

## 1. Executive Summary

The Caribbean Large Marine Ecosystem and Adjacent Project (the CLME Project) addresses two Large Marine Ecosystems (LMEs): the Caribbean LME and North Brazil Shelf LME. The Caribbean LME is a semi-enclosed tropical sea of about 3 million km<sup>2</sup> bounded to the north by the Bahamas and the Florida Keys, to the west by Central America, to the south by South America and to the east by the Lesser and Greater Antilles Island chain. The CLME is also bordered by the Gulf of Mexico LME to the north and the North Brazil Shelf LME to the south. The North Brazil Shelf LME extends along the north eastern South American coast from the Parniba River in Brazil to the boundary of the Caribbean. The focus of the UNDP/GEF CLME Project is on assisting the Caribbean countries to improve the management of their shared living marine resources, most of which are experiencing overexploitation and degradation, through an ecosystem based approach.

A number of unique features make the CLME of special global and regional significance. The region is the most geopolitically diverse and complex in the world. With 22 independent states and 17 dependent territories (USA, UK, France, and the Netherlands) the CLME has the highest number of maritime boundaries of any other LME. This presents a considerable challenge for the effective management of the region's living marine resources, especially as many of them are shared.

An important component of the CLME project has been to undertake a Transboundary Diagnostic Analysis (TDA). A TDA is a widely-used tool within GEF International Waters Projects to provide a scientifically objective assessment of the causes of the main problems affecting transboundary and shared systems. In the project development phase (PDF-B) a preliminary TDA identified three priority transboundary problems that affect the CLME: unsustainable exploitation of fish and other living resources, habitat degradation and community modification, and pollution associated with three geographical areas (Insular Caribbean, Central/South America and Guianas/Brazil) within the Wider Caribbean Region (WCR). The PDF-B phase also highlighted the importance of having an effective governance regime to address the sustainability of the living marine resources of the WCR and the need to develop a specific framework targeted at interventions needed to bring about change in regional fisheries governance.

This report is the revised and updated Regional TDA based on TDAs of three fisheries ecosystems of regional significance: the reef, pelagic and continental shelf fisheries ecosystems. This Regional TDA (supported by the three fisheries TDAs and a regional governance analysis) will serve as the science basis for development of an agreed program of interventions including fisheries management reforms, conservation measures and pollution control. A Strategic Action Programme (SAP) with a shared vision for the CLME will be developed, and required priority interventions, reforms and investments to address the main transboundary problems agreed to. To assist this process, the project will create an integrated information management system bringing together congruent fisheries, biological, pollution and socio-economic data and information as a powerful management tool. Similarly, a monitoring and evaluation framework within a Regional Monitoring Environmental Programme will be developed. Pilot projects and case studies on specific transboundary fisheries (spiny lobster, reef, flyingfish, large pelagic and, shrimp and groundfish fisheries) will trial governance models at the local, national and sub-

regional levels and provide additional knowledge on means of applying ecosystem based approaches to fisheries management and determining the fisheries' socio-economic importance and sensitivities.

### *The WCR ecosystem*

The CLME region has considerable ecosystem resources that both contribute to the socio-economic growth of the region and offer ecological and biodiversity value. The WCR contains significant ecological features including:

- Over 12,000 species reported by the Census of Marine Life,;
- About 118 marine invasive species;
- Over 185 species of water birds and over 350 species of North American migratory birds during the winter months;

There is considerable spatial and seasonal heterogeneity in productivity throughout the WCR through interactions of open-ocean, coastal and ocean process and significant riverine inflows. High productivity is found in a range of coastal habitats such as coral reefs, mangrove forests and seagrass beds as well at ocean fronts and upwellings, and continental shelf influenced by river outflow.

The WCR provides valuable ecosystem 'services' (benefits derived from ecosystems), including through fisheries, tourism, coastal defences, and biodiversity support. These valuable systems are under growing threat from direct and indirect human activities, including climate change and variability. Marine ecosystems in the WCR have been treated in a fragmented manner, with individual habitats or fish stocks assessed and managed separately, with little consideration to preserving the overall health of the ecosystem. The focus of this TDA (this Regional TDA, and the detailed fisheries ecosystem TDAs) is to assess specific fisheries ecosystems and to identify the causes for their degradation that will lead to coherent management actions for the protection and sustainable exploitation of the living resources through the planned SAP.

The marine resources of the Caribbean Sea are largely shared resources, and the effectiveness of any management initiative will depend on collaborative and cooperative actions at the regional level, or other appropriate scale, depending on the issue and the resource. A number of regional initiatives and organizations already exist, and the establishment of an appropriate governance mechanism or framework for management of Caribbean transboundary living marine resources should be urgently pursued.

## ***Approach to developing this Regional TDA***

This Regional TDA is based on the outputs of three fishery ecosystem TDAs and a detailed governance analysis. These source documents should be referred to for further detail and are available on the project website<sup>1</sup>.

At a meeting of the Technical Task Team (TTT) and the Stakeholder Advisory Group (STAG) assembled to discuss the development of this TDA in Cartagena (January 2010), it was agreed to refocus the preliminary TDA undertaken in the PDF-B phase from three geographical sub-regions (Insular Caribbean, Central/South America and Guianas/Brazil) to three ecosystems representing the key types of fisheries of the CLME (reef, pelagic and continental shelf fisheries ecosystems). The reorientation towards fishery ecosystems represents a significant and innovative advance for the CLME Project. Most coastal and marine fisheries in the WCR take place in one of these three ecosystem types. These ecosystems are also the basis for a variety of other non-fishing activities such as recreation, tourism and transportation. The three ecosystems TDAs form the basis of this regional TDA and will lead to specific management plans and interventions within the SAP. The TTT/STAG meeting also adopted the Ecosystem Based Management (EBM) approach to developing the TDA consistent with FAO's Ecosystem Approach to Fisheries. In the perspective on the Ecosystem Approach that appears to be preferred by the countries of the WCR, the full range of human uses and the tradeoffs among them must be considered.

At the TTT/STAG meeting the Causal Chain Analysis (CCA) was also reviewed and updated for each of the three previously identified priority transboundary issues (unsustainable exploitation of fish and other living resources, habitat degradation and community modification, and pollution) for each fisheries ecosystem. The TTT/STAG meeting recommended the appointment of three international experts to develop detailed reports on the fisheries ecosystems and on regional governance that have been summarised by a forth expert into this Regional TDA. Over 600 pages of detailed assessments and information are available in reports on Reef & Pelagic Fisheries ecosystems, Continental Shelf fisheries ecosystem and Regional Governance. These in-depth reports (available on the project website) will be a prime reference for the subsequent development of SAPs for the three fisheries ecosystems including the regional governance of these ecosystems.<sup>1</sup>

This Regional TDA summarises regional information on the socio-economic features and activities of the CLME, provides the key findings from the three fisheries ecosystems reports (including the CCAs) and the governance analysis and summarises the main recommendations to be further developed in the SAP. The TDAs utilizes existing information available from the previous TDA and available literature.

## ***Regional Socio-Economic Background***

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<sup>1</sup> <http://www.clmeproject.org/documents/projectdocuments/fishery-ecosystems-tDas>

The WCR countries range from the most to the least developed, and includes the poorest country in the western hemisphere as well as a number of SIDs and low lying coastal countries such as Belize and Guyana. Caribbean countries are considered middle- and high-income, except Haiti, which is classified as low-income. About 25% of the Caribbean population can be considered as poor, with more women than men living in poverty. The WCR countries have a high degree of vulnerability to climate change and associated phenomena. In the last decade, the region suffered from several large natural disasters (mainly hurricanes and earthquakes) that caused significant damage and economic losses, and a great number of human fatalities.

The WCR is intensively used for fishing, tourism, shipping, and petroleum exploitation. It is noted for its maritime industry, with the Panama Canal the world's leading maritime hub. Tourism and fisheries are heavily dependent on the living resources and are of considerable socio-economic importance in the region. Relative to its size, the Insular Caribbean is the most tourism-driven region in the world, with the economies of many of the islands very dependent on tourism. Almost 25 million tourists travelled to the Caribbean during the year 2000. Although marine fisheries make only a small contribution to GDP, they represent a very important source of food, livelihoods, employment, income, and foreign exchange earnings in all the countries. In the 1970s and 1980s, many Caribbean countries embarked on large fisheries expansion programmes, mostly targeting offshore resources. Nevertheless, the fisheries remain predominantly small scale, with numerous artisanal fishers in coastal areas. It was estimated that over 5 million people are dependent on marine fisheries for their livelihoods in the region. In 2006, the value of the total fisheries landings from the WCR is estimated at more than US\$500 million.

### ***The Fisheries Ecosystems***

The CLME Project has defined three fisheries ecosystems on which to prepare detailed TDAs that will form the scientific basis for the development of a SAP.

- ***Reef Fisheries Ecosystem:*** is considered to include shallow water coral reefs as well as mangroves, seagrass beds, lagoons, estuaries and beaches, as well as coral banks and rocky outcrops in deep waters that support valuable fisheries resources. There is high connectivity among these different components, making it necessary to consider them as one large, interdependent marine ecosystem with shared biodiversity. The coral reef-mangrove-seagrass complex is one of the most biologically diverse and productive systems in the world. They serve as habitat, feeding and nursery grounds for numerous commercially important fish and invertebrate species, including many with transboundary distribution. Among the major reef associated species that are exploited in the CLME are spiny lobster, queen conch, snappers and groupers, in addition to an immense variety of other reef fish species.

Mangroves and seagrass are important carbon sinks, which is pertinent to the issue of concentration of greenhouse gases and global warming. Coral reefs contribute to the region's tourism industry and support important fisheries throughout the region. The annual value of ecosystem services provided by Caribbean coral reefs has been estimated at between US\$3.1 billion and US\$4.6 billion, with degradation by 2015 potentially costing between US\$350 million and US\$870 million per year.

- ***Pelagic Fisheries Ecosystem:*** considered as the epipelagic zone of the ocean, extending from the surface to a depth of about 200m. Areas of high productivity within the pelagic zone include coastal upwelling and ocean fronts.

The pelagic realm provides important habitats for adult and early life history stages of living marine resources as well as lower trophic levels (phyto and zooplankton) that are important in ocean food webs. The fish communities in the pelagic system include a wide range of small coastal pelagic species that are important components of the pelagic food web as well as large pelagic species such as mackerels, tunas, sharks and billfishes, and eggs and larvae of reef organisms.

For the purposes of the pelagic ecosystem TDA, the focus is on the large pelagic fish stocks, which comprise two groups: large coastal pelagics (e.g. small tunas and mackerels); and the more widely distributed and highly migratory large oceanic species (e.g. yellowfin and skipjack tunas, swordfish and marlins). Many of these fisheries resources are transboundary as they are shared between countries with some even extending into international waters, and there is likely wide dispersal of larval stages across EEZs. Over the last 15 - 20 years, the region's capacity for exploiting large pelagic resources has expanded considerably, especially through the development of longlining for oceanic pelagic species. The countries with well-developed fisheries for large pelagic resources include Barbados, Grenada, St. Lucia, Trinidad and Tobago, and Venezuela.

- ***Continental Shelf Fisheries Ecosystem:*** The North Brazil Shelf Large Marine Ecosystem owes its definition to the influence of the North Brazil Current (NBC), which flows parallel to Brazil's coast. The hydrodynamics of this region is dominated by the North Brazil Current, which is an extension of the South Equatorial Current and its prolongation, the Guyana Current. The shrimp resources in the Continental Shelf Fishery Ecosystem supports one of the most important export oriented shrimp fisheries in the world while the groundfish resources are important for commercial and social reasons, with the red snapper being probably the most important groundfish in the region because of its wide distribution range and export value. There are lesser fisheries for shelf-based schooling pelagic resources such as mackerels and jacks and for sharks.

Human activities along the coastlands have led to severe habitat modification in the Continental Shelf Fishery Ecosystem, with mangroves, which dominate a major part of the shoreline, having been seriously depleted in some areas. Unsustainable fishing of the shrimp and groundfish resources of the Continental Shelf Fishery Ecosystem could result in considerable socio-economic consequences as these fisheries make significant contributions to food security, poverty alleviation, foreign exchange earnings and the development of coastal communities.

### ***Regional Fisheries Governance***

In addition to identifying the priority issues within the CLME region, the PDF-B phase highlighted the need to develop a WCR-tailored framework targeted at the interventions needed to bring about changes in regional governance. An assessment of the regional and fisheries ecosystem-specific stakeholders has been undertaken.

In reviewing advances in ocean governance thinking since the PDF-B phase this TDA analysis summarises: key legal and policy-level advances at the international level, a growing awareness of ecosystem-based management, climate change impacts and specific projects focused on regional governance. There have also been a number of global ocean governance initiatives contributing to an increased understanding of factors affecting governance and resilience thinking. Given the increasing recognition of the need to take an ecosystem approach to managing transboundary living resources and the cross-cutting effects of climate change, new players have been identified. Among these new players, representatives of the tourism and conservation sectors are prominent.

### ***Priority Transboundary Issues***

The three agreed key transboundary issues (unsustainable fisheries, habitat degradation and pollution) have been analysed with specific reference to each of the three fisheries ecosystems. Inevitably, due to the physical and ecological linkages between these ecosystems many of the causes of the transboundary issues are common to all three fisheries ecosystems. In addition, there are links between the three transboundary issues (for example, pollution is addressed as a key transboundary issue but is also a cause of the habitat degradation). In addition the biological (demographic) linkages between the three fisheries ecosystems (for example between fish spawning, juveniles etc.) have to be considered. The fisheries ecosystem reports identify the uncertainty, and concerns, that climate change and variability could have in the CLME region and acknowledges the cross-cutting nature of climate impacts and the need for more data and assessments to understand the vulnerability and potential means to adapt to climate change.

The three identified transboundary issues that have an impact on the overall health and functioning of all three fisheries ecosystems. These impacts have a negative effect on the socio-economic development and sustainability of the WCR reducing the benefits available from the ecosystem services. As these issues are of 'transboundary' significance their impacts affect the WCR as a whole leading to the recommendation of a need for a coherent marine governance structure to protect and allow for sustainable development in the region. There are common aspects to the root causes of the three transboundary issues, for example; poor or inadequate governance, poverty, inadequate data and lack of public and governmental interest. The planned SAP will need to review the details of these causes and assess the potential options to address these.

The three transboundary issues are:

- ***Unsustainable Fisheries:*** applies to all three fisheries ecosystems with considerable similarity to the causes. There is significant evidence that overfishing or fishing close to maximum sustainable yields is impacting stock levels reflected in declining landings and collapsed stocks. Fishing is also having impacts at the ecosystem level, as evident in progressively declining mean trophic level of the catch, which signifies that larger predators are being depleted. illegal, unregulated and unreported (IUU) fishing is a regional problem and fishery regulations, where they exist, are poorly monitored and enforced. This is especially so in the offshore pelagic fisheries mainly because of the high costs and complexity of monitoring vessels in the exclusive economic zones. In addition, vessels under flags of convenience contribute to the unsustainable exploitation

of the region's fisheries. High bycatch levels are a common concern in all three fisheries ecosystems, particularly the Continental Shelf Fishery Ecosystem.

Over-fishing threatens more than 70% of Caribbean reefs. Large pelagic resources are also being exploited beyond sustainable levels, including dolphinfish, wahoo, blue and white marlin, sailfish and yellowfin tuna. The number of overexploited and collapsed stocks of large pelagic resources increased markedly from the late 1970s, with the proportion of collapsed stocks reaching almost 40% in 2006. In this year, about 60% of the pelagic stocks were overexploited and collapsed and about 10% rebuilding. These trends confirm the widespread reports of overexploited and collapsed stocks in the CLME, and are consistent with the unregulated expansion of fishing in previous decades. Many of the demersal fisheries in the area are either fully or overexploited, with by-catch and discards being of concern throughout the area, especially for the trawl fisheries. IUU fishing poses a significant threat to fisheries management in the region.

In general, all the shrimp species in the Continental Shelf Fishery Ecosystem are subjected to increasing trends in fishing mortality and the fisheries are generally overcapitalized. Despite the relatively stable catches, overexploitation was found to be severe, with there being evidence that some of the groundfish fisheries in this area may be fully or overexploited.

Unsustainable exploitation leads to reduced stocks and reduced opportunities to sustain livelihoods in the WCR. The root causes identified by the CCA for unsustainable fisheries include: poor governance, unsustainable development models, inadequate knowledge and public awareness, lack of alternative food sources and employment.

- **Habitat degradation:** The CLME habitats and their associated living resources are responsible for the valuable fisheries and tourism in the CLME. There are common concerns leading to habitat degradation across the fisheries ecosystems, e.g. shipping (and ship pollution), alien species introduction, climate change (including: acidification, increase storm damage, water temperature increases, pollution from land-based sources). Coastal habitats within the reef and continental shelf ecosystems are subject to impacts from destructive fishing methods, coastal development, watershed and marine pollution. Coastal environments are also more impacted from increasing sediment loads (for example from inappropriate land use in river basins, including forest clearance and agriculture) that can result in increased turbidity and choking of sensitive reef environments. Due to their proximity to the land-based sources (e.g. wastewater, industry, mining, agriculture) pollution can be more significant with regards to habitat degradation (e.g. through eutrophic conditions) within the reef and continental shelf ecosystems. The threats to these coastal environments from the loss of reefs and mangroves (for example) are potentially very significant given the important 'ecosystem services' these provide, for example, in supporting commercially important species and providing coastal defences against extreme weather events.

Unsustainable exploitation has led to deterioration of reef condition in the Caribbean, as seen in the overgrowth of reefs by algae when the abundance of herbivorous fish (such as the Caribbean parrotfish) is reduced through overexploitation. This is of particular concern in areas where reefs have already been affected by the mass mortality of the