XV-49 Caribbean Sea: LME #12

S. Heileman and R. Mahon

The Caribbean Sea LME is a tropical sea bounded by North America (South Florida), Central and South America and the Antilles chain of islands. The LME has a surface area of about 3.3 million km^2, of which 3.89% is protected, and contains 7.09% and 1.35% of the world's coral reefs and sea mounts, respectively (Sea Around Us 2007). The average depth is 2,200 m, with the deepest part, the Cayman Trench, at 7,100 m. Most of the Caribbean islands are influenced by the nutrient-poor North Equatorial Current that enters the Caribbean Sea through the passages between the Lesser Antilles. A significant amount of water is transported northwestward by the Caribbean Current through the Caribbean Sea and into the Gulf of Mexico, via the Yucatan Current. Run-off from two of the largest river systems in the world, the Amazon and the Orinoco, as well as numerous other large rivers dominates the north coast of South America (Müller-Karger 1993). A book chapter and reports pertaining to this LME have been published by Richards & Bohnsack (1990) and UNEP (2004a, 2004b, 2006).

I. Productivity

The Caribbean Sea LME can be considered a Class II, moderate productivity ecosystem (150-300 gCm^{-2}yr^{-1}). There is considerable spatial and seasonal heterogeneity in productivity throughout the region. Areas of high productivity include the plumes of continental rivers, localised upwelling areas and nearshore habitats such as coral reefs, mangroves and seagrass beds. Relatively high productivity occurs off the northern coast of South America where nutrient input from rivers, estuaries and wind-induced upwelling is greatest (Richards & Bohnsack 1990). The remaining area of the LME is mostly comprised of clear, nutrient-poor waters.

The Wider Caribbean Region is a biogeographically distinct area of coral reef development within which the majority of corals and coral reef-associated species are endemic (Spalding *et al*. 2001, Wilkinson 2002), making the entire region particularly important in terms of global biodiversity. Among the LME's coral reefs is the Meso-American Barrier Reef, the second largest barrier coral reef in the world. There have been yearly migrations of marine mammals such as the humpback, sperm and killer whales. Manatees are not as common as they once were along many of the river mouths. Sea turtles, such as hawksbill, green and leatherback nest on beaches within this LME.

Oceanic Fronts (Belkin *et al.* 2009)(Figure XV-49.1): In the southern Caribbean Sea, fronts are generated by coastal wind-induced upwelling off Venezuela and Colombia at 75°-78°W, 70°-75°W, and 62°-66°W. A 100-km-long front dissects the Gulf of Venezuela along 70°40'W, likely caused by the brackish outflow from Lake Maracaibo combined with coastal upwelling. Two shelf-break fronts off Cuba encompass two relatively wide shelf areas off the southern Cuban coast, east of Isla de la Juventad (83°W) and along the Jardines de la Reina island chain (79°-80°W), both best developed in winter. The Windward Passage Front between Cuba and Hispaniola (73°W) separates the westward Atlantic inflow waters moving into the Caribbean in the western part of the passage from the Caribbean outflow waters heading eastward in the eastern part of the passage. A 200-km-long front in the Gulf of Honduras peaks in winter, likely related to a salinity differential between the Gulf's apex and offshore waters caused by high precipitation in southern Belize (Heyman & Kjerfve 1999).

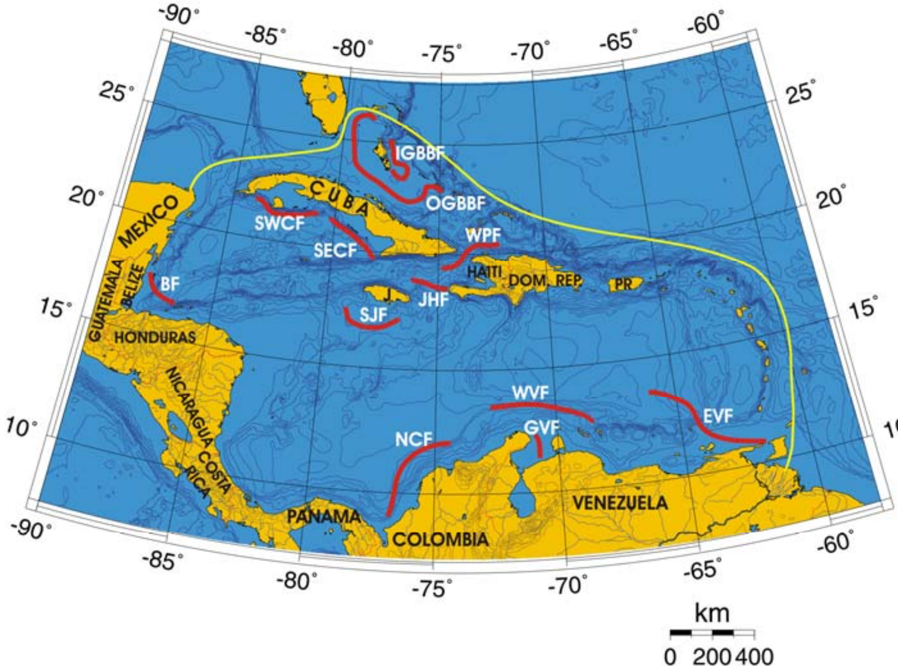

Figure XV-49.1. Fronts of the Caribbean Sea LME. Acronyms: BF, Belize Front; DOM.REP., Dominican Republic; EVF, East Venezuela Front; GVF, Gulf of Venezuela Front; IGBBF, Inner Great Bahama Bank Front; JHF, Jamaica-Haiti Front; NCF, North Colombia Front; OGBBF, Outer Great Bahama Bank Front; PR, Puerto Rico (U.S.); SECF, Southeast Cuba Front; SJF, South Jamaica Front; SWCF, Southwest Cuba Front; WPF, Windward Passage Front; WVF, West Venezuela Front. Yellow line, LME boundary. After Belkin *et al.* (2009).

Caribbean Sea LME SST (Belkin 2009)(Figure XV-49.2):
Linear SST trend since 1957: 0.03°C.
Linear SST trend since 1982: 0.50°C.

The Caribbean Sea went through three phases over the last 50 years: (1) cooling until 1974; (2) cold phase with two cold spells of 1974-1976 and 1984-1986; (3) warming since 1986. Using the year of 1985 as a true breakpoint, the post-1985 warming amounted to >0.6°C over the last 20 years. Both cold spells were synchronous with cold events across the Central American Isthmus, in the Central American Pacific LME. The first cooling period was interrupted by a major warm event (peak) of 1968-1970, when SST reached its all-time maximum of 28.2°C in 1969. This event was confined to the Caribbean Sea. None of the adjacent LMEs experienced a pronounced warming in 1968-1970. If the warm event of 1968-1970 cannot be explained by anomalous atmospheric conditions, the reason should be in the open ocean east of the Caribbean Sea, in the trade winds zone, where the Canary Current LME experienced a warm event that peaked in 1969.

Virtually all significant maxima and minima of SST in the Caribbean Sea correlate strongly with El Niños and La Niñas respectively (National Weather Service/Climate Prediction Center 2007). This strong correlation is a good example of atmospheric teleconnections across the Central American Isthmus. This link is so strong that El Niños' and La Niñas' effects in the Caribbean Sea have comparable magnitudes with their counterparts in the Pacific Central-American Coastal LME on the other side of the Isthmus.

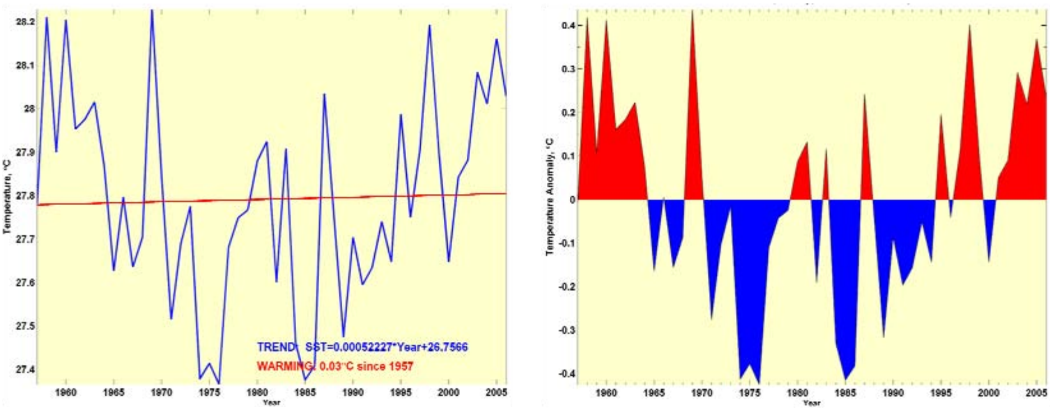

Figure XV-49.2. Caribbean Sea LME annual mean SST (left) and SST anomalies (right), 1957-2006, based on Hadley climatology. After Belkin (2009).

Caribbean Sea LME Chlorophyll and Primary Productivity

The Caribbean Sea LME is considered a Class II, moderate productivity ecosystem (150-300 $gCm^{-2}yr^{-1}$)(Figure XV-49.3).

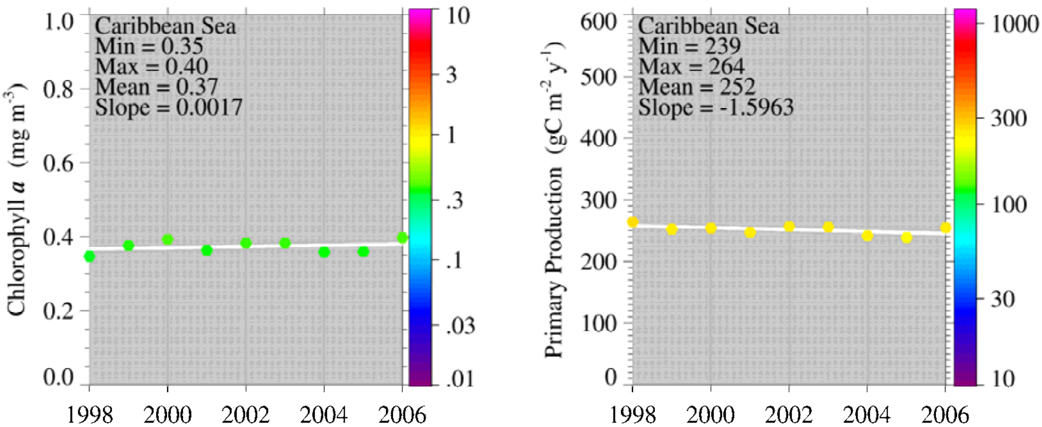

Figure XV-49.3. Caribbean Sea LME trends in chlorophyll *a* (left) and primary productivity (right), 1998 – 2006, from satellite ocean colour imagery. Values are colour coded to the right hand ordinate. Figure courtesy of J. O'Reilly and K. Hyde. Sources discussed p. 15 this volume.

II. Fish and Fisheries

The fisheries of the Caribbean Sea LME are based on a diverse array of resources (Mahon 2002). Those of greatest importance are spiny lobster (*Panulirus argus*), queen conch (*Strombus gigas*), penaeid shrimps, reef fish, continental shelf demersal fish, deep slope and bank fish and large coastal pelagics such as king mackerel (*Scomberomorus cavalla*), Spanish mackerel (*S. maculatus*), dolphinfish (*Coryphaena hippurus*) and amberjack (*Seriola* spp.). In addition, fisheries based on stocks of large oceanic fish such as yellowfin tuna, skipjack tuna, Atlantic blue marlin and swordfish, several of which have been considered underexploited, have expanded considerably in recent years (Chakalall & Cochrane 2004). All of the large pelagic stocks are transboundary or Highly Migratory Species (HMS) and Straddling Stocks (SS), moving in and out of all or most of the EEZs and extending into the High Seas (Mahon 2003, Die 2004). The distribution of the large coastal pelagics, which occur largely within the EEZs of Caribbean countries, also extends into the High Seas (Mahon 2003). The fishery resources are mostly coastal and intensively exploited by large numbers of small-scale fishers using a variety of gears, while foreign fleets from distant water fishing nations are known to exploit the region's High Seas fisheries (Singh-Renton & Mahon 1996). Caribbean countries are often perceived to be fishing for HMS & SS on the High Seas when they flag foreign vessels on their open registries (Mahon 2003). This has resulted in problems for several countries of the Caribbean Community (CARICOM) and there are attempts to eliminate this practice (FAO 2002). Recreational fishing is an important activity in some of the countries, particularly for large pelagic fishes (Mahon 2004). Developments in fishing technology, as well as growing demands for fish have resulted in increasing pressure on the LME's fish stocks. Additionally, government initiatives have led to substantial increases in fishing effort, despite the inadequate institutional capacity to manage and monitor the fishing industry. Total reported landings in this LME, which are probably underestimated (see e.g., contributions in Zeller *et al.* 2003) showed a general increase to about 430,000 tonnes in the mid-1990s, followed by a slight decline (Figure XV-49.4). In the mid 1990s, the reported landings were valued at over US$360,000 (in 2000 US dollars; Figure XV-49.5).

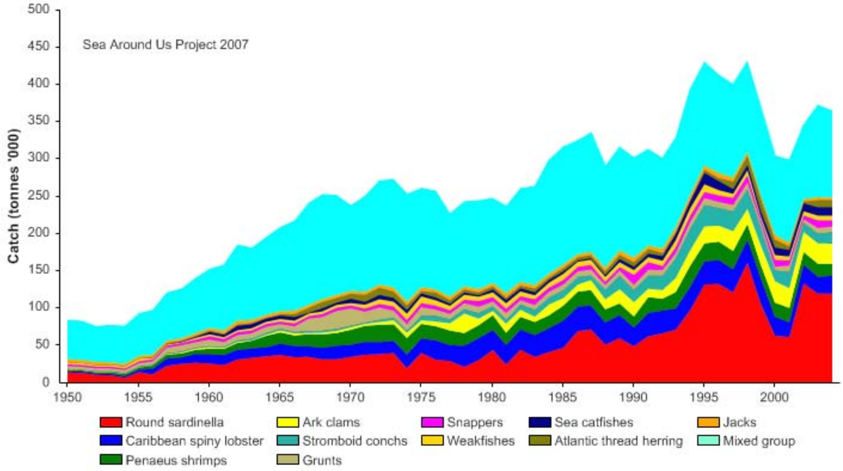

Figure XV-49.4. Total reported landings in the Caribbean Sea LME by species (Sea Around Us 2007).

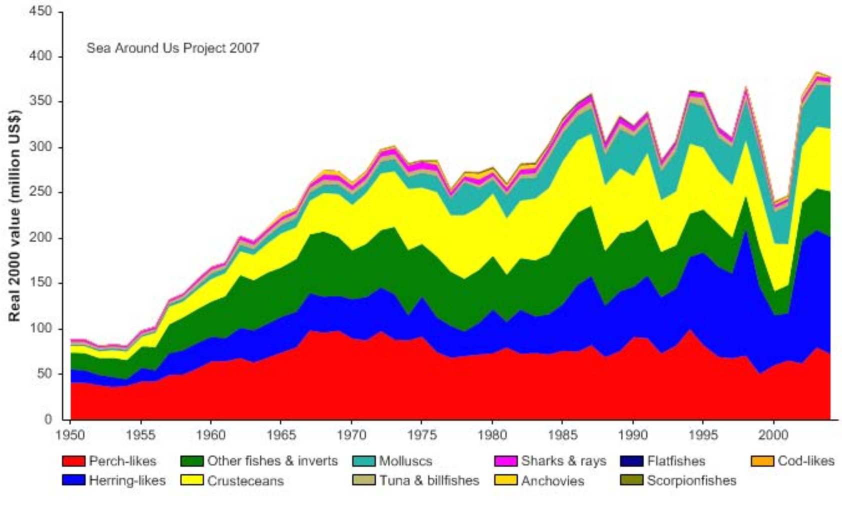

Figure XV-49.5. Value of reported landings in the Caribbean Sea LME by commercial groups (Sea Around Us 2007).

The primary production required (PPR; Pauly & Christensen 1995) to sustain the reported landings in the LME reached 3% of the observed primary production in 1994 and have fluctuated between 2.5 to 3% in recent years (Figure XV-49.6). Venezuela accounts for the largest share of the ecological footprint in this LME.

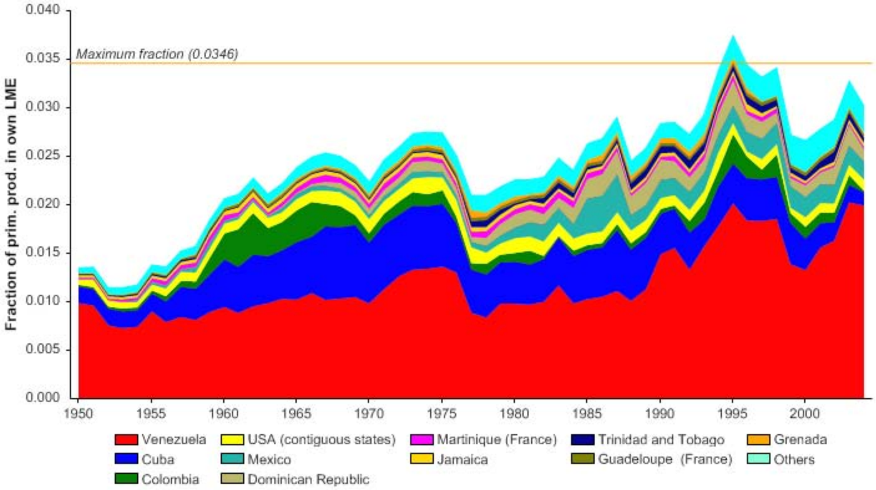

Figure XV-49.6. Primary production required to support reported landings (i.e., ecological footprint) as fraction of the observed primary production in the Caribbean Sea LME (Sea Around Us 2007). The 'Maximum fraction' denotes the mean of the 5 highest values.

The decline of the mean trophic level of the reported landings (i.e., the MTI, Pauly & Watson 2005) is almost linear over the reported period (Figure XV-49.7, top), representing a classic case of a 'fishing down' of the food web in the LME (Pauly *et al*. 1998). This confirms Pauly & Palomares (2005), who performed a preliminary analysis of MTI in this region. Indeed, the decline in the mean trophic level would have been greater were it not for the expansion of the fisheries from the mid 1950 to the mid 1980s as implied by the increasing FiB index (Figure XV-49.7, bottom).

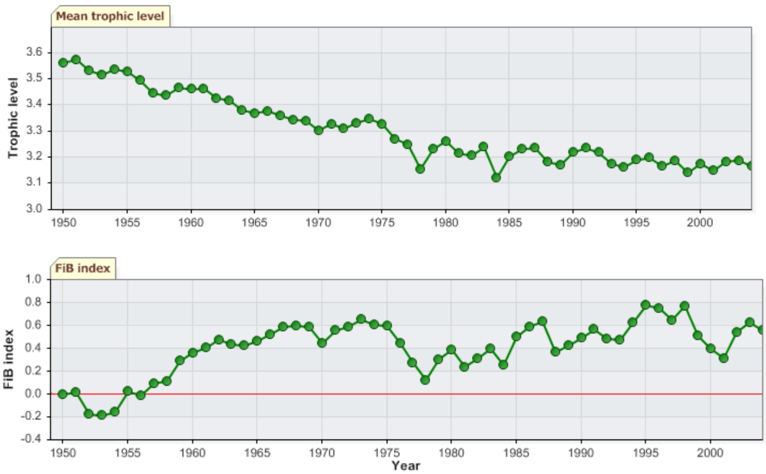

Figure XV-49.7. Mean trophic level (i.e., Marine Trophic Index) (top) and Fishing-in-Balance Index (bottom) in the Caribbean Sea LME (Sea Around Us 2007).

The Stock-Catch Status Plots indicate that nearly 80% of the commercially exploited stocks in the LME are either overexploited or have collapsed (Figure XV-49.8, top) and these stocks now contribute 60% of the reported landings (Figure XV-49.8, bottom).

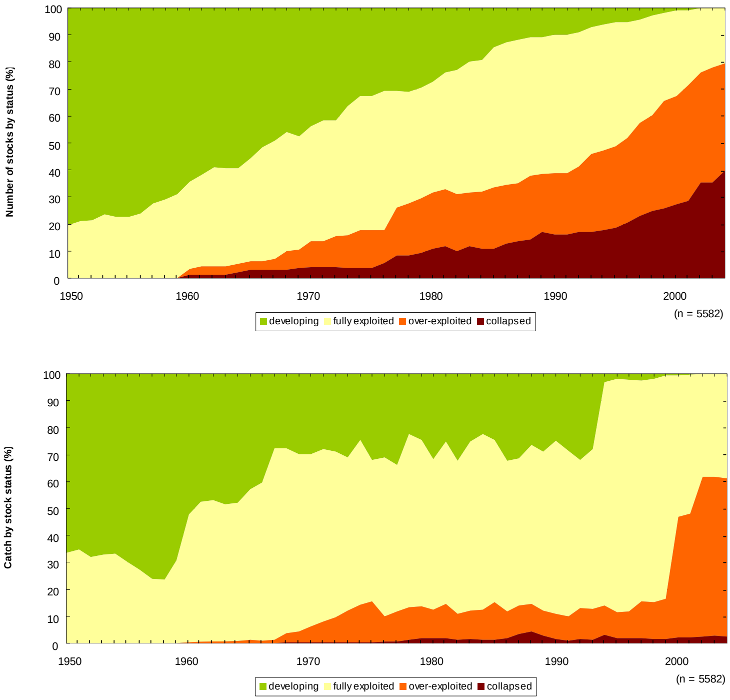

Figure XV-49.8. Stock-Catch Status Plots for the Caribbean Sea LME, showing the proportion of developing (green), fully exploited (yellow), overexploited (orange) and collapsed (purple) fisheries by number of stocks (top) and by catch biomass (bottom) from 1950 to 2004. Note that (n), the number of 'stocks', i.e., individual landings time series, only include taxonomic entities at species, genus or family level, i.e., higher and pooled groups have been excluded (see Pauly *et al*,, this volume, for definitions).

Overexploitation was found to be severe throughout the Caribbean Sea LME (UNEP 2004a, 2004b, 2006). Most coastal resources are considered to be fully or overexploited and there is increasing evidence that pelagic predator biomass has been depleted (Mahon 2002, Myers & Worm 2003). Many local fisheries had collapsed by the mid-1980s following the depletion of lobster, conch and finfish stocks (UNEP 2000). Overfishing, particularly of herbivorous species, has been identified as a key-controlling agent on Caribbean reefs leading to shifts in species dominance (Aronson & Precht 2000, Eakin *et al*. 1997; Hughes, T.P. 1994).

There is concern over the long-term sustainability of spiny lobster stocks due to an increase in fishing effort for this species. Furthermore, the minimum legal size of lobsters is well below the size of reproductive maturity in some areas (Richards & Bohnsack 1990). The conch fishery has collapsed in many areas and it is unlikely that conch catches can be sustained (Richards & Bohnsack 1990, Smith *et al*. 2000). Several species of sea turtles are threatened or endangered in many areas as a result of overexploitation (FAO 1997). Overfishing and reduced abundance of large-sized carnivorous reef fish such as snappers (*Lutjanus spp*.) and groupers (*Epinephelus spp*.) have been observed in several locations throughout the LME (e.g., Manickchand-Heileman and Phillip 1999, Charuau *et al*. 2001, Kramer 2003). Regardless of location, legal designation or local fishing regulations, these species have been overexploited in the entire Western Atlantic region (Ginsberg & Lang 2003). The sustainability of the groundfish fisheries in the southern Caribbean is also of concern in countries such as Venezuela and Trinidad and Tobago (Booth *et al*. 2001). These stocks have experienced high fishing pressure, particularly from trawlers. In the Gulf of Paria (between Trinidad and Venezuela), intense pressure from bottom trawling is thought to have contributed to a reduction in the abundance of species at higher trophic levels and the predominance of low trophic-level species (Manickchand-Heileman *et al*. 2004).

There is a clear trend of increasing landings of large pelagic fishes, both coastal and HMS and SS, by Caribbean countries. This indicates that these fisheries are expanding steadily, despite the absence of any indication of the levels that may be sustainable (Mahon 2003). In fact, some of these HMS and SS are already considered to be overfished, based on assessments carried out by the International Commission for the Conservation of Atlantic Tunas (ICCAT) (Die 2004). These include the Atlantic swordfish (ICCAT 2001a) and Atlantic blue marlin and white marlin (ICCAT 2001b). As a result of both management interventions and high recruitment levels in recent years, the swordfish stock has been slowly recovering (ICCAT 1999). The Atlantic yellowfin tuna stock is considered to be fully fished (ICCAT 2001a) but there is concern that the tendency for fishing effort to increase will ultimately result in overfishing of this species (ICCAT 2001a). The abundance of Western Atlantic sailfish fell dramatically in the 1960s and has not increased much since. Current catches seem sustainable, but it is not known how far the current levels are from maximum sustainable yield (ICCAT 2001b).

The quantity of bycatch and discards in the Caribbean Sea LME is significant, with bottom trawling for shrimp producing the greatest quantity of bycatch (UNEP/CEP 1996). Immature individuals of commercially important species generally dominate the shrimp bycatch. Moreover, the bycatch species composition has changed over the years and several species have practically disappeared, indicating a dramatic shrinking of their populations, notably in the case of sharks (Charlier 2001). Considerable quantities of bycatch, which includes sharks and large coastal pelagics, are also taken in the longline and other High Seas fisheries (Mahon 2003).

Destructive fishing practices such as dynamite and poison fishing are also contributing to the decline of some fish species throughout the region (Garzón-Ferreira *et al*. 2000). There is a lack of monitoring and enforcement to prevent these illegal practices, except for coast-watching by communities and coast guards.

Overfishing could have significant transboundary implications in the Caribbean Sea LME. In addition to the large migratory pelagic fishes, reef organisms, lobster, conch and small coastal pelagics are also likely to be shared resources by virtue of planktonic larval dispersal. In many species, larval dispersal lasts for many weeks or months, resulting in transport across EEZ boundaries (Richards & Bohnsack 1990). Therefore, even these coastal resources have an important transboundary component to their management. Therefore, fisheries management should be based on the status of the stock evaluated at the scale of the entire stock (Die 2004).

III. Pollution and Ecosystem Health

Pollution: Pollution of marine and coastal areas of the Caribbean Sea LME is a major and recurrent transboundary environmental issue in the region. Land-based pollution and physical alteration and destruction of habitats are among the major threats to the coastal and marine environments of the Caribbean Small Island Developing States (SIDS) (Heileman & Corbin 2006). In addition to land-based sources of pollution, the discharge of solid waste, wastewater and bilge water from both commercial and cruise ships as well as other offshore sources are of increasing concern (CAR/RCU 2000, GEF/CEHI/CARICOM/UNEP 2001). Pollution is moderate in general and severe in some coastal hotspots particularly around the large cities, especially in the Central America/Mexico sub-region (UNEP 2004a, 2004b, 2006). The entire Caribbean Sea may be considered a hotspot in terms of risks from shipping and threats to coral reefs (Heileman & Corbin 2006).

Sewage is one of the most significant pollutants affecting the coastal environments of the Wider Caribbean Region (CAR/RCU 2000). Rapid population growth, urbanisation and the increasing number of ships and recreational vessels have resulted in the discharge of increasing amounts of poorly treated or untreated sewage into the coastal waters (CAR/RCU 2000). Of even greater concern are the high bacterial counts that have been detected in some areas, including in bays where there is a large concentration of boats and berthing facilities. In addition to microbiological contamination, the input of sewage contributes high levels of nutrients to coastal areas. This, as well as inputs of fertilisers from agricultural run-off, have promoted hotspots of eutrophication as well as harmful algal blooms in some localised areas throughout the region (UNEP 2004a, 2004b). The estimated nutrient load from land-based sources is 130,000 tonnes nitrogen yr^{-1} and 58,000 tonnes phosphorus yr^{-1} (UNEP 2000). Discharges of suspended and dissolved solids have intensified through human activities, such as deforestation, urbanisation and agriculture. The region's rivers supply about 300 million tonnes suspended solids per year to the Greater Caribbean Region (PNUMA 1999). High turbidity and sedimentation have reduced biodiversity in shallow coastal waters throughout the region (UNEP 2000).

Of growing concern is the increasing amount of solid waste generated within the Caribbean countries. Because of inadequate collection and disposal facilities, much of this material eventually ends up on beaches and other coastal areas. About 70-80% of marine debris originates from the intense shipping traffic, especially cruise ships and oil tankers that cause an important transboundary movement of marine debris and tar balls (UNEP 2004a, 2004b). In addition to reducing the aesthetic value of the coastal areas, solid waste such as plastics are of considerable threat to marine fauna such as turtles, marine mammals and sea birds.

Chemical contamination from industrial and agricultural activities is severe in some localised areas (UNEP 2004a, 2004b). For example, pollution by copper, lead and zinc was found in water and sediments in Cuba, the Dominican Republic and Jamaica (GEF/UNDP/UNEP 1998). Coastal areas near to oil installations show significant heavy metal concentrations in sediments, for example, the Santo Domingo coastal zone and Havana Bay (GEF/UNDP/UNEP 1998, Beltrán *et al*. 2001). Chemical pollution is severe in some coastal areas of Central America, which has the highest use of pesticides per capita and which is expected to increase in the future.

One of the biggest potential threats to the Caribbean Sea LME is that of oil spills. Because of their petroleum-based industry, countries such as Trinidad, Tobago and Venezuela continue to have a higher risk of oil spills within their marine environments. Large volumes of hydrocarbons are discharged from tankers and private vessels in the region. More than one third of oil spilled at sea between 1983 and 1999 was caused by accidents at ports and oil installations located in the coastal zone (UNEP 2000). Thousands of large vessels, including those passing through the Panama Canal, transport nuclear and other hazardous materials through the Caribbean Sea annually, which increases the threat of spills of these materials.

Habitat and community modification: The coastal areas of the Caribbean Sea LME are comprised of habitats such as mangrove wetlands, seagrass beds and coral reefs, which dominate the land-sea margin and harbour high biological diversity. These habitats, however, are being impacted by a range of anthropogenic activities that have resulted in severe habitat and community modification, particularly around the smaller islands and along the mainland coast (UNEP 2004a, 2004b, 2006).

Signs of stress are particularly evident in the shallow-water coral reef habitats (Richards & Bohnsack 1990). Major threats to coral reefs are linked to overexploitation of reef fish communities, sewage, industrial and agricultural pollution, as well as tourism and sedimentation (Bryant *et al*. 1998, Garzón-Ferreira *et al*. 2000) and global warming. Recent studies have revealed a trend of serious and continuing long-term decline in the health of Caribbean coral reefs (Wilkinson 2002, Gardner *et al*. 2003, Lang 2003, Wilkinson and Souter 2005). About 30% of Caribbean reefs are now considered to be either destroyed or at extreme risk from anthropogenic threats (Wilkinson 2000). More was lost in the 2005 bleaching event (Wilkinson and Souter 2008). Another 20% or more are expected to be lost over the next 10-30 years if significant action is not taken to manage and protect them over and beyond existing activities. Dramatic changes in the community structure of coral reefs have taken place over the past two decades. Prior to the 1980s, scleractinian (stony) corals dominated Caribbean coral reefs and the abundance of macroalgae was low. Over the past two decades a combination of anthropogenic and natural stressors has caused a reduction in the abundance of hard corals and an increase in macroalgae cover (Richards & Bohnsack 1990, Kramer 2003). This has been exacerbated by the mass mortality of an important algal grazer, the sea urchin *Diadema* sp., in 1983 (Lessios *et al*. 2001). The worldwide mass coral bleaching events of 1997-1998 resulting from elevated sea surface temperatures affected coral reefs in almost the entire Wider Caribbean region (Hoegh-Guldberg 1999), where bleaching continued until the severe event of 2005. The impact of the bleaching events varied across the Wider Caribbean, with the Meso-American Barrier Reef sustaining severe damage.

Hurricanes have also impacted coral reefs in localised areas, for example, in Mexico and Belize, with varying degree of recovery (Gardner et al. 2005). A range of diseases has also affected Caribbean coral reefs, starting with black band disease in the early 1970s followed by white band disease in the late 1970s. Diseases of stony corals and gorgonians have been reported with increasing frequency (Woodley *et al*. 2000).

The major threats to the region's mangroves include coastal development and charcoal production. Many islands have reported deforestation of mangroves for fuel wood, often by squatters (GEF/CEHI/CARICOM/UNEP 2001). Between 1990 and 2000, 21 out of 26 countries showed decreasing mangrove cover, with annual rates of decline ranging from 0.3% in the Bahamas to 3.8% in Barbados (FAO 2003). Clearing of mangrove forests has made the coast more vulnerable to erosion and destroyed the habitat of many species (UNEP/CEP 1996). Sandy foreshores have also been severely destroyed and modified due to sand mining and poorly-devised shoreline protection structures (BEST 2002). Seagrass beds in some areas are affected by chronic sedimentation. Habitat destruction and alteration is significantly impacting the LME's biodiversity. For example, the population of the West Indian manatee has dramatically declined because of degradation of essential habitats and because they have been hunted (UNEP/CEP 1995).

Recognising the importance of the Caribbean Sea LME and its resources to economic development and human well-being, the countries are embarking on numerous programmes and activities to address the degradation of the marine environment. As a result, some improvements in the health of this LME are expected in the coming decades (UNEP 2004a, 2004b).

IV. Socioeconomic Conditions

The Caribbean Sea LME is bordered by 38 countries and dependent territories of the U.S., France, U.K. and the Netherlands. Sixteen of the independent states and the 14 dependent territories are Small Island Developing States (SIDS). The population of the Caribbean Sea region is approximately 107 million, with the majority inhabiting the coastal zones. In addition, each year the population increases considerably due to the influx of large numbers of tourists during the tourist season. The Caribbean countries, especially the SIDS, are highly dependent on the marine environment for their economic, nutritional and cultural well-being. There is a high dependence of the economies of the islands on tourism, with revenues from tourism ranging between 15 to 99% of total exports in 90% of the islands (CIA 2005). Marine fisheries also play an important social and economic role, and are an important source of protein, employment and foreign exchange earnings in many of the countries.

The socioeconomic impacts of overexploitation vary among the countries, but are generally slight to moderate (UNEP 2004a, 2004b). The Lesser Antilles Islands suffer the greatest socioeconomic impacts of overexploitation. Decreasing inshore resources, increasing harvesting expenses and increasing demand have led to an increase in the market prices of fish as well as conflicts between traditional and recreational fishers. Reduced employment opportunities in the fisheries sector have forced fishers to seek other sources of income. Declining fisheries resources also threaten the food security of fishers and others who are dependent on fisheries resources.

The socioeconomic impacts of pollution are moderate to severe, particularly in the Lesser Antilles and the Central American countries (UNEP 2004a, 2004b). Human health is threatened and the propagation of disease vectors promoted by the discharge of non-treated sewage and other contaminants (UNEP 2000). Where algal biomasses are significantly elevated due to eutrophication, such as in nutrient/sewage-enriched areas, the risk of disease and ciguatera poisoning is high (PNUMA 1999). Pollution has also diminished the aesthetic value of some parts of the region resulting in a loss of revenue from tourism (UNEP/CEP 1997).

The socioeconomic impacts of habitat modification range from slight to severe (UNEP 2004a, 2004b). The Caribbean islands are particularly affected by habitat degradation, as are the Central American countries. The impacts include medium to long-term loss of employment and income opportunities in the tourism sector, loss of recreational, cultural, educational, scientific values as well as costs of restoration of modified ecosystems (UNEP 2004a, 2004b). Habitats, such as mangroves and coral reefs, perform an important role in coastal protection and stabilisation. Therefore, the destruction of these coastal habitats has serious implications for the Caribbean Sea countries, particularly the SIDS, in view of rising sea levels and an increase in the frequency and intensity of storms and hurricanes (UNEP 2005).

V. Governance

With 38 countries and dependencies in the LME, the EEZs form a complete mosaic, resulting in many transboundary resource management issues, even at relatively small spatial scales. The need for countries of the Wider Caribbean to pay attention to the management of transboundary marine resources is well documented (Mahon 1987, FAO 1997). The fisheries initiatives in the region are partly governed by international frameworks such as UNCLOS, the UN Fish Stocks Agreement and the FAO Code of Conduct for Responsible Fisheries. At the regional level, there are several initiatives for the coordination of fisheries management (Mahon 2003). These are broad in scope, covering resources that range in distribution from coastal/national to HMS & SS. Among them are the FAO Western Central Atlantic Fisheries Commission, the Latin American Organisation for Fishery Development, CARICOM Regional Fisheries Mechanism, the Caribbean Fisheries Management Council and the Intergovernmental Oceanic Commission Sub-commission for the Caribbean (IOCARIBE). Operating at the international level are ICCAT and the International Whaling Commission. In 2001, the UN Fish Stocks Agreement that seeks to implement the provisions of UNCLOS related to conservation and management of HMS & SS came into force.

Despite a recognised need, there is no Regional Fisheries Management Organisation for the Wider Caribbean, including the Caribbean Sea LME, with a mandate to manage the fisheries resources. The most established and operational fisheries management organisation with relevance to the Caribbean Sea LME is ICCAT, which has the mandate to manage all tuna and tuna-like species in the Atlantic. The coastal species are perceived as being western Atlantic stocks that could be managed by the countries of the Wider Caribbean, whereas the oceanic stocks require a level of collaboration that would be best facilitated by an organisation such as ICCAT (Mahon 2003).

Regional programmes related to the marine environment include the UNEP's Regional Seas Programme, the Caribbean Coastal Marine Productivity Programme and the Caribbean Environment Programme (CEP), a sub-programme of UNEP's Regional Seas Programme. The aim of CEP is to p*romote regional cooperation for the protection and development of the marine environment of the Wider Caribbean Region. C*EP, which is facilitated by the Caribbean Regional Coordinating Unit located in Jamaica, is involved in several regional projects and initiatives including the International Coral Reef Initiative and its Action Network.

A number of marine environmental policy frameworks have been developed in the Caribbean. These include the 1981 CEP Caribbean Action Plan and the Convention for the Protection and Development of the Marine Environment in the Wider Caribbean Region (the Cartagena Convention) and its three protocols (Protocol Concerning Cooperation in Combating Oil Spills in the Wider Caribbean Region, Protocol Concerning Specially Protected Areas and Wildlife in the Wider Caribbean Region, and Protocol Concerning Marine Pollution from Land-Based Sources and Activities). In 1991, the Marine Environment Protection Committee of the International Maritime Organisation designated the Gulf of Mexico and the Wider Caribbean Region as a Special Area under Annex V of the MARPOL Convention. An ongoing initiative to have the Caribbean Sea internationally recognised as a special area in the context of sustainable development led to the adoption in 2003 by the UN General Assembly of the resolution ‘Promoting an integrated management approach to the Caribbean Sea area in the context of sustainable development’.

GEF is supporting the project ‘Integrating Watershed and Coastal Area Management in Small Island Developing States of the Caribbean’. The overall objective of this project is to assist participating countries in improving their watershed and coastal zone management practices. The project ‘Sustainable Management of the Shared Living Marine Resources of the Caribbean Large Marine Ecosystem and Adjacent Regions’ has been developed by IOCARIBE and is being implemented. The goal of this project is the sustainable management of the shared living marine resources of the LME and adjacent areas through an integrated management approach. The project is focused on aligning institutions on the national and regional scales to sustainably manage near shore and deep-water fisheries and related habitats of the LME, including the development and use of a knowledge base to support institutional decision-making. One of the objectives of this project is the preparation of a Transboundary Diagnostic analysis (TDA) and Strategic Action Plan (SAP) for the Caribbean Sea LME and Adjacent Regions.

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