Havs och Vatten myndigheten

Large Marine Ecosystems:

Study of the Concept of Large Marine Ecosystems and its Institutional Relevance for Ecosystem-based Management and Development

Havs- och vattenmyndighetens rapport 2012:17

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Anna Tengberg
Arne Andreasson

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Havs- och vattenmyndigheten
Box 11 930, 404 39 Göteborg
www.havochvatten.se

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Preface

The concept of large marine ecosystems (LME) was developed to address trans-boundary characteristics of the use of marine resources and the protection of the marine environment. Other approaches to these issues include the establishment of regionally based forums, such as conventions, regional economic organizations, and regional fisheries bodies (RFB).

It is evident that potential for overlapping and possibly conflicting responsibilities and approaches between these various initiatives exist. Unclear relations and mandates may result in a less than optimal use of resources and less than optimal measures to protect the marine environment and ensure sustainable use of natural resources.

When considering development support it is of great value to know the funds donated are put to optimal use. The Swedish Agency for Marine and Water Management has prepared this Report to increase our knowledge and to serve as guidance for future Swedish support to the protection of the marine environment and the sustainable use of natural resources in developing countries. Our hope is that it will be of use for us as well as other interested parties. The report is funded by Swedish international Development Cooperation Agency, Sida.

I would like to express my gratitude to the partners who have contributed by answering the Questionnaire survey. The answers have been most helpful. The main author of the report is Anna Tengberg. Important contributions have been provided by Arne Andreasson and Janne Fogelgren.

Gothenburg, June 2012

Ingemar Berglund,
Director

Abbreviations and Acronyms

ACB	-	ASEAN Center for Biodiversity
ADB	-	Asian Development Bank
APFIC	-	Asia-Pacific Fishery Commission
ASCLME	-	Agulhas and Somali Current Large Marine Ecosystem
ASEAN	-	Association of Southeast Asian Nations
ASOEN	-	ASEAN Ministerial Meeting on the Environment
ATS	-	Arafura and Timor Seas
ATSEA	-	Arafura Timor Seas Ecosystem Action Programme
ATSEF	-	Arafura-Timor Seas Expert Forum
AU	-	African Union
BCC	-	Benguela Current Commission
BCLME	-	Benguela Current Large Marine Ecosystem
BIMP-EAGA	-	Brunei-Indonesia-Malaysia-Philippines East Asia Growth Area
BOBP-IGO	-	Bay of Bengal Programme –Inter-Governmental Organization
BOBLME	-	Bay of Bengal Large Marine Ecosystem
CCLME	-	Canary Current Large Marine Ecosystem
CECAF		Fishery Committee for the Eastern Central Atlantic
COBSEA	-	Coordinating Body on the Seas of East Asia
COMHAFAT	-	Ministerial Conference on Fisheries Cooperation among African States bordering the Atlantic Ocean
COREP	-	Regional Fisheries Committee for the Gulf of Guinea
Corin-Asia	-	Asian Coastal Resources Institute-Foundation
CTI	-	Coral Triangle Initiative
EAF	-	Ecosystem Approach to Fisheries
EAS	-	East Asian Seas
ECOWAS	-	Economic Community of West African States
EEZ	-	Exclusive Economic Zone
ENSO	-	El Niño Southern Oscillation
FAO	-	UN Food and Agricultural Organization
FCWC	-	Fishery Committee for the West Central Gulf of Guinea
GCLME	-	Guinea Current Large Marine Ecosystem
GEF	-	Global Environment Facility
GPA	-	Global Programme of Action for the Protection of the Marine Environment from Land-based Activities
HELCOM	-	Helsinki Commission
IBSFC	-	International Baltic Sea Fishery Commission
ICCAT	-	International Commission for the Conservation of Atlantic Tunas
ICES	-	International Council for Exploration of the Sea
ICM	-	Integrated Coastal Management
IGCC	-	Interim Guinea Current Commission
IOSEA	-	Indian Ocean – Southeast Asia Marine Turtle MOU
IUCN		International Union for Conservation of Nature
IUU	-	Illegal, Unreported and Unregulated [fishing]
IW	-	International Waters
LME	-	Large Marine Ecosystem
MFF	-	Coral Triangle Initiative

MPAs	-	Marine Protected Areas
COSMAR	-	New Partnership for Africa's Development NEPAD-Environment Initiative - Coastal and Marine Programme
NGO	-	Non-Governmental Organisation
ORASECOM		Orange-Senque River Commission
PEMSEA	-	Partnerships in Environmental Management for the Seas of East Asia
POPs		Persistent Organic Pollutants
PTSs		Persistent Toxic Substances
REC	-	Regional Economic Community
RFB	-	Regional Fisheries Body
RSP	-	Regional Seas Programme
SAARC	-	South Asian Association for Regional Cooperation
SADC	-	Southern African Development Community
SAP	-	Strategic Action Programme
SBF	-	Swedish Board of Fisheries
SDS-SEA	-	Sustainable Development Strategy for the Seas of East-Asia
SEAFDEC	-	Southeast Asian Fisheries Development Center
SEAFO	-	South East Atlantic Fisheries Organisation
Sida	-	Swedish International Development Agency
SRFC	-	Sub-regional Fisheries Commission
TDA	-	Transboundary Diagnostic Analysis
UNDP	-	United Nations Development Programme
UNEP	-	United Nations Environment Programme
UNIDO	-	Inited Nations Industrial Development Programme
WACAF	-	Regional Seas Programme for West and Central Africa Region
WCPFC	-	Western and Central Pacific Fisheries Commission
WIOSEA	-	West Indian Ocean Sustainable Ecosystem Alliance
WSSD	-	World Summit on Sustainable Development
YSLME	-	Yellow Sea Large Marine Ecosystem

Executive Summary

The concept of large marine ecosystems (LME) has been used since the mid-1980s to investigate the problems affecting the world's coastal and marine ecosystems and to formulate effective management interventions. The purpose of the study is to conduct an analysis of the LME approach and its relevance for strengthening ecosystem-based management of the marine environment and marine resources as well as the relations, including potential conflicts and overlap, with other global or regional initiatives with similar ambitions.

Case studies were selected in the East Asian Seas region, West and Central Africa regional seas and South Asia. LMEs that have or are receiving support from the Global Environment Facility (GEF) that display different levels of maturity and success in implementing the LME approach were selected. The study is based on desk review of relevant programme and project documents, other publications, as well as a questionnaire survey circulated to key LME partners in the selected regions.

The LME approach can result in considerably improved cross-sectorial coordination and collaboration on coastal and marine management when there are long-term commitments from countries to establish LME-based institutions, such as the Benguela Current Commission and Interim Guinea Current Commission. However, it is difficult to identify clear criteria of success in implementing the LME approach. The funding provided from GEF is merely catalytic and varies considerably across LMEs, from US$26 million in total for subsequent phases of the Guinea Current LME to less than US$3 million for the Arafura Timor Seas (ATS).

The successful development of a Transboundary Diagnostic Analysis (TDA), adoption of a Strategic Action Programme (SAP) and strengthening of institutional arrangements for SAP implementation seems to be more dependent on political factors than GEF funding, linked to factors such as number of countries bordering the LME, political will to engage in regional collaboration and existing regional policy and institutional frameworks. Capacity to execute the LME approach in an adaptive way probably also plays an important role.

Fishing canoes, Timor Leste.

Before establishing institutions for joint ecosystem-based management, such as new LME Commissions, to implement agreed LME SAPs, it is recommended that an institutional assessment be conducted that examines opportunities for embedding the LME approach into existing regional institutional and policy frameworks of e.g. Regional Economic Communities, joint programming with Regional Fisheries Bodies and Regional Seas Programmes, and financial capacity of governments and regional partners to sustain a new regional mechanism.

To ensure scientific and technical sustainability of the LME approach, the TDA/SAP methodology also needs updating to incorporate new scientific concepts and good practices in ICM, marine spatial planning, rights-based management and other ecosystem approaches, while also adjusting the methodology to ensure a shortened assessment period. Finally, there is also a need to align the LME approach with the ecosystem services concept of provisioning, regulating, cultural, and supporting ecosystem services, and their impact on human well-being and systematically integrate these concepts into the LME modules.

Introduction

Background to the study

The concept of large marine ecosystems (LME) has been used for more than 25 years to investigate the problems affecting the world's coastal and marine ecosystems and to formulate effective management interventions. Other approaches to marine and coastal management include the establishment of regionally based forums, such as conventions, regional economic organisations, and regional fisheries bodies (RFB). Sixty-four LMEs have been defined worldwide around the coastal margins of the Atlantic, the Pacific Ocean and the Indian Ocean. These areas account for 80% of the world's marine fish landings, but they are also subject to coastal pollution, nutrient overload, habitat degradation, overfishing, biodiversity loss, and climate change effects. Their contribution to the world economy is estimated at US$ 12.6 trillion annually (Sherman and Hempel, 2009).

The Regional Seas Programme (RSP), which is co-ordinated by UNEP, has formed a partnership with the LME approach. The RSP aims at using LMEs to translate its principles into concrete action. As opposed to the LMEs and LME projects, the geographical scope of regional seas action plans and/or conventions, regional economic organisations and regional fisheries bodies is mainly based on political and economic interests for cooperation. There are 38 Regional Seas Conventions and Protocols, and in a report to the Swedish Government in 2010, the Swedish Board of Fisheries identified 29 regional fisheries organizations (SBF, 2010). Out of these, two are global, twelve cover the Atlantic, one the Mediterranean and adjacent seas, four the Indian Ocean, and eight organisations cover the Pacific Ocean. In addition, there are numerous regional political and economic forums for cooperation.

Africa has a well-developed network of regional arrangements for political and economic cooperation, the African Union (AU) being the apex organisation. Within the remit of the AU, there are more than 30 organisations, often with overlapping mandates, and most countries are members of more than one. The political, monetary and economic organisations have increasingly expressed ambitions to participate in fisheries and aquaculture development in terms of policies, strategies and programmes, and some of them are closely linked to existing and emerging mechanisms for regional and sub-regional fisheries cooperation. In Asia, the South Asian Association for Regional Cooperation (SAARC), and the Association of Southeast Asian Nations (ASEAN) are the most prominent mechanisms for regional political and economic co-operation.

It is evident that is potential for overlapping and possibly conflicting responsibilities and approaches between these various initiatives. Unclear relations and mandates may result in a less than optimal use of resources and less than optimal measures to protect the marine environment and ensure sustainable use of natural resources.

Purpose of the study

The purpose of the study is to conduct an analysis of the Large Marine Ecosystem approach and its relevance for strengthening ecosystem-based management of the marine environment and marine resources as well as the relations, including potential conflicts and overlap, with other global or regional initiatives with similar ambitions. The study also examines the potential contribution of the LME approach to poverty eradication and to strengthening governance systems. The means to achieve this has so far mainly been through donor-funded projects, and this study will briefly review the impact these projects have had in achieving the aforementioned objectives. The study will also review the sustainability of the LME mechanism through regional agreements.

The conclusions and recommendations emanating from the study are intended to serve as guidance for future Swedish support to the protection of the marine environment and the sustainable use of natural resources in developing countries.

Recycled flip flops: a sustainable use of resources?

The Large Marine Ecosystem approach

Origin of the concept

The LME approach, first introduced in 1984 to investigate the problems affecting the world's coastal and marine ecosystems, has had a fundamental impact on how projects to address these problems are designed and funded. It was developed to provide a framework for utilizing ecologically defined LMEs as place-based areas around the globe, to focus the methods of marine science, policy, law, economics and governance on a common strategy for assessing, managing, recovering and sustaining marine resources and their environments. The physical extent of an LME and its boundaries are based on bathymetry, hydrology, productivity and trophic relationships (Sherman and Hempel, 2009).

Geographical coverage

Out of the 64 LMEs identified globally, the LME concept for ecosystem-based management is applied to 17 regional GEF-funded and/or World Bank funded projects in Africa, Asia, Latin America, and Eastern Europe (Sherman et al, 2009). These projects engage or have engaged more than 100 countries in their activities (Table 1).

In addition, the GEF recently allocated additional resources to support new LME projects in the West Bering Sea, Antarctic LME and Pacific Central-American Coastal LME.

Thematic coverage

The LME approach uses a five-module strategy for measuring the changing states of the ecosystem and for taking remedial actions toward recovery and sustainability of degraded resources and environments. The modules are focused on the application of suites of indicators measuring LME (1) productivity, (2) fish and fisheries, (3) pollution and ecosystem health, (4) socio-economics, and (5) governance.

Table 1. GEF-funded LME projects

LME	Number of countries	GEF funding (US$)	Duration
1. Aghulas and Somali Currents LME Project	9	12,920,000	2006-present
2. Baltic Sea LME	4*	5,850,000	2003-2007
3. Bay of Bengal LME Project	8	12,082,100	2005-present
4. Benguela Current LME	3	20,500,000	1995-present
5. Black Sea LME	6	11,820,000	1992-2006
6. Canary Current LME	7*	8,790,000	2007-present
7. Caribbean Sea LME	25*	9,710,000	2006-present
8. Guinea Current LME	16	26,000,000	1995-present
9. Gulf of Mexico LME Project	2*	4,970,000	2007-present
10. Gulf of Thailand and South China Sea LMEs	8	16,414,000	1996-2008
11. Humboldt Current LME	2	6,925,000	2009-present
12. Indonesia Sea LME/Arafura-Timor Seas	1/4	2,650,000	2008-present
13. Mediterranean Sea LME	11*	25,690,000	1998-present
15. Red Sea LME	7	19,340,000	1999-2005
16. Sulu-Celebes Sea LME	3	3,000,000	2008-present
17. Yellow Sea LME	2*	14,740,000	2000-present

*GEF-eligible countries

Application of the concept

The Global Environment Facility (GEF) was established in 1991 provide grants to developing countries and countries with economies in transition for projects related to biodiversity, climate change, international waters, land degradation, the ozone layer, and persistent organic pollutants. The GEF is today the largest funder of projects to improve the global environment. The GEF International Waters (IW) Focal Area was established to help countries work together to overcome tensions in large water systems.

One of the IW objectives in GEF's fifth replenishment phase is to: Catalyse multi-state cooperation to rebuild marine fisheries and reduce pollution of coasts and large marine ecosystems while considering climatic variability and change. This objective relates to GEF assistance to States for implementing agreed Strategic Action Programmes (SAPs) for LMEs and coasts.

The Strategy uses the LME as the unit of assessment and builds on a place-based transboundary diagnostic analysis (TDA) of priority transboundary issues (Duda, 2009, Pernetta & Bewers, 2012). The TDA uses the best available verified scientific information to examine the state of the environment, and the root causes/drivers for its degradation. It encompasses a causal-chain analysis that identifies information gaps, policy distortions and institutional deficiencies. Through step-wise consensus building, the TDA provides the technical and scientific basis for the logical development of a SAP that is based on a reasoned, holistic and multi-sectoral consideration of the problems associated with the state of and threats to transboundary water systems and resources. A key expected outcome of the LME approach and the GEF Strategy is institutions for joint ecosystem-based and adaptive management that has in some cases resulted in establishment of LME Commissions.

Methodology of the study

The study is carried out as a desk study using all relevant documentation from SBF, GEF, UNEP, FAO as well as project publications and evaluations. All projects have been reviewed based on the following criteria:

- Issues covered in the LME modular approach in selected LMEs.
- Common approaches taken by Projects in the LMEs, to address these concerns including the use of:

    i. Transboundary Diagnostic Analysis (TDA) and development of Strategic Action Programs (SAPs);
    ii. Integrated Coastal Management (ICM);
    iii. Ecosystem Approach to Fisheries (EAF);
    iv. Rights-based approaches to habitat and fisheries management (e.g., establishment of community-based fisheries refugia and limited entry fisheries) and
    v. Conservation-based approaches to habitat and fisheries management (e.g., establishment of marine protected areas).

- Existing regional coordination and/or governance mechanisms in the LMEs for management of coastal and marine resources through review of relevant literature
- A questionnaire survey circulated to relevant partners (see Annexes 1 & 2).

The next chapter is presenting selected case studies of GEF-supported LME projects to explore linkages with other approaches and governance arrangements as well as potential overlaps and conflicts. Case studies were selected in the Africa and Asia regions based on their relevance to Swedish development assistance. Within these regions, LMEs that have or are receiving GEF support were selected that display different levels of maturity and success in implementing the LME approach.

Case studies

East Asian Seas LMEs

The Seas of East Asia (EAS) are bordered by China, Japan and the Korean Peninsula in the north and the Southeast Asian nations in the south. The region harbours a significant part of the world's coral reefs and mangroves and also produces about 40 percent of the world's fish catch and more than 80 percent of aquaculture. The human pressure on marine and coastal resources is very high with approximately 2 billion people living in the region (PEMSEA, 2007). The EAS region encompasses a series of large marine ecosystems (LME), subregional seas and their coastal areas — six LMEs of great ecological and economic importance. Total GEF funding committed to the EAS region since its inception amounts to US$ 210.69 million, spread over almost 30 projects, which is equivalent to almost 20 percent of total GEF IW funding.[1] Five out of the EAS LMEs, Yellow Sea, Gulf of Thailand, South China Sea, Sulu-Celebes Sea, and sub-systems of the Indonesia Sea, have or are receiving GEF support to implement the LME approach (Tengberg & Cabanban, 2011). Other important regional mechanisms and programmes are listed below and also summaries in Table 2:

Partnerships in Environmental Management for the Seas of East Asia (PEMSEA) has been funded in successive phases by the GEF, through UNDP, since 1994. It has resulted in the adoption of the non-legally binding Sustainable Development Strategy for the Seas of East-Asia (SDS-SEA), which provides a framework of actions for achieving the goals of key international agreements and action plans related to coasts, islands and oceans. PEMSEA was established as an independent regional institution in 2009 mandated for the implementation of the SDS-SEA.

Coordinating Body on the Seas of East Asia (COBSEA) under UNEP's Regional Seas Programme, operates the "Action Plan for the Protection and Development of the Marine and Coastal Areas of the East Asian Region" (UNEP, 1983). The programme promotes compliance with existing environmental treaties and is based on member country goodwill (Kirkman, 2006).

ASEAN Ministerial Meeting on the Environment (ASOEN) is developing the ASEAN Charter to discuss environmental issues (Koh, 2007). This will be a rules-based approach that provides legal backing for solutions without interfering in the internal affairs of each country. **The ASEAN Center for Biodiversity (ACB)** was created in 2005 with the mandate to facilitate cooperation and coordination of conservation and sustainable use of biological diversity; and the fair and equitable sharing of benefits from sustainable use of natural resources.

[1] Note that some projects also received funding from other focal areas and the total IW funding therefore probably comes to around 18% of GEF total to the focal area.

Coral Triangle Initiative (CTI) officially launched a Regional Plan of Action in May 2009. The action plan has five overall goals covering priority seascapes, ecosystem approach to management of fisheries and other marine resources, marine protected areas, climate change adaptation and threatened species (CTI, 2009). The GEF is providing funding to the CTI in collaboration with the Asian Development Bank (ADB) and two LME projects are funded under the CTI: the Sulu-Celebes and the Arafura-Timor Seas projects.

Mangroves for the Future (MFF) was launched in December 2006, and focuses on the countries worst affected by the tsunami, including Indonesia and Thailand in the EAS region and MFF has also initiated dialogue with other EAS countries. The initiative uses mangroves as a flagship ecosystem, but also includes other coastal ecosystems, such as coral reefs, estuaries, lagoons, sandy beaches, seagrasses and wetlands.

Mangroves.

Brunei-Indonesia-Malaysia-Philippines East Asia Growth Area (BIMP-EAGA) has three focal areas for cooperation: facilitating free movement of people, goods, and services; making best use of infrastructure and natural resources; and taking fullest advantage of economic complementation.

Arafura-Timor Seas Expert Forum (ATSEF) was formed by Australia, Indonesia and Timor-Leste during the Preparatory Committee IV for the World Summit on Sustainable Development (WSSD) in June 2002. Papua New Guinea joined in October 2011.

Western and Central Pacific Fisheries Commission (WCPFC) was established by the Convention for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean which entered into force in 2004. Oceanic tuna stocks in the EAS are currently partially managed under the auspices of the WCPF Convention and the Commission.

Southeast Asian Fisheries Development Center (SEAFDEC) is an autonomous intergovernmental body established in 1967. SEAFDEC was mandated to develop the fisheries potential of the Southeast Asian region by rational utilization of the resources to provide food security to the people through transfer of new technologies, and to conduct research and information dissemination activities.

Asia-Pacific Fishery Commission (APFIC) was established in 1993 under the intergovernmental agreement as the Indo-Pacific Fisheries Council in 1948 by the Food and Agriculture Organization of the United Nations (FAO). It provides advice, coordinates activities and acts as an information broker to increase knowledge of fisheries and aquaculture in the Asia-Pacific region to underpin decision making.

Against this background, this report will focus on an in-depth analysis of the application of the LME concept in two GEF funded projects: the Gulf of Thailand (LME #35) and South China Sea (LME #36) project, and the Arafura-Timor Seas project that are at the intersection of the Indonesian Sea (LME #38) and the North Australian Shelf (LME #39).

Shipping outside a reef in the Pacific.

Gulf of Thailand and South China Sea

The South China Sea and the Gulf of Thailand are two distinct, but interconnected LMEs. Coastal waters are relatively shallow and are influenced by marine as well as river and terrestrial inputs. The South China Sea LME is particularly sensitive to the El Niño Southern Oscillation (ENSO), which can cause significant changes in rainfall patterns. The UNEP/GEF Project entitled Reversing Environmental Degradation Trends in the South China Sea and Gulf of Thailand was funded by the GEF and implemented by UNEP in partnership with seven riparian states bordering the South China Sea. Planning commenced in 1996 and the implementation phase lasted from 2002 to 2009. Based on a Transboundary Diagnostic Analysis (Talaue-McManus, 2000), the objective of the project was to elaborate and agree at an intergovernmental level on a Strategic Action Programme (SAP) encompassing specific targeted and costed actions for the longer-term, to address priority issues and concerns.

The TDA identified the following key environmental concerns:

- The loss and degradation of coastal habitats (coral reefs, seagrass, mangroves, and wetlands);
- Overexploitation of living aquatic resources;
- Land-based marine pollution; and
- Critical absence of regional agreements

A SAP was approved in 2008 and a follow-up project is pending ministerial level signing of the SAP. It is expected that the SAP will be implemented under the umbrella of COBSEA (Pernetta, 2009). Separate projects have been developed to implement the fisheries component of the SAP that integrates rights-based and area-based measures for fisheries and habitat management by establishing fisheries *refugia*.

As can be seen in Table 2, there is a complex overlap of mandates and geographical coverage between different initiatives and mechanisms in the EAS region. In particular, there has been a lack of synergies between the Regional Seas and South China Sea LME interventions, on the one hand, and the PEMSEA interventions, on the other. This is also reflected in lack of coordination at the national level between LME and Integrated Coastal Management (ICM) approaches in cases where there are different national partner agencies that do not interact, such as Ministries of Environment and Ministries of Marine Affairs and Fisheries (Tortell, 2009).

This division was re-emphasised by the questionnaire survey where COBSEA, formerly in charge of the Gulf of Thailand and South China Sea project, responded that governance arrangements in the EAS could be strengthened by establishing a regional coordination forum of all relevant bodies to meet once a year and chaired by alternating organisations. PEMSEA, on the other hand, responded that the EAS is already addressing this issue, having recognised PEMSEA and the SDS-SEA as the governance mechanism and regional framework strategy.

There is also a need to strengthen the coordination between regional fisheries commissions and technical partners in fisheries with mechanisms for coastal and marine management in the EAS. PEMSEA has initiated dialogue with WCPFC and SEAFDEC, but much remains to be done to better coordinate LME and ICM approaches with fisheries management. In the questionnaire survey, APFIC pointed out that many GEF programmes over-focus on environmental strategies that do not adequately engage fishery management and approach fishery management through a conservation/marine protected area (MPA) focus, which creates institutional blind spots/conflicts and results in poor adoption and compliance. SEAFDEC recommends that the focus is shifted from the ecosystem to assessment of key institutions, NGOs and community groups and other that need to be involved to ensure a sufficiently stable platform for interventions. WCPFC points out that projects and research is often focused on the symptoms rather than the cause of management issues and that funding and capacity are the two most pertinent constraints.

Traditional fisheries.

Indonesian Sea – Arafura and Timor Seas

The tropical and semi-enclosed Arafura and Timor Seas (ATS) are located at the intersection of the two major LMEs, the Indonesian Seas to the north and northern Australian waters to the south, and form an integral part of the Coral Triangle. The Indonesia Sea LME is situated at the confluence of the Pacific and Indian Oceans and is bordered by Indonesia and Timor-Leste. It is an engine of global atmospheric circulation with complex ocean-atmospheric dynamics, including the ENSO phenomenon. The Indonesian Throughflow, a warm-water current flowing from the Pacific into the Indian Ocean, crosses the north-western part of this LME and plays a vital role in driving the world's climate system.

Timor-Leste.

A UNDP/GEF project entitled 'Arafura and Timor Seas Ecosystem Action Programme' (ATSEA) was approved under the CTI and started implementation in 2009. It initially involved only Indonesia, Timor-Leste and Australia, but Papua New Guinea joined in late 2011. The objective of the project is to ensure integrated, cooperative, sustainable, ecosystem-based management and use of the living coastal and marine resources, including fisheries and biodiversity, of the ATS, through the formulation, intergovernmental adoption and initial implementation of a regional SAP.

This will be achieved through four interrelated components: (1) development and approval of a TDA, (2) development and approval of a SAP, (3) initial implementation of the SAP and (4) development and strengthening of the Arafura-Timor Seas Expert Forum

(ATSEF) as a regional cooperative mechanism for ecosystem-based management of the ATS.

The ATSEA TDA was approved in February 2012 (ATSEA, 2012) and includes the following key environmental concerns:

- Unsustainable fisheries and decline and loss of living coastal and marine resources
- Modification, degradation and loss of coastal and marine habitats
- Marine and land-based pollution (e.g. marine debris, sediments, oil spills)
- Decline and loss of biodiversity and key marine species
- Impacts of climate change including ocean warming and ocean acidification

A SAP is expected to be finalised and approved late in 2012 and as in the case with the Gulf of Thailand and South China Sea, it should take into consideration the need to strengthen collaboration and coordination at two levels (Table 2):

- Enhanced vertical coordination between different governance levels is required, i.e., between regional mechanisms with a mandate to work with all countries in the EAS, such as PEMSEA and COBSEA, ASOEN, and the RFBs, and sub-regional mechanisms focused on a particular LME, such as ATSEF;
- Enhanced intersectoral coordination between mechanisms with different mandates, which could include strengthened collaboration between ICM and LME related mechanisms, and regional fisheries management bodies, such as SEAFDEC and WCPFC.

Results of EAS case study

Evidence from the questionnaire survey indicates that there are some existing or planned initiatives in the EAS to strengthen cooperation and coordination between LME programmes, Regional Seas Programmes and RFBs, but each body is listing different initiatives pointing to the overall lack of coordination. PEMSEA mentions a programme to strengthen collaboration with ATSEA and WCPFC, while COBSEA mentions programmes on sea level rise and coastal erosion with LMEs in the region as well as on marine litter. WCPFC highlights collaboration on management of tuna, and APFIC on reduction of bycatch. APFIC and SEAFDEC collaborate with COBSEA on the South China Sea. SEAFDEC also mentions regional collaboration to combat Illegal, Unreported and Unregulated (IUU) fishing. ATSEA reports collaboration with CTI.

Recommendations for how to strengthen coordination and collaboration between LME and ICM initiatives, Regional Seas Programmes and RFBs in the EAS region include:

- Have mandatory cross invitations between RFBs, RSPs, LMEs and parallel bodies to relevant meetings and workshops (COBSEA)
- Combine regional events, such as the EAS Congress, APFIC's Regional Conference, etc. (UNDP)
- Improve donor coordination (PEMSEA)
- Plan for joint research (ATSEA)
- Build of a cadre of fishery managers capable of applying EAF (APFIC)
- Regional, sub-regional and transboundary cooperation need to be built around the needs and institutional setting in a given location and not on a precooked model (SEAFDEC).

Table 2.
Transboundary Issues Addressed by Regional Mechanisms in the EAS relevant to the Gulf of Thailand and South China Sea and the Arafura-Timor Seas.

Transboundary issue addressed by Regional Body/ programme	Water pollution/ eutrophication	Loss of habitat & bio-diversity	Overexploitation of fisheries		Climate Change impacts	Invasive Species	Targeted Research/ Other (specify)	Member Countries (in East Asia)
			Coastal	Oceanic/ Highly migratory				
1. Regional EAS Mechanisms								
PEMSEA	x	x	x		x	x	x/oil spill preparedness and response and compensation for damage	Cambodia, China, DPR Korea, East Timor, Indonesia, Japan, Lao PDR, Philippines, RO Korea, Singapore, Thailand, Viet Nam
Regional Seas Programme: COBSEA	x	x	x		x	x		Australia, Cambodia, China, Indonesia, RO Korea, Malaysia, Philippines, Singapore, Thailand, Viet Nam
ASEAN (ASOEN)	x	x						Brunei Darussalam, Cambodia, Indonesia, Lao PDR, Malaysia, Myanmar, Philippines, Singapore, Thailand, Viet Nam
ASEAN - ACB		x			x		taxonomy, endangered species	Brunei Darussalam, Cambodia, Indonesia, Lao PDR, Malaysia, Myanmar, Philippines, Singapore, Thailand, Viet Nam
CTI Regional Secretariat/SOM		x	x	x	x			Indonesia, Malaysia, Papua New Guinea, Philippines, Solomon Islands, Timor-Leste
MFF (Mangroves For the Future)		x			x			India, Indonesia, Maldives, Seychelles, Sri Lanka, and Thailand.
2. Subregional/LME Mechanisms								
ATSEF		x	x		x			Indonesia, Timor-Leste, Australia
BIMP-EAGA			x					Brunei, Indonesia, Malaysia, Philippines
3. Regional Fisheries Bodies								
WCPFC				x	x		x	Countries in South China Sea and Arafura-Timor Seas: China, Indonesia (joined in 2011), Papua New Guinea and the Philippines. Viet Nam has observer status.
APFIC			x	x				Asia-Pacific
SEAFDEC		x	x					Brunei Darussalam, Cambodia, Indonesia, Japan, Lao PDR, Malaysia, Myanmar, the Philippines, Singapore, Thailand, Viet Nam

South Asia

The South Asian Regional Seas area includes one LME – the Bay of Bengal Large Marine Ecosystem (LME #34). The countries around the Bay of Bengal belong to the most densely populated countries in the world. Twenty-five percent (1.8 billion) of the world's population lives in the countries surrounding the bay, and 450 million live in the coastal zone. The use of living aquatic resources is highly important for livelihoods of costal populations and for nutrition, with fish being the main source of animal protein.

There is no region-wide arrangement for collaboration between the Bay of Bengal countries, the region being divided in a west and an east sub-region (Table 3). There are two major political and economic organisations; competition between them may deter region-wide collaboration. These are for the western part **SAARC (South Asian Association for Regional Cooperation)** in which Bangladesh, India, Sri Lanka and Maldives are members, and **ASEAN (Association of Southeast Asian Nations)** covering the eastern part of the bay. In the western part the **BOBP-IGO (Bay of Bengal Programme –Inter-Governmental Organization)** with the same members as SAARC, has the ambition to develop into a fisheries management organization and an extended membership.

SEAFDEC also has a limited mandate (biodiversity and coastal fisheries). **PEMSEA** and **COBSEA** have only one member from South Asia and are thus not relevant for regional or sub-regional collaboration. **APFIC** which works to improve understanding, awareness and cooperation in fisheries issues in the Asia-Pacific region, is an important platform for dialogue between the countries but has no mandate to provide concrete collaborative measures for joint management. The ongoing GEF funded **BOBLME (Bay of Bengal Large Marine Ecosystem) Project** has a mandate to elaborate on and promote the establishment of region-wide collaborative arrangements for the marine environment and fisheries.

Table 3.
Transboundary Issues Addressed by Regional Mechanisms in the South Asia as relevant to the Bay of Bengal

Transboundary issue addressed by Regional Body/ programme	Water pollution/ eutrophication	Loss of habitat & bio-diversity	Overexploitation of fisheries		Climate Change impacts	Invasive Species	Targeted Research/ Other (specify)	Member Countries (in South Asia)
			Coastal	Oceanic/ Highly migratory				
1. Regional EAS Mechanisms								
PEMSEA	x	x	x		x	x	x/oil spill preparedness and response and compensation for damage	Thailand,
Regional Seas Programme: COBSEA	x	x	x		x	x		Thailand
ASEAN (ASOEN)	x	x						Malaysia, Myanmar, Thailand, Indonesia
ASEAN - ACB		x			x		taxonomy, endangered species	Malaysia, Myanmar, Thailand, Indonesia
MFF (Mangroves For the Future)		x			x			India, Indonesia, Maldives, Sri Lanka, and Thailand.
2. Sub regional/LME Mechanisms								
ATSEF		x	x		x			Indonesia
BIMP-EAGA			x					Indonesia, Malaysia,
3. Regional Fisheries Bodies								
APFIC			x	x				Asia-Pacific
SEAFDEC		x	x					Indonesia, Malaysia, Myanmar, Thailand
BOBP-IGO	(x)		x	x				Bangladesh, India, Maldives and Sri Lanka

Bay of Bengal LME

The Bay of Bengal Large Marine Ecosystem (BOBLME) consists of the bay itself, the Andaman Seas and the Straits of Malacca. For the sake of the BOBLME Project it was extended to include also the EEZ of Maldives. Its total area is 6.2 km², of which 4.3 km² is EEZs, the remaining (1.9 km²) high seas. The primary production is generally low, except in coastal areas, deltas and rivers. Fisheries produce some 6 million tonnes per year (note that the statistical evidence for the figure is weak). There are 4.5 million people employed in the fishing industry and the number of fishers is 2.2 million working on an estimated 415 000 fishing boats. The value of the fisheries production is US$ 4 billion. A large portion of fishing households are poor and the 50% of the world's coastal poor people live in BOBLME countries. The countries are prone to natural disasters, with frequent cyclones and earthquakes. The tsunami 2004 caused severe damage to lives and livelihoods in the region.

Myanmar, Bangladesh and India and to a lesser extent Thailand have large mangrove areas, with Sundarbans in India and Bangladesh being the largest. Coral reefs are important ecosystems in India, Maldives, and Myanmar and to a lesser extent in Indonesia and Thailand.

The Bay of Bengal Large Marine Ecosystem Project was initiated in 1995 through a request by the then Bay of Bengal Programme. The formulation of the project took time and when it was ready for implementation the tsunami hit the region, diverting the focus of the Governments and international community to disaster relief and rehabilitation. The project was slightly reformulated to incorporate actions triggered by the tsunami (mainly climate change) and the FAO/GEF project became operational in 2009. The TDA was concluded and adopted by the countries through the Project Steering Committee in March 2012 and the SAP formulation process was formally initiated at the same time.

The TDA identifies three main problem areas:

- Overexploitation of marine living resources
- Degradation of mangroves, coral reefs and seagrass
- Pollution

There has been a decline in the overall availability of fish resources in the region and changes in the composition of catches. Further evidence of overexploitation is a high proportion of juveniles in the catches and changes in biodiversity. Many of the fish stocks in the region are shared between two or more countries, especially hilsa (shad) in the north (India, Bangladesh and Myanmar) and Indian mackerel which seems to be shared by all countries except Maldives (note that there may be uncertainties in the taxonomy of Indian mackerel, which may influence its transboundary nature). Also fishing overlaps the fixed borders between countries, both legally and illegally. Overcapacity and overfishing result in migration of fishers and fishing capacity. Fisheries management and implementation of management measures are weak in most countries and the statistical evidence for deciding on management measures is generally unreliable. Several countries have legally limited access

rights to fisheries resources through licensing. However, these systems can often not be implemented because of the pressure of rapid population increase and marginalization of coastal populations. There is a high and rising demand for fish in the region and in major export markets which is also a driving force (cause) for overexploitation.

Polluted mangroves.

Degradation of critical habitats are most obvious with regard to mangroves, coral reefs and seagrass areas. The transboundary dimension of this problem is that all habitats exist in all countries and the Sundarbans is shared between India and Bangladesh. Similar coastal developments in all countries threaten the critical habitats. Also potential climate change impacts are shared between the countries. Population increase and food security for coastal poor populations increases the pressure on critical habitats as well as commercial development of shrimp farming and tourism. Most countries have legislation on place to protect critical habitats, but face problems in implementation.

There are a number of important pollution issues in the Bay of Bengal: sewage-borne pathogens and organic load, solid waste/marine litter, increasing nutrient inputs, oil pollution, POPs and PTSs, sedimentation and heavy metals. This is a transboundary issue, mainly through the spread of pollutants through currents. Increasing coastal populations, industrialization and intensification of agricultural production are major causes for the situation.

Results of Bay of Bengal case study

The BOBLME project seems to effectively exercise its mandate to promote the establishment of region-wide collaborative arrangements for the marine environment and fisheries, and has already at mid-term established collaboration in the following areas:

- Development of arrangements with regional bodies to lead the regional fisheries management forums for the project's focus species, e.g. BOBP-IGO for hilsa; SEAFDEC & BOBP-IGO for Indian mackerel
- Collaboration with Mangrove for the Future on communications and training
- Collaboration with IUCN Sri Lanka on ICM practices and IUCN Bangladesh on MPAs
- Collaboration with Wetlands, CORIN-Asia on Myeik Archipelago work
- Collaboration with IOSEA on sea turtles
- Collaboration with UNEP-GPA on pollution
- Collaboration with UNEP and SAARC Coastal Zone Management Centre on coral reef monitoring

APFIC and SEAFDEC also indicate that they collaborate with the BOBLME project. In additions to recommendations for strengthening of collaboration given by APFIC and SEAFDEC under the EAS section, it was suggested that collaboration could be further strengthened through more communication between project and portfolio managers working in fisheries, ecosystems, coastal management, pollution and habitat protection.

It was also suggested that improved communications within and between governments and investing in building the capacity of the next generation of managers would strengthen the future governance arrangements for the BOBLME. However, according to the mid-term evaluation of BOBLME (FAO, 2012), there seems at present not to be any political interest in the region to establish a region-wide mechanism. The BOBLME project is instead at present supporting sub-regional and bi-lateral arrangements, with the project coordinating unit providing the platform for regional dialogue and collaboration. It is anticipated that there will be need for a project also after the present phase of BOBLME to provide the regional glue for sub-regional collaboration with a longer term ambition to create a regional organisation.

West and Central African LMEs

The coastal countries from Mauritania to Namibia contain highly productive and diverse ecosystems supporting rich fisheries, coastal tourism, industries and busy ports. In recent decades coastal ecosystems have suffered greatly from rapid development, unsustainable use of resources, extensive pollution and loss of habitats. These trends are likely to be further exacerbated by climate change. The region contains three LMEs - the Canary Current (LME #27), the Guinea Current (LME #28) and the Benguela Current (ME #29) that are all supported by GEF projects and therefore have been selected as case studies for this report. Relevant regional and sub-regional mechanisms for management of the coastal and marine environment in West and Central Africa, including fisheries, are listed below and also summaries in Table 4:

New Partnership for Africa's Development (NEPAD) Environment Initiative and Coastal and Marine Programme area (COSMAR) focuses on coastal erosion, tourism, sustainable use of living resources, pollution and management of key habitats. NEPAD is a programme of the African Union (AU) that is also linked to the Southern African Development Community (SADC) and the Economic Community of West African States (ECOWAS).

The Regional Seas Programme for West and Central Africa Region (WACAF) was forged in the early 1980s followed by the adoption of the West and Central African Action Plan and the **Abidjan Convention**. The priority issues covered by WACAF include: land-based sources of pollution, coastal erosion, habitat loss and endangered species, exploitation o fisheries, atmospheric pollution, and climate change and sea-level rise.

Benguela Current Commission (BCC) was established in 2007 and has a mandate to promote the integrated management, sustainable development and protection of the BCLME. The Commission is focused on the management of shared fish stocks, the assessment and monitoring of the physical environment, the establishment of an ecosystem information system, and the cooperative management of biodiversity and ecosystem health.

Interim Guinea Current Commission (IGCC) was established in 2010 through the adoption by GCLME countries of the Osu Ministerial Declaration and given the mandate to promote the implementation of the GCLME SAP.

Fishery Committee for the Eastern Central Atlantic (CECAF) acts as and advisory body and promotes the sustainable utilization of the all living marine resources within its area of competence by the proper management and development of fisheries and fishing operations.

Ministerial Conference on Fisheries Cooperation among African States bordering the Atlantic Ocean (COMHAFAT) covers all living marine resources within its area of competence. It promotes cooperation in the area of fisheries management and development.

Sub-regional Fisheries Commission (SRFC) covers all fisheries within its area of competence. Its main objective is to harmonise the long-term policies of member States in the preservation, conservation and exploitation of fisheries.

Fishery Committee for the West Central Gulf of Guinea (FCWC) area of competence comprises all marine waters under national jurisdiction of the member countries. It promotes cooperation with a view to ensuring the conservation and optimal utilisation of living marine resources.

Regional Fisheries Committee for the Gulf of Guinea (COREP) was established by the Convention Concerning the Regional Development of Fisheries in the Gulf of Guinea to cover all living marine resources within the area of competence, but the convention has not entered into force.

International Commission for the Conservation of Atlantic Tunas (ICCAT) – its area of competence comprises all waters of the Atlantic Ocean, including the adjacent seas. It main objective is to maintain the populations of tuna and tuna-like species found in the Atlantic, but it has no regulatory powers.

South East Atlantic Fisheries Organisation (SEAFO) covers all fishery resources within the convention area, excluding highly migratory species. The objective is to ensure the long-term conservation and sustainable use of the fishery resources in the convention area.

The role of the respective mechanisms and relevance in implementation of the LME approach is analysed further in the case studies.

Canary Current LME

The Canary Current Large Marine Ecosystem (CCLME) extends southwards from the Atlantic coast of Morocco to the Bijagos Archipelago of Guinea Bissau and westwards to the Canary Islands (Spain) and following the western extent of the North West African continental shelf (corresponding approximately with the EEZs of the coastal states). The countries within the recognized limits of the CCLME are Spain (Canary Islands), Morocco, Mauritania, Senegal, The Gambia and Guinea Bissau. Cape Verde and the waters of Guinea are considered adjacent areas within the zone of influence of the CCLME.

The Canary Current LME is one of the world's major boundary current systems with cold water upwelling, ranking third in the world in terms of primary productivity after the Humboldt and Benguela LMEs and having the highest fisheries production of any African LME (annual production ranges from 2 to 3 million tonnes). The CCLME also provides important ecosystem goods and services including provision of habitat for fish and other coastal species, supply of fresh water from coastal rivers and estuaries, wood from mangroves and provision of coastal and marine space for agriculture, aquaculture, urban development, tourism and transport. The CCLME is a vital food and economic resource not only for coastal populations bordering the LME, but also for much of West Africa and beyond.

The CCLME UNEP/FAO/GEF project started in 2009 after a preparatory phase of two years. According to its preliminary TDA, there are three main domains of trans-boundary issues affecting the CCLME – declining fisheries, habitat modification and changes in water quality:

- Declining fisheries and changes in ecosystem - declining or vulnerable small pelagic resources, declining demersal finfish fisheries, decline and vulnerability of elasmobranchs (sharks & rays), decline of marine turtles, decline of cetaceans and uncertain status of tuna resources;
- Habitat modification - disappearance and destruction of mangroves, degradation and
- modification of seabed habitat and seamounts, degradation and modification of wetlands (*sensu* Ramsar: coastal zones, coral reefs, estuaries);
- Declining water quality – changing salinity upstream of river mouths, hydrocarbon pollution (actual or threatened), eutrophication of coastal waters, alien invasive species, sediment mobilisation in water column and toxicity from pesticides.

The synthesis and detailed results of the Preliminary TDA have contributed to the formulation of a Preliminary Strategic Action Plan ('Pre-SAP') and to the design of the main components and specific activities of the CCLME project itself.

Seabirds in the Canary Current LME, northen Senegal.

Guinea Current LME

The Guinea Current Large Marine Ecosystem is one of the world's most productive marine and coastal areas, with rich fishery resources, oil and gas reserves, precious minerals, and high coastal tourism potential. It is shared by 16 riparian countries and is an important global reservoir of marine biological diversity. The total economic value of the environmental goods and services provided by the GCLME's coastal and marine resources is estimated to be some US$18 billion per year. The environmental goods and services of this shared resource support the livelihoods of approximately 40 percent of the region's 350 million people in proximity of, and dependent upon the fisheries and other coastal and marine resources.

The GCLME has received GEF support through UNEP and UNIDO since 1995, when a pilot project was approved for the GCLME with only five out of the 16 riparian states participating. More recently, UNDP and FAO have also joined as partners in the GCLME/IGCC.

A TDA was finalised after a second phase of funding and identifies three priority environmental concerns (GCLME, 2006):

- Decline in GCLME fish stocks and non-optimal harvesting of living resources
- Loss of ecosystem integrity (changes in community composition, vulnerable species and biodiversity, introduction of alien species) and yields in a highly variable environment including effects of global climat change
- Deterioration in water quality (chronic and chatastrophic) from land and sea-based activities, euthrophication and harmful algal blooms
- Habitat destruction and alteration including inter-alia modification of seabed and coastal zone, degradation of coastscapes, coastline erosion.

The SAP was endorsed by member countries in 2008 and re-affirms regional joint commitment to an ecosystem based approach for the integrated management, the protection and use of the resources of the GCLME and their sustainable development by the people of the sixteen riparian countries (GCLME, 2008). This regional joint commitment has also been reaffirmed in the Abuja Ministerial Declaration (2006) and the Osu Declaration (2010) in which the GCLME countries agree to institutionalize regional cooperation by the creation of a technical Interim Guinea Current Commission.

Table 4.
Transboundary Issues Addressed by Regional Mechanisms in the West and Central African LMEs

Transboundary issue addressed by Regional Body/ programme	Water pollution/ eutrophication	Loss of ecosystem integrity and bio-diversity	Overexploitation of fisheries		Loss of coastal and marine habitats	Climate Change impacts	Other (specify)	Member Countries (in West and Central Africa)
			Coastal	Oceanic/ Highly migratory				
1. Regional Mechanisms								
AU – NEPAD/COSMAR	x	x	x	x	x	x	Coastal erosion Tourism	Africa regional
WACAF (Abidjan Convention)	x	x	x	x	x	x	Coastal erosion Atmospheric pollution	Angola, Benin, Cameroon, Cape Verde, Congo, Democratic Republic of the Congo, Cote d'Ivoire, Equatorial Guinea, Gabon, Gambia, Ghana, Guinea, Guinea-Bissau, Liberia, Mauritania, Namibia, Nigeria, Sao Tome and Principe, Senegal, Sierra Leone, South Africa, Togo
2. LME Mechanisms								
BCC	x	x	x		x	x	Harmful algal blooms	Angola, Namibia, South Africa
Interim GCC	x	x	x		x	x		Angola, Benin, Cameroon, Congo, Democratic Republic of the Congo, Cote d'Ivoire, Gabon, Ghana, Guinea, Equatorial Guinea, Guinea-Bissau, Liberia, Nigeria, Sao Tome and Principe, Sierra Leone, Togo

Table 4.
Transboundary Issues Addressed by Regional Mechanisms in the West and Central African LMEs

Transboundary issue addressed by Regional Body/ programme	Water pollution/ eutrophication	Loss of ecosystem integrity and bio-diversity	Overexploitation of fisheries		Loss of coastal and marine habitats	Climate Change impacts	Other (specify)	Member Countries (in West and Central Africa)
			Coastal	Oceanic/ Highly migratory				
3. Regional Fisheries Bodies								
CECAF			x	x				Angola, Benin, Cameroon, Cape Verde, Congo, Côte d'Ivoire, Democratic Republic of the Congo, Equatorial Guinea, Gabon, Gambia, Ghana, Guinea, Guinea-Bissau, Liberia, Mauritania, Morocco, Nigeria, Sao Tome and Principe, Senegal, Sierra Leone, Togo
COMHAFAT			x	x			Socio-economic development	Angola, Benin, Cameroon, Cape Verde, Congo, Côte d'Ivoire, Democratic Republic of the Congo, Equatorial, Guinea, Gabon, Gambia, Ghana, Guinea, Guinea-Bissau, Morocco, Mauritania, Nigeria, Senegal, Sierra Leone, Togo
SRFC			x	x				Cape Verde, Gambia, Guinea, Guinea-Bissau, Mauritania, Senegal
FCWC			x	x				Benin, Côte d'Ivoire, Ghana, Liberia, Nigeria, Togo
COREP			x	x				Congo, Democratic Republic of the Congo, Gabon, Sao Tome and Principe.
ICCAT				x				Angola, Cape Verde, Côte d'Ivoire, Equatorial Guinea, Gabon, Ghana, Guinea, Namibia, Nigeria, Sao Tome and Principe, Senegal, South Africa
SEAFO			x					Angola, Namibia, South Africa

Benguela Current LME

The Benguela Current Large Marine Ecosystem extends from the Agulhas Bank to the Angola front at the latitude of the Congo River with a zone of upwelling extending from the Cape of Good Hope to the Angola/Benguela Front. The BCLME has been severely impacted by a long history of industrial fishing and recently by marine diamond mining and offshore petroleum exploitation. It is one of the most dynamic, variable and unpredictable of the eastern boundary current LMEs, subject to Benguela Niños, Low Oxygen Water events and Harmful Algal Blooms. The BCLME is of great socioeconomic importance to the coastal states sharing this transboundary water body, i.e. Angola, Namibia and South Africa. The GEF, through UNDP, has provided funding to the BCLME since 1998 to enable the development of a TDA and a SAP and also funded the initial implementation of the SAP and the establishment of the BCLME Commission.

The BCLME TDA (UNDP, 1999a) as well as the SAP (UNDP, 1999b) was finalized in 1999 and the TDA includes the following priority environmental concerns:

- Decline in BCLME commercial fish stocks and non-optimal harvesting of living resources
- Uncertainty regarding ecosystem status and yields in a highly variable environment
- Deterioration in water quality – chronic and catastrophic
- Habitat destruction and alteration, including inter alia modification of seabed and coastal zone, and degradation of coastscapes
- Loss of biotic integrity and threat to biodiversity/endangered and vulnerable species
- Inadequate capacity to assess ecosystem health (resources and environment, and variability thereof)
- Harmful algal blooms

The Benguela Current Commission was established in 2007 and has a mandate from Angola, Namibia and South Africa to promote the integrated management, sustainable development and protection of the BCLME. The Benguela Current Commission provides a vehicle for the three countries to introduce an ecosystem approach to the management of the BCLME. The Commission is focused on the management of shared fish stocks, the assessment and monitoring of the physical environment, the establishment of an ecosystem information system, and the cooperative management of biodiversity and ecosystem health.

Results from West and Central Africa case study

Responses from the questionnaire survey are summarised in Table 5. It is interesting to note that the BCLME/BCC, which is the most mature of the LME Programmes/mechanisms also diplays the highest level of collaboration with partners in the region and beyond. The BCC collaborates with AU/NEPAD, SADC, the Regional Seas Programme (Abidjan Convention), and the Orange-Senque River Commission (ORASECOM), as well as with foreign donors and programmes, such as the EAF Nansen programme funded by Norway, and has research collaboration with Denmark and the United States.

The GCLME/IGCC has initiated collaboration with some of the many regional fisheries bodies that cover the LME, such as CECAF, FCWC and COREP. It is also collaborating on other transboundary priority issues, such as ballast water and oil spill management. The CCLME programme, which is the most recent LME initiative in the the region, collaborates on fisheries management, MPAs and mangrove conservation, but so far seems to have fewer formal agreements with other initiaitves in the region.

A number of suggestions were made for how to further improve transboundary collaboration and governance. Improved information flows were considered essential for transboundary collaborative management creating conditions for harmonisation of planning, management and management frameworks among states. Regional bodies, such as SADC, ECOWAS and AU/NEPAD could take the lead in linking similar initiatives in the region and establish an online database. Involving young people and the private sector was also considered important to strengthen the future governance of the LMEs. In addition, CECAF suggested that EAF should be incorporated into management efforts in a more comprehensive way.

Table 5. Summary of West and Central Africa case study results.

Mechanism/ Programme	Existing and planned collaboration	Ways of further improving collaboration and strengthen governance
CCLME	▪ Management of shared small pelagic stocks ▪ Bycatch reduction of coastal shrimp trawling ▪ Transboundary co-management of migratory coastal species ▪ Demonstration of MPAs ▪ Regional mangrove conservation plan	▪ Establishment of cooperation mechanisms between LME projects ▪ Review existing programmes and increase material and human resources ▪ Sensitise policy makers to respond to their commitments - a gap exists between what has been agreed in policies and legislation and the definition of responsibilities, tasks and expected objectives ▪ Promote initiatives in the context of EAF ▪ Encourage projects to host young researchers ▪ Improved procedures for information flows ▪ Strengthened involvement of the private sector
GCLME/ IGCC	▪ MOU for joint programming with COREP ▪ MOU for joint programming with FCWC ▪ Establishment of Platform for Fisheries for GCLME ▪ MOU with FAO for fisheries ▪ LOA with IMO for Ballast Water Management and Oil Spill Contingency Planning ▪ Joint programming with IPIECA on Oil Spill Prevention and response ▪ Coordination with Gulf of Guinea Commission on Security and Socioeconomic development ▪ MOU with CECAF	▪ Use the LME concept to ensure intersectoral coordination and its implementation through LME-based Commissions ▪ The BCC governance model of country driven and ultimately resourced LME institutions will improve governance and strengthen ecosystem-based approaches
BCLME/ BCC	▪ Chair of the Africa LME Caucus, which includes collaboration on ocean governance, research and scientific work, co-financing of activities of common ▪ Sub-regional implementation partner for the AU/NEPAD Fisheries Programme funded by Sida ▪ Sub-regional implementation partner for the SADC Protocol on Fisheries and relevant aspects of the Protocol on Shared Watercourses ▪ Collaboration with ORASECOM on improving health of the Orange River Mouth estuary ▪ Collaboration with the Namibia Coast Conservation and Management (NACOMA) Project on linking the LME to the coastal zone ▪ Networking with the other three eastern boundary upwelling currents in the world ▪ Sub-regional implementation partner for the Abidjan Convention ▪ Partnership with Norway for the implementation of the BCC Science Programme ▪ Partnership with ICEIDA for the implementation of the BCC Training and Capacity Building Strategy ▪ Partnership with Danish Technical University on scientific research ▪ Partnership with EAF Nansen Project and with WWF ▪ Partnership with International Knowledge Management for implementation of BCC Stakeholder Involvement Plan ▪ Partnership planned with NOAA to improve ocean and climate monitoring and assessment	▪ Regional bodies, such as SADC and AU/NEPAD should take the lead in identifying all similar organisations/institutions/projects/ initiatives in the regions and facilitate linking them through an online database ▪ Harmonisation of planning, management and policy frameworks among states is essential. In addition, an agreement to share and exchange information and data will form the basis for transboundary collaborative management.

The contribution of the LME approach to ocean governance

Establishment of LME Commissions

The LME approach can result in considerably improved cross-sectoral coordination and collaboration on coastal and marine management when there are long-term commitments from countries to establish LME-based institutions, such as the Benguela Current Commission and Interim Guinea Current Commission. However, when this kind of commitment is lacking, as in the case of the Gulf of Thailand and South China Sea LMEs, confusion and conflicts about regional institutional mandates can ensue, illustrated by the differing perspectives given by PEMSEA and COBSEA on how to improve coordination and collaboration on coastal and marine management in the EAS.

The ATSEA, BOBLME and CCLME have more recently embarked on the process of institutionalising the LME approach and have to make choices about whether to establish stand-alone LME Commissions or to embed them within existing institutional frameworks. For example, the ATSEA is planning to strengthen the already existing Arafura and Timor Seas Expert Forum (ATSEF); the BOBLME may follow another approach given the lack of enthusiasm to create a region-wide mechanism in the BOBLME, while the CCLME may well follow the BCC model, which is already being extended to the IGCC. The West and Central Africa region will thus host the world's first two LME Commissions.

Yet another model for strengthening governance of LMEs is provided by the UNDP/GEF-funded Yellow Sea LME (YSLME) project, which has not been analysed in detail in this report. However, the YSLME is planning to capitalise on the policy and institutional framework established by PEMSEA and the recognition by EAS countries in 2009 of PEMSEA as an institution with its own legal personality, to establish a Commission for the YSLME based on a non-legally binding agreement (Zavadsky et al., 2011). This approach has been designed to overcome the reluctance of countries to transfer national sovereign rights to regional bodies, and may result in the establishment of the world's third LME Commission.

Aquaculture, Yellow Sea.

Examples of other approaches to strengthening LME governance includes the Aghulas-Somali Current LME project that is establishing a West Indian Ocean Sustainable Ecosystem Alliance (WIOSEA) that is expected to act as a coordinating platform for implementation of the future SAP (ASCLME, 2010). The Baltic Sea LME worked with three existing institutions - HELCOM (the Helsinki Commission), the International Baltic Sea Fishery Commission (IBSFC), and the International Council for Exploration of the Sea (ICES) - to promote sustainable ecosystem management at the LME level.

Synergies and potential conflicts between the LME approach and other regional bodies with a mandate in ocean and fisheries governance

The LME approach as well as the Regional Seas Programme are both promoting a cross-sectoral approach to coastal and marine management and thus go beyond the more sectoral mandate of RFBs that have fisheries as their main focus, and often cover vast areas that include several LMEs. LME programmes, such as the GCLME, are establishing regional fisheries platforms and are entering into agreements for collaboration with relevant RFBs. This type of partnerships should be encouraged, as the RFBs bring expertise and information on fisheries necessary for effective implementation of fisheries components of SAPs. The RFBs, in turn, will benefit from being part of initiatives that remove cross-sectoral threats to fisheries in a collaborative and participatory manner. The need to strengthen coordination and collaboration on coastal fisheries was also identified as the top priority, together with climate change, in the questionnaire survey (Figure 1).

As was illustrated by the EAS case study, efforts to establish new LME-based institutions have not always been successful, and regional, sub-regional and transboundary cooperation need to be built around the needs and institutional setting in a given location.

The UNEP Large Marine Ecosystems Report (Sherman and Hempel, 2009) is a welcome sign of closer integration between the LME and RS programmes. However, GEF-supported LME projects could still be better mainstreamed in regional seas agendas and programmes of work to ensure better coordination and harmonisation at regional level. GEF's own Monitoring and Evaluation Unit (GEF, 2005) has criticized GEF IW projects for failing to conduct careful analysis of stakeholders, institutional capacities and responsibilities. This has sometimes led to difficulties in strategic planning and effective operationalization of projects at later stages, which could partly explain the long period it has taken for many LME programmes to move from assessment and diagnosis of environmental problems (up to 20 years according to Table 1) to implementation of cross-sectoral remedial actions.

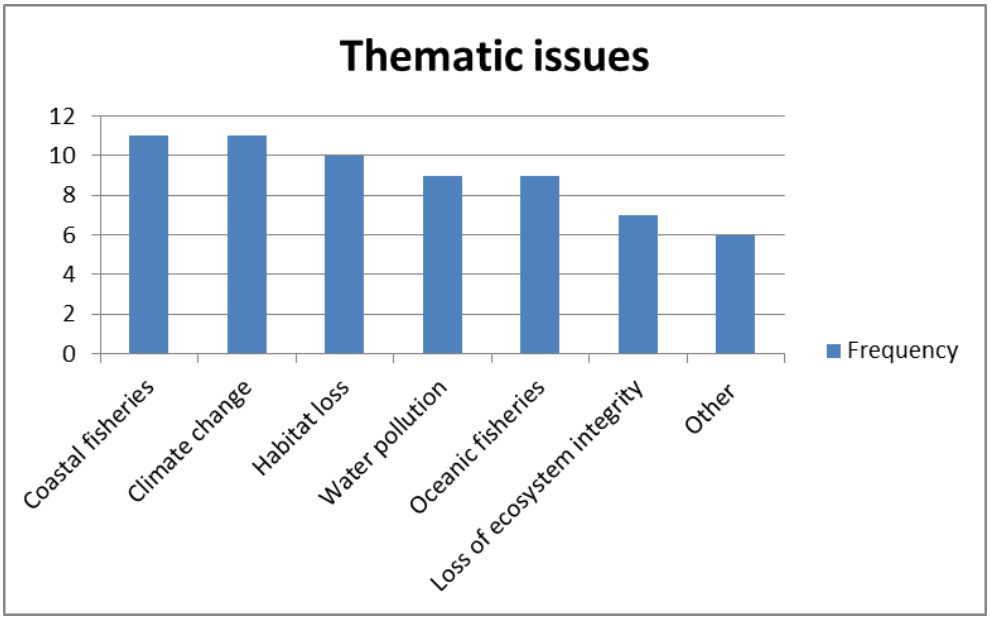

Figure 1. Thematic issues that would benefit from closer coordination and collaboration between different programmes and institutions according to survey.

Furthermore, the terminal evaluation of the UNEP/GEF funded project Promoting Ecosystem-Based Approaches to Fisheries Conservation and Large Marine Ecosystems pointed out that there may be a need in general to review and consider how the LME unit fits into the larger institutional picture for ocean governance and how LME projects can also contribute and influence at other levels. It concluded that it is important that projects working to support ecosystem-based fisheries management approaches liaise and collaborate with all relevant stakeholder organisations (Westerlund, 2008).

It has also been argued that on moving from investigation of the problems to implementation of solutions, the LME approach becomes less appropriate due to the weak governance module and the compartmentalised structure of the modules (Mahon et al., 2009). Better integration of the LME approach into existing governance arrangements for the coastal and marine environment could help addressing this weakness with the LME approach and existing LME modules.

Sustainability of LME mechanisms and the LME approach

The challenge of ensuring financial sustainability of LME programmes and mechanisms is illustrated by the fact that both the BCC and PEMSEA, although fully institutionalised, are still receiving GEF funding. PEMSEA, that has received GEF funding from 1993 amounting to a total of almost US$37 million, is preparing its fourth GEF project to support scaling up of ICM in the EAS, as government contributions to its Resource Facility are not yet sufficient to sustain its operations. Furthermore, the IGCC is preparing its third GEF project to support the creation of the GCC and implementation of the SAP. Nevertheless, governments participating in LME programmes are increasingly providing funding to these mechanisms, as the GEF is requiring higher levels of co-financing for each new phase it funds.

It is difficult to identify clear criteria of success in implementing the LME approach. The funding provided from GEF is merely catalytic and varies considerably across LMEs, from US$26 million in total for subsequent phases of the GCLME to less than US$3 million for the ATSEA (Table 1). The BCLME programme that has resulted in the establishment of the world's first LME Commission has received around US$20 million in total, but only around US$15 million up until the establishment of the BCC. The Gulf of Thailand and South China Sea project that has so far not resulted in sustainably strengthened institutional arrangements for ecosystem-based management, has received US$16 million.

The successful adoption of a SAP and strengthening of institutional arrangements for its implementation seems to be more dependent on political factors than on funding, linked to number of countries bordering the LME (only three in the BCLME), political will to engage in regional collaboration, and existing regional policy and institutional frameworks, which were already quite strong in for example the ATS region. Capacity to execute the LME approach in an adaptive way is probably also an important factor, as strong diplomatic and negotiating skills are required to negotiate a SAP as well as to reach agreement on how to strengthen cross-sectoral governance arrangements for ecosystem-based management.

Furthermore, to ensure scientific and technical sustainability of the LME approach, the TDA/SAP methodology needs to be updated to fully integrate concepts that have emerged since its development, such as the Ecosystem Approach to Fisheries. In the questionnaire survey, IOC-UNESCO stressed that LME management can be improved by incorporating good practices on Integrated Coastal Management and Marine Spatial Planning into the LME approach. It can also be seen in Figure 2 that rights-based management approaches are still in limited use among the partners consulted.

Finally, there is also a need to align the LME approach with the ecosystem services concept that emerged from the Millennium ecosystem Assessment (MA, 2005), including a clearer conceptualisation of provisioning, regulating, cultural, and supporting ecosystem services, and their impact on human well-being. The YSLME and ATSEA are already integrating this broadened understanding of ecosystem services into their TDA/SAP processes, but the concept could be more systematically integrated into the LME modules.

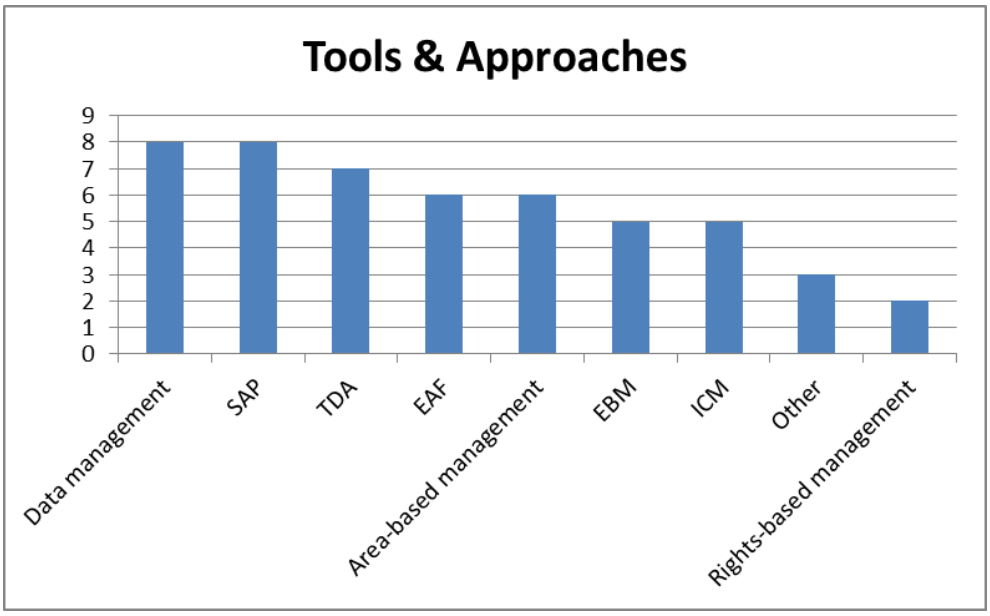

Figure 2. Tools and approaches used by consulted LME partners.

Conclusions and recommendations

The LME approach and its modules on pollution and ecosystem health, fish and fisheries, productivity, socio-economic drivers and governance are useful tools to ensure cross-sectoral assessment and analysis of threats to the marine and coastal environment. Transboundary Diagnostic Analysis, including causal-chain analysis, provides an effective way of identifying direct and indirect causes of environmental problems and identification of possible remedial actions leading to the formulation of a Strategic Action Programme. However, several of the projects reviewed in this report have spent more than ten years on assessing and diagnosing the environmental problems affecting the LMEs. There is thus an urgent need to try to shorten the period of assessment and analysis and shift the focus to implementation of LME-based solutions to coastal and marine environmental problems.

Further efforts are needed to strengthen coordination and collaboration between LME programmes, RSPs, RFBs and other regional bodies with a mandate in coastal and marine management, to improve communication and information flows, harmonisation of approaches and interventions, and donor coordination. Before establishing institutions for joint ecosystem-based management to implement agreed LME SAPs, such as new LME Commission, an institutional assessment should be conducted that examines different options in terms of opportunities for: Embedding the LME approach into existing regional institutional and policy frameworks of e.g. regional economic communities;

- Joint programming with RFBs and RSPs; and
- Financial capacity of governments and regional partners to sustain a new regional mechanism.

Updating of the TDA/SAP methodology should also be a priority in order to incorporate new scientific concepts and good practices in ICM, marine spatial planning, rights-based management and other ecosystem approaches, while also adjusting the methodology to shorten the assessment period.

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Annex 1: Questionnaire

Questionnaire for:

STUDY ON THE CONCEPT OF LARGE MARINE ECOSYSTEMS AND ITS INSTITUTIONAL RELEVANCE FOR ECOSYSTEM-BASED MANAGEMENT

Background information

Name of Programme/Institution:

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Name and position of respondent:

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Counterpart institution(s) at national level (e.g. Ministry of Environment, Ministry of Fisheries, etc.)

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Questions

1. Please tick the boxes in the Table below for areas where your Programme/Institution collaborates with other Programmes/Institutions with a mandate in coastal, marine and/or fisheries management. [See tables 1-3 in report]

2. Which thematic issues would benefit from closer coordination and collaboration between the different programmes and institutions in your region with a mandate in coastal, marine management?

☐ Water pollution/Eutrophication

☐ Loss of ecosystem integrity

☐ Overexploitation of coastal fisheries

☐ Overexploitation of oceanic fisheries/highly migratory species

☐ Loss of coastal and marine habitats (if possible, specify habitats – e.g. mangroves, seagrass beds, coral reefs, coastal wetlands, etc.)

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☐ Climate change

☐ Other (specify)……

☐ Other (specify)……

3. Which tools and approaches is your Programme/Institution applying?

☐ Transboundary Diagnostic Analysis (TDA)

☐ Development of Strategic Action Programme (SAP)

☐ Ecosystem-based management (specify)

……

……

☐ Integrated Coastal Management (ICM)

☐ Ecosystem Approach to Fisheries (EAF)

☐ Rights-based approaches to habitat and fisheries management (specify - e.g., establishment of community-based fisheries refugia and limited entry fisheries)
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☐ Area-based management tools (specify – e.g. establishment of marine protected area (MPAs))
……

……

☐ Data collection and analysis (specify – e.g. data on biodiversity, fisheries, pollution, climate change, etc.)

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☐ Other (specify).....

4. List any existing or planned initiatives to strengthen cooperation and coordination between the LME Programme, Regional Seas Programme, Regional Fisheries Bodies (RFBs) and any other relevant regional body with a mandate in coastal, marine and/or fisheries management in your region.

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5. What else could be done to improve coordination and collaboration on coastal, marine and fisheries management in your region?

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6. Do you have any suggestions for how the governance arrangements could be improved to further strengthen ecosystem-based approaches to coastal, marine and fisheries management?

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Thank you for your cooperation!

Annex 2: Questionnaire send list

Sendlist for LME Questionnaire	Sent	Response
APFIC	x	1
ATSEA	x	1
BCLME	x	1
BOBLME	x	1
BOBP-IGO	x	
CCLME	x	1
CECAF	x	1
COBSEA	x	1
COMHAFAT	x	
COREP	x	
FAO	x	
FCWC	x	
GCLME	x	1
GEFSEC	x	
GT och SCS	x	
ICCAT	x	
IOC/UNESCO	x	1
IOTC	x	
MFF	x	
NOAA info	x	1
PEMSEA	x	1
SAARC	x	
SEAFDEC	x	1
SEAFO	x	
SRFC	x	
UNDP Water Governance (HQ)	x	
UNDP Regional Centre in Bangkok	x	1
UNEP Regional Seas Programme	x	
Wetlands Alliance	x	1
WCPFC	x	1
TOTAL:	**30**	**15**