, storage and processing system needs to be put in place.	Identify and quantify sources of liquid waste as basis for solution and develop sanitation systems accordingly	Environmental authorities Land use planners Information Management: - Monitoring waste generation, disposal and management - Monitoring sources of liquid waste, its disposal and impact in recipient environment Capacity among: - Relevant government departments at national and local levels - BMUs - Guidelines	Waste water treatment systems: - collection - treatment technology - discharge Solid Waste Management Systems: - collection - storage - processing - financing - minimisation - reuse? Green Infrastructure Storm Water Systems Technology for monitoring receiving environment.	Enforce existing laws related to waste disposal	Not Applicable	Not applicable	Awareness raising campaigns: - public at large - schools - stakeholders benefitting from beaches (tourism operators, hotels, fishermen, etc.) - tourists. Impact of pollution on environment and health Pollution pathways and waste management. Upstream/downstream.	Curricula development for relevant education in primary and secondary schools. Importance of environmentally sound agriculture production. Importance of integrated management (upstream / downstream). Importance of marine environment. Pollution, environment, health. Waste minimisation and recycling.
3	Beach and near shore pollution	Selander Bridge beach	Uncontrolled solid waste disposal into Mzimbazi Creek valley, being washed down stream during heavy rain.	Coordination among stakeholders in addressing coastal and riverine pollution. Beach management guidelines.	To the extent that solid and liquid waste origin from upstream activities in Msimbazi River basin.	Beaches included in zoning and development of associated regulations	Identifying management units requiring local management arrangements.	Waste collection, storage and processing system needs to be put in place.	Identify and quantify sources of liquid waste as basis for solution and develop sanitation systems accordingly	Information Management: - Monitoring waste generation, disposal and management - Monitoring sources of liquid waste, its disposal and impact in recipient environment Capacity among: - Relevant government departments at national and local levels - BMUs - Guidelines	Waste water treatment systems: - collection - treatment technology - discharge Solid Waste Management Systems: - collection - storage - processing - financing - minimisation - reuse? Green Infrastructure Storm Water Systems	Enforce existing laws related to waste disposal	Not Applicable	Not Applicable	Awareness raising campaigns: - public at large - schools - stakeholders benefitting from beaches (tourism operators, hotels, fishermen, etc.) - tourists. Impact of pollution on environment and health Pollution pathways and waste management. Upstream/downstream.	Curricula development for relevant education in primary and secondary schools. Importance of beaches. Pollution, environment, health. Waste minimisation and recycling.
3	Sewage pollution	Ocean Road beach	AgaKhan Hospital and nearby residences discharging untreated sewage directly onto shore.	Coordination among stakeholders in addressing coastal pollution. Beach management guidelines.	Not applicable	Beaches included in zoning and development of associated regulations	Identifying management units requiring local management arrangements.	Waste collection, storage and processing system needs to be put in place.	Identify and quantify sources of liquid waste as basis for solution and develop sanitation systems accordingly	Information Management: - Monitoring waste generation, disposal and management - Monitoring sources of liquid waste, its disposal and impact in recipient environment Capacity among: - Relevant government departments at national and local levels - BMUs - Guidelines	Waste water treatment systems: - collection - treatment technology - discharge Solid Waste Management Systems: - collection - storage - processing - financing - minimisation - reuse? Green Infrastructure Storm Water Systems	Enforce existing laws related to waste disposal	Not Applicable	Not Applicable	Awareness raising campaigns: - public at large - schools - stakeholders benefitting from beaches (tourism operators, hotels, fishermen, etc.) - tourists. Impact of pollution on environment and health Pollution pathways and waste management. Upstream/downstream.	Curricula development for relevant education in primary and secondary schools. Importance of beaches. Pollution, environment, health. Waste minimisation and recycling.

RV	Threat	Location	Causes	ICZM	IWRM	Land Use Management	Shoreline Management Planning	Solid and Liquid Waste Management	Sanitation	Capacity building	Technology	Law enforcement	Legal Review	Alternative/Improved Livelihood	Awareness raising	Education
3	Beach Erosion	Ocean Road	Local oceanographic conditions...	ICZM is an important tool in addressing the complex requirements to address unsustainable resources usage. Implications at and between all management levels.	Upstream catchment management influences hydrology and sediment flow and may thus interfere with erosion accretion patterns along the coast. Catchment and coast management needs to be coordinated. IWRM is the appropriate tool such management in the catchment but needs to incorporate coastal concerns (ICZM)	Zoning of beaches to be included in Land Use Plans, providing regulations and guidelines for land use. Ideally to be informed from Shoreline Management Planning efforts. Regulations may define types of use as well as set back arrangements. Guidelines may also cover coral reef, seagrass and mangrove management to the extent of importance to beach erosion.	An understanding of processes and factors behind erosion and accretion along the Tanzanian coast is required. Such an understanding can be attained through a structural effort in Shoreline Management Planning which can then inform Spatial Planning at local level. First step is to identify sediment cells along the coast based on littoral drift considerations, next step to identify management units within these cells based on environment, economic and socio-economic consideration.	Not Applicable	Not Applicable	District level capacity building related to ICZM and in particular shoreline management. Information management - Monitoring occurrences of illegal fisheries - Monitoring fishing practises - Monitoring land uses - Monitoring beach sand mining	Beach protection technologies, from engineering (groynes, etc.) to soft (beach nourishment) solutions and green technologies (mangrove planting, other shoreline vegetation).	Enforce existing laws related to resources exploitation sand mining and construction near shore (set back provisions).	Establish required regulations, bylaws and guidelines to ensure sustainable and safe development along near the sea. Informed by shoreline management study.	Provide alternatives to current destructive and unsustainable livelihood practises related to mangrove exploitation and fisheries in particular.	The impact of unsustainable resources usage on beach erosion highlighted in awareness raising campaigns. Services of mangroves and corals in protecting against erosive forces (targeting resource users). Impact of physical structures along the coast on shorelines included in awareness raising campaigns (targeting developers and planners)	Curricula development for relevant education in primary and secondary schools. Importance of beaches.
3	Heavy metals pollution	Msimbazi River valley, Dar es Salaam Harbour and vicinity, Mtoni River area	Wastes from construction sites, workshops, garages and industries located upstream along the two rivers.	Coordination among stakeholders in addressing coastal and riverine industry pollution. Beach management guidelines.	To the extent that solid and liquid waste origin from upstream activities in Mtoni River basin.	Lower portions of rivers included in zoning and development of associated regulations	Identifying management units requiring local management arrangements.	Waste collection, storage and processing system needs to be put in place.	Identify and quantify sources of liquid waste as basis for solution and develop sanitation systems accordingly	Information Management: - Monitoring waste generation, disposal and management - Monitoring sources of liquid waste, its disposal and impact in recipient environment Capacity among: - Relevant government departments at national and local levels - Guidelines	Waste water treatment systems: - collection - treatment technology - discharge Solid Waste Management Systems: - collection - storage - processing - financing - minimisation - reuse? Green Infrastructure Storm Water Systems	Enforce existing laws related to waste disposal	Not Applicable	Not Applicable	Awareness raising campaigns: - public at large - schools - stakeholders benefitting from beaches (tourism operators, hotels, fishermen, etc.) - tourists. Impact of pollution on environment and health Pollution pathways and waste management. Upstream/downstream.	Curricula development for relevant education in primary and secondary schools. Importance of beaches. Pollution, environment, health. Waste minimisation and recycling.
3	Industrial pollution	Dar es Salaam Harbour and vicinity	Effluent from KTM and other industries	Coordination among stakeholders in addressing harbour industry pollution.	Not applicable	Harbour included in zoning and development of associated regulations	Identifying management units requiring local management arrangements.	Waste collection, storage and processing system needs to be put in place.	Not Applicable	Information Management: - Monitoring waste generation, disposal and management - Monitoring sources of industrial waste, its disposal and impact in recipient environment Capacity among: - Relevant government departments at national and local levels - Guidelines	Waste water treatment systems: - collection - treatment technology - discharge Solid Waste Management Systems: - collection - storage - processing - financing - minimisation - reuse? Green Infrastructure Storm Water Systems	Enforce existing laws related to waste disposal	Not Applicable	Not Applicable	Awareness raising campaigns: - public at large - schools - industry Impact of pollution on environment and health Pollution pathways and waste management. Upstream/downstream.	Curricula development for relevant education in primary and secondary schools. Importance of beaches. Pollution, environment, health. Waste minimisation and recycling.

Temeke District

Table 211: Broad assessment of measures to mitigate identified threats to local coastal communities and ecosystems in Temeke District in Mainland Tanzania.

RV	Threat	Location	Causes	ICZM	IWRM	Land Use Management	Shoreline Management Planning	Solid and Liquid Waste Management	Sanitation	Capacity building	Technology	Law enforcement	Legal Review	Alternative/Improved Livelihood	Awareness raising	Education
4	Beach erosion	Kimbiji, Kigamboni, and Vijibweni and small islands	Mangrove cutting, dynamite fishing, beach sand mining, unplanned construction along the coast.	ICZM is an important tool in addressing the complex requirements to address unsustainable resources usage. Implications at and between all management levels. Catchment and coast management needs to be coordinated. IWRM is the appropriate tool such management in the catchment but needs to incorporate coastal concerns (ICZM).	Upstream catchment management influences hydrology and sediment flow and may thus interfere with erosion accretion patterns along the coast (Kizinga, Mzingu, Nguva, Mbarajange).	Zoning of beaches to be included in Land Use Plans, providing regulations and guidelines for land use. Ideally to be informed from Shoreline Management Planning efforts. Regulations may define types of use as well as set back arrangements. Guidelines may also cover coral reef, seagrass and mangrove management to the extent of importance to beach erosion.	An understanding of processes and factors behind erosion and accretion along the Tanzanian coast is required. Such an understanding can be attained through a structural effort in Shoreline Management Planning which can then inform Spatial Planning at local level. First step is to identify sediment cells along the coast based on littoral drift considerations, next step to identify management units within these cells based on environment, economic and socio-economic consideration.	Not Applicable	Not Applicable	District level capacity building related to ICZM and in particular shoreline management. Information management - Monitoring occurrences of illegal fisheries - Monitoring fishing practises - Monitoring land uses - Monitoring beach sand mining	Beach protection technologies, from engineering (groynes, etc.) to soft (beach nourishment) solutions and green technologies (mangrove planting, other shoreline vegetation).	Enforce existing laws related to resources exploitation sand mining and construction near shore (set back provisions).	Establish required regulations, bylaws and guidelines to ensure sustainable and safe development along near the sea. Informed by shoreline management study.	Provide alternatives to current destructive and unsustainable livelihood practises related to mangrove exploitation, fisheries and sand mining in particular.	The impact of unsustainable resources usage on beach erosion highlighted in awareness raising campaigns. Services of mangroves and corals in protecting against erosive forces (targeting resource users). Impact of physical structures along the coast on shorelines included in awareness raising campaigns (targeting developers and planners)	Curricula development for relevant education in primary and secondary schools. Importance of beaches and sustainable coastal resources use.
4	Fisheries decline	Mjimwema, Vijibweni, Kigamboni, Mtoni and Kimbiji	Destruction of fish nurseries such as mangrove cutting, illegal fishing such as dynamite fishing and other poor fishing methods as well as coral mining for lime production.	Coordination among stakeholders in addressing fisheries decline. Guidelines for best practices in mangrove management. Guidelines for best practises in fisheries. Guidelines for best practises in coral reef management. Guidelines to be based on outcome of legal review.	Not applicable	Mangroves and other habitats of importance (including seagrass areas and coral reefs) for fisheries included in land use information management systems and incorporated into spatial planning.	Identifying management units requiring local management arrangements.	Not Applicable	Not Applicable	Information Management: - Monitoring occurrences of illegal fisheries - Monitoring fishing practises - Monitoring fisheries catches - Monitoring fisheries resources - Monitoring fisheries habitats (mangroves, coral reefs) Capacity among: - Relevant government departments at national and local levels - BMUs and MPAs	Offshore fisheries Aquaculture; Add value to existing harvest.	Enforce existing laws related to fisheries. Enforce existing laws related to mangrove exploitation. Enforce existing laws related to coral mining.	Review appropriateness of fisheries regulations in relation to local conditions, environment, species and gears. Establish local zoning and fishing effort seasonality.	Provide alternatives to current destructive and unsustainable livelihood practises related to fisheries. - Emphasis on young generation	Awareness raising campaigns: - public at large - schools - stakeholders benefitting from fisheries (fishing communities, middlemen, hotels and restaurants)	Curricula development for relevant education in primary and secondary schools. - Sustainable Fisheries. - Fisheries ecology.
3	Beach pollution	Mbagala Kuu and Mjimwema	Uncontrolled solid and liquid waste disposal, often in creeks (such as branches of Mtoni River)	Coordination among stakeholders in addressing beach pollution. Beach management guidelines	To the extent that solid and liquid waste origin from upstream activities	Beaches included in zoning and development of associated regulations	Identifying management units requiring local management arrangements.	Waste collection, storage and processing system needs to be put in place.	- Identify and quantify sources of liquid waste as basis for solution	Information Management: - Monitoring waste generation, disposal and management - Monitoring sources of liquid waste, its disposal and impact in recipient environment Capacity among: - Relevant government departments at national and local levels - BMUs - Guidelines	Waste water treatment systems: - collection - treatment technology - discharge Solid Waste Management Systems: - collection - storage - processing - financing - minimisation - reuse?	Enforce existing laws related to waste disposal	Not Applicable	Not applicable	Awareness raising campaigns: - public at large - schools - stakeholders benefitting from beaches (tourism operators, hotels, fishermen, etc.) - tourists	Curricula development for relevant education in primary and secondary schools. Importance of beaches.
3	Forest decline	Kimbiji, Mjimwema, Mtoni	Exploitation and uncontrollable use of coastal forest and mangrove	Coordination among stakeholders in addressing forest management. Mangrove forest reserve management plans.	Not applicable	Forest reserves and forests included in land use information management systems and incorporated into spatial planning.	Identifying management units requiring local management arrangements.	Not Applicable	Not Applicable	Information Management: - Monitoring forest reserves - Monitoring forest reserve exploitation Capacity among: - Relevant government departments at national and local levels - BMUs	Best forest management practises Alternative livelihood technologies Alternatives to coastal forest wood usage	Enforce existing laws related to coastal forest exploitation.	Not Applicable	Provide alternatives to current destructive and unsustainable livelihood practises related to coastal forests, particularly fuel wood and other resources.	Awareness raising campaigns: - public at large - schools - stakeholders benefitting from mangrove services and products	Curricula development for relevant education in primary and secondary schools. - Coastal forest ecology - Coastal forest management
3	River condition decline	Mtoni River, Nguva River, seasonal streams	Pollution from dumping of solid and liquid waste	ICARM ensuring linkage between catchment management and coastal management.	Land uses in catchment and its impacts on water resources included in IWRM planning	Agriculture zoning in catchments. Regulations for riverside vegetation.	Not applicable	Waste collection, storage and processing system needs to be reviewed and improved.	- Identify and quantify sources of liquid waste as basis for solution	Information Management: - Monitoring waste generation, disposal and management - Monitoring sources of liquid waste, its disposal and impact in recipient environment Capacity among: - Relevant government departments at national and local levels - Guidelines	Waste Water Management systems: - collection - treatment technology - discharge Solid Waste Management Systems: - collection - storage - processing - financing - minimisation - reuse?	Enforce existing laws related to waste disposal	Not Applicable	Not applicable	Awareness raising campaigns: - public at large - schools - stakeholders benefitting from beaches (tourism operators, hotels, fishermen, etc.) - tourists	Curricula development for relevant education in primary and secondary schools. Importance of beaches. Pollution, environment, health. Waste minimisation and recycling.
3	Heavy metal pollution	Mtoni River and Dar es Salaam Port	Wastes from construction sites, workshops, garages and industries located upstream.	Coordination among stakeholders in addressing industrial pollution.	To the extent that solid and liquid waste origin from upstream activities	Lower portions of rivers included in zoning and development of associated regulations	Identifying management units requiring local management arrangements.	Waste collection, storage and processing system needs to be reviewed and improved.	Not Applicable	Information Management: - Monitoring waste generation, disposal and management - Monitoring sources of liquid waste, its disposal and impact in recipient environment Capacity among: - Relevant government departments at national and local levels - BMUs - Guidelines	Waste collection, storage and processing system needs to be put in place.	Enforce existing laws related to waste disposal	Not Applicable	Waste water treatment systems: - collection - treatment technology - discharge Solid Waste Management Systems: - collection - storage - processing - financing - minimisation - reuse? Green Infrastructure Storm Water Systems	Awareness raising campaigns: - public at large - schools - stakeholders benefitting from beaches (tourism operators, hotels, fishermen, etc.) - tourists. Impact of pollution on environment and health Pollution pathways and waste management. Upstream/downstream.	Curricula development for relevant education in primary and secondary schools. Importance of beaches. Pollution, environment, health. Waste minimisation and recycling.

RV	Threat	Location	Causes	ICZM	IWRM	Land Use Management	Shoreline Management Planning	Solid and Liquid Waste Management	Sanitation	Capacity building	Technology	Law enforcement	Legal Review	Alternative/Improved Livelihood	Awareness raising	Education
3	Oil pollution	Kigamboni and vicinity, Inner Makutumba Island, Msimbazi river valley	Waste products from Kigamboni refinery plant, loading and offloading of fuel at Dar es Salaam port, disposal of untreated liquid wastes from some industries and garages.	Coordination among stakeholders in addressing oil pollution. Coordinated development and implementation of contingency plans.	Not applicable	Not applicable	Shoreline sensitivity to oil spills included in shoreline management planning.	Waste collection, storage and processing system needs to be reviewed and improved.	Not Applicable	Port Authorities Industry Shipping Environmental authorities	Best available technology use for waste handling and disposal. Technology for monitoring receiving environment.	Enforce existing regulations for waste product handling and disposal.	Not Applicable	Not applicable	Awareness raising campaigns targeting relevant industries. Awareness raising related to oil spill contingency plans.	Not applicable
3	Industrial Pollution	Mbagala and Mtoni wards	Effluents from KTM textile industry	Coordination among stakeholders in addressing harbour industry pollution.	Not applicable	Harbour included in zoning and development of associated regulations	Identifying management units requiring local management arrangements.	Waste collection, storage and processing system needs to be put in place.	Not Applicable	Information Management: - Monitoring waste generation, disposal and management - Monitoring sources of industrial waste, its disposal and impact in recipient environment Capacity among: - Relevant government departments at national and local levels - Guidelines	Waste water treatment systems: - collection - treatment technology - discharge Solid Waste Management Systems: - collection - storage - processing - financing - minimisation - reuse? Green Infrastructure Storm Water Systems	Enforce existing laws related to waste disposal	Not Applicable	Not Applicable	Awareness raising campaigns: - public at large - schools - industry Impact of pollution on environment and health Pollution pathways and waste management. Upstream/downstream.	Curricula development for relevant education in primary and secondary schools. Importance of beaches. Pollution, environment, health. Waste minimisation and recycling.
3	Flooding	Mtoni River valley	Construction in vulnerable river valleys, absence of sieves in drainage channels, disposing solid wastes in drainage system, poor drainage system, and blockage of drainage channels and unplanned constructions and developments.	ICARM ensuring linkage between catchment management and coastal management.	Land uses in catchment and its impacts on water resources included in IWRM planning	Review and update of spatial plans including zoning to guide development planning and development control. Storm water drainage infrastructure aligned to climate variability and change predictions. Consider and integrate green infrastructure measures.	Not applicable	Waste collection, storage and processing system needs to be put in place.	Not Applicable	Environmental authorities Land use planners Information Management: - Monitoring waste generation, disposal and management - Monitoring sources of liquid waste, its disposal and impact in recipient environment Capacity among: - Relevant government departments at national and local levels - BMUs - Guidelines Balance between green and grey infrastructure solutions	Waste water treatment systems: - collection - treatment technology - discharge Solid Waste Management Systems: - collection - storage - processing - financing - minimisation - reuse? Green Infrastructure Storm Water Systems and Early Warning System Technology for monitoring receiving environment.	Enforce existing laws related to waste disposal	Not Applicable	Provide alternatives to current destructive and unsustainable livelihood practises related to coastal forests, particularly fuel wood and other resources.	Awareness raising campaigns: - public at large - schools - stakeholders benefitting from mangrove services and products	Curricula development for relevant education in primary and secondary schools. Importance of integrated management (upstream / downstream). Pollution, environment, health.
2	Loss of habitat and agricultural area	Forest reserve and river valley vegetation	Rapid urbanization, high increase of people immigration in the city and spilling over into the northern portions of Temeke.	Catchment and coast management need to be coordinated. IWRM is the appropriate tool for such management in the catchment but needs to incorporate coastal concerns (ICZM).	Upstream catchment management influences hydrology and sediment flow and may thus interfere with erosion accretion patterns along the coast.	Review and up-date spatial plans for development control clarifying district land uses.	Shoreline Management Planning informs Spatial Planning at local level. First step is to identify sediment cells along the coast based on littoral drift considerations, next step to identify management units within these cells based on environment, economic and socio-economic considerations.	Not Applicable	Not Applicable	Land use planning commission Local Government Authorities	Strengthen/modernise spatial planning tools (GIS, remote imageries)	Enforce land use and building regulations.	Not Applicable	Provide alternatives for people losing traditional livelihoods in rural areas planned for other uses.	Awareness campaigns related to sustainable development planning and development control targeting: - public at large - district authorities - developers/entrepreneurs	Curricula development for relevant education in primary and secondary schools. Complex requirements in coastal areas (high population and economic pressure). Sustainable development. Spatial Planning to service Population requirements.

Mkuranga District

Table 212: Broad assessment of measures to mitigate identified threats to local coastal communities and ecosystems in Mkuranga District in Mainland Tanzania.

RV	Threat	Location	Causes	ICZM	IWRM	Land Use Management	Shoreline Management Planning	Solid and Liquid Waste Management	Sanitation	Capacity building	Technology	Law enforcement	Legal Review	Alternative/Improved Livelihood	Awareness raising	Education
4	Fisheries decline	Entire district coastal are including	Destruction of fish nurseries for action such as Mangrove cutting, illegal fishing such as Dynamite fishing and other poor fishing methods (fine meshed nets, beach seining) as well as coral mining for lime production. Over utilization of fisheries resources by large number of fisher in the small area	Coordination among stakeholders in addressing fisheries decline. Guidelines for best practices in mangrove management. Guidelines for best practises in fisheries. Guidelines for best practises in coral reef management. Guidelines to be based on outcome of legal review.	Not applicable	Mangroves and other habitats of importance (including seagrass areas and coral reefs) for fisheries included in land use information management systems and incorporated into spatial planning.	Identifying management units requiring local management arrangements.	Not Applicable	Not Applicable	Information Management: - Monitoring occurrences of illegal fisheries - Monitoring fishing practises - Monitoring fisheries catches - Monitoring fisheries resources - Monitoring fisheries habitats (mangroves, coral reefs) Capacity among: - Relevant government departments at national and local levels - BMUs	Offshore fisheries Aquaculture; Add value to existing harvest.	Enforce existing laws related to fisheries. Enforce existing laws related to mangrove exploitation. Enforce existing laws related to coral mining.	Review appropriateness of fisheries regulations in relation to local conditions, environment, species and gears. Establish local zoning and fishing effort seasonality.	Provide alternatives to current destructive and unsustainable livelihood practises related to fisheries. - Emphasis on young generation	Awareness raising campaigns: - public at large - schools - stakeholders benefitting from fisheries (fishing communities, middlemen, hotels and restaurants)	Curricula development for relevant education in primary and secondary schools. - Sustainable Fisheries. - Fisheries ecology.
3	Beach pollution	Koma, Kwale, Kisiju Pwani,	Indiscriminate dumping of household waste in the beaches and vicinities. Uncontrolled dumping of fish remains and carcasses. Lack of toilets in some coastal households. Weak of enforcement of public health regulations	Coordination among stakeholders in addressing beach pollution. Beach management guidelines	To the extent that solid and liquid waste origin from upstream activities	Beaches included in zoning and development of associated regulations	Identifying management units requiring local management arrangements.	Waste collection, storage and processing system needs to be put in place.	- Identify and quantify sources of liquid waste as basis for solution	Information Management: - Monitoring waste generation, disposal and management - Monitoring sources of liquid waste, its disposal and impact in recipient environment Capacity among: - Relevant government departments at national and local levels - BMUs - Guidelines	Waste water treatment systems: - collection - treatment technology - discharge Solid Waste Management Systems: - collection - storage - processing - financing - minimisation - reuse?	Enforce existing laws related to waste disposal	Not Applicable	Not applicable	Awareness raising campaigns: - public at large - schools - stakeholders benefitting from beaches (tourism operators, hotels, fishermen, etc.) - tourists	Curricula development for relevant education in primary and secondary schools. Importance of beaches.
3	Diseases outbreaks	Throughout the coastal areas of the district	Inadequate sewerage control, flooding, poor quality of sewerage construction, poor solid waste management, uncontrolled food vending. Lack of latrines and toilets in some coastal dwellings	ICARM ensuring linkage between catchment management and coastal management.	Land uses in catchment and its impacts on water resources included in IWRM planning; to the extent that disease vectors origin from upstream activities	Infrastructure development. Supply of sanitation and health services.	Not applicable	Waste collection, storage and processing system needs to be put in place.	Identify and quantify sources of liquid waste as basis for solution and develop sanitation systems accordingly	Environmental authorities Land use planners Information Management: - Monitoring waste generation, disposal and management - Monitoring sources of liquid waste, its disposal and impact in recipient environment Capacity among: - Relevant government departments at national and local levels - BMUs - Guidelines	Waste water treatment systems: - collection - treatment technology - discharge Solid Waste Management Systems: - collection - storage - processing - financing - minimisation - reuse? Green Infrastructure Storm Water Systems Technology for monitoring receiving environment.	Enforce existing laws related to waste disposal	Not Applicable	Not applicable	Awareness raising campaigns: - public at large - schools - stakeholders benefitting from beaches (tourism operators, hotels, fishermen, etc.) - tourists. Impact of pollution on environment and health Pollution pathways and waste management. Upstream/downstream.	Curricula development for relevant education in primary and secondary schools. Importance of environmentally sound agriculture production. Importance of integrated management (upstream / downstream). Importance of marine environment. Pollution, environment, health. Waste minimisation and recycling.
3	Habitat loss as well as loss of agricultural area	Here and there along the coast	Rapid urbanization, high increase of people immigration in the city. Salt production and livestock.	ICZM is an important tool in preventing land use conflicts through coordinated and participatory development planning.	Not applicable	Review and up-date spatial plans for development control clarifying district land uses.	Shoreline Management Planning informs Spatial Planning at local level. First step is to identify sediment cells along the coast based on littoral drift considerations, next step to identify management units within these cells based on environment, economic and socio-economic considerations.	Not Applicable	Not Applicable	Land use planning commission Local Government Authorities	Strengthen/modernise spatial planning tools (GIS, remote imageries)	Enforce land use and building regulations.	Not Applicable	Provide alternatives for people losing traditional livelihoods in rural areas planned for other uses.	Awareness campaigns related to sustainable development planning and development control targeting: - public at large - district authorities - developers/entrepreneurs	Curricula development for relevant education in primary and secondary schools. Complex requirements in coastal areas (high population and economic pressure). Sustainable development. Spatial Planning to service Population requirements.
3	Decrease in mangrove and forest habitat and agricultural area	Koma, Kwale, Kimanzichana	Illegal and uncontrolled mangrove cutting. Illegal trees cutting in the forest for charcoal burning. Mangrove clearing for salt production. Increase urbanisation and settlement construction.	Coordination among stakeholders in addressing forest management. Forest reserve management plans.	Not applicable	Forest reserves and forests included in land use information management systems and incorporated into spatial planning.	Identifying management units requiring local management arrangements.	Not Applicable	Not Applicable	Information Management: - Monitoring forest reserves - Monitoring forest reserve exploitation Capacity among: - Relevant government departments at national and local levels - BMUs	Best forest management practises Alternative livelihood technologies Alternatives to coastal forest wood usage	Enforce existing laws related to coastal forest exploitation.	Not Applicable	Provide alternatives to current destructive and unsustainable livelihood practises related to coastal forests, particularly fuel wood and other resources.	Awareness raising campaigns: - public at large - schools - stakeholders benefitting from mangrove services and products	Curricula development for relevant education in primary and secondary schools. - Coastal forest ecology - Coastal forest management

RV	Threat	Location	Causes	ICZM	IWRM	Land Use Management	Shoreline Management Planning	Solid and Liquid Waste Management	Sanitation	Capacity building	Technology	Law enforcement	Legal Review	Alternative/Improved Livelihood	Awareness raising	Education
2	Beach erosion	Kisiju	Mangrove cutting, Dynamite fishing, unplanned construction along the coast.	ICZM is an important tool in addressing the complex requirements to address unsustainable resources usage. Implications at and between all management levels.	Upstream catchment management influences hydrology and sediment flow and may thus interfere with erosion accretion patterns along the coast. Catchment and coast management needs to be coordinated. IWRM is the appropriate tool such management in the catchment but needs to incorporate coastal concerns (ICZM)	Zoning of beaches to be included in Land Use Plans, providing regulations and guidelines for land use. Ideally to be informed from Shoreline Management Planning efforts. Regulations may define types of use as well as set back arrangements. Guidelines may also cover coral reef, seagrass and mangrove management to the extent of importance to beach erosion.	An understanding of processes and factors behind erosion and accretion along the Tanzanian coast is required. Such an understanding can be attained through a structural effort in Shoreline Management Planning which can then inform Spatial Planning at local level. First step is to identify sediment cells along the coast based on littoral drift considerations, next step to identify management units within these cells based on environment, economic and socio-economic consideration.	Not Applicable	Not Applicable	District level capacity building related to ICZM and in particular shoreline management. Information management - Monitoring occurrences of illegal fisheries - Monitoring fishing practises - Monitoring land uses - Monitoring beach sand mining	Beach protection technologies, from engineering (groynes, etc.) to soft (beach nourishment) solutions and green technologies (mangrove planting, other shoreline vegetation).	Enforce existing laws related to resources exploitation and sand mining and construction near shore (set back provisions).	Establish required regulations, bylaws and guidelines to ensure sustainable and safe development along near the sea. Informed by shoreline management study.	Provide alternatives to current destructive and unsustainable livelihood practises related to mangrove exploitation and fisheries in particular.	The impact of unsustainable resources usage on beach erosion highlighted in awareness raising campaigns. Services of mangroves and corals in protecting against erosive forces (targeting resource users). Impact of physical structures along the coast on shorelines included in awareness raising campaigns (targeting developers and planners)	Curricula development for relevant education in primary and secondary schools. Importance of beaches.
2	Loss of biodiversity (i.e. disappearance of Dugong)	Kisiju and vicinity	Destructive fisheries, mangrove cutting, salt production	Coordination among stakeholders in addressing dugong decline. Guidelines for best practices in mangrove management. Guidelines for best practises in fisheries. Guidelines to be based on outcome of legal review.	Not applicable	Mangroves and other habitats of importance (including seagrass areas and coral reefs) for fisheries included in land use information management systems and incorporated into spatial planning.	Identifying management units requiring local management arrangements.	Not Applicable	Not Applicable	Information Management: - Monitoring occurrences of illegal fisheries - Monitoring fishing practises - Monitoring fisheries catches - Monitoring fisheries resources - Monitoring fisheries habitats (mangroves, coral reefs) Capacity among: - Relevant government departments at national and local levels - BMUs	Offshore fisheries Aquaculture; Add value to existing harvest.	Enforce existing laws related to fisheries. Enforce existing laws related to mangrove exploitation. Enforce existing laws related to protected species.	Review appropriateness of fisheries regulations in relation to local conditions, environment, species and gears. Establish local zoning and fishing effort seasonality.	Provide alternatives to current destructive and unsustainable livelihood practises related to fisheries. - Emphasis on young generation	Awareness raising campaigns: - public at large - schools - stakeholders benefitting from fisheries (fishing communities, middlemen, hotels and restaurants)	Curricula development for relevant education in primary and secondary schools. - Sustainable Fisheries. - Fisheries ecology. - Conservation and protected species.
2	Land use conflicts	Along the coastal front	Land use conflict between villages	ICZM is an important tool in preventing land use conflicts through coordinated and participatory development planning.	Not applicable	Review and up-date spatial plans for development control clarifying district land uses.	Shoreline Management Planning informs Spatial Planning at local level. First step is to identify sediment cells along the coast based on littoral drift considerations, next step to identify management units within these cells based on environment, economic and socio-economic considerations.	Not Applicable	Not Applicable	Land use planning commission Local Government Authorities	Strengthen/modernise spatial planning tools (GIS, remote imageries)	Enforce land use and building regulations.	Not Applicable	Provide alternatives for people losing traditional livelihoods in rural areas planned for other uses.	Awareness campaigns related to sustainable development planning and development control targeting: - public at large - district authorities - developers/entrepreneurs	Curricula development for relevant education in primary and secondary schools. Complex requirements in coastal areas (high population and economic pressure). Sustainable development. Spatial Planning to service Population requirements.

Rufiji District

Table 213: Broad assessment of measures to mitigate identified threats to local coastal communities and ecosystems in Rufiji District in Mainland Tanzania.

RV	Threat	Location	Causes	ICZM	IWRM	Land Use Management	Shoreline Management Planning	Solid and Liquid Waste Management	Sanitation	Capacity building	Technology	Law enforcement	Legal Review	Alternative/Improved Livelihood	Awareness raising	Education
4	Beach pollution	Populated area such as Kibanjo, Kiasi, Simbaulanga	Uncontrolled solid and liquid waste disposal, often in creeks.	Coordination among stakeholders in addressing beach pollution. Beach management guidelines	To the extent that solid and liquid waste origin from upstream activities in Rufiji river basin.	Beaches included in zoning and development of associated regulations	Identifying management units requiring local management arrangements.	Waste collection, storage and processing system needs to be put in place.	Identify and quantify sources of liquid waste as basis for solution and develop sanitation systems accordingly	Information Management: - Monitoring waste generation, disposal and management - Monitoring sources of liquid waste, its disposal and impact in recipient environment Capacity among: - Relevant government departments at national and local levels - BMUs - Guidelines	Waste water treatment systems: - collection - treatment technology - discharge Solid Waste Management Systems: - collection - storage - processing - financing - minimisation - reuse? Green Infrastructure Storm Water Systems	Enforce existing laws related to waste disposal	Not Applicable	Not applicable	Awareness raising campaigns: - public at large - schools - stakeholders benefitting from beaches (tourism operators, hotels, fishermen, etc.) - tourists. Impact of pollution on environment and health Pollution pathways and waste management. Upstream/downstream.	Curricula development for relevant education in primary and secondary schools. Importance of beaches. Pollution, environment, health. Waste minimisation and recycling.
4	Marine pollution	Along the near shores	Large plantations in the highland drain into Rufiji basin and hence fertilizers, pesticides, herbicides and fungicides may pose as threat	ICARM ensuring linkage between catchment management and coastal management.	Land uses in catchment and its impacts on water resources included in IWRM planning	Agriculture zoning in catchments. Regulations for riverside vegetation.	Not applicable	Review of management of agrochemicals upstream	Not Applicable	Environmental authorities Agriculture extension services Land use planners	Agriculture technologies minimising impact for agrochemicals on water resources Technology for monitoring receiving environment.	Enforce regulations for use of agrochemicals.	Not Applicable	Not applicable	Awareness raising campaigns targeting agriculture	Curricula development for relevant education in primary and secondary schools. Importance of environmentally sound agriculture production. Importance of integrated management (upstream / downstream).
4	Fisheries decline	All along the shore	Destruction of fish nurseries such as mangrove cutting, illegal fishing such as dynamite fishing and other poor fishing methods	Coordination among stakeholders in addressing fisheries decline. Guidelines for best practices in mangrove management. Guidelines for best practices in fisheries. Guidelines for best practices in coral reef management.	Not applicable	Mangroves and other habitats of importance for fisheries included in land use information management systems and incorporated into spatial planning.	Identifying management units requiring local management arrangements.	Not Applicable	Not Applicable	Information Management: - Monitoring occurrences of illegal fisheries - Monitoring fishing practises - Monitoring fisheries catches - Monitoring fisheries resources - Monitoring fisheries habitats (mangroves, coral reefs) Capacity among: - Relevant government departments at national and local levels - BMUs	Offshore fisheries Aquaculture; Add value to existing harvest.	Enforce existing laws related to fisheries. Enforce existing laws related to mangrove exploitation.	Not Applicable	Provide alternatives to current destructive and unsustainable livelihood practises related to fisheries. - Emphasis on young generation	Awareness raising campaigns: - public at large - schools - stakeholders benefitting from fisheries (fishing communities, middlemen, hotels and restaurants)	Curricula development for relevant education in primary and secondary schools. - Sustainable Fisheries. - Fisheries ecology.
4	Loss of habitat and agricultural area	Along Rufiji Delta and coastal forests area	Rapid urbanization, high increase of people immigration in the rapidly growing towns/villages. Uncontrolled mangrove cutting, forest clearing for firewood collection, charcoal production, logging and pole collection	Coordinated and participatory land and resource use planning expressed in integrated spatial plans and regulations.	Land uses in catchment and its impacts on water resources included in IWRM planning	Review and up-date spatial plans for development control clarifying district land uses.	Shoreline Management Planning informs Spatial Planning at local level. First step is to identify sediment cells along the coast based on littoral drift considerations, next step to identify management units within these cells based on environment, economic and socio-economic considerations.	Not Applicable	Not Applicable	Land use planning commission Local Government Authorities	Strengthen/modernise spatial planning tools (GIS, remote imageries)	Enforce land use and building regulations.	Not Applicable	Provide alternatives for people losing traditional livelihoods in rural areas planned for other uses.	Awareness campaigns related to sustainable development planning and development control targeting: - public at large - district authorities - developers/entrepreneurs	Curricula development for relevant education in primary and secondary schools. Complex requirements in coastal areas (high population and economic pressure). Sustainable development. Spatial Planning to service Population requirements.
3	Diseases outbreaks	In coastal villages such as Kiasi and Kibanjo	Inadequate sewerage control, flooding, poor quality of sewerage construction, poor solid waste management, uncontrolled food vending, lack of latrines, lack of clean domestic water	ICARM ensuring linkage between catchment management and coastal management.	Land uses in catchment and its impacts on water resources included in IWRM planning; to the extent that disease vectors origin from upstream activities	Infrastructure development. Supply of sanitation and health services.	Not applicable	Waste collection, storage and processing system needs to be put in place.	Identify and quantify sources of liquid waste as basis for solution and develop sanitation systems accordingly	Environmental authorities Land use planners Information Management: - Monitoring waste generation, disposal and management - Monitoring sources of liquid waste, its disposal and impact in recipient environment Capacity among: - Relevant government departments at national and local levels - BMUs - Guidelines	Waste water treatment systems: - collection - treatment technology - discharge Solid Waste Management Systems: - collection - storage - processing - financing - minimisation - reuse? Green Infrastructure Storm Water Systems Technology for monitoring receiving environment.	Enforce existing laws related to waste disposal	Not Applicable	Not applicable	Awareness raising campaigns: - public at large - schools - stakeholders benefitting from beaches (tourism operators, hotels, fishermen, etc.) - tourists. Impact of pollution on environment and health Pollution pathways and waste management. Upstream/downstream.	Curricula development for relevant education in primary and secondary schools. Importance of environmentally sound agriculture production. Importance of integrated management (upstream / downstream). Importance of marine environment. Pollution, environment, health. Waste minimisation and recycling.
3	Flooding of construction areas and vulnerable river valleys	Rufiji delta and river basin	Climate influences such as El-Nino and storm rains, heavy rains up Rufiji Valley Basin	ICARM ensuring linkage between catchment management and coastal management.	Land uses in catchment and its impacts on water resources included in IWRM planning	Review and update of spatial plans including zoning to guide development planning and development control. Storm water drainage infrastructure aligned to climate variability and change predictions. Consider and integrate green infrastructure measures.	Not applicable	Not Applicable	Not Applicable	Environmental authorities Land use planners Information Management: - Monitoring weather parameters, especially rainfall. Capacity among: - Relevant government departments at national and local levels - Guidelines Balance between green and grey infrastructure solutions	Green Infrastructure Storm Water Systems and Early Warning System Technology for monitoring receiving environment. Weather forecasting and dissemination.	Enforce existing laws related to construction areas with respect to river margins.	Not Applicable	Not applicable	Awareness raising campaigns: - public at large - schools - stakeholders benefitting from mangrove/catchment forest services and products	Curricula development for relevant education in primary and secondary schools. Importance of integrated management (upstream / downstream). Pollution, environment, health.

RV	Threat	Location	Causes	ICZM	IWRM	Land Use Management	Shoreline Management Planning	Solid and Liquid Waste Management	Sanitation	Capacity building	Technology	Law enforcement	Legal Review	Alternative/Improved Livelihood	Awareness raising	Education
3	Land use conflicts	Ikwiriri, Kibiti and in many villages and wards	Land utilization for animal grazing and cultivation (cultivators vs grazers). Conflicts between villages on village borders disputes.	Coordinated and participatory land and resource use planning expressed in integrated spatial plans and regulations.	Not applicable	Review and update of spatial plans including zoning to guide development planning and development control.	An understanding of processes and factors behind erosion and accretion along the Tanzanian coast is required. Such an understanding can be attained through a structural effort in Shoreline Management Planning which can then inform Spatial Planning at local level. First step is to identify sediment cells along the coast based on littoral drift considerations, next step to identify management units within these cells based on environment, economic and socio-economic considerations.	Not applicable	Not applicable	District level capacity building related to: - Spatial Planning - Conflict resolution	Technology for defining most appropriate agricultural land-use (farming or grazing).	Not Applicable	Not Applicable	Provide alternatives for people losing traditional livelihoods in rural areas planned for other uses.	Awareness raising campaigns: - public at large - schools	Curricula development for relevant education in primary and secondary schools. Sustainable development in areas under high demographic and economic development pressure (coastal areas, urban areas).
3	River and estuary pollution	Rufiji River	Organochlorine pesticides used to control crab pest in rice paddies, potentially affecting carapace formation in prawn and other shellfish (Stadlinger et al 2003).	ICARM ensuring linkage between catchment management and coastal management.	Land uses in catchment and its impacts on water resources included in IWRM planning	Agriculture zoning in catchments. Regulations for riverside vegetation.	Not applicable	Review of management of agrochemicals upstream	Not Applicable	Environmental authorities Agriculture extension services Land use planners	Agriculture technologies minimising impact for agrochemicals on water resources Technology for monitoring receiving environment.	Enforce regulations for use of agrochemicals.	Not Applicable	Not applicable	Awareness raising campaigns targeting agriculture	Curricula development for relevant education in primary and secondary schools. Importance of environmentally sound agriculture production. Importance of integrated management (upstream / downstream).

Mafia District

Table 214: Broad assessment of measures to mitigate identified threats to local coastal communities and ecosystems in Mafia District in Mainland Tanzania.

RV	Threat	Location	Causes	ICZM	IWRM	Land Use Management	Shoreline Management Planning	Solid and Liquid Waste Management	Sanitation	Capacity building	Technology	Law enforcement	Legal Review	Alternative/Improved Livelihood	Awareness raising	Education
4	Fisheries decline	All along the near shore areas	Destruction of fish nurseries such as mangrove cutting, illegal fishing such as dynamite fishing and other poor fishing methods such as purse seine, beach seine, poisonous fishing, SCUBA gun fishing, etc.	Coordination among stakeholders in addressing fisheries decline. Guidelines for best practices in mangrove management. Guidelines for best practises in coral reef management. Guidelines to be based on outcome of legal review.	Not applicable	Mangroves and other habitats of importance (including seagrass areas and coral reefs) for fisheries included in land use information management systems and incorporated into spatial planning.	Identifying management units requiring local management arrangements.	Not Applicable	Not Applicable	Information Management: - Monitoring occurrences of illegal fisheries - Monitoring fishing practises - Monitoring fisheries catches - Monitoring fisheries resources - Monitoring fisheries habitats (mangroves, coral reefs) Capacity among: - Relevant government departments at national and local levels - BMUs	Offshore fisheries Aquaculture; Add value to existing harvest.	Enforce existing laws related to fisheries. Enforce existing laws related to mangrove exploitation. Enforce existing laws related to coral mining.	Review appropriateness of fisheries regulations in relation to local conditions, environment, species and gears. Establish local zoning and fishing effort seasonality.	Provide alternatives to current destructive and unsustainable livelihood practises related to fisheries. - Emphasis on young generation	Awareness raising campaigns: - public at large - schools - stakeholders benefitting from fisheries (fishing communities, middlemen, hotels and restaurants)	Curricula development for relevant education in primary and secondary schools. - Sustainable Fisheries. - Fisheries ecology.
3	Beach pollution	Kilindoni	Uncontrolled solid and liquid waste disposal, lack of toilets for public as well as residential houses	Coordination among stakeholders in addressing beach pollution. Beach management guidelines	To the extent that solid and liquid waste origin from upstream activities	Beaches included in zoning and development of associated regulations	Identifying management units requiring local management arrangements.	Waste collection, storage and processing system needs to be put in place.	- Identify and quantify sources of liquid waste as basis for solution	Information Management: - Monitoring waste generation, disposal and management - Monitoring sources of liquid waste, its disposal and impact in recipient environment Capacity among: - Relevant government departments at national and local levels - BMUs - Guidelines	Waste water treatment systems: - collection - treatment technology - discharge Solid Waste Management Systems: - collection - storage - processing - financing - minimisation - reuse?	Enforce existing laws related to waste disposal	Not Applicable	Not applicable	Awareness raising campaigns: - public at large - schools - stakeholders benefitting from beaches (tourism operators, hotels, fishermen, etc.) - tourists	Curricula development for relevant education in primary and secondary schools. Importance of beaches.
3	Diseases outbreaks	Kilindoni, Bwejuu, Jibondo	Inadequate sewerage control, poor solid waste management, uncontrolled food vending.	Not applicable	Not applicable	Infrastructure development. Supply of sanitation and health services.	Not applicable	Waste collection, storage and processing system needs to be put in place.	Identify and quantify sources of liquid waste as basis for solution and develop sanitation systems accordingly	Environmental authorities Land use planners Information Management: - Monitoring waste generation, disposal and management - Monitoring sources of liquid waste, its disposal and impact in recipient environment Capacity among: - Relevant government departments at national and local levels - Guidelines	Waste water treatment systems: - collection - treatment technology - discharge Solid Waste Management Systems: - collection - storage - processing - financing - minimisation - reuse? Green Infrastructure Storm Water Systems Technology for monitoring receiving environment.	Enforce existing laws related to waste disposal	Not Applicable	Not applicable	Awareness raising campaigns: - public at large - schools - stakeholders benefitting from beaches (tourism operators, hotels, fishermen, etc.) - tourists. Impact of pollution on environment and health Pollution pathways and waste management.	Curricula development for relevant education in primary and secondary schools. Importance of environmentally sound agriculture production. Importance of integrated management (upstream / downstream). Importance of marine environment. Pollution, environment, health. Waste minimisation and recycling.
3	HIV/AIDS increases	Especially at Kilindoni and dago (migrant fishing csmps) areas	In-migration of many seasonal fishers from Dar es Salaam, Pemba. Unguja and other mainland coastal areas.	Not applicable	Not applicable	Not applicable	Not applicable	Not Applicable	Not Applicable	Health and education authorities Capacity among: - Relevant government departments at national and local levels.	Not Applicable	Enforce existing laws related to drug use, early age sex among girls.	Not Applicable	Livelihood alternative focused on young women.	STD awareness raising campaigns: - public at large - schools Awareness raising campaigns on impact of drugs and early age sex and pregnancy.	Curricula development for relevant education in primary and secondary schools. Importance of sexual education, HIV, drugs. Population health and environment.
3	Loss of habitat area	All along the coast	Mangrove cutting, blast fishing, coral mining, salt production, prawn farming	ICZM is an important tool in preventing land use conflicts through coordinated and participatory development planning.	Not applicable	Review and up-date spatial plans for development control clarifying district land uses.	Identifying management units requiring local management arrangements.	Not Applicable	Not Applicable	Land use planning commission Local Government Authorities	Strengthen/modernise spatial planning tools (GIS, remote imageries); Offshore fisheries and Aquaculture; add value to existing harvest	Enforce existing laws related to fisheries. Enforce existing laws related to mangrove exploitation. Enforce existing laws related to coral mining, salt production, and prawn farming.	Not Applicable	Provide alternatives for people losing traditional livelihoods in rural areas planned for other uses.	Awareness campaigns related to sustainable development planning and development control targeting: - public at large - district authorities - developers/entrepreneurs	Curricula development for relevant education in primary and secondary schools. Complex requirements in coastal areas (high population and economic pressure). Sustainable development. Spatial Planning to service Population requirements.

RV	Threat	Location	Causes	ICZM	IWRM	Land Use Management	Shoreline Management Planning	Solid and Liquid Waste Management	Sanitation	Capacity building	Technology	Law enforcement	Legal Review	Alternative/Improved Livelihood	Awareness raising	Education
2	Beach erosion	Utende, Kilindoni, Bwejuu, Juani, Jibondo	Mangrove cutting, dynamite fishing, beach sand mining for construction purposes, unplanned construction along the coast	ICZM is an important tool in addressing the complex requirements to address unsustainable resources usage. Implications at and between all management levels.	Upstream catchment management influences hydrology and sediment flow and may thus interfere with erosion accretion patterns along the coast. Catchment and coast management needs to be coordinated. IWRM is the appropriate tool such management in the catchment but needs to incorporate coastal concerns (ICZM)	Zoning of beaches to be included in Land Use Plans, providing regulations and guidelines for land use. Ideally to be informed from Shoreline Management Planning efforts. Regulations may define types of use as well as set back arrangements. Guidelines may also cover coral reef, seagrass and mangrove management to the extent of importance to beach erosion.	An understanding of processes and factors behind erosion and accretion along the Tanzanian coast is required. Such an understanding can be attained through a structural effort in Shoreline Management Planning which can then inform Spatial Planning at local level. First step is to identify sediment cells along the coast based on littoral drift considerations, next step to identify management units within these cells based on environment, economic and socio-economic consideration.	Not Applicable	Not Applicable	District level capacity building related to ICZM and in particular shoreline management. Information management - Monitoring occurrences of illegal fisheries - Monitoring fishing practises - Monitoring land uses - Monitoring beach sand mining	Beach protection technologies, from engineering (groynes, etc.) to soft (beach nourishment) solutions and green technologies (mangrove planting, other shoreline vegetation).	Enforce existing laws related to resources exploitation and construction near shore (set back provisions).	Establish required regulations, bylaws and guidelines to ensure sustainable and safe development along near the sea. Informed by shoreline management study.	Provide alternatives to current destructive and unsustainable livelihood practises related to mangrove exploitation and fisheries in particular.	The impact of unsustainable resources usage on beach erosion highlighted in awareness raising campaigns. Services of mangroves and corals in protecting against erosive forces (targeting resource users). Impact of physical structures along the coast on shorelines included in awareness raising campaigns (targeting developers and planners)	Curricula development for relevant education in primary and secondary schools. Importance of beaches.
2	Marine pollution (incl. Possible future increase)	Kilindoni	Possible oil leakages and pollution from loading and off loading at Kilindoni Harbour, garages, and factory	Coordination among stakeholders in addressing oil pollution. Coordinated development and implementation of contingency plans.	Not applicable	Not applicable	Shoreline sensitivity to oil spills included in shoreline management planning.	Oil spill collection, storage and processing system and waste collection, storage and processing system needs to be reviewed and improved.	Not Applicable	Port Authorities Industry Shipping Environmental authorities	Best available technology use for waste handling and disposal. Technology for monitoring receiving environment.	Enforce existing regulations for waste product handling and disposal.	Not Applicable	Not applicable	Awareness raising campaigns targeting relevant industries Awareness raising related to oil spill contingency plans.	Not applicable
2	Land use conflicts	Mafia Island Marine Park area	Conflict between environmental conservation authorities and groups and community which want to utilize resources, especially marine resources, e.g. MIMP and fishermen.	Coordinated and participatory land and resource use planning expressed in integrated spatial plans and regulations.	Not applicable	Review and update of spatial plans including zoning to guide development planning and development control. Spatial plans to also consider marine spaces.	Not applicable	Not applicable	Not applicable	District level and MPA capacity building related to: - Shoreline management - Spatial Planning - Conflict resolution	Offshore fisheries and aquaculture to increase productivity of affected parties.	Enforce existing laws related to resources exploitation.	not Applicable	Not applicable	The impact of unsustainable resources usage highlighted in awareness raising campaigns. Community participation important.	Curricula development for relevant education in primary and secondary schools. Sustainable development in areas under high demographic and economic development pressure (coastal areas, urban areas). Importance of coasts and coastal habitats and resources.

Kilwa District

Table 215: Broad assessment of measures to mitigate identified threats to local coastal communities and ecosystems in Kilwa District in Mainland Tanzania.

RV	Threat	Location	Causes	ICZM	IWRM	Land Use Management	Shoreline Management Planning	Solid and Liquid Waste Management	Sanitation	Capacity building	Technology	Law enforcement	Legal Review	Alternative/Improved Livelihood	Awareness raising	Education
4	Fisheries decline	All along the Kilwa coast including Kiswera Harbour, Ruhaha, Mamba, Songo Mnara, Kilwa Masoko, Tikwoiri, Gigwera, Ras Wango, Songo archipelago	Destruction of fish nurseries such as mangrove cutting, illegal fishing such as dynamite fishing and other poor fishing methods as well as coral mining for lime production	Coordination among stakeholders in addressing fisheries decline. Guidelines for best practices in mangrove management. Guidelines for best practises in coral reef management. Guidelines to be based on outcome of legal review.	Not applicable	Mangroves and other habitats of importance (including seagrass areas and coral reefs) for fisheries included in land use information management systems and incorporated into spatial planning.	Identifying management units requiring local management arrangements.	Not Applicable	Not Applicable	Information Management: - Monitoring occurrences of illegal fisheries - Monitoring fishing practises - Monitoring fisheries catches - Monitoring fisheries resources - Monitoring fisheries habitats (mangroves, coral reefs) Capacity among: - Relevant government departments at national and local levels - BMUs	Offshore fisheries Aquaculture; Add value to existing harvest.	Enforce existing laws related to fisheries. Enforce existing laws related to mangrove exploitation. Enforce existing laws related to coral mining.	Review appropriateness of fisheries regulations in relation to local conditions, environment, species and gears. Establish local zoning and fishing effort seasonality.	Provide alternatives to current destructive and unsustainable livelihood practises related to fisheries. - Emphasis on young generation	Awareness raising campaigns: - public at large - schools - stakeholders benefitting from fisheries (fishing communities, middlemen, hotels and restaurants)	Curricula development for relevant education in primary and secondary schools. - Sustainable Fisheries. - Fisheries ecology.
2	Beach pollution	Kilwa Kivinje	Uncontrolled solid and liquid waste disposal, often in creeks.	Coordination among stakeholders in addressing beach pollution. Beach management guidelines	To the extent that solid and liquid waste origin from upstream activities	Beaches included in zoning and development of associated regulations	Identifying management units requiring local management arrangements.	Waste collection, storage and processing system needs to be put in place.	- Identify and quantify sources of liquid waste as basis for solution	Information Management: - Monitoring waste generation, disposal and management - Monitoring sources of liquid waste, its disposal and impact in recipient environment Capacity among: - Relevant government departments at national and local levels - BMUs - Guidelines	Waste water treatment systems: - collection - treatment technology - discharge Solid Waste Management Systems: - collection - storage - processing - financing - minimisation - reuse?	Enforce existing laws related to waste disposal	Not Applicable	Not applicable	Awareness raising campaigns: - public at large - schools - stakeholders benefitting from beaches (tourism operators, hotels, fishermen, etc.) - tourists	Curricula development for relevant education in primary and secondary schools. Importance of beaches.
2	Beach erosion	Masoko, Rushungi, Kilwa Kisiwani World Heritage monuments.	Mangrove cutting, dynamite fishing, beach sand mining, unplanned construction along the coast.	ICZM is an important tool in addressing the complex requirements to address unsustainable resources usage. Implications at and between all management levels.	Not applicable	Zoning of beaches to be included in Land Use Plans, providing regulations and guidelines for land use. Ideally to be informed from Shoreline Management Planning efforts. Regulations may define types of use as well as set back arrangements. Guidelines may also cover coral reef, seagrass and mangrove management to the extent of importance to beach erosion.	An understanding of processes and factors behind erosion and accretion along the Tanzanian coast is required. Such an understanding can be attained through a structural effort in Shoreline Management Planning which can then inform Spatial Planning at local level. First step is to identify sediment cells along the coast based on littoral drift considerations, next step to identify management units within these cells based on environment, economic and socio-economic consideration.	Not Applicable	Not Applicable	District level capacity building related to ICZM and in particular shoreline management. Information management - Monitoring occurrences of illegal fisheries - Monitoring fishing practises - Monitoring land uses - Monitoring beach sand mining	Beach protection technologies, from engineering (groynes, etc.) to soft (beach nourishment) solutions and green technologies (mangrove planting, other shoreline vegetation).	Enforce existing laws related to resources exploitation sand mining and construction near shore (set back provisions).	Establish required regulations, bylaws and guidelines to ensure sustainable and safe development along near the sea. Informed by shoreline management study.	Provide alternatives to current destructive and unsustainable livelihood practises related to mangrove exploitation and fisheries in particular.	The impact of unsustainable resources usage on beach erosion highlighted in awareness raising campaigns. Services of mangroves and corals in protecting against erosive forces (targeting resource users). Impact of physical structures along the coast on shorelines included in awareness raising campaigns (targeting developers and planners)	Curricula development for relevant education in primary and secondary schools. Importance of beaches.
2	Marine pollution (incl. Possible future increase)	Songo Songo, Kilwa Masoko and Kilwa Kivinje	Potential oil spills from Songo Songo gas processing plant (plant discharges and fuel transfers), Kilwa Masoko and Kilwa Kisiwani Harbour fuel transfers, agrochemicals from upstream agriculture.	Coordination among stakeholders in addressing oil and agrochemical pollution. Coordinated development and implementation of contingency plans.	To the extent that soil and agrochemical pollution origin from upstream activities	Agriculture zoning in catchments. Regulations for riverside vegetation.	Shoreline sensitivity to oil spills included in shoreline management planning. Identifying management units requiring local management arrangements.	Oil spill collection, storage and processing system needs to be reviewed and improved. Review of management of agrochemicals upstream.	Not Applicable	Port Authorities Industry Shipping Environmental authorities	Best available technology use for waste handling and disposal. Technology for monitoring receiving environment.	Enforce existing regulations for waste product handling and disposal and oil and agrochemical use and disposal.	Not Applicable	Not applicable	Awareness raising campaigns targeting relevant industries/activities. Awareness raising related to oil spill contingency plans.	Not applicable

Lindi Rural District

Table 216: Broad assessment of measures to mitigate identified threats to local coastal communities and ecosystems in Lindi Rural District in Mainland Tanzania.

RV	Threat	Location	Causes	ICZM	IWRM	Land Use Management	Shoreline Management Planning	Solid and Liquid Waste Management	Sanitation	Capacity building	Technology	Law enforcement	Legal Review	Alternative/Improved Livelihood	Awareness raising	Education
4	Fisheries decline	All along the near shore Lindi	Destruction of fish nurseries such as mangrove cutting, illegal fishing such as dynamite fishing and other poor fishing methods as well as coral mining for lime production, poisonous fishing	Coordination among stakeholders in addressing fisheries decline. Guidelines for best practices in mangrove management. Guidelines for best practices in fisheries. Guidelines for best practices in coral reef management. Guidelines to be based on outcome of legal review.	Not applicable	Mangroves and other habitats of importance (including seagrass areas and coral reefs) for fisheries included in land use information management systems and incorporated into spatial planning.	Identifying management units requiring local management arrangements.	Not Applicable	Not Applicable	Information Management: - Monitoring occurrences of illegal fisheries - Monitoring fishing practises - Monitoring fisheries catches - Monitoring fisheries resources - Monitoring fisheries habitats (mangroves, coral reefs) Capacity among: - Relevant government departments at national and local levels - BMUs	Offshore fisheries Aquaculture; Add value to existing harvest.	Enforce existing laws related to fisheries. Enforce existing laws related to mangrove exploitation. Enforce existing laws related to coral mining.	Review appropriateness of fisheries regulations in relation to local conditions, environment, species and gears. Establish local zoning and fishing effort seasonality.	Provide alternatives to current destructive and unsustainable livelihood practises related to fisheries. - Emphasis on young generation	Awareness raising campaigns: - public at large - schools - stakeholders benefitting from fisheries (fishing communities, middlemen, hotels and restaurants)	Curricula development for relevant education in primary and secondary schools. - Sustainable Fisheries. - Fisheries ecology.
4	Freshwater source drying	River valley wells throughout	Forest clearing for agricultural purposes, burning charcoal, shifting cultivation	ICARM ensuring linkage between catchment management and coastal management.	Forest management and catchment land uses addressed in integrated water resources management planning. Link IWRM to coastal integrated planning ensuring upstream/downstream considerations.	Zoning in spatial plans providing guidance for land uses and for development control addressing water resources problems arising from unsustainable land uses.	Not applicable	Not Applicable	Not Applicable	Environmental authorities Land use planners Information Management: - Monitoring land uses	Agriculture / forestry technologies sustaining recharge of aquifers; rain harvest; Alternative technology replacing charcoal and fuel wood as energy source.	Enforce existing laws related to coastal forest exploitation.	Not Applicable	Provide alternatives to current destructive and unsustainable livelihood practises related to coastal forests, particularly fuel wood and other resources.	Awareness raising campaigns: - public at large - schools - stakeholders benefitting from mangrove services and products	Curricula development for relevant education in primary and secondary schools. - Coastal forest ecology - Coastal forest management; - Hydrologic cycle
3	Loss of habitat	Forested areas	Forest clearing for agricultural purposes, burning charcoal, shifting cultivation, mangrove cutting, dynamite fishing and other poor fishing methods	ICZM is an important tool in addressing the complex requirements to address unsustainable resources usage. Implications at and between all management levels.	Not applicable	Mangroves and other habitats of importance (including seagrass areas and coral reefs) for fisheries included in land use information management systems and incorporated into spatial planning.	Identifying management units requiring local management arrangements.	Not Applicable	Not Applicable	Information Management: - Monitoring occurrences of illegal fisheries - Monitoring fishing practises - Monitoring fisheries catches - Monitoring fisheries resources - Monitoring fisheries habitats (mangroves, coral reefs) - Forests Capacity among: - Relevant government departments at national and local levels - BMUs	Agriculture / forestry technologies sustaining recharge of aquifers; rain harvest; Alternative technology replacing charcoal and fuel wood as energy source. Offshore fisheries Aquaculture; Add value to existing harvest.	Enforce existing laws related to resources exploitation, sand mining and coral mining	Not Applicable	Provide alternatives to current destructive and unsustainable livelihood practises related to mangrove exploitation and fisheries in particular.	Awareness campaigns related to sustainable development planning and development control targeting: - public at large - district authorities - developers/entrepreneurs	Curricula development for relevant education in primary and secondary schools. Complex requirements in coastal areas (high population and economic pressure). Sustainable development. Spatial Planning to service Population requirements.
2	Beach erosion	Sudi, Shuka, Mmumbu, Kikwetu, Mbanja, Mchingana Kijiweni	Mangrove cutting, dynamite fishing, beach sand mining, unplanned construction along the coast.	ICZM is an important tool in addressing the complex requirements to address unsustainable resources usage. Implications at and between all management levels.	Upstream catchment management influences hydrology and sediment flow and may thus interfere with erosion accretion patterns along the coast. Catchment and coast management needs to be coordinated. IWRM is the appropriate tool such management in the catchment but needs to incorporate coastal concerns (ICZM)	Zoning of beaches to be included in Land Use Plans, providing regulations and guidelines for land use. Ideally to be informed from Shoreline Management Planning efforts. Regulations may define types of use as well as set back arrangements. Guidelines may also cover coral reef, seagrass and mangrove management to the extent of importance to beach erosion.	An understanding of processes and factors behind erosion and accretion along the Tanzanian coast is required. Such an understanding can be attained through a structural effort in Shoreline Management Planning which can then inform Spatial Planning at local level. First step is to identify sediment cells along the coast based on littoral drift considerations, next step to identify management units within these cells based on environment, economic and socio-economic consideration.	Not Applicable	Not Applicable	District level capacity building related to ICZM and in particular shoreline management.	Beach protection technologies, from engineering (groynes, etc.) to soft (beach nourishment) solutions and green technologies (mangrove planting, other shoreline vegetation).	Enforce existing laws related to resources exploitation and sand mining and construction near shore (set back provisions).	Establish required regulations, bylaws and guidelines to ensure sustainable and safe development along near the sea. Informed by shoreline management study.	Provide alternatives to current destructive and unsustainable livelihood practises related to mangrove exploitation and fisheries in particular.	The impact of unsustainable resources usage on beach erosion highlighted in awareness raising campaigns. Services of mangroves and corals in protecting against erosive forces (targeting resource users). Impact of physical structures along the coast on shorelines included in awareness raising campaigns (targeting developers and planners)	Curricula development for relevant education in primary and secondary schools. Importance of beaches.
1	Beach pollution	Mchinga	Uncontrolled solid waste disposal, lack of latrines in some coastal houses, lack of proper fish landing facilities	Coordination among stakeholders in addressing beach pollution. Beach management guidelines	To the extent that solid and liquid waste origin from upstream activities	Beaches included in zoning and development of associated regulations	Identifying management units requiring local management arrangements.	Waste collection, storage and processing system needs to be put in place.	- Identify and quantify sources of liquid waste as basis for solution	Information Management: - Monitoring waste generation, disposal and management - Monitoring sources of liquid waste, its disposal and impact in recipient environment Capacity among: - Relevant government departments at national and local levels - BMUs - Guidelines	Waste water treatment systems: - collection - treatment technology - discharge Solid Waste Management Systems: - collection - storage - processing - financing - minimisation - reuse?	Enforce existing laws related to waste disposal	Not Applicable	Not applicable	Awareness raising campaigns: - public at large - schools - stakeholders benefitting from beaches (tourism operators, hotels, fishermen, etc.) - tourists	Curricula development for relevant education in primary and secondary schools. Importance of beaches.
1	Marine pollution	River mouths	Influx of agrochemicals from upstream, poisonous fishing	Coordination among stakeholders in addressing agrochemical pollution. Coordinated development and implementation of contingency plans.	To the extent that soil and agrochemical pollution origin from upstream activities	Agriculture zoning in catchments. Regulations for riverside vegetation.	Identifying management units requiring local management arrangements.	Review of management of agrochemicals upstream	Not Applicable	Environmental authorities	Best available technology use for waste handling and disposal. Technology for monitoring receiving environment.	Enforce existing regulations for waste product handling and disposal and agrochemical use and disposal.	Not Applicable	Not applicable	Awareness raising campaigns targeting relevant industries/activities.	Not applicable

Lindi Urban District

Table 217: Broad assessment of measures to mitigate identified threats to local coastal communities and ecosystems in Lindi Urban District in Mainland Tanzania.

RV	Threat	Location	Causes	ICZM	IWRM	Land Use Management	Shoreline Management Planning	Solid and Liquid Waste Management	Sanitation	Capacity building	Technology	Law enforcement	Legal Review	Alternative/Improved Livelihood	Awareness raising	Education
4	Fisheries decline	All along the near shore waters	Destruction of fish nurseries such as mangrove cutting, illegal fishing such as dynamite fishing, poisonous fishing, beach seining and other poor fishing methods as well as coral mining for lime production	Coordination among stakeholders in addressing fisheries decline. Guidelines for best practices in mangrove management. Guidelines for best practises in coral reef management. Guidelines to be based on outcome of legal review.	Not applicable	Mangroves and other habitats of importance (including seagrass areas and coral reefs) for fisheries included in land use information management systems and incorporated into spatial planning.	Identifying management units requiring local management arrangements.	Not Applicable	Not Applicable	Information Management: - Monitoring occurrences of illegal fisheries - Monitoring fishing practises - Monitoring fisheries catches - Monitoring fisheries resources - Monitoring fisheries habitats (mangroves, coral reefs) Capacity among: - Relevant government departments at national and local levels - BMUs	Offshore fisheries Aquaculture; Add value to existing harvest.	Enforce existing laws related to fisheries. Enforce existing laws related to mangrove exploitation. Enforce existing laws related to coral mining.	Review appropriateness of fisheries regulations in relation to local conditions, environment, species and gears. Establish local zoning and fishing effort seasonality.	Provide alternatives to current destructive and unsustainable livelihood practises related to fisheries and forestry/fuel. - Emphasis on young generation	Awareness raising campaigns: - public at large - schools - stakeholders benefitting from fisheries (fishing communities, middlemen, hotels and restaurants)	Curricula development for relevant education in primary and secondary schools. - Sustainable Fisheries. - Fisheries ecology. - Coastal forest management; - Hydrologic cycle
3	Bush fires	Sub-urban wards	Agricultural use of fire to clear land	not applicable	Not applicable	Review and up-date spatial plans for development control clarifying district land uses.	Not applicable	Not Applicable	Not Applicable	Land use planning commission Local Government Authorities; particularly Forestry and Agriculture	Strengthen/modernise spatial planning tools (GIS, remote imageries); Best forest management practises Alternative livelihood technologies Alternatives to coastal forest wood usage	Enforce land use and building regulations.	Not Applicable	Provide alternatives for people losing traditional livelihoods in rural areas planned for other uses.	Awareness campaigns related to sustainable development planning and development control targeting: - public at large - district authorities - land-users	Curricula development for relevant education in primary and secondary schools. Complex requirements in coastal areas (high population and economic pressure). Sustainable development. Spatial Planning to service Population requirements.
2	Beach pollution	Lindi Town	Uncontrolled solid and liquid waste disposal, lack of latrines in public areas (e.g. landing sites) and residential houses	Coordination among stakeholders in addressing beach pollution. Beach management guidelines	To the extent that solid and liquid waste origin from upstream activities	Beaches included in zoning and development of associated regulations	Identifying management units requiring local management arrangements.	Waste collection, storage and processing system needs to be put in place.	- Identify and quantify sources of liquid waste as basis for solution	Information Management: - Monitoring waste generation, disposal and management - Monitoring sources of liquid waste, its disposal and impact in recipient environment Capacity among: - Relevant government departments at national and local levels - BMUs - Guidelines	Waste water treatment systems: - collection - treatment technology - discharge Solid Waste Management Systems: - collection - storage - processing - financing - minimisation - reuse?	Enforce existing laws related to waste disposal	Not Applicable	Not applicable	Awareness raising campaigns: - public at large - schools - stakeholders benefitting from beaches (tourism operators, hotels, fishermen, etc.) - tourists	Curricula development for relevant education in primary and secondary schools. Importance of beaches.
2	Beach erosion	Many spots along the district beach stretch	Mangrove cutting, dynamite fishing, beach sand mining, coral mining	ICZM is an important tool in addressing the complex requirements to address unsustainable resources usage. Implications at and between all management levels.	Upstream catchment management influences hydrology and sediment flow and may thus interfere with erosion accretion patterns along the coast. Catchment and coast management needs to be coordinated. IWRM is the appropriate tool such management in the catchment but needs to incorporate coastal concerns (ICZM)	Zoning of beaches to be included in Land Use Plans, providing regulations and guidelines for land use. Ideally to be informed from Shoreline Management Planning efforts. Regulations may define types of use as well as set back arrangements. Guidelines may also cover coral reef, seagrass and mangrove management to the extent of importance to beach erosion.	An understanding of processes and factors behind erosion and accretion along the Tanzanian coast is required. Such an understanding can be attained through a structural effort in Shoreline Management Planning which can then inform Spatial Planning at local level. First step is to identify sediment cells along the coast based on littoral drift considerations, next step to identify management units within these cells based on environment, economic and socio-economic consideration.	Not Applicable	Not Applicable	District level capacity building related to ICZM and in particular shoreline management.	Beach protection technologies, from engineering (groynes, etc.) to soft (beach nourishment) solutions and green technologies (mangrove planting, other shoreline vegetation).	Enforce existing laws related to resources exploitation, sand mining and coral mining	Establish required regulations, bylaws and guidelines to ensure sustainable and safe development along near the sea. Informed by shoreline management study.	Provide alternatives to current destructive and unsustainable livelihood practises related to mangrove exploitation and fisheries in particular.	The impact of unsustainable resources usage on beach erosion highlighted in awareness raising campaigns. Services of mangroves and corals in protecting against erosive forces (targeting resource users). Impact of physical structures along the coast on shorelines included in awareness raising campaigns (targeting developers and planners)	Curricula development for relevant education in primary and secondary schools. Importance of beaches.
1	Diseases outbreaks	Urban centre and settlements	Inadequate sewerage control, flooding, poor quality of sewerage construction, poor solid waste management, uncontrolled food vending, lack of toilets in public areas	ICARM ensuring linkage between catchment management and coastal management.	Land uses in catchment and its impacts on water resources included in IWRM planning; to the extent that disease vectors origin from upstream activities	Infrastructure development. Supply of sanitation and health services.	Not applicable	Waste collection, storage and processing system needs to be put in place.	Identify and quantify sources of liquid waste as basis for solution and develop sanitation systems accordingly	Environmental authorities Land use planners Information Management: - Monitoring waste generation, disposal and management - Monitoring sources of liquid waste, its disposal and impact in recipient environment Capacity among: - Relevant government departments at national and local levels - BMUs - Guidelines	Waste water treatment systems: - collection - treatment technology - discharge Solid Waste Management Systems: - collection - storage - processing - financing - minimisation - reuse? Green Infrastructure Storm Water Systems Technology for monitoring receiving environment.	Enforce existing laws related to waste disposal	Not Applicable	Not applicable	Awareness raising campaigns: - public at large - schools - stakeholders benefitting from beaches (tourism operators, hotels, fishermen, etc.) - tourists. Impact of pollution on environment and health Pollution pathways and waste management. Upstream/downstream.	Curricula development for relevant education in primary and secondary schools. Importance of environmentally sound agriculture production. Importance of integrated management (upstream / downstream). Importance of marine environment. Pollution, environment, health. Waste minimisation and recycling.

RV	Threat	Location	Causes	ICZM	IWRM	Land Use Management	Shoreline Management Planning	Solid and Liquid Waste Management	Sanitation	Capacity building	Technology	Law enforcement	Legal Review	Alternative/Improved Livelihood	Awareness raising	Education
1	Loss of habitat and agricultural area	Lindi Town	Rapid urbanization, high increase of people immigration in the city, shifting cultivation	ICZM is an important tool in preventing land use conflicts through coordinated and participatory development planning.	Not applicable	Review and up-date spatial plans for development control clarifying district land uses.	Shoreline Management Planning informs Spatial Planning at local level. First step is to identify sediment cells along the coast based on littoral drift considerations, next step to identify management units within these cells based on environment, economic and socio-economic considerations.	Not Applicable	Not Applicable	Land use planning commission Local Government Authorities	Strengthen/modernise spatial planning tools (GIS, remote imageries)	Enforce land use and building regulations.	Not Applicable	Provide alternatives for people losing traditional livelihoods in rural areas planned for other uses.	Awareness campaigns related to sustainable development planning and development control targeting: - public at large - district authorities - developers/entrepreneurs	Curricula development for relevant education in primary and secondary schools. Complex requirements in coastal areas (high population and economic pressure). Sustainable development. Spatial Planning to service Population requirements.

Mtwara Rural District

Table 218: Broad assessment of measures to mitigate identified threats to local coastal communities and ecosystems in Mtwara Rural District in Mainland Tanzania.

RV	Threat	Location	Causes	ICZM	IWRM	Land Use Management	Shoreline Management Planning	Solid and Liquid Waste Management	Sanitation	Capacity building	Technology	Law enforcement	Legal Review	Alternative/Improved Livelihood	Awareness raising	Education
4	Fisheries decline	All along the near shores of the district	Destruction of fish nurseries such as mangrove cutting, illegal fishing such as dynamite fishing and beach seining and other poor fishing methods as well as coral mining for lime production	Coordination among stakeholders in addressing fisheries decline. Guidelines for best practices in mangrove management. Guidelines for best practises in coral reef management. Guidelines to be based on outcome of legal review.	Not applicable	Mangroves and other habitats of importance (including seagrass areas and coral reefs) for fisheries included in land use information management systems and incorporated into spatial planning.	Identifying management units requiring local management arrangements.	Not Applicable	Not Applicable	Information Management: - Monitoring occurrences of illegal fisheries - Monitoring fishing practises - Monitoring fisheries catches - Monitoring fisheries resources - Monitoring fisheries habitats (mangroves, coral reefs) Capacity among: - Relevant government departments at national and local levels - BMUs	Offshore fisheries Aquaculture; Add value to existing harvest.	Enforce existing laws related to fisheries. Enforce existing laws related to mangrove exploitation. Enforce existing laws related to coral mining.	Review appropriateness of fisheries regulations in relation to local conditions, environment, species and gears. Establish local zoning and fishing effort seasonality.	Provide alternatives to current destructive and unsustainable livelihood practises related to fisheries. - Emphasis on young generation	Awareness raising campaigns: - public at large - schools - stakeholders benefitting from fisheries (fishing communities, middlemen, hotels and restaurants)	Curricula development for relevant education in primary and secondary schools. - Sustainable Fisheries. - Fisheries ecology.
4	Land use conflicts	All along the coast	Conflict between environmental conservation groups and resource users; conflicting interests between sectors e.g. Forestry (mangrove) and mining (salt pans), forestry (mangrove) and lands;	ICZM is an important tool in addressing the complex requirements to address unsustainable resources usage. Implications at and between all management levels.	Link IWRM to coastal integrated planning ensuring upstream/downstream considerations.	Review and update of spatial plans including zoning to guide development planning and development control.	An understanding of processes and factors behind erosion and accretion along the Tanzanian coast is required. Such an understanding can be attained through a structural effort in Shoreline Management Planning which can then inform Spatial Planning at local level. First step is to identify sediment cells along the coast based on littoral drift considerations, next step to identify management units within these cells based on environment, economic and socio-economic considerations.	Not applicable	Not applicable	District level capacity building related to: - Shoreline management - Spatial Planning - Conflict resolution	Beach protection technologies, from engineering (groynes, etc.) to soft (beach nourishment) solutions and green technologies (mangrove planting, other shoreline vegetation).	Enforce existing laws related to resources exploitation sand mining and construction near shore (set back provisions). Enforce development control measures according to updated spatial plans.	Establish required regulations, bylaws and guidelines to ensure sustainable and safe development along near the sea. Local guidelines based on updated spatial plans informed by shoreline management study.	Provide alternatives to current destructive and unsustainable livelihood practises related to fisheries. - Emphasis on young generation	The impact of unsustainable resources usage on beach erosion highlighted in awareness raising campaigns. Services of mangroves and corals in protecting against erosive forces (targeting resource users). Impact of physical structures along the coast on shorelines included in awareness raising campaigns (targeting developers and planners)	Curricula development for relevant education in primary and secondary schools. Sustainable development in areas under high demographic and economic development pressure (coastal areas, urban areas). Importance of coasts and coastal habitats and resources.
3	Habitat destruction	In many villages	Clearing of forest for agricultural use, deforestation, bush fires, coral mining, mangrove cutting, shifting cultivation, poverty, low level of education	ICZM is an important tool in preventing land use conflicts through coordinated and participatory development planning.	Not applicable	Review and up-date spatial plans for development control clarifying district land uses.	Identifying management units requiring local management arrangements.	Not Applicable	Not Applicable	Land use planning commission Local Government Authorities	Strengthen/modernise spatial planning tools (GIS, remote imageries); Offshore fisheries and Aquaculture; add value to existing harvest; forestry resource use;	Enforce existing laws related to fisheries. Enforce existing laws related to mangrove exploitation. Enforce existing laws related to coral mining, salt production.	Not Applicable	Provide alternatives for people losing traditional livelihoods in rural areas planned for other uses.	Awareness campaigns related to sustainable development planning and development control targeting: - public at large - district authorities - developers/entrepreneurs	Curricula development for relevant education in primary and secondary schools. Complex requirements in coastal areas (high population and economic pressure). Sustainable development. Spatial Planning to service Population requirements.
2	Beach pollution	All along the coastal populated areas such as Msimbati	Uncontrolled solid and liquid waste disposal, often in creeks.	Coordination among stakeholders in addressing beach pollution. Beach management guidelines	To the extent that solid and liquid waste origin from upstream activities	Beaches included in zoning and development of associated regulations	Identifying management units requiring local management arrangements.	Waste collection, storage and processing system needs to be put in place.	- Identify and quantify sources of liquid waste as basis for solution	Information Management: - Monitoring waste generation, disposal and management - Monitoring sources of liquid waste, its disposal and impact in recipient environment Capacity among: - Relevant government departments at national and local levels - BMUs - Guidelines	Waste water treatment systems: - collection - treatment technology - discharge Solid Waste Management Systems: - collection - storage - processing - financing - minimisation - reuse?	Enforce existing laws related to waste disposal	Not Applicable	Not applicable	Awareness raising campaigns: - public at large - schools - stakeholders benefitting from beaches (tourism operators, hotels, fishermen, etc.) - tourists	Curricula development for relevant education in primary and secondary schools. Importance of beaches.
2	Beach erosion	Lijombe, Ras Mivinjeni, Sinde Bay, Mnazi Village	Mangrove cutting, dynamite fishing, beach sand mining, unplanned construction along the coast.	ICZM is an important tool in addressing the complex requirements to address unsustainable resources usage. Implications at and between all management levels.	Upstream catchment management influences hydrology and sediment flow and may thus interfere with erosion accretion patterns along the coast. Catchment and coast management needs to be coordinated. IWRM is the appropriate tool such management in the catchment but needs to incorporate coastal concerns (ICZM)	Zoning of beaches to be included in Land Use Plans, providing regulations and guidelines for land use. Ideally to be informed from Shoreline Management Planning efforts. Regulations may define types of use as well as set back arrangements. Guidelines may also cover coral reef, seagrass and mangrove management to the extent of importance to beach erosion.	An understanding of processes and factors behind erosion and accretion along the Tanzanian coast is required. Such an understanding can be attained through a structural effort in Shoreline Management Planning which can then inform Spatial Planning at local level. First step is to identify sediment cells along the coast based on littoral drift considerations, next step to identify management units within these cells based on environment, economic and socio-economic consideration.	Not Applicable	Not Applicable	District level capacity building related to ICZM and in particular shoreline management. Information management - Monitoring occurrences of illegal fisheries - Monitoring fishing practises - Monitoring land uses - Monitoring beach sand mining	Beach protection technologies, from engineering (groynes, etc.) to soft (beach nourishment) solutions and green technologies (mangrove planting, other shoreline vegetation).	Enforce existing laws related to resources exploitation sand mining and construction near shore (set back provisions). Informed by shoreline management study.	Establish required regulations, bylaws and guidelines to ensure sustainable and safe development along near the sea. Informed by shoreline management study.	Provide alternatives to current destructive and unsustainable livelihood practises related to mangrove exploitation and fisheries in particular.	The impact of unsustainable resources usage on beach erosion highlighted in awareness raising campaigns. Services of mangroves and corals in protecting against erosive forces (targeting resource users). Impact of physical structures along the coast on shorelines included in awareness raising campaigns (targeting developers and planners)	Curricula development for relevant education in primary and secondary schools. Importance of beaches.

RV	Threat	Location	Causes	ICZM	IWRM	Land Use Management	Shoreline Management Planning	Solid and Liquid Waste Management	Sanitation	Capacity building	Technology	Law enforcement	Legal Review	Alternative/Improved Livelihood	Awareness raising	Education
1	Diseases outbreaks	In many highly populated areas in the district	Inadequate liquid and solid waste product disposal and management system control, uncontrolled food vending.	Not applicable	Not applicable	Infrastructure development. Supply of sanitation and health services.	Not applicable	Waste collection, storage and processing system needs to be put in place.	Identify and quantify sources of liquid waste as basis for solution and develop sanitation systems accordingly	Environmental authorities Land use planners Information Management: - Monitoring waste generation, disposal and management - Monitoring sources of liquid waste, its disposal and impact in recipient environment Capacity among: - Relevant government departments at national and local levels - BMUs - Guidelines	Waste water treatment systems: - collection - treatment technology - discharge Solid Waste Management Systems: - collection - storage - processing - financing - minimisation - reuse? Green Infrastructure Storm Water Systems Technology for monitoring receiving environment.	Enforce existing laws related to waste disposal	Not Applicable	Not applicable	Awareness raising campaigns: - public at large - schools - stakeholders benefiting from beaches (tourism operators, hotels, fishermen, etc.) - tourists. Impact of pollution on environment and health Pollution pathways and waste management. Upstream/downstream.	Curricula development for relevant education in primary and secondary schools. Importance of environmentally sound agriculture production. Importance of integrated management (upstream / downstream). Importance of marine environment. Pollution, environment, health. Waste minimisation and recycling.
1	River and estuary pollution	Ruvuma River	Mercury from gold mining upstream (Tamatama pers. com.).	ICARM ensuring linkage between catchment management and coastal management.	Land uses in catchment and its impacts on water resources included in IWRM planning	Agriculture zoning in catchments. Regulations for riverside vegetation.	Not applicable	Review of management of mining wastes upstream	Not Applicable	Environmental authorities Mining extension services Land use planners	Mining technologies minimising pollution of mercury into water resources Technology for monitoring receiving environment.	Enforce regulations for use of mining/hazardous chemicals.	Not Applicable	Not applicable	Awareness raising campaigns targeting mining	Not applicable

Mtwara Urban District

Table 219: Broad assessment of measures to mitigate identified threats to local coastal communities and ecosystems in Mtwara Urban District in Mainland Tanzania.

RV	Threat	Location	Causes	ICZM	IWRM	Land Use Management	Shoreline Management Planning	Solid and Liquid Waste Management	Sanitation	Capacity building	Technology	Law enforcement	Legal Review	Alternative/Improved Livelihood	Awareness raising	Education
4	Beach pollution	At the passage to Mtwara Port, Mikindani		Coordination among stakeholders in addressing beach pollution. Beach management guidelines	To the extent that solid and liquid waste origin from upstream activities in Likonde and other local river basins.	Beaches included in zoning and development of associated regulations	Identifying management units requiring local management arrangements.	Waste collection, storage and processing system needs to be put in place.	Identify and quantify sources of liquid waste as basis for solution and develop sanitation systems accordingly	Information Management: - Monitoring waste generation, disposal and management - Monitoring sources of liquid waste, its disposal and impact in recipient environment Capacity among: - Relevant government departments at national and local levels - BMUs - Guidelines	Waste water treatment systems: - collection - treatment technology - discharge Solid Waste Management Systems: - collection - storage - processing - financing - minimisation - reuse? Green Infrastructure Storm Water Systems	Enforce existing laws related to waste disposal	Not Applicable	Not applicable	Awareness raising campaigns: - public at large - schools - stakeholders benefitting from beaches (tourism operators, hotels, fishermen, etc.) - tourists. Impact of pollution on environment and health Pollution pathways and waste management. Upstream/downstream.	Curricula development for relevant education in primary and secondary schools. Importance of beaches. Pollution, environment, health. Waste minimisation and recycling.
4	Beach erosion	Mikindani and Mtwara towns	Mangrove cutting, dynamite fishing, beach sand mining, unplanned construction along the coast.	ICZM is an important tool in addressing the complex requirements to address unsustainable resources usage. Implications at and between all management levels. Catchment and coast management needs to be coordinated. IWRM is the appropriate tool such management in the catchment but needs to incorporate coastal concerns (ICZM).	Upstream catchment management influences hydrology and sediment flow and may thus interfere with erosion accretion patterns along the coast (Likonde and other local rivers).	Zoning of beaches to be included in Land Use Plans, providing regulations and guidelines for land use. Ideally to be informed from Shoreline Management Planning efforts. Regulations may define types of use as well as set back arrangements. Guidelines may also cover coral reef, seagrass and mangrove management to the extent of importance to beach erosion.	An understanding of processes and factors behind erosion and accretion along the Tanzanian coast is required. Such an understanding can be attained through a structural effort in Shoreline Management Planning which can then inform Spatial Planning at local level. First step is to identify sediment cells along the coast based on littoral drift considerations, next step to identify management units within these cells based on environment, economic and socio-economic consideration.	Not Applicable	Not Applicable	District level capacity building related to ICZM and in particular shoreline management. Information management - Monitoring occurrences of illegal fisheries - Monitoring fishing practises - Monitoring land uses - Monitoring beach sand mining	Beach protection technologies, from engineering (groynes, etc.) to soft (beach nourishment) solutions and green technologies (mangrove planting, other shoreline vegetation).	Enforce existing laws related to resources exploitation and sand mining and construction near shore (set back provisions).	Establish required regulations, bylaws and guidelines to ensure sustainable and safe development along near the sea. Informed by shoreline management study.	Provide alternatives to current destructive and unsustainable livelihood practises related to mangrove exploitation and fisheries in particular.	The impact of unsustainable resources usage on beach erosion highlighted in awareness raising campaigns. Services of mangroves and corals in protecting against erosive forces (targeting resource users). Impact of physical structures along the coast on shorelines included in awareness raising campaigns (targeting developers and planners)	Curricula development for relevant education in primary and secondary schools. Importance of beaches and sustainable coastal resources use.
4	Fisheries decline	All along the near shore seas	Destruction of fish nurseries such as mangrove cutting, illegal fishing such as dynamite fishing and other poor fishing methods (beach seine) as well as coral mining for lime production	Coordination among stakeholders in addressing fisheries decline. Guidelines for best practices in mangrove management. Guidelines for best practises in coral reef management. Guidelines to be based on outcome of legal review.	Not applicable	Mangroves and other habitats of importance (including seagrass areas and coral reefs) for fisheries included in land use information management systems and incorporated into spatial planning.	Identifying management units requiring local management arrangements.	Not Applicable	Not Applicable	Information Management: - Monitoring occurrences of illegal fisheries - Monitoring fishing practises - Monitoring fisheries catches - Monitoring fisheries resources - Monitoring fisheries habitats (mangroves, coral reefs) Capacity among: - Relevant government departments at national and local levels - BMUs	Offshore fisheries Aquaculture; Add value to existing harvest.	Enforce existing laws related to fisheries. Enforce existing laws related to mangrove exploitation. Enforce existing laws related to coral mining.	Review appropriateness of fisheries regulations in relation to local conditions, environment, species and gears. Establish local zoning and fishing effort seasonality.	Provide alternatives to current destructive and unsustainable livelihood practises related to fisheries. - Emphasis on young generation	Awareness raising campaigns: - public at large - schools - stakeholders benefitting from fisheries (fishing communities, middlemen, hotels and restaurants)	Curricula development for relevant education in primary and secondary schools. - Sustainable Fisheries. - Fisheries ecology.
4	Loss of habitat and agricultural area	Mtwara urban suburbs, near shores	Rapid urbanization, high increase of people immigration in the city. Beach seining, coral mining, dynamite fishing.	ICZM is an important tool in preventing land use conflicts through coordinated and participatory development planning.	Not applicable	Review and up-date spatial plans for development control clarifying district land uses.	Not applicable	Not Applicable	Not Applicable	Land use planning commission Local Government Authorities	Strengthen/modernise spatial planning tools (GIS, remote imageries)	Enforce land use and building regulations.	Not Applicable	Provide alternatives for people losing traditional livelihoods in rural areas planned for other uses.	Awareness campaigns related to sustainable development planning and development control targeting: - public at large - district authorities - developers/entrepreneurs	Curricula development for relevant education in primary and secondary schools. Complex requirements in coastal areas (high population and economic pressure). Sustainable development. Spatial Planning to service Population requirements.
2	Diseases outbreaks	Mtwara Town, Mikindani	Inadequate sewerage control, poor solid waste management, uncontrolled food vending.	Not applicable	Not applicable	Infrastructure development. Supply of sanitation and health services.	Not applicable	Waste collection, storage and processing system needs to be put in place.	Identify and quantify sources of liquid waste as basis for solution and develop sanitation systems accordingly	Environmental authorities Land use planners Information Management: - Monitoring waste generation, disposal and management - Monitoring sources of liquid waste, its disposal and impact in recipient environment Capacity among: - Relevant government departments at national and local levels - BMUs - Guidelines	Waste water treatment systems: - collection - treatment technology - discharge Solid Waste Management Systems: - collection - storage - processing - financing - minimisation - reuse? Green Infrastructure Storm Water Systems Technology for monitoring receiving environment.	Enforce existing laws related to waste disposal	Not Applicable	Not applicable	Awareness raising campaigns: - public at large - schools - stakeholders benefitting from beaches (tourism operators, hotels, fishermen, etc.) - tourists. Impact of pollution on environment and health Pollution pathways and waste management. Upstream/downstream.	Curricula development for relevant education in primary and secondary schools. Importance of environmentally sound agriculture production. Importance of integrated management (upstream / downstream). Importance of marine environment. Pollution, environment, health. Waste minimisation and recycling.

RV	Threat	Location	Causes	ICZM	IWRM	Land Use Management	Shoreline Management Planning	Solid and Liquid Waste Management	Sanitation	Capacity building	Technology	Law enforcement	Legal Review	Alternative/Improved Livelihood	Awareness raising	Education
1	Heavy metal pollution	Within Mtwara Port waters, near shore waters	Ships and machineries produced wastes at the port and nearby upstream areas	Coordination among stakeholders in addressing industrial pollution.	To the extent that solid and liquid waste origin from upstream activities	Lower portions of rivers included in zoning and development of associated regulations	Identifying management units requiring local management arrangements.	Waste collection, storage and processing system needs to be reviewed and improved.	Not Applicable	Information Management: - Monitoring waste generation, disposal and management - Monitoring sources of liquid waste, its disposal and impact in recipient environment Capacity among: - Relevant government departments at national and local levels - BMUs - Guidelines	Waste collection, storage and processing system needs to be put in place.	Enforce existing laws related to waste disposal	Not Applicable	Waste water treatment systems: - collection - treatment technology - discharge Solid Waste Management Systems: - collection - storage - processing - financing - minimisation - reuse? Green Infrastructure Storm Water Systems	Awareness raising campaigns: - public at large - schools - stakeholders benefitting from beaches (tourism operators, hotels, fishermen, etc.) - tourists. Impact of pollution on environment and health Pollution pathways and waste management. Upstream/downstream.	Curricula development for relevant education in primary and secondary schools. Importance of beaches. Pollution, environment, health. Waste minimisation and recycling.

Zanzibar Regions

Pemba North Region

Table 220: Broad assessment of measures to mitigate identified threats to local coastal communities and ecosystems in Pemba North Region in Zanzibar.

RV	Threat	Location	Causes	ICZM	IWRM	Land Use Management	Shoreline Management Planning	Solid and Liquid Waste Management	Sanitation	Capacity building	Technology	Law enforcement	Legal Review	Alternative/Improved Livelihood	Awareness raising	Education
4	Fisheries decline	Along shallow waters in the region	Destruction of fish nurseries such as mangrove cutting, illegal fishing such as dynamite fishing and other poor fishing methods such as beach seine and kigumi	Coordination among stakeholders in addressing fisheries decline. Guidelines for best practices in mangrove management. Guidelines for best practices in fisheries. Guidelines for best practices in coral reef management.	Not applicable	Mangroves and other habitats of importance for fisheries included in land use information management systems and incorporated into spatial planning.	Identifying management units requiring local management arrangements.	Not Applicable	Not Applicable	Information Management: - Monitoring occurrences of illegal fisheries - Monitoring fishing practises - Monitoring fisheries catches - Monitoring fisheries resources - Monitoring fisheries habitats (mangroves, coral reefs) Capacity among: - Relevant government departments at national and local levels - BMUs	Offshore fisheries Aquaculture; Add value to existing harvest.	Enforce existing laws related to fisheries. Enforce existing laws related to mangrove exploitation.	Not Applicable	Provide alternatives to current destructive and unsustainable livelihood practises related to fisheries. - Emphasis on young generation	Awareness raising campaigns: - public at large - schools - stakeholders benefitting from fisheries (fishing communities, middlemen, hotels and restaurants)	Curricula development for relevant education in primary and secondary schools. - Sustainable Fisheries. - Fisheries ecology.
3	Loss of habitat and agricultural area	Mtambwe, Wete bay, Micheweni area	Mangrove cutting, Influx of sea water to agricultural land. Limestone brick cutting	ICZM is an important tool in preventing land use conflicts through coordinated and participatory development planning.	Not applicable	Review and up-date spatial plans for development control clarifying district land uses.	Shoreline Management Planning informs Spatial Planning at local level. First step is to identify sediment cells along the coast based on littoral drift considerations, next step to identify management units within these cells based on environment, economic and socio-economic considerations.	Not Applicable	Not Applicable	Land use planning commission Local Government Authorities	Strengthen/modernise spatial planning tools (GIS, remote imageries)	Enforce land use and building regulations.	Not Applicable	Provide alternatives for people losing traditional livelihoods in rural areas planned for other uses.	Awareness campaigns related to sustainable development planning and development control targeting: - public at large - district authorities - developers/entrepreneurs	Curricula development for relevant education in primary and secondary schools. Complex requirements in coastal areas (high population and economic pressure). Sustainable development. Spatial Planning to service Population requirements.
2	Diseases outbreaks	Micheweni town and villages	Inadequate sewerage control, poor solid waste management. Lack of latrines and toilets in some coastal dwellings.	Not applicable	Not applicable	Infrastructure development. Supply of sanitation and health services.	Not applicable	Waste collection, storage and processing system needs to be put in place.	Identify and quantify sources of liquid waste as basis for solution and develop sanitation systems accordingly	Environmental authorities Land use planners Information Management: - Monitoring waste generation, disposal and management - Monitoring sources of liquid waste, its disposal and impact in recipient environment Capacity among: - Relevant government departments at national and local levels - BMUs - Guidelines	Waste water treatment systems: - collection - treatment technology - discharge Solid Waste Management Systems: - collection - storage - processing - financing - minimisation - reuse? Green Infrastructure Storm Water Systems Technology for monitoring receiving environment.	Enforce existing laws related to waste disposal	Not Applicable	Not applicable	Awareness raising campaigns: - public at large - schools - stakeholders benefitting from beaches (tourism operators, hotels, fishermen, etc.) - tourists. Impact of pollution on environment and health Pollution pathways and waste management. Upstream/downstream.	Curricula development for relevant education in primary and secondary schools. Importance of environmentally sound agriculture production. Importance of integrated management (upstream / downstream). Importance of marine environment. Pollution, environment, health. Waste minimisation and recycling.
2	Marine pollution	Wete and Micheweni towns and villages. Wete port	Uncontrolled solid waste dump sites, as well as untreated sewage from domestic uses in the area. Influx of pesticides, nutrients and fertilizers from nearby firms, especially in the undulations and valleys where sea water near the agricultural areas. Possible oil leak during loading and offloading of petroleum from ships at Wete port.	Coordination among stakeholders in addressing beach pollution. Beach management guidelines	To the extent that solid and liquid waste origin from upstream activities in Likonde and other local river basins.	Beaches included in zoning and development of associated regulations	Identifying management units requiring local management arrangements.	Waste collection, storage and processing system needs to be put in place.	Identify and quantify sources of liquid waste as basis for solution and develop sanitation systems accordingly	Information Management: - Monitoring waste generation, disposal and management - Monitoring sources of liquid waste, its disposal and impact in recipient environment Capacity among: - Relevant government departments at national and local levels - BMUs - Guidelines	Waste water treatment systems: - collection - treatment technology - discharge Solid Waste Management Systems: - collection - storage - processing - financing - minimisation - reuse? Green Infrastructure Storm Water Systems	Enforce existing laws related to waste disposal	Not Applicable	Not applicable	Awareness raising campaigns: - public at large - schools - stakeholders benefitting from beaches (tourism operators, hotels, fishermen, etc.) - tourists. Impact of pollution on environment and health Pollution pathways and waste management. Upstream/downstream.	Curricula development for relevant education in primary and secondary schools. Importance of beaches. Pollution, environment, health. Waste minimisation and recycling.
1	Beach pollution	Micheweni and Wete town and villages	Uncontrolled solid and liquid waste disposal	Coordination among stakeholders in addressing beach pollution. Beach management guidelines	To the extent that solid and liquid waste origin from upstream activities	Beaches included in zoning and development of associated regulations	Identifying management units requiring local management arrangements.	Waste collection, storage and processing system needs to be put in place.	- Identify and quantify sources of liquid waste as basis for solution	Information Management: - Monitoring waste generation, disposal and management - Monitoring sources of liquid waste, its disposal and impact in recipient environment Capacity among: - Relevant government departments at national and local levels - BMUs - Guidelines	Waste water treatment systems: - collection - treatment technology - discharge Solid Waste Management Systems: - collection - storage - processing - financing - minimisation - reuse?	Enforce existing laws related to waste disposal	Not Applicable	Not applicable	Awareness raising campaigns: - public at large - schools - stakeholders benefitting from beaches (tourism operators, hotels, fishermen, etc.) - tourists	Curricula development for relevant education in primary and secondary schools. Importance of beaches.

RV	Threat	Location	Causes	ICZM	IWRM	Land Use Management	Shoreline Management Planning	Solid and Liquid Waste Management	Sanitation	Capacity building	Technology	Law enforcement	Legal Review	Alternative/Improved Livelihood	Awareness raising	Education
1	Beach erosion	Ras Kigamasha, Wete, Mtambwe	Mangrove cutting, beach sand mining, unplanned construction along the coast, currents and waves	ICZM is an important tool in addressing the complex requirements to address unsustainable resources usage. Implications at and between all management levels.	Not applicable	Zoning of beaches to be included in Land Use Plans, providing regulations and guidelines for land use. Ideally to be informed from Shoreline Management Planning efforts. Regulations may define types of use as well as set back arrangements. Guidelines may also cover coral reef, seagrass and mangrove management to the extent of importance to beach erosion.	An understanding of processes and factors behind erosion and accretion along the Tanzanian coast is required. Such an understanding can be attained through a structural effort in Shoreline Management Planning which can then inform Spatial Planning at local level. First step is to identify sediment cells along the coast based on littoral drift considerations, next step to identify management units within these cells based on environment, economic and socio-economic consideration.	Not Applicable	Not Applicable	Regional level capacity building related to ICZM and in particular shoreline management. Information management - Monitoring occurrences of illegal fisheries - Monitoring fishing practises - Monitoring land uses - Monitoring beach sand mining - Monitoring mangrove usage	Beach protection technologies, from engineering (groynes, etc.) to soft (beach nourishment) solutions and green technologies (mangrove planting, other shoreline vegetation).	Enforce existing laws related to resources exploitation sand mining and construction near shore (set back provisions).	Establish required regulations, bylaws and guidelines to ensure sustainable and safe development along near the sea. Informed by shoreline management study.	Provide alternatives to current destructive and unsustainable livelihood practises related to mangrove exploitation and fisheries in particular.	The impact of unsustainable resources usage on beach erosion highlighted in awareness raising campaigns. Services of mangroves and corals in protecting against erosive forces (targeting resource users). Impact of physical structures along the coast on shorelines included in awareness raising campaigns (targeting developers and planners)	Curricula development for relevant education in primary and secondary schools. Importance of beaches.

Pemba South Region

Table 221: Broad assessment of measures to mitigate identified threats to local coastal communities and ecosystems in Pemba South Region in Zanzibar.

RV	Threat	Location	Causes	ICZM	IWRM	Land Use Management	Shoreline Management Planning	Solid and Liquid Waste Management	Sanitation	Capacity building	Technology	Law enforcement	Legal Review	Alternative/Improved Livelihood	Awareness raising	Education
4	Fisheries decline	Along shallow waters in the region	Destruction of fish nurseries such as mangrove cutting, illegal fishing such as dynamite fishing and other poor fishing methods such as beach seine and kigumi	Coordination among stakeholders in addressing fisheries decline. Guidelines for best practices in mangrove management. Guidelines for best practises in fisheries. Guidelines for best practises in coral reef management.	Not applicable	Mangroves and other habitats of importance for fisheries included in land use information management systems and incorporated into spatial planning.	Identifying management units requiring local management arrangements.	Not Applicable	Not Applicable	Information Management: - Monitoring occurrences of illegal fisheries - Monitoring fishing practises - Monitoring fisheries catches - Monitoring fisheries resources - Monitoring fisheries habitats (mangroves, coral reefs) Capacity among: - Relevant government departments at national and local levels - BMUs	Offshore fisheries Aquaculture; Add value to existing harvest.	Enforce existing laws related to fisheries. Enforce existing laws related to mangrove exploitation.		Provide alternatives to current destructive and unsustainable livelihood practises related to fisheries. - Emphasis on young generation	Awareness raising campaigns: - public at large - schools - stakeholders benefitting from fisheries (fishing communities, middlemen, hotels and restaurants)	Curricula development for relevant education in primary and secondary schools. - Sustainable Fisheries. - Fisheries ecology.
4	Marine pollution	Chake and Mkoani towns and villages. Weshi, Mkoani Port	Uncontrolled solid waste dump sites, as well as untreated sewage from domestic uses in the area. Influx of pesticides, nutrients and fertilizers from nearby firms, especially in the undulations and valleys where sea water near the agricultural areas. Possible oil leak during loading and offloading of petroleum from ships at Weshi depot and Mkoani Port.	Coordination among stakeholders in addressing beach pollution. Beach management guidelines	To the extent that solid and liquid waste origin from upstream activities in Likonde and other local river basins.	Beaches included in zoning and development of associated regulations	Identifying management units requiring local management arrangements.	Waste collection, storage and processing system needs to be put in place.	Identify and quantify sources of liquid waste as basis for solution and develop sanitation systems accordingly	Information Management: - Monitoring waste generation, disposal and management - Monitoring sources of liquid waste, its disposal and impact in recipient environment Capacity among: - Relevant government departments at national and local levels - BMUs - Guidelines	Waste water treatment systems: - collection - treatment technology - discharge Solid Waste Management Systems: - collection - storage - processing - financing - minimisation - reuse? Green Infrastructure Storm Water Systems	Enforce existing laws related to waste disposal	Not Applicable	Not applicable	Awareness raising campaigns: - public at large - schools - stakeholders benefitting from beaches (tourism operators, hotels, fishermen, etc.) - tourists. Impact of pollution on environment and health Pollution pathways and waste management. Upstream/downstream.	Curricula development for relevant education in primary and secondary schools. Importance of beaches. Pollution, environment, health. Waste minimisation and recycling.
3	Beach pollution	Mkoani and Chake Chake town and in some villages	Uncontrolled solid and liquid waste disposal	Coordination among stakeholders in addressing beach pollution. Beach management guidelines	To the extent that solid and liquid waste origin from upstream activities	Beaches included in zoning and development of associated regulations	Identifying management units requiring local management arrangements.	Waste collection, storage and processing system needs to be put in place.	- Identify and quantify sources of liquid waste as basis for solution	Information Management: - Monitoring waste generation, disposal and management - Monitoring sources of liquid waste, its disposal and impact in recipient environment Capacity among: - Relevant government departments at national and local levels - BMUs - Guidelines	Waste water treatment systems: - collection - treatment technology - discharge Solid Waste Management Systems: - collection - storage - processing - financing - minimisation - reuse?	Enforce existing laws related to waste disposal			Awareness raising campaigns: - public at large - schools - stakeholders benefitting from beaches (tourism operators, hotels, fishermen, etc.) - tourists	Curricula development for relevant education in primary and secondary schools. Importance of beaches.
3	Beach erosion	Tandauwa, Wambaa, Mkoani, Kangani, etc.,	Mangrove cutting, beach sand mining, unplanned construction along the coast, currents and waves	ICZM is an important tool in addressing the complex requirements to address unsustainable resources usage. Implications at and between all management levels.	Upstream catchment management influences hydrology and sediment flow and may thus interfere with erosion accretion patterns along the coast. Catchment and coast management needs to be coordinated. IWRM is the appropriate tool such management in the catchment but needs to incorporate coastal concerns (ICZM)	Zoning of beaches to be included in Land Use Plans, providing regulations and guidelines for land use. Ideally to be informed from Shoreline Management Planning efforts. Regulations may define types of use as well as set back arrangements. Guidelines may also cover coral reef, seagrass and mangrove management to the extent of importance to beach erosion.	An understanding of processes and factors behind erosion and accretion along the Tanzanian coast is required. Such an understanding can be attained through a structural effort in Shoreline Management Planning which can then inform Spatial Planning at local level. First step is to identify sediment cells along the coast based on littoral drift considerations, next step to identify management units within these cells based on environment, economic and socio-economic consideration.	Not Applicable	Not Applicable	Regional level capacity building related to ICZM and in particular shoreline management. Information management - Monitoring occurrences of illegal fisheries - Monitoring fishing practises - Monitoring land uses - Monitoring beach sand mining	Beach protection technologies, from engineering (groynes, etc.) to soft (beach nourishment) solutions and green technologies (mangrove planting, other shoreline vegetation).	Enforce existing laws related to resources exploitation sand mining and construction near shore (set back provisions).	Establish required regulations, bylaws and guidelines to ensure sustainable and safe development along near the sea. Informed by shoreline management study.	Provide alternatives to current destructive and unsustainable livelihood practises related to mangrove exploitation and fisheries in particular.	The impact of unsustainable resources usage on beach erosion highlighted in awareness raising campaigns. Services of mangroves and corals in protecting against erosive forces (targeting resource users). Impact of physical structures along the coast on shorelines included in awareness raising campaigns (targeting developers and planners)	Curricula development for relevant education in primary and secondary schools. Importance of beaches.
3	Diseases outbreaks	Chake Chake and Mkoani town, some villages in the region	Inadequate sewerage control, poor solid waste management. Lack of latrines and toilets in some coastal dwellings.	Not applicable	Not applicable	Infrastructure development. Supply of sanitation and health services.	Not applicable	Waste collection, storage and processing system needs to be put in place.	Identify and quantify sources of liquid waste as basis for solution and develop sanitation systems accordingly	Environmental authorities Land use planners Information Management: - Monitoring waste generation, disposal and management - Monitoring sources of liquid waste, its disposal and impact in recipient environment Capacity among: - Relevant government departments at national and local levels - BMUs - Guidelines	Waste water treatment systems: - collection - treatment technology - discharge Solid Waste Management Systems: - collection - storage - processing - financing - minimisation - reuse? Green Infrastructure Storm Water Systems Technology for monitoring receiving environment.	Enforce existing laws related to waste disposal	Not Applicable	Not applicable	Awareness raising campaigns: - public at large - schools - stakeholders benefitting from beaches (tourism operators, hotels, fishermen, etc.) - tourists. Impact of pollution on environment and health Pollution pathways and waste management. Upstream/downstream.	Curricula development for relevant education in primary and secondary schools. Importance of environmentally sound agriculture production. Importance of integrated management (upstream / downstream). Importance of marine environment. Pollution, environment, health. Waste minimisation and recycling.

RV	Threat	Location	Causes	ICZM	IWRM	Land Use Management	Shoreline Management Planning	Solid and Liquid Waste Management	Sanitation	Capacity building	Technology	Law enforcement	Legal Review	Alternative/Improved Livelihood	Awareness raising	Education
1	Loss of habitat and agricultural area	Along the coastal front. Kisiwa Panza	Mangrove cutting, Influx of sea water to agricultural land. Limestone brick cutting	ICZM is an important tool in preventing land use conflicts through coordinated and participatory development planning.	Not applicable	Review and up-date spatial plans for development control clarifying district land uses.	Shoreline Management Planning informs Spatial Planning at local level. First step is to identify sediment cells along the coast based on littoral drift considerations, next step to identify management units within these cells based on environment, economic and socio-economic considerations.	Not Applicable	Not Applicable	Land use planning commission Local Government Authorities	Strengthen/modernise spatial planning tools (GIS, remote imageries)	Enforce land use and building regulations.	Not Applicable	Provide alternatives for people losing traditional livelihoods in rural areas planned for other uses.	Awareness campaigns related to sustainable development planning and development control targeting: - public at large - district authorities - developers/entrepreneurs	Curricula development for relevant education in primary and secondary schools. Complex requirements in coastal areas (high population and economic pressure). Sustainable development. Spatial Planning to service Population requirements.

Unguja North Region

Table 222: Broad assessment of measures to mitigate identified threats to local coastal communities and ecosystems in Unguja North Region in Zanzibar.

RV	Threat	Location	Causes	ICZM	IWRM	Land Use Management	Shoreline Management Planning	Solid and Liquid Waste Management	Sanitation	Capacity building	Technology	Law enforcement	Legal Review	Alternative/Improved Livelihood	Awareness raising	Education
5	Beach erosion	Kiwengwa, Mnemba, Fukuchani, Nungwi	Beach sand mining, unplanned construction along the coast, currents and waves, clearing coastal vegetation.	ICZM is an important tool in addressing the complex requirements to address unsustainable resources usage. Implications at and between all management levels.	Upstream catchment management influences hydrology and sediment flow and may thus interfere with erosion accretion patterns along the coast. Catchment and coast management needs to be coordinated. IWRM is the appropriate tool such management in the catchment but needs to incorporate coastal concerns (ICZM)	Zoning of beaches to be included in Land Use Plans, providing regulations and guidelines for land use. Ideally to be informed from Shoreline Management Planning efforts. Regulations may define types of use as well as set back arrangements. Guidelines may also cover coral reef, seagrass and mangrove management to the extent of importance to beach erosion.	An understanding of processes and factors behind erosion and accretion along the Tanzanian coast is required. Such an understanding can be attained through a structural effort in Shoreline Management Planning which can then inform Spatial Planning at local level. First step is to identify sediment cells along the coast based on littoral drift considerations, next step to identify management units within these cells based on environment, economic and socio-economic consideration.	Not Applicable	Not Applicable	Regional level capacity building related to ICZM and in particular shoreline management. Information management - Monitoring occurrences of illegal fisheries - Monitoring fishing practises - Monitoring land uses - Monitoring beach sand mining	Beach protection technologies, from engineering (groynes, etc.) to soft (beach nourishment) solutions and green technologies (mangrove planting, other shoreline vegetation).	Enforce existing laws related to resources exploitation sand mining and construction near shore (set back provisions).	Establish required regulations, bylaws and guidelines to ensure sustainable and safe development along near the sea. Informed by shoreline management study.	Provide alternatives to current destructive and unsustainable livelihood practises related to mangrove exploitation and fisheries in particular.	The impact of unsustainable resources usage on beach erosion highlighted in awareness raising campaigns. Services of mangroves and corals in protecting against erosive forces (targeting resource users). Impact of physical structures along the coast on shorelines included in awareness raising campaigns (targeting developers and planners)	Curricula development for relevant education in primary and secondary schools. Importance of beaches.
4	Beach pollution	Nungwi, Matemwe, Tumbatu	Uncontrolled solid and liquid waste disposal	Coordination among stakeholders in addressing beach pollution. Beach management guidelines	To the extent that solid and liquid waste origin from upstream activities	Beaches included in zoning and development of associated regulations	Identifying management units requiring local management arrangements.	Waste collection, storage and processing system needs to be put in place.	- Identify and quantify sources of liquid waste as basis for solution	Information Management: - Monitoring waste generation, disposal and management - Monitoring sources of liquid waste, its disposal and impact in recipient environment Capacity among: - Relevant government departments at national and local levels - BMUs - Guidelines	Waste water treatment systems: - collection - treatment technology - discharge Solid Waste Management Systems: - collection - storage - processing - financing - minimisation - reuse?	Enforce existing laws related to waste disposal	Not Applicable	Not applicable	Awareness raising campaigns: - public at large - schools - stakeholders benefitting from beaches (tourism operators, hotels, fishermen, etc.) - tourists	Curricula development for relevant education in primary and secondary schools. Importance of beaches.
4	Fisheries decline	All along shallow waters of the region	Destruction of fish nurseries such as mangrove cutting, illegal fishing such as dynamite fishing and other poor fishing methods such as beach seine and kigumi	Coordination among stakeholders in addressing fisheries decline. Guidelines for best practices in mangrove management. Guidelines for best practises in fisheries. Guidelines for best practises in coral reef management.	Not applicable	Mangroves and other habitats of importance for fisheries included in land use information management systems and incorporated into spatial planning.	Identifying management units requiring local management arrangements.	Not Applicable	Not Applicable	Information Management: - Monitoring occurrences of illegal fisheries - Monitoring fishing practises - Monitoring fisheries catches - Monitoring fisheries resources - Monitoring fisheries habitats (mangroves, coral reefs) Capacity among: - Relevant government departments at national and local levels - BMUs	Offshore fisheries Aquaculture; Add value to existing harvest.	Enforce existing laws related to fisheries. Enforce existing laws related to mangrove exploitation.	Not Applicable	Provide alternatives to current destructive and unsustainable livelihood practises related to fisheries. - Emphasis on young generation	Awareness raising campaigns: - public at large - schools - stakeholders benefitting from fisheries (fishing communities, middlemen, hotels and restaurants)	Curricula development for relevant education in primary and secondary schools. - Sustainable Fisheries. - Fisheries ecology.
4	Land use conflicts	Pwani Mchangani, Nungwi, Matemwe and Mangapwani. Mnemba Island and Matemwe	Use of space, especially beaches and intertidals, between hoteliers and local community – seaweed farmers and fishers. Use of space and resources between fishers and Mnemba Island CA	Coordinated and participatory land and resource use planning expressed in integrated spatial plans and regulations.	Not applicable	Review and update of spatial plans including zoning to guide development planning and development control. Spatial plans to also consider coastal farm/grazing land and seaweed farming and marine spaces.	Identifying management units requiring local management arrangements.	Not applicable	Not applicable	Regional level capacity building related to: - Shoreline management - Spatial Planning - Conflict resolution	Technology for defining most appropriate agricultural land-use (farming or grazing) and coastal land use (beach hotels, seaweed farming or fishing).	Enforce existing laws related to resources exploitation fishing/seaweed farming. Enforce development control measures according to updated spatial plans.	Establish required regulations, bylaws and guidelines to ensure sustainable and safe development along near the sea, and agricultural land. Local guidelines based on updated spatial plans informed by shoreline management study.	Not applicable	Awareness raising campaigns: - public at large - schools - stakeholders benefitting from beaches (tourism operators, hotels, fishermen, etc.)	Curricula development for relevant education in primary and secondary schools. Sustainable development in areas under high demographic and economic development pressure (coastal areas, urban areas). Importance of coasts and coastal habitats and resources.
4	Sea water intrusion in underground freshwater aquifers	All along the coast	Overuse of ground water by tourist hotel and increased population related to tourism (Gössling, 2001).	not applicable	Forest management and catchment land uses addressed in integrated water resources management planning. Link IWRM to coastal integrated planning ensuring upstream/downstream considerations.	Zoning in spatial plans providing guidance for land uses and for development control addressing water resources problems arising from unsustainable land uses.	Not applicable	Not Applicable	Not Applicable	Environmental authorities Land use planners Agriculture extension Information Management: - Monitoring land uses	Agriculture / forestry technologies sustaining recharge of aquifers; rain harvest;	Not Applicable	Not Applicable	Not applicable	Awareness raising campaigns: - public at large - schools on water management and need to conserve water and avoid waste/leaks.	Curricula development for relevant education in primary and secondary schools. - Coastal forest ecology - Coastal forest management; - Hydrologic cycle

RV	Threat	Location	Causes	ICZM	IWRM	Land Use Management	Shoreline Management Planning	Solid and Liquid Waste Management	Sanitation	Capacity building	Technology	Law enforcement	Legal Review	Alternative/Improved Livelihood	Awareness raising	Education
3	Loss of coral cover	All along the regional coast	Crown of Thorn outbreak; over exploitation of habitat by fishers, gleaners and tourists	Coordination among stakeholders in addressing reef coral decline. Guidelines for best practices in reef management and fisheries.	Not applicable	Coral reefs and other habitats of importance for fisheries included in land use information management systems and incorporated into spatial planning.	Identifying management units requiring local management arrangements.	Not Applicable	Not Applicable	Information Management: - Monitoring occurrences of illegal fisheries - Monitoring fishing practises - Monitoring fisheries catches - Monitoring fisheries resources - Monitoring fisheries habitats (mangroves, coral reefs) Capacity among: - Relevant government departments at national and local levels - BMUs	Offshore fisheries Aquaculture; Add value to existing harvest.	Enforce existing laws related to fisheries. Enforce existing laws related to coral reef exploitation.	Not Applicable	Provide alternatives to current destructive and unsustainable livelihood practises related to fisheries. - Emphasis on young generation	Awareness raising campaigns: - public at large - schools - stakeholders benefitting from fisheries (fishing communities, middlemen, hotels and restaurants)	Curricula development for relevant education in primary and secondary schools. - Sustainable Fisheries. - Coral reef ecology.
2	Diseases outbreaks	Nungwi, Matemwe, Tumbatu, Pwani Mchangani, Kiwengwa	Inadequate sewerage control, poor solid waste management. Lack of latrines and toilets in some coastal dwellings.	Not applicable	Not applicable	Infrastructure development. Supply of sanitation and health services.	Not applicable	Waste collection, storage and processing system needs to be put in place.	Identify and quantify sources of liquid waste as basis for solution and develop sanitation systems accordingly	Environmental authorities Land use planners Information Management: - Monitoring waste generation, disposal and management - Monitoring sources of liquid waste, its disposal and impact in recipient environment Capacity among: - Relevant government departments at national and local levels - BMUs - Guidelines	Waste water treatment systems: - collection - treatment technology - discharge Solid Waste Management Systems: - collection - storage - processing - financing - minimisation - reuse? Green Infrastructure Storm Water Systems Technology for monitoring receiving environment.	Enforce existing laws related to waste disposal	Not Applicable	Not applicable	Awareness raising campaigns: - public at large - schools - stakeholders benefitting from beaches (tourism operators, hotels, fishermen, etc.) - tourists. Impact of pollution on environment and health Pollution pathways and waste management. Upstream/downstream.	Curricula development for relevant education in primary and secondary schools. Importance of environmentally sound agriculture production. Importance of integrated management (upstream / downstream). Importance of marine environment. Pollution, environment, health. Waste minimisation and recycling.
2	Marine pollution	All along the north coast, especially Pwani Mchangani Kiwengwa on the east, and Muwanda – Makoba embayment on the west; Matemwe, Nungwi, Mkokotoni, Mangapwani	Uncontrolled solid waste dump sites, as well as untreated sewage from domestic uses and tourist hotels in the area. Influx of pesticides, nutrients and fertilizers from nearby farms, especially in valleys with agricultural areas close to the shore. Possible oil leak during loading/unloading fuels in landing sites and small local harbours	Coordination among stakeholders in addressing beach pollution. Beach management guidelines	To the extent that solid and liquid waste origin from upstream activities in local river basins.	Agriculture zoning in catchments. Regulations for riverside vegetation.	Identifying management units requiring local management arrangements.	Review of management of agrochemicals upstream; Waste collection, storage and processing system needs to be put in place.	Identify and quantify sources of liquid waste as basis for solution and develop sanitation systems accordingly	Information Management: - Monitoring waste generation, disposal and management - Monitoring sources of liquid waste, its disposal and impact in recipient environment Capacity among: - Relevant government departments at national and local levels - BMUs - Guidelines	Waste water treatment systems: - collection - treatment technology - discharge Solid Waste Management Systems: - collection - storage - processing - financing - minimisation - reuse? Green Infrastructure Storm Water Systems; Agriculture technologies minimising impact for agrochemicals on water resources Technology for monitoring receiving environment.	Enforce regulations for disposal of waste; and use of agrochemicals.	Not Applicable	Not applicable	Awareness raising campaigns targeting agriculture	Curricula development for relevant education in primary and secondary schools. Importance of environmentally sound agriculture production. Importance of integrated management (upstream / downstream).

Unguja West and Urban Region

Table 223: Broad assessment of measures to mitigate identified threats to local coastal communities and ecosystems in Unguja West and Urban Region in Zanzibar.

RV	Threat	Location	Causes	ICZM	IWRM	Land Use Management	Shoreline Management Planning	Solid and Liquid Waste Management	Sanitation	Capacity building	Technology	Law enforcement	Legal Review	Alternative/Improved Livelihood	Awareness raising	Education
4	Beach pollution	All along the regional sea front	Uncontrolled solid and liquid waste disposal, lack of toilets in public gatherings	Coordination among stakeholders in addressing beach pollution. Beach management guidelines	To the extent that solid and liquid waste origin from upstream activities	Beaches included in zoning and development of associated regulations	Identifying management units requiring local management arrangements.	Waste collection, storage and processing system needs to be put in place.	- Identify and quantify sources of liquid waste as basis for solution	Information Management: - Monitoring waste generation, disposal and management - Monitoring sources of liquid waste, its disposal and impact in recipient environment Capacity among: - Relevant government departments at national and local levels - BMUs - Guidelines	Waste water treatment systems: - collection - treatment technology - discharge Solid Waste Management Systems: - collection - storage - processing - financing - minimisation - reuse?	Enforce existing laws related to waste disposal			Awareness raising campaigns: - public at large - schools - stakeholders benefitting from beaches (tourism operators, hotels, fishermen, etc.) - tourists	Curricula development for relevant education in primary and secondary schools. Importance of beaches.
4	Beach erosion	Kilimani, Mazizini, Maruhubi, Mtoni, Mbweni	Beach sand mining, unplanned construction along the coast, currents and waves, clearing coastal vegetation.	ICZM is an important tool in addressing the complex requirements to address unsustainable resources usage. Implications at and between all management levels.	Upstream catchment management influences hydrology and sediment flow and may thus interfere with erosion accretion patterns along the coast. Catchment and coast management needs to be coordinated. IWRM is the appropriate tool such management in the catchment but needs to incorporate coastal concerns (ICZM)	Zoning of beaches to be included in Land Use Plans, providing regulations and guidelines for land use. Ideally to be informed from Shoreline Management Planning efforts. Regulations may define types of use as well as set back arrangements. Guidelines may also cover coral reef, seagrass and mangrove management to the extent of importance to beach erosion.	An understanding of processes and factors behind erosion and accretion along the Tanzanian coast is required. Such an understanding can be attained through a structural effort in Shoreline Management Planning which can then inform Spatial Planning at local level. First step is to identify sediment cells along the coast based on littoral drift considerations, next step to identify management units within these cells based on environment, economic and socio-economic consideration.	Not Applicable	Not Applicable	District level capacity building related to ICZM and in particular shoreline management. Information management - Monitoring occurrences of illegal fisheries - Monitoring fishing practises - Monitoring land uses - Monitoring beach sand mining	Beach protection technologies, from engineering (groynes, etc.) to soft (beach nourishment) solutions and green technologies (mangrove planting, other shoreline vegetation).	Enforce existing laws related to resources exploitation sand mining and construction near shore (set back provisions).	Establish required regulations, bylaws and guidelines to ensure sustainable and safe development along near the sea. Informed by shoreline management study.	Provide alternatives to current destructive and unsustainable livelihood practises related to mangrove exploitation and fisheries in particular.	The impact of unsustainable resources usage on beach erosion highlighted in awareness raising campaigns. Services of mangroves and corals in protecting against erosive forces (targeting resource users). Impact of physical structures along the coast on shorelines included in awareness raising campaigns (targeting developers and planners)	Curricula development for relevant education in primary and secondary schools. Importance of beaches.
4	Fisheries decline	All around the region	Destruction of fish nurseries such as mangrove cutting, illegal fishing such as dynamite fishing and other poor fishing methods such as beach seine and kigumi	Coordination among stakeholders in addressing fisheries decline. Guidelines for best practises in mangrove management. Guidelines for best practises in fisheries. Guidelines for best practises in coral reef management.	Not applicable	Mangroves and other habitats of importance for fisheries included in land use information management systems and incorporated into spatial planning.	Identifying management units requiring local management arrangements.	Not Applicable	Not Applicable	Information Management: - Monitoring occurrences of illegal fisheries - Monitoring fishing practises - Monitoring fisheries catches - Monitoring fisheries resources - Monitoring fisheries habitats (mangroves, coral reefs) Capacity among: - Relevant government departments at national and local levels - BMUs	Offshore fisheries Aquaculture; Add value to existing harvest.	Enforce existing laws related to fisheries. Enforce existing laws related to mangrove exploitation.		Provide alternatives to current destructive and unsustainable livelihood practises related to fisheries. - Emphasis on young generation	Awareness raising campaigns: - public at large - schools - stakeholders benefitting from fisheries (fishing communities, middlemen, hotels and restaurants)	Curricula development for relevant education in primary and secondary schools. - Sustainable Fisheries. - Fisheries ecology.
4	Marine pollution	Zanzibar municipality, Zanzibar port, Maruhubi, Mtoni Deport, Kizingo	Uncontrolled solid waste dump sites, as well as untreated sewage from domestic uses and tourist hotels in the area. Possible oil leak during loading and offloading of fuels in landing sites and small local harbours	Coordination among stakeholders in addressing beach pollution. Beach management guidelines	To the extent that solid and liquid waste origin from upstream activities in local river basins.	Beaches included in zoning and development of associated regulations	Identifying management units requiring local management arrangements.	Waste collection, storage and processing system needs to be put in place.	Identify and quantify sources of liquid waste as basis for solution and develop sanitation systems accordingly	Information Management: - Monitoring waste generation, disposal and management - Monitoring sources of liquid waste, its disposal and impact in recipient environment Capacity among: - Relevant government departments at national and local levels - BMUs - Guidelines	Waste water treatment systems: - collection - treatment technology - discharge Solid Waste Management Systems: - collection - storage - processing - financing - minimisation - reuse? Green Infrastructure Storm Water Systems	Enforce existing laws related to waste disposal	Not Applicable	Not applicable	Awareness raising campaigns: - public at large - schools - stakeholders benefitting from beaches (tourism operators, hotels, fishermen, etc.) - tourists. Impact of pollution on environment and health Pollution pathways and waste management. Upstream/downstream.	Curricula development for relevant education in primary and secondary schools. Importance of beaches. Pollution, environment, health. Waste minimisation and recycling.
4	Land use conflicts	In some spots along the coast, Southeast of region where it borders with Menai Bay	Use of space, especially beaches and intertidals, between hoteliers and local community. Use of space and resources between fishers and Menai Bay Conservation Authority	Coordinated and participatory land and resource use planning expressed in integrated spatial plans and regulations.	Not applicable	Review and update of spatial plans including zoning to guide development planning and development control. Spatial plans to also consider marine spaces.	Identifying management units requiring local management arrangements.	Not applicable	Not applicable	Regional level and MPA capacity building related to: - Shoreline management - Spatial Planning - Conflict resolution	Technology for defining most appropriate agricultural land-use (farming or grazing) and coastal land use (beach hotels, seaweed farming or fishing).	Enforce existing laws related to resources exploitation fishing/seaweed farming. Enforce development control measures according to updated spatial plans.	Establish required regulations, bylaws and guidelines to ensure sustainable and safe development along near the sea, and agricultural land. Local guidelines based on updated spatial plans informed by shoreline management study.	Not applicable	Awareness raising campaigns: - public at large - schools - stakeholders benefitting from beaches (tourism operators, hotels, fishermen, etc.)	Curricula development for relevant education in primary and secondary schools. Sustainable development in areas under high demographic and economic development pressure (coastal areas, urban areas). Importance of coasts and coastal habitats and resources.

RV	Threat	Location	Causes	ICZM	IWRM	Land Use Management	Shoreline Management Planning	Solid and Liquid Waste Management	Sanitation	Capacity building	Technology	Law enforcement	Legal Review	Alternative/Improved Livelihood	Awareness raising	Education
3	Loss of coral cover	Stone town reefs and other western coral reef areas	Crown of Thorn outbreak. Over exploitation of habitat by fishers, gleaners and tourists	Coordination among stakeholders in addressing reef coral decline. Guidelines for best practices in reef management and fisheries.	Not applicable	Coral reefs and other habitats of importance for fisheries included in land use information management systems and incorporated into spatial planning.	Identifying management units requiring local management arrangements.	Not Applicable	Not Applicable	Information Management: - Monitoring occurrences of illegal fisheries - Monitoring fishing practises - Monitoring fisheries catches - Monitoring fisheries resources - Monitoring fisheries habitats (mangroves, coral reefs) Capacity among: - Relevant government departments at national and local levels - BMUs	Offshore fisheries Aquaculture; Add value to existing harvest.	Enforce existing laws related to fisheries. Enforce existing laws related to coral reef exploitation.	Not Applicable	Provide alternatives to current destructive and unsustainable livelihood practises related to fisheries. - Emphasis on young generation	Awareness raising campaigns: - public at large - schools - stakeholders benefitting from fisheries (fishing communities, middlemen, hotels and restaurants)	Curricula development for relevant education in primary and secondary schools. - Sustainable Fisheries. - Coral reef ecology.
3	Seawater intrusion in underground freshwater aquifers	Stone Town constituency, Kilimani, Kisiwandui	Overuse of ground water by tourist hotel and increased population related to tourism (Gössling, 2001).	not applicable	Forest management and catchment land uses addressed in integrated water resources management planning. Link IWRM to coastal integrated planning ensuring upstream/downstream considerations.	Zoning in spatial plans providing guidance for land uses and for development control addressing water resources problems arising from unsustainable land uses.	Not applicable	Not Applicable	Not Applicable	District level capacity building related to: - Catchment management - Spatial Planning - Conflict resolution	Agriculture / forestry technologies sustaining recharge of aquifers; rain harvest;	Not Applicable	Not Applicable	Not applicable	Awareness raising campaigns: - public at large - schools on water management and need to conserve water and avoid waste/leaks.	Curricula development for relevant education in primary and secondary schools. - Coastal forest ecology - Coastal forest management; - Hydrologic cycle
2	Diseases outbreaks	Especially in Urban District	Inadequate sewerage control, poor solid waste management. Lack of latrines and toilets in some coastal dwellings.	Not applicable	Not applicable	Infrastructure development. Supply of sanitation and health services.	Not applicable	Waste collection, storage and processing system needs to be put in place.	Identify and quantify sources of liquid waste as basis for solution and develop sanitation systems accordingly	Environmental authorities Land use planners Information Management: - Monitoring waste generation, disposal and management - Monitoring sources of liquid waste, its disposal and impact in recipient environment Capacity among: - Relevant government departments at national and local levels - BMUs - Guidelines	Waste water treatment systems: - collection - treatment technology - discharge Solid Waste Management Systems: - collection - storage - processing - financing - minimisation - reuse? Green Infrastructure Storm Water Systems Technology for monitoring receiving environment.	Enforce existing laws related to waste disposal	Not Applicable	Not applicable	Awareness raising campaigns: - public at large - schools - stakeholders benefitting from beaches (tourism operators, hotels, fishermen, etc.) - tourists. Impact of pollution on environment and health Pollution pathways and waste management. Upstream/downstream.	Curricula development for relevant education in primary and secondary schools. Importance of environmentally sound agriculture production. Importance of integrated management (upstream / downstream). Importance of marine environment. Pollution, environment, health. Waste minimisation and recycling.

Unguja South Region

Table 224: Broad assessment of measures to mitigate identified threats to local coastal communities and ecosystems in Unguja South Region in Zanzibar.

RV	Threat	Location	Causes	ICZM	IWRM	Land Use Management	Shoreline Management Planning	Solid and Liquid Waste Management	Sanitation	Capacity building	Technology	Law enforcement	Legal Review	Alternative/Improved Livelihood	Awareness raising	Education
1	Beach pollution	All along the coast	Uncontrolled solid and liquid waste disposal	Coordination among stakeholders in addressing beach pollution. Beach management guidelines	To the extent that solid and liquid waste origin from upstream activities	Beaches included in zoning and development of associated regulations	Identifying management units requiring local management arrangements.	Waste collection, storage and processing system needs to be put in place.	- Identify and quantify sources of liquid waste as basis for solution	Information Management: - Monitoring waste generation, disposal and management - Monitoring sources of liquid waste, its disposal and impact in recipient environment Capacity among: - Relevant government departments at national and local levels - BMUs - Guidelines	Waste water treatment systems: - collection - treatment technology - discharge Solid Waste Management Systems: - collection - storage - processing - financing - minimisation - reuse?	Enforce existing laws related to waste disposal	Not Applicable	Not applicable	Awareness raising campaigns: - public at large - schools - stakeholders benefitting from beaches (tourism operators, hotels, fishermen, etc.) - tourists	Curricula development for relevant education in primary and secondary schools. Importance of beaches.
5	Beach erosion	Rampant in many areas including Unguja Ujuu, Jambiani, Makunduchi, Uroa, Paje, Bwejuu and Michamvi	Beach sand mining, unplanned construction along the coast, currents and waves, clearing coastal vegetation.	ICZM is an important tool in addressing the complex requirements to address unsustainable resources usage. Implications at and between all management levels.	Upstream catchment management influences hydrology and sediment flow and may thus interfere with erosion accretion patterns along the coast. Catchment and coast management needs to be coordinated. IWRM is the appropriate tool such management in the catchment but needs to incorporate coastal concerns (ICZM)	Zoning of beaches to be included in Land Use Plans, providing regulations and guidelines for land use. Ideally to be informed from Shoreline Management Planning efforts. Regulations may define types of use as well as set back arrangements. Guidelines may also cover coral reef, seagrass and mangrove management to the extent of importance to beach erosion.	An understanding of processes and factors behind erosion and accretion along the Tanzanian coast is required. Such an understanding can be attained through a structural effort in Shoreline Management Planning which can then inform Spatial Planning at local level. First step is to identify sediment cells along the coast based on littoral drift considerations, next step to identify management units within these cells based on environment, economic and socio-economic consideration.	Not Applicable	Not Applicable	Regional level capacity building related to ICZM and in particular shoreline management. Information management - Monitoring occurrences of illegal fisheries - Monitoring fishing practises - Monitoring land uses - Monitoring beach sand mining	Beach protection technologies, from engineering (groynes, etc.) to soft (beach nourishment) solutions and green technologies (mangrove planting, other shoreline vegetation).	Enforce existing laws related to resources exploitation sand mining and construction near shore (set back provisions).	Establish required regulations, bylaws and guidelines to ensure sustainable and safe development along near the sea. Informed by shoreline management study.	Provide alternatives to current destructive and unsustainable livelihood practises related to mangrove exploitation and fisheries in particular.	The impact of unsustainable resources usage on beach erosion highlighted in awareness raising campaigns. Services of mangroves and corals in protecting against erosive forces (targeting resource users). Impact of physical structures along the coast on shorelines included in awareness raising campaigns (targeting developers and planners)	Curricula development for relevant education in primary and secondary schools. Importance of beaches.
4	Fisheries decline	All along the shallow water coastal areas	Destruction of fish nurseries such as mangrove cutting, illegal fishing such as dynamite fishing and other poor fishing methods such as beach seine and kigumi	Coordination among stakeholders in addressing fisheries decline. Guidelines for best practises in mangrove management. Guidelines for best practises in fisheries. Guidelines for best practises in coral reef management.	Not applicable	Mangroves and other habitats of importance for fisheries included in land use information management systems and incorporated into spatial planning.	Identifying management units requiring local management arrangements.	Not Applicable	Not Applicable	Information Management: - Monitoring occurrences of illegal fisheries - Monitoring fishing practises - Monitoring fisheries catches - Monitoring fisheries resources - Monitoring fisheries habitats (mangroves, coral reefs) Capacity among: - Relevant government departments at national and local levels - BMUs	Offshore fisheries Aquaculture; Add value to existing harvest.	Enforce existing laws related to fisheries. Enforce existing laws related to mangrove exploitation.	Not Applicable	Provide alternatives to current destructive and unsustainable livelihood practises related to fisheries. - Emphasis on young generation	Awareness raising campaigns: - public at large - schools - stakeholders benefitting from fisheries (fishing communities, middlemen, hotels and restaurants)	Curricula development for relevant education in primary and secondary schools. - Sustainable Fisheries. - Fisheries ecology.
1	Diseases outbreaks	In every big village of the region	Inadequate sewerage control, poor solid waste management. Lack of latrines and toilets in some coastal dwellings	Not applicable	Not applicable	Infrastructure development. Supply of sanitation and health services.	Not applicable	Waste collection, storage and processing system needs to be put in place.	Identify and quantify sources of liquid waste as basis for solution and develop sanitation systems accordingly	Environmental authorities Land use planners Information Management: - Monitoring waste generation, disposal and management - Monitoring sources of liquid waste, its disposal and impact in recipient environment Capacity among: - Relevant government departments at national and local levels - BMUs - Guidelines	Waste water treatment systems: - collection - treatment technology - discharge Solid Waste Management Systems: - collection - storage - processing - financing - minimisation - reuse? Green Infrastructure Storm Water Systems Technology for monitoring receiving environment.	Enforce existing laws related to waste disposal	Not Applicable	Not applicable	Awareness raising campaigns: - public at large - schools - stakeholders benefitting from beaches (tourism operators, hotels, fishermen, etc.) - tourists. Impact of pollution on environment and health Pollution pathways and waste management. Upstream/downstream.	Curricula development for relevant education in primary and secondary schools. Importance of environmentally sound agriculture production. Importance of integrated management (upstream / downstream). Importance of marine environment. Pollution, environment, health. Waste minimisation and recycling.

RV	Threat	Location	Causes	ICZM	IWRM	Land Use Management	Shoreline Management Planning	Solid and Liquid Waste Management	Sanitation	Capacity building	Technology	Law enforcement	Legal Review	Alternative/Improved Livelihood	Awareness raising	Education
2	Marine pollution	All most the entire coast from Makunduchi to Michamvi through Jambiani, Paje and Bwejuu	Uncontrolled solid waste dump sites, as well as untreated sewage from domestic uses and tourist hotels in the area. Possible oil leak during loading and offloading of fuels in landing sites and small local harbours	Coordination among stakeholders in addressing beach pollution. Beach management guidelines	To the extent that solid and liquid waste origin from upstream activities in local river basins.	Beaches included in zoning and development of associated regulations	Identifying management units requiring local management arrangements.	Waste collection, storage and processing system needs to be put in place.	Identify and quantify sources of liquid waste as basis for solution and develop sanitation systems accordingly	Information Management: - Monitoring waste generation, disposal and management - Monitoring sources of liquid waste, its disposal and impact in recipient environment Capacity among: - Relevant government departments at national and local levels - BMUs - Guidelines	Waste water treatment systems: - collection - treatment technology - discharge Solid Waste Management Systems: - collection - storage - processing - financing - minimisation - reuse? Green Infrastructure Storm Water Systems	Enforce existing laws related to waste disposal	Not Applicable	Not applicable	Awareness raising campaigns: - public at large - schools - stakeholders benefitting from beaches (tourism operators, hotels, fishermen, etc.) - tourists. Impact of pollution on environment and health Pollution pathways and waste management. Upstream/downstream.	Curricula development for relevant education in primary and secondary schools. Importance of beaches. Pollution, environment, health. Waste minimisation and recycling.
2	Land use conflicts	Chwaka Bay	Use of space, especially beaches and intertidal, between hoteliers and local community – seaweed farmers and fishers. Use of space and resources between fishers and MBCA	Coordinated and participatory land and resource use planning expressed in integrated spatial plans and regulations.	Not applicable	Review and update of spatial plans including zoning to guide development planning and development control. Spatial plans to also consider coastal farm/grazing land and seaweed farming and marine spaces.	Identifying management units requiring local management arrangements.	Not applicable	Not applicable	Regional level capacity building related to: - Shoreline management - Spatial Planning - Conflict resolution	Technology for defining most appropriate agricultural land-use (farming or grazing) and coastal land use (beach hotels, seaweed farming or fishing).	Enforce existing laws related to resources exploitation fishing/seaweed farming. Enforce development control measures according to updated spatial plans.	Establish required regulations, bylaws and guidelines to ensure sustainable and safe development along near the sea, and agricultural land. Local guidelines based on updated spatial plans informed by shoreline management study.	Not applicable	Awareness raising campaigns: - public at large - schools - stakeholders benefitting from beaches (tourism operators, hotels, fishermen, etc.)	Curricula development for relevant education in primary and secondary schools. Sustainable development in areas under high demographic and economic development pressure (coastal areas, urban areas). Importance of coasts and coastal habitats and resources.
2	Loss of coral cover	Jambiani, Bwejuu, Michamvi, Paje, Menai Bay	Crown of Thorn outbreak. Over exploitation of habitat by fishers, gleaners and tourists	Coordination among stakeholders in addressing reef coral decline. Guidelines for best practices in reef management and fisheries.	Not applicable	Coral reefs and other habitats of importance for fisheries included in land use information management systems and incorporated into spatial planning.	Identifying management units requiring local management arrangements.	Not Applicable	Not Applicable	Information Management: - Monitoring occurrences of illegal fisheries - Monitoring fishing practises - Monitoring fisheries catches - Monitoring fisheries resources - Monitoring fisheries habitats (mangroves, coral reefs) Capacity among: - Relevant government departments at national and local levels - BMUs	Offshore fisheries Aquaculture; Add value to existing harvest.	Enforce existing laws related to fisheries. Enforce existing laws related to coral reef exploitation.	Not Applicable	Provide alternatives to current destructive and unsustainable livelihood practises related to fisheries. - Emphasis on young generation	Awareness raising campaigns: - public at large - schools - stakeholders benefitting from fisheries (fishing communities, middlemen, hotels and restaurants)	Curricula development for relevant education in primary and secondary schools. - Sustainable Fisheries. - Coral reef ecology.
1	Seawater intrusion in underground freshwater aquifers	Menai Bay	Overuse of ground water by tourist hotel and increased population related to tourism (Gössling, 2001).	not applicable	Forest management and catchment land uses addressed in integrated water resources management planning. Link IWRM to coastal integrated planning ensuring upstream/downstream considerations.	Zoning in spatial plans providing guidance for land uses and for development control addressing water resources problems arising from unsustainable land uses.	Not applicable	Not Applicable	Not Applicable	District level capacity building related to: - Catchment management - Spatial Planning - Conflict resolution	Agriculture / forestry technologies sustaining recharge of aquifers; rain harvest;	Not Applicable	Not Applicable	Not applicable	Awareness raising campaigns: - public at large - schools on water management and need to conserve water and avoid waste/leaks.	Curricula development for relevant education in primary and secondary schools. - Coastal forest ecology - Coastal forest management; - Hydrologic cycle