THEMATIC REPORT FOR THE GUIANAS–BRAZIL SUB-REGION

Prepared for the CLME Project

by

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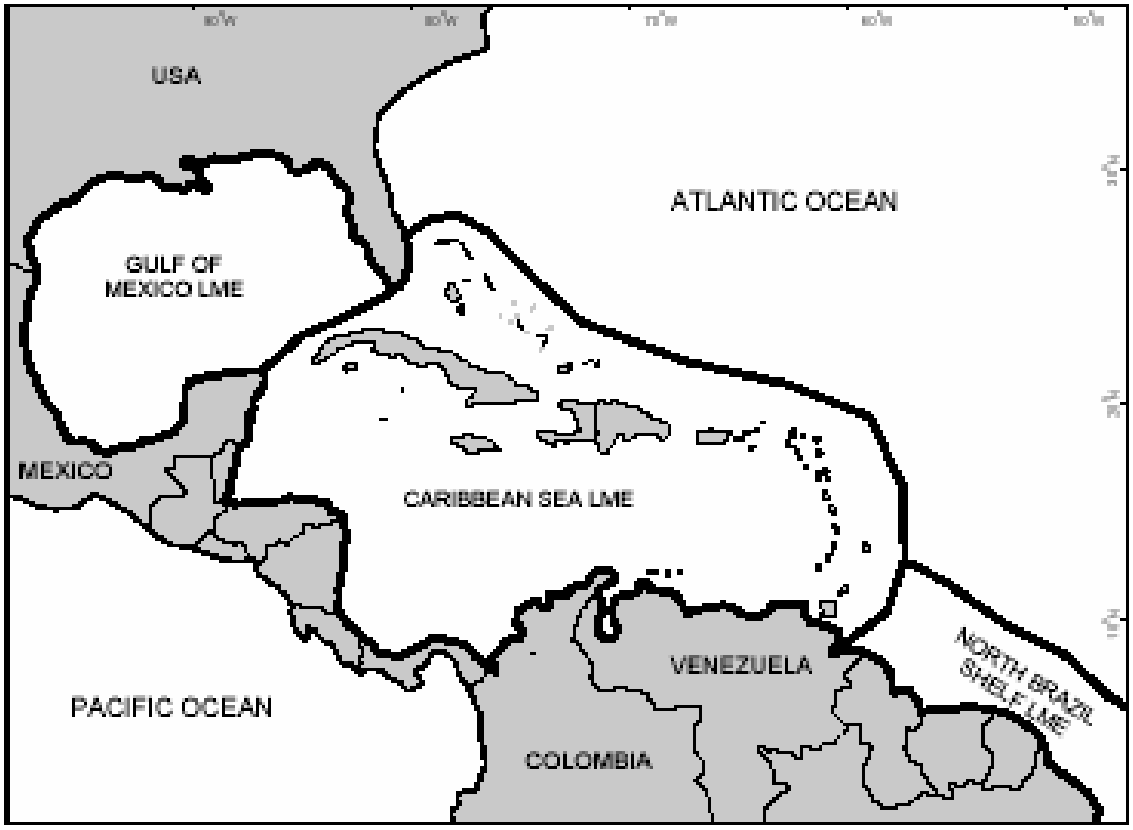

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1 INTRODUCTION

The Caribbean Sea Large Marine Ecosystem is a semi-enclosed tropical sea bounded by North America (South Florida), Central and South America and the Lesser Antilles Chain of Islands (Figure 1). The Caribbean Sea and adjacent regions include a wide variety of tropical ecosystems, associated natural resources and biodiversity. The region includes 26 countries and 19 dependent territories of the USA, UK, France and Netherlands, with countries ranging from the largest (e.g Brazil and the USA) to the smallest (e.g. Barbados, St. Kitts and Nevis) in the world, and from the most to the least developed. Throughout the region, there is a high dependence on marine resources for livelihoods, particularly from fishing and tourism. As such, the sustainability of its living resources is of considerable importance to an appreciable portion of the countries in the region.

The overall objective of the CLME Project is the sustainable management of the shared living marine resources of the Caribbean LME and adjacent regions through an integrated management approach. It is expected that the Project will provide the opportunity for the implementation of management reforms that will permit sustainable development and management of the shared LMRs of the Caribbean Large Marine Ecosystem and adjacent regions. Since most LMRs are shared in some way, these reforms can be expected to lead to improved food security and enhanced livelihoods in coastal communities that rely on fisheries and tourism (CLME Project Coordinating Office, 2006).

This Thematic Report will outline the key transboundary living marine resources issues for the Guianas–Brazil sub-region, the root causes and potential options for addressing them. For the purpose of this Report, the Guianas–Brazil sub-region will be viewed as the marine area comprised of the North Brazil Large Marine Ecosystem and the Gulf of Paria (Figures 1 and 2). This area is bordered by Brazil (states of Amapá, Pará, Maranhão), French Guiana, Guyana, Suriname, the southeastern part of Venezuela and Trinidad (Republic of Trinidad and Tobago) (Heileman. In press, Charlier 2001, and http://en.wikipedia.org/wiki/Gulf_of_Paria).

2 DESCRIPTION OF THE GUIANAS-BRAZIL SUB-REGION

This section provides an overview of the Guianas-Brazil sub-region, covering the geographical characteristics of the sub-region, its ecological status and a summary of the socio-economic situation.

2.1 Physical and Geographical Characteristics

The North Brazil Shelf Large Marine Ecosystem (Figure 2) is characterized by its tropical climate and it owes its definition to the influence of North Brazil Current (NBC), which flows parallel to Brazil's coast. The hydrodynamics of this region is dominated by the North Brazil Current (NBC), which is an extension of the South Equatorial Current and its prolongation, the Guyana Current (Figure 3).

As described by Bischof, Mariano and Ryan, the NBC plays a dual role in that it first closes the wind-driven equatorial gyre circulation and feeds a system of zonal countercurrents, and

secondly, provides a conduit for cross-equatorial transport of upper-ocean waters as part of the Atlantic meridional overturning cell. Large anticyclonic rings shed by the current swirl northwestwards along the South American coast, often reaching the eastern edges of the Lesser Antilles, where they eventually become absorbed into the Caribbean and Florida Currents.

The NBC appears as a surface-intensified flow with maximum speeds located above the 24.5 isopyncnal surface on the southern edge of all sections. Maximum speeds are typically found in the southern portion. Peak speeds of 110 cm s^{-1} have been recorded, although generally the current flows between 60-100 cm s^{-1} (Arnault *et. al*., 1999; Bourles, *et. al*., 1999). At about 5°S and 35°W, a salinity maximum of 37.1 was measured declining to 36.7 at the equator. However, salinity on average ranges anywhere from 35 to 36.75 (Bourles *et al*, 1999). Average temperatures of the NBC range from 22°C to 29°C. Near surface waters in this region show enhanced nutrient content (phosphate, silicate and nitrate) and their distribution confirm meanders of the NBC deduced from drifter experiments. These meanders are generated by the retroflection of the NBC in the western area, which then feeds the North Equatorial Countercurrent. (Oudot *et. al*., 1998).

The vertical structure of circulation of the NBC is a well-studied and well-understood phenomenon and clearly summarized by Bourles *et al* (1999). The NBC rings are a significant contributor to transporting water across current gyres and between hemispheres in the tropical Atlantic. On the average, NBC rings form 5-6 times per year, propagate at 14 km/day with a range of 8-30 km/day, and have a radius on the order of 100-200 km (Bourles *et al*., 1999)

Defined and influenced by the NBC, the North Brazil Shelf LME extends along northeastern South America from the Parnaíba River estuary in Brazil to the boundary with the Caribbean Sea and has a surface area of about 1.1 million $km^{2.}$ It contains 0.01% of the world's coral reefs and 0.06% of the world's sea mounts. Shelf topography and external sources of material, particularly the Amazon River with its average discharge of 180,000 m^3s^{-1}, exert a significant influence on the marine ecosystem, with this being complemented by discharge from other rivers such as Tocantins, Maroni, Corentyne, and Essequibo. A wide continental shelf, macrotides and upwellings along the shelf edge are some other features of this LME. (Heileman. In press, and LME 17: North Brazil Shelf). The Gulf of Paria, is a 7800 km^2 inlet of the Caribbean Sea, lying between the Venezuelan coast (including the mountainous Paria Peninsula) and Trinidad. It extends about 160 km east-west and 65 km north-south, and is linked with the Caribbean to the north by the strait called the Dragon's Mouths and with the Atlantic to the south by the Serpent's Mouth (both roughly 16 km wide) (http://www.britannica.com/eb/article-9058456/Gulf-of-Paria).

2.2 Ecological Status

2.2.1 Productivity

The North Brazil Shelf LME is considered a Class I, highly productive ecosystem (>300 $gCm^{-2}yr^{-1}$), with the Amazon River and its extensive plume being the main source of nutrients (Figure 4). Primary production is limited by low light penetration in turbid waters influenced by the Amazon, while it is nutrient-limited in the clearer offshore waters. Primary productivity on the continental shelf has been found to be greatest in the transition zone between these two types of

waters, occasionally exceeding 8 $gCm^{-2}day^{-1}$. It has a high number of amphibians, birds and reptile species. In addition to high production, the food webs in this LME are moderately diverse. Brazil's coral fauna is notable for having low species diversity yet a high degree of endemism (Heileman. In press and LME 17: North Brazil Shelf). The Gulf of Paria is a brackish water body, with wet season salinities being below 23 ppt. The extensive mangroves along the Venezuelan and Trinidadian coastlines are considered to be an important wildlife habitat and probably play a crucial role in regional fisheries (http://en.wikipedia.org/wiki/Gulf_of_Paria).

Major fronts within the North Brazil LME are associated with outflow from the Amazon River and, to a lesser extent, that of the Orinoco River. The Amazon plume initially turns northwestward and flows along the Brazil coast as the North Brazil Current. Off the Guiana coast, between 5°N and 7°N, the North Brazil Current retroflects and flows eastward. This retroflection develops seasonally and produces anticyclonic rings of warm, low-salinity water that propagate northwestward toward Barbados, the Lesser Antilles Islands and eventually the Caribbean Sea. The second major source of fresh water is the Orinoco River plume. Most thermal fronts are associated with salinity fronts related to freshwater lenses and plumes originated at the Amazon and Orinoco estuaries. Such fronts are relatively shallow, sometimes just a few meters deep. However, these fronts are important to many species whose ecology is related to the upper mixed layer. Fresh lenses generated by the Amazon and Orinoco outflows persists for months, largely owing to the sharp density contrasts across TS-fronts that form their boundaries (in case of fresh, warm tropical lenses, the temperature and salinity contributions to the density differential reinforce each other) (Heileman. In press).

2.2.2 Fish and Fisheries

The shrimp resources in the Guianas–Brazil sub-region support one of the most important export oriented shrimp fisheries in the world. These resources include four of the larger penaeids (southern brown shrimp *Penaeus subtilis,* pink spotted shrimp *P. brasiliensis,* southern pink shrimp *P. notialis* and southern white shrimp *P. schmitti*) and the smaller seabob shrimp (*Xiphopenaeus kroyeri*), with their general distribution and abundance differing markedly amongst the countries in the region. In general, the brown shrimp, *P. subtilis*, is more abundant in the eastern (Brazil through Suriname) than in the western (Guyana through Venezuela) regions of the shelf, while the pink spotted shrimp, *P. brasiliensis*, is far more important in Guyana and Suriname than in the remaining countries. The species is not caught in the Brazilian fishery and usually very large individuals are caught off the Venezuelan coast, but the species is secondary to *P. subtilis* in the inshore areas of the Gulf of Paria (Ehrhardt, 2001).

The groundfish resources such as red snapper (*Lutjanus purpureus*), weakfish (*Cynoscion* sp.*)*, whitemouth croaker or corvina (*Micropogonias furnieri*) and sea catfish (*Arius* sp.) in the Guianas-Brazil shelf region are important for commercial and social reasons, with the red snapper probably being the most important groundfish in the region as its distribution range is throughout the region and it is mainly exported. The fisheries are multigear, multispecies and multinational, using fishing methods that can be classified as industrial or artisanal depending on the level of mechanization (Booth *et al*, 2001). Sardine (*Sardinella* sp.) and tuna are also exploited, and although the volume of the tuna catch is relatively small, the value is significant (Heileman. In press).

The total annual fish landings in this area showed a steady increase to 438,000 tonnes in 1973, following which they were more or less stable for about a decade, declined slightly, and then stabilised (Figure 5). The value of the annual landings peaked at over 900 million US$ in 1986 (Figure 6). Brazil, followed by Venezuela, Guyana and Suriname, accounts for most of the catch from this area (Figure 7).

Between 1983 and 2003, the Marine Trophic Index showed a slightly increasing trend (Figure 8 top), while the Fishing in Balance Index remained relatively constant (Figure 8 bottom). These trends reflect the targeting of higher trophic level species and stable catches over this period, and suggest some degree of fisheries sustainability (Heileman. In press).

Despite the relatively stable catches, overexploitation was found to be severe, with there being evidence that some of the fisheries in this area may be fully or overexploited, particularly some of the groundfish stocks. In cases where assessments have been undertaken, there are clear signs of overexploitation of the southern red snapper (*Lutjanus purpureus*) resource, with declining catch rates and a decrease in the size of this species. Recent trends in catch per unit effort and other analyses indicate that the corvina is now overexploited in some areas, with the low stock levels of this species being commensurate with exploitation levels beyond the MSY level. Similarly, lane snappers (*L. synagris*), bangamary (*Macrodon ancylodon*) and sharks are also showing signs of overexploitation. A decrease in the average size of some groundfish species has raised sustainability issues. The increasing capture of small individuals is potentially compromising recruitment to the spawning stock. For instance, in Brazil, immature southern red snappers comprise over 60% of the catch of this species. Trawl and Chinese seines harvest bangamary at ages far below the age at maturity. Some deep slope demersal and pelagic species, however, are underexploited and have significant potential for development (Heileman. In press).

In general, all the shrimp species in the region are subjected to increasing trends in fishing mortality and the fishery is generally overcapitalised. Stocks of brown and pink spotted shrimp may be close to being fully exploited, with the latter being overexploited in some areas. There has been a general downward trend in the abundance of brown and pink shrimps, particularly during the late 1980s and throughout the 1990s. The trends in fishing mortality were not high enough to have created the very conspicuous decline in abundance, which implies that environmental factors (seasonal river run-off and rainfall) may be more significant than fishing in determining recruitment in these species.

Excessive by-catch and discards and destructive fishing practices are severe, and are of concern throughout the area, with the shrimp by-catch situation being well know for the region (Heilemen. In press). Analysis of the species and sizes composition of shrimp by-catch has indicated that many commercial species are included, with only a small part being utilised, and that undersized individuals generally predominate. It is also felt that the species composition has changed over the years and that several species have practically disappeared from the by-catch (Charlier, 2001). In 1998, a study showed that by-catch from the shrimp fishery in northern Brazil was about 7.2 kg of by-catch per kg of shrimp, with 4.4 kg of by-catch being useful for human consumption. It is possible that the above rates have not changed significantly since then. For the same period, in Venezuela, the by-catch amounted to 93% of the total catch in the nets, with 33 % being sold in the local markets and about 60% being returned, mostly dead to the sea

(FAO/WECAFC, 2002.). Artisanal fishing gears such as "Chinese seines" and pin seines also catch large numbers of undersized fish, which result in inefficient utilization while making a significant contribution to overexploitation (FAO/WECAFC, 2001).

Sea turtles occurring in the area include the leatherback (*Dermochelys coriacea*), green turtle (*Chelonia mydas*), olive ridley (*Lepidochelys olivacea*), hawksbill (*Eretmochelys imbricata)* and loggerhead (*Caretta caretta*). Taken at the regional level, the leatherback colony in the Guianas was considered to be very volatile, but presently appears to be stable. However, continued careful monitoring for accurate determination of its overall status is required. Based on the limited data available, Green turtles do not seem to be particularly threatened in Suriname or in French Guiana, but ongoing capture on the beaches of Guyana could constitute a serious threat to the sub-population nesting in the region. With regards to the olive ridley, it has been pointed out that the apparent declines in both Suriname and Guyana could be due to a shift to new nesting sites in French Guiana. Due to their relatively low numbers in the Guianas, little is known about the status of hawksbills, or their relationship to other sub-populations in the Wider Caribbean Region. In the Western Atlantic, loggerheads nest mainly in the USA and Brazil, with rare occurrences on the beaches of the Guianas. Little is know about the abundance, distribution and behaviour of these turtles in nearshore and offshore waters (Kelle *et al,* 2000).

All sea turtles nesting and/or foraging in the Guianas may belong to shared populations, as evidenced by uniquely tagged females nesting on either side of an international border; post-nesting adults migrating between nations, and by juveniles exploiting habitats extending over multiple political jurisdictions. The IUCN has classified sea turtles as critically endangered or endangered and all locally occurring sea turtle species are protected by the national laws of the Guianas (Kelle *et al,* 2000).

Most uses of sea turtles, whether consumptive or non-consumptive, are regulated and/or monitored in some way. The offshore drowning of sea turtles associated with incidental capture by fisheries, especially by shrimp trawlers off the Guianas-Brazil area, posed a serious management issue. This is being addressed by the nets of such trawlers having to be outfitted with turtle excluder devices (TEDs), moreso if the operators are exporting their product to the USA, which conducts an annual inspection and certification programme. However, due to the potential threat of incidental capture by fishing gear in offshore waters, sea turtles should be included in any regional and national fisheries management plans.

IUU fishing poses one of the biggest threats to fisheries management for developing states, with the problem being compounded by a number of factors, such as the large area of marine space to be policed; close proximity of the states leading to situations of stocks straddling the borders of neighbouring states; migratory nature of some fisheries resources and the fishing fleets that follow them; lack of financial and technical resources for surveillance and enforcement; and the lack of skilled manpower for maintaining adequate management systems (CRFM, 2005). It is know that such activities occur within the Guianas–Brazil area, especially in the shrimp and red snapper fisheries, with Brazil, Suriname, Guyana, Venezuela and Trinidad & Tobago having identified illegal fishing as a key management issue that needs to be addressed (Chakalall et al, 2002).

2.2.3 Pollution and ecosystem health

Overall, pollution was found to be moderate, but severe in localised hotspots near urban areas. Most of the pollution is concentrated in densely populated and industrialised coastal basins, and not widespread across the region. Water quality in the coastal areas are threatened by human activities that give rise to contamination from sewage and other organic material, agrochemicals, industrial effluents, solid wastes and suspended solids (Heileman. In press).

Effluents from industries are released, sometimes untreated, into the water bodies. Contamination by mercury as well as by agro-chemical wastes is the main source of chemical pollution in the Amazon Basin. Gold is exploited in all the countries of the region and mercury from mainly artisanal and small scale gold mining operations is dispersed into the air, with the assumption that the largest part ends up in rivers, transforms into methyl-mercury and other chemical compounds and concentrates along the food chain. Mercury contamination could, on the longer-term, become a hazard for the coastal marine ecosystem and for human health, if suitable measures to limit its use are not implemented. There is also the potential risk of pollution from oil extraction, both in the coastal plain and the sea.

Agricultural development is concentrated along the coast and includes intensive cultivation of sugarcane, bananas and other crops. This involves the application of large quantities of fertilisers and pesticides, which eventually end up in the coastal environment. Sugarcane plantations along the coast are also suspected to contribute persistent organic contaminants, which are widely used in pest control, to the coastal habitats (Heileman, In press and LME 17: North Brazil; Shelf.)

As a result of the coastal hydrodynamics in this area, the potential for transboundary pollution impacts is significant. River outflow is deflected towards the northwest and influences the coastal environment in an area situated west of each estuary. It has been estimated that 40-50% of the annual Amazon run-off transits along the Guyana coast. In fact, Amazon waters can be detected as far away as the island of Barbados. As a result, most of the coastal area of the Guianas-Brazil region has been described as an ‘attenuated delta of the Amazon’. This implies that contaminants in river effluents, particularly those of the Amazon, could be transported across national boundaries and EEZs (Figure 9) (Charlier, 2001 Heileman. In press).

2.2.4 Habitat and community modification

Brazil holds about one-third of the world's remaining rainforests, including a majority of the Amazon rainforest, and is also overwhelmingly the most biodiverse country on Earth, with more than 56,000 described species of plants, 1,700 species of birds, 695 amphibians, 578 mammals, and 651 reptiles. Due to the vastness of the Amazon rainforest, Brazil's average loss of 34,660 square kilometers of primary forest per year between 2000 and 2005 represents only about 0.8 percent of its forest cover. However, deforestation in Brazil is one of the most important global environmental issues today. The increase in Amazon deforestation in the early 1970s coincided with the construction of the Trans-Amazonian Highway, which opened large forest areas to development by settlers and commercial interests, while in more recent years, growing populations in the Amazon region, combined with increased viability of agricultural operations, have caused a further rise in deforestation rates (http://rainforests.mongabay.com/20brazil.htm).

The rainforests of French Guiana are still largely unexploited and sparsely populated, with the majority of the population living on the Atlantic coastal zone. For the immediate future, the forests of French Guiana face relatively few threats, although timber extraction is increasing and a relatively high population growth rate of displaced Lao farmers and other local groups may pressure coastal forest regions with subsistence agriculture. Gold potential in the interior regions is attracting foreign development interest, and there are some concerns over a potential road project (http://rainforests.mongabay.com/20frenchg.htm). Suriname's extensive forest cover and low population, about 400,000 concentrated in the capital and coastal cities, with 5 percent living in the rainforest, give it one of the lowest deforestation rates in the world. However, in the past years there has been increasing concern over the developing mining sector, as Suriname is known to have rich deposits of gold and bauxite. Also, its inexpensive power costs makes it attractive to the energy-intensive aluminum business. Such developments suggest deforestation is likely to increase. (http://rainforests.mongabay.com/20suriname.htm).

Guyana, a small, lightly populated country, is about three-quarters forested; with approximately 60 percent being classified as primary forest. In the past, these extensive forests have been lightly exploited, largely due to obsolete equipment and lack of capital. However, in the early 1990s, a large logging concession was granted to a foreign logging firm, and there was a rush from other firms to obtain similar concessions, but this was curtailed, and today, the level of harvesting in Guyana is very low (http://rainforests.mongabay.com/20guyana.htm). Venezuela is one of the ten most biodiverse countries on Earth, with extensive rainforests that are increasingly threatened by development. Each year, roughly 287,600 hectares of forest are permanently destroyed, while other areas are degraded by logging, mining, and oil extraction. Between 1990 and 2005, it is reported that Venezuela lost 8.3 percent of its forest cover, or around 4,313,000 hectares (http://rainforests.mongabay.com/20venezuela.htm).

At present, the tropical forests of the Guianas–Brazil sub region would appear to be relatively unexploited and face few threats, but with increases in large scale logging, artisanal and industrial gold mining, agricultural operations and the growing populations in some of the forested areas, the impacts of these activities can lead to environmental degradation.

Human activities along the coastlands have led to severe habitat modification in the Guianas–Brazil area. Mangroves, which dominate a major part of the shoreline, have been seriously depleted in some areas. For example, in Guyana, mangrove swamps have been drained and replaced by a complex coastal protection system, while on the Brazilian coast, there has been significant reduction in the original mangrove area by cutting for charcoal production and timber, evaporation of ponds for salt, and drained and filled for agricultural, industrial or residential uses and development of tourist facilities. In Brazil, erosion also threatens coastal habitats and some coastal lagoons have been cut off from the sea (Heileman. In Press.).

In the past, the coral reefs were mined for construction material. Currently, they are exposed to increased sedimentation due to poor land use practices and coastal erosion, chemical pollution from domestic sewage and agricultural pesticides, overfishing, tourism and development of oil and gas terminals. Additionally, there has been some coral bleaching associated with climate variation (Heileman. In press and LME 17: North Brazil Shelf).

Trawlers often operate without restriction in the shallower areas of the shelf, over ecologically sensitive areas inhabited by early life stages of shrimp. The environmental impact of such activities is likely to be high, considering the intensity of shrimp trawling operations in these areas. Evidence from other regions suggests that precautionary measures should be undertaken in environmentally sensitive areas of the continental shelf. Trawlers also catch significant quantities of finfish as by-catch, of which dumping at sea is still a widespread practice in the region. In Suriname, small-scale fishers have reported the incidence of 'dead waters', in shallow areas, following fishing activity by trawlers. These dead waters were scattered with dead fish in larger amounts than could have been discarded by the trawlers. Vast areas were devoid of live fish, as they had apparently died or moved out of the area. Such mortality could be the result of local oxygen depletion, caused by the re-suspension of anoxic sediment combined with the presence of organic matter dumped from the vessels (Charlier, 2001).

Invasive alien species (IAS) are increasingly being viewed as a threat to indigenous biodiversity, through their impacts on natural habitats and ecosystems, but little is know about marine invasive species (MIS) compared to terrestrial ones. However, the ballast water (BW) from ships is considered to be a major invasion pathway. Information compiled from various sources during a recent study of marine invasive species in the Wider Caribbean Region (WCR), which stretches from as far north as Florida (USA) to as far south as French Guiana in South America, revealed that the total number of MIS recorded so far was 118, with fishes forming the largest group (39) and arthropods (31) and molluscs (15) coming after. The green mussel (*Perna viridis*), an invasive species from the Indian and Pacific oceans was found in Trinidad and Tobago (Lopez and Krauss, 2006).

The issue of invasive species as an environmental and sustainable development threat has been recognised by a number of treaties, including the Convention on Biological Diversity (CBD) and the Specially Protected Areas and Wildlife (SPAW) Protocol. In 2004, the International Convention for the Control and Management of Ships Ballast Water and Sediments was adopted to control and manage the release of ballast water by ships in order to reduce the threat of IAS in waters near BW release sites. The Convention is awaiting ratification (Lopez and Kraus, 2006). With regards to BW, the International Maritime Organization (IMO) is collaborating with the Global Environment Facility (GEF), the United Nations Development Programme (UNDP), member governments and the shipping industry to assist less-industrialised countries to tackle the ballast water problem under the Global Ballast Water Management Programme, or GloBallast. The overall objectives of the programme are to assist developing countries to reduce the transfer of harmful organisms from ships' ballast water; implement the IMO ballast water guidelines; and prepare for implementation of the Convention (http://globallast.imo.org/index.asp?page=gef_interw_project.htm). Brazil was involved as one of the six pilot countries in the first phase (2000-2004) of the Project, while, in preparation for the second phase, a scoping workshop was held in Venezuela in 2006 for WCR countries (Lopez and Krauss, 2006).

Growth of the local human population and pressures associated with urban and industrial development will continue to threaten the environmental health of this sub-region. The problems are, however, potentially reversible, considering that there is a greater public and governmental

awareness about environmental issues and several measures at national and regional levels are being taken to address some of these problem (Heileman. In press).

2.3 Socio-Economic Background

The coastal zone in the Guianas–Brazil sub-region has not been an area of spectacular economic or industrial development, with the largest part of the coast being even virtually untouched by human activities. Urban development is concentrated in the neighbourhood of river mouths and on riverbanks close to sea, with human impact being probably the highest at both extremities of the region: on the right bank of the Amazon-Para estuarine system, and along the Gulf of Paria, on the Trinidadian side (Charlier, 2001).

Table 1 provides some socio-economic statistics for the countries in the Guianas-Brazil sub-region. The most populated country is Brazil, followed by Venezuela and Trinidad and Tobago, with the least populated being French Guiana. Of the six countries, Trinidad and Tobago has the highest per capita GDP and Guyana the lowest, with the others averaging US$8,000.00. In 2006, the infant mortality rate ranged from 21 to 32 for Venezuela, Suriname, Trinidad & Tobago and Guyana, while French Guiana had an infant mortality rate of 12.07 in 2005. The per capita consumption of fish protein is significantly higher than the global average in Guyana, while for the other countries it ranges from 5 to 17 kg. The level of human development, as reflected by the UN Development Index (HDI), is medium for all the countries, except Trinidad &Tobago, which showed a high.

Human activities include subsistence agriculture (rice, corn, cassava and beans), fisheries (mostly artisanal and focused on shrimp), and the exploitation of gold in the Amazon Basin. Also, logging and mining are taking place in the Amazon basin. There is coastal exploitation of clay and sand, and limited ecotourism. (LME 17: North Brazil Shelf and Heileman. In press). In Guyana and Suriname, agriculture (crops cultivated in the coastal areas), fisheries, and natural resources such as gold and bauxite are among the main economic activities.

Marine fisheries constitute an important economic sector in the region, providing foreign exchange earnings, employment, incomes, and animal protein. A significant portion of the region's population depends upon fishing for its survival and is unable to substitute fish with other sources of animal protein. In Brazil, while fisheries activity does not make a significant contribution to the GDP, about 0.4 %, it makes an important contribution to the livelihoods of the population living along the extensive coast, lakes, rivers and weirs, and has created about 800,000 jobs directly, with about 4 million persons depending indirectly on fisheries and fish farming (http://www.fao.org/fi/fcp/en/BRA/profile.htm).

In Guyana, the fishery sector is of critical importance to the economy and to social well-being, with its economic contribution having grown dramatically in recent years. The sector contributes about 6% to GDP and employs about 10,000 persons directly (Heileman. In press.). In Trinidad and Tobago, the economy is dominated by oil, natural gas and petroleum exploration and export, so the contribution of the fisheries sector to the Gross Domestic Product (GDP) is small, and is estimated to be about 0.3%, representing about 13 % of the total contribution of agriculture to GDP. However, it is estimated that the fishing industry employs over 10, 000 individuals

directly, with another 50, 000 or so engaged in ancillary and support services, representing approximately 10% of the agriculture labour force.
(http://www.fao.org/fi/fcp/en/TTO/BODY.HTM).

In general, unsustainable overexploitation of living resources as well as environmental degradation may result in threats to food security and loss of employment, as well as loss of foreign exchange to the countries bordering this sub-region. (Heileman. In press).

3 KEY TRANSBOUNDARY ISSUES

Based on a review of the existing literature, this section will identify the key transboundary living marine resources issues for the Guianas–Brazil sub-region and the root causes underlying these issues.

Within the context of the LME Modules (productivity, fish/fisheries, pollution/ecosystem health, socio-economics and governance (Duda and Sherman, 2002), the key transboundary issues in the Guianas–Brazil sub-region that would need to be addressed are set out below.

Fish and Fisheries
The key transboundary issues identified within the Guianas–Brazil sub-region would appear to be:

(i) Overexploitation of the shrimp and groundfish fisheries.
(ii) Excessive by-catch and discards and destructive fishing practices.
(iii) Illegal, Unreported and Unregulated (IUU) fishing.

Pollution and Ecosystems Health
With regards pollution and ecosystem health the key transboundary issues would appear to be:

(i) Chemical pollution by fertilisers and pesticides from agriculture.
(ii) Heavy metal pollution by mercury from the gold mining industry.

Habitat and Community Modification
Under habitat and community modification, the key transboundary issue would appear to be:

(i) Modification or loss of ecosystems (mangroves/corals) and ecotones.

3.1 Fish and Fisheries

3.1.1 Environmental Impacts

(i). Overexploitation of the shrimp and groundfish resources

The effects of fisheries activities on the environment are considerable in the Guianas-Brazil region and can affect fisheries productivity, with the intensity of these effects depending on local conditions, particularly the type of substrate and benthic cover, and the natural variability of the environment. They may be more marked, as far as the benthic environment is concerned, in the outer part of the shelf (beyond 20 m depth) than in the shallow, coastal, soft-bottom zone. But the impact on the structure of the fish communities themselves (species and size composition) is real both on the inshore and offshore components of the ecosystem. However, at present, the

interactions between the fisheries and environment are difficult to define and quantify, as understanding these interactions requires a detailed knowledge of the mechanisms of the ecosystem, including its natural variability, which is not currently available (Charlier, 2001).

(ii). Excessive by-catch and discards and destructive fishing practices

Practically all fishing gear catch non-target species that cannot, in general, be returned alive to the sea. This unintended fishing mortality has reduced drastically several fish populations around the world, particularly demersal species in areas where there is an intensive shrimp trawl fishery. Fish populations can even be reduced outside the fishing grounds. The shrimp by-catch issue is well known in the Guianas–Brazil sub-region, where studies in several countries have attempted to quantify the impact on several commercial species. Analysis of the species and sizes composition of the by-catch reveals that many commercial species are included, that only a small part is utilised, and that undersized individuals generally predominate. It is also felt that the species composition has changed over the years and that several species have practically disappeared from the by-catch, indicating a dramatic shrinking of their populations, notably in the case of sharks (Charlier, 2001) "Chinese seines" and pin seines also catch large numbers of undersized fish.

Destructive fishing practices, such as the use of explosives and poisons on the reefs and mangroves to capture octopus and crabs respectively, and the use of nets to catch lobsters also contribute to habitat degradation.

(iii). Illegal, Unregulated and Unreported Fishing

Illegal, Unregulated and Unreported (IUU) fishing does not pay heed to national boundaries or regional/international attempts to manage fisheries resources, so it can place unsustainable pressure on fish stocks, marine wildlife and habitats (http://www.illegal-fishing.info/).

3.1.2 Socioeconomic Consequences

Overexploitation of the shrimp and groundfish stocks in the Guianas–Brazil sub-region with inadequate fisheries management could impact on income, employment, food supply, and foreign exchange earnings in the countries of the region. IUU fishing can lead to major losses in revenue in an area where dependency on fisheries for food, livelihoods and revenues is high.

3.1.3 Linkages with other transboundary problems

In addition to overcapacity in the fishing operations, overexploitation may be linked to environmental factors, which may be more significant than fishing in determining recruitment in some of these species. Shrimp and fin-fish trawls by legal and illegal operators can contribute to habitat and community modification.

3.1.4 Immediate causes

The immediate causes for overexploitation of the shrimp and groundfish resources, excessive by-catch and IUU fishing can be attributed to:

- The multispecies nature of these fisheries;

- Overcapacity (fishing effort, processing infrastructure) in the mainly industrial shrimp fishery and in the mainly open access, multigear groundfish artisanal fishery based in rural communities;
- Indirect fishing effort by the shrimp trawl fisheries on groundfish species and the destruction of juvenile groundfish by "Chinese seines" and pin seines;
- IUU fishing due to the decline in catches for shrimp, red snapper, large sciaenids and marine catfish fisheries which have led to fishers operating in breach of management controls within their respective EEZ's as well as fishing illegally in the waters of other countries;
- Habitat loss or degradation due to nearshore trawling and deforestation of mangrove forests; and
- Possible chemical pollution from the agricultural (fertilizers and pesticides) and mining (mercury and possibly cyanide) sectors.

3.1.5 Underlying causes

The underlying causes for overexploitation of the shrimp and groundfish resources, excessive by-catch and IUU fishing include:

- The high level of investment in a shrimp fishery that is driven by the export demand for the product, with the main markets being the USA, Japan and the EU;
- Demand for groundfish as a source of protein in the local markets, and the export demand for red snappers, some large sciaenids and marine catfishes to North America;
- The need for foreign exchange by the countries involved;
- Dependence on the groundfish fishery as a source of employment and income in many rural communities;
- Subsidies in the form of duty free equipment, fuel, spares, etc.; and
- Inadequate institutional frameworks for fisheries and coastal zone management, such as ineffective policies, deficiencies in legislation and insufficient technical capacity in such areas as data management, analysis, management and enforcement in the countries bordering the Guianas–Brazil area.

3.1.6 Socio-economic, legal and political root causes

The main economic and political root causes affecting the sustainability of the shrimp and groundfish fisheries in the sub-region and contributing to excessive by-catch and IUU fishing include:

- The need by the shrimp industry to obtain adequate returns on their large capital investment and lack of integrated governance structures;
- Rural poverty, illiteracy; and
- Lack of integrated governance structures and weak governance.

3.1.7 Knowledge gaps

Recent work on the brown shrimp and pink-spotted shrimp show a consistent decrease in biomass in recent years, with the decline being attributed to such factors as fishing mortality, increasing fishing close to shore where immature shrimp are caught, and environmental factors possibly linked to rainfall and river outflow. However, there is still need to improve on the

quality of data/information as it relates to the fishing capacity, including processing infrastructure, operating in the Guianas–Brazil shrimp fishery and on the intensity and effects of near shore fishing by shrimp trawlers. In like manner, there is need to determine the possible links between recruitment and environment and its likely effects on the fishery. Also, more bio-economic assessments are required as previous work had shown that the current levels of exploitation were above the economic minimum, suggesting that potential revenue was being dissipated. In addition, there is need to evaluate the effectiveness of the management tools, such as effort control, closed areas and closed seasons being used in the shrimp fisheries, and determine how they can be improved. Basic assessment work needs to be done on the seabob as this species is now being targeted by the industrial trawl fleets in countries such as Guyana and Suriname (FAO/WECAFC, 2001).

With regards to the groundfish fisheries, the results of assessments of a limited number of species indicate high levels of exploitation with most stocks being fully exploited and frequently overexploited, but despite a desire for sustainable utilization, management was seriously hindered by a lack of comprehensive and reliable information on many important species (FAO/WECAFC, 2001). For example, even though the red snapper fishery, which started in 1940, is one of the most important fisheries in the region between eastern Venezuela and northern Brazil, not much is known about the stock structure and fishing effort being applied. The identification of the structure and fishing effort would contribute significantly to more effective management (Charuau, *et al.* 2001).

Not much is known about the impacts of nearshore fishing gear such as the "Chinese seines", some nearshore gillnets, and pin seines on the resources and habitats.

The extent of IUU fishing in the Guianas–Brazil sub-region is unknown, but it is recognized that such activities can be detrimental to the management of the fisheries in the sub-region, in terms of its impact on the assessment of the resources, management and economic returns.

3.1.8 Proposed Options

Overexploitation of the shrimp and groundfish resources combined with excessive by-catch and discards and destructive fishing practices and IUU fishing due to inadequate fisheries management and enforcement could lead to further loss of income, employment, food supply and foreign exchange in the sub-region and should be urgently addressed. Among the interventions required are:

(i) Determination of the level of poverty in the fishing communities and the identification of alternative livelihood programmes.
(ii) Institutional strengthening of the fisheries administrations and research institutions at the national and sub-regional levels.
(iii) Harmonisation of fisheries and related legislation in the sub-region.
(iv) Strengthening of the existing mechanisms for sub-regional collaboration in resource assessment and management.
(v) Development of mechanisms for improved stakeholder participation in the management process.
(vi) Development of mechanisms for conflict resolution.

(vii) Development of a sub-regional database for fisheries and related data/information.
(viii) Evaluation of the tools being used for fisheries management in the sub-region.
(ix) Continued assessment, including bio-economic assessments, of the shrimp and groundfish resources.
(x) Review and determination of the most suitable methods for by-catch utilization and reduction. In this instance, the information from the GEF Reduction of Environmental Impact From Tropical Shrimp Trawling through the Introduction of By-Catch Reduction Technologies and Change of Management, in which Venezuela and Trinidad and Tobago were involved, could be reviewed and utilized (http://www.fao.org/figis/servlet/static?xml=gef shrimp.xml&dom=org&xp nav=14).
(xi) Determination of the extent of IUU fishing in the sub-region and the development of mechanisms to combat it at the national and sub-regional levels.
(xii) Determination of the environmental factors that may be influencing recruitment to the shrimp fishery.

3.2 Pollution and Ecosystem Health

3.2.1 Environmental Impacts

In general, pollution was found to be moderate, with most of it being concentrated in densely populated and industrialised coastal basins and not widespread across the region. However, contamination by mercury from gold mining and agro-chemical wastes were identified as the main sources of heavy metal and chemical pollution, with it being pointed out that mercury contamination could, on the longer-term, become a hazard for the coastal marine ecosystem and for human health, if suitable measures to limit its use were not implemented (Heileman. In press).

Impacts on marine ecosystems generated by land-based human activities are called Marine Catchment Basin (MCB) effects. Such effects are particularly crucial in enclosed or semi-enclosed seas, but they are also important in the case of ecosystems that are strongly influenced by river run-off, as in the shallow areas of the Guianas-Brazil shelf (Charlier, 2001).

Urban development is concentrated in the neighbourhood of river mouths and on riverbanks close to sea, with human impact being probably the highest at both extremities of the region: on the right bank of the Amazon-Para estuarine system, and along the Gulf of Paria, on the Trinidadian side. Due to the hydrodynamics of the region, the central, largest part of the area may remain basically unaffected. Effluents from the relatively industrialised and populated Belém region, situated on the East bank of Pará River, are barred from this region by the outflow of the Amazon and Pará rivers. Effluents from the west coast of Trinidad reach the Gulf of Paria and, given the Northwards current through the Columbus Channel, cannot impact any region to the South. However, some land-based human activities could have a potential impact on the marine environment and on fisheries in the region (Charlier, 2001).

(i). Chemical pollution by fertilisers and pesticides from agriculture
Agriculture is very important to many economies in the region. It can have a direct impact on the marine environment when it involves areas included in the "broader marine ecosystem" (including brackish zones connected with the sea). Such areas are generally not suitable for

agriculture, due to their salt content. For example, it has been a policy, in Suriname not to allow agricultural projects within a certain distance from the coastline, for technical as well as environmental reasons, but exceptions have been tolerated and there have been encroachments on the mangrove and associated brackish-water biota, for rice (as well as in French Guiana) and livestock development, but the areas concerned seem to remain modest.

Agricultural development can be described as very modest in terms of area used. On the other hand, farmed areas are concentrated in a coastal stretch of a few tens of kilometres breadth, the cultures are water-intensive (rice) as well as agrochemicals-intensive (sugar cane, bananas), and the drainage is directly to the sea, without treatment or monitoring of the effluents. Local effects could therefore be observed, particularly if input of an additional nutrient charge from agriculture would combine, for example, with re-suspension of organic matter trapped in sediment.

Areas within the coastal brackish-water belt have been identified as suitable for aquaculture, particularly for marine shrimp, with a few projects having been undertaken in Suriname. These did not cover any significant part of the available area. However, aquaculture seems to have a potential for development and more extended areas could be affected in the future.

Effluents carrying chemicals used in agriculture or residues can also be expected to have impacts if they are drained in sufficient concentration to the sea. They can be pesticides, deleterious for some marine organisms, or fertilizers that may alter the nutrient balance in the sea (Charlier, 2001).

(ii). Heavy metal pollution by mercury from the gold mining industry

Gold is being exploited on a small-scale in all countries of the region. The main technology used to separate and amalgamate gold is the least expensive available and involves the application of mercury. This mercury is dispersed into the air and it is assumed that the largest part ends up in rivers, transforms into methyl-mercury and other chemical compounds, and concentrates along the food chain. According to the IUCN, high concentrations of mercury were detected in fish as far as 800 km downstream from gold mining areas in Brazil. Recently initiated investigations in Suriname indicate that mercury concentrations in fish may approach maximum norm (0.5 mg/kg) in piscivorous fish from the upper course of rivers, close to gold mines, and decreases towards the middle and lower course. Larger scale gold mines, present as well in the region, use cyanide to separate gold. Errors can have disastrous consequences for aquatic life, as happened in 1995 in Guyana with the accidental release of cyanide into the Omai and Essequibo rivers (Charlier, 2001).

3.2.2 Socio-economic Consequences

The value of fisheries products could decrease due to contamination by mercury and cyanide, from artisanal and large-scale gold mining respectively, and pesticides and other chemicals from agriculture. Also, the occurrence of mercury in fish species and the environment could pose problems for human health.

3.2.3 Linkages with other transboundary problems

If not checked, the hazards posed to the coastal marine ecosystem by contamination from some chemicals being used in agriculture and gold mining could lead to the decline in fish stocks and other marine organisms.

3.2.4 Immediate Causes

The immediate causes for pollution of the coastal marine ecosystems by chemicals (fertilizers, pesticides) from agriculture can be attributed to:

- Farmed areas being concentrated in the coastal belt;
- Culture practices being used that are water (rice) and agrochemical intensive (sugar cane, bananas) draining directly to the sea; and
- Lack of treatment or monitoring of the effluents and non-point sources of discharge.

The immediate cause for the pollution of the marine ecosystem by mercury from the gold mining industry is:

- The use of the least expensive technology available for mainly artisanal mining in the interior areas of countries such as Brazil, Suriname and Guyana.

It should also be noted that inadequate construction and maintenance of storage facilities for the waste containing cyanide from large scale mining operations could lead to an increase in the contamination of rivers and the marine ecosystem.

3.2.5 Underlying causes

The underlying causes for chemical pollution by fertilizers and pesticides from agriculture can be attributed to:

- Inadequate land use policies;
- The need to produce crops for food (nutrition) and export; and
- Limited job and income earning opportunities in other sectors.

The underlying causes for the pollution of the marine ecosystem by mercury from the gold mining industry can be attributed to:

- The demand for gold in the world market;
- Unemployment and lack of income earning opportunities;
- Illegal immigration; and
- Insufficient institutional capacity to regulate the mining sector.

3.2.6 Socio-economic, legal and political root causes

The root causes for pollution can be attributed to:

- Inadequate integrated development strategies;
- Insufficient consideration being given to the effects on other economic activities or on the environment in sectoral planning;
- Poverty;
- Illiteracy;
- Need for adequate returns on investment; and

- Weak governance.

3.2.7 Knowledge gaps

Agriculture is very important to many economies in the region, such as Suriname and Guyana, but not much is known about its impact when extended into areas included in the broader marine environment, and the effluents carrying chemicals used in agriculture if they are drained in sufficient concentration to the sea. Little information is available on the effects of mercury from artisanal gold mining on the riverain, estuarine and marine ecosystems, and on the health of the miners and those living in nearby communities.

3.2.8 Proposed Options

Heavy metal pollution from mining and agro-chemical pollution, if not effectively managed, could lead to degradation of the coastal marine ecosystems. In the case of mercury, it could affect the health of miners, as well as the health of other members of the community should it enter the food chain. Among the interventions required are:

(i) Strengthening of the institutional framework for integrated coastal management.
(ii) Improved land use and mining policies.
(iii) Determination of the level of poverty in the mining areas and the identification of alternative livelihood programmes.
(iv) Development and implementation of adult education and public awareness programmes.
(v) Strengthening of the institutional mechanisms for monitoring and enforcement in the mining industry.
(vi) Improved knowledge of the effects of agro-chemicals and heavy metals on coastal ecosystems.

If the GEF/UNIDO project to formulate a global action plan for countries that pollute their waters with mercury used as part of the process of artisanal gold mining is still being developed and/or implemented, then, in addition to Brazil, the countries bordering the sub-region should seek to become involved in it (LME 17: North Brazil Shelf).

3.3 Habitat and Community Modification

3.3.1 Environmental impacts

Modification or loss of ecosystems and ecotones

In this sub-region, there are clear indications that the entire shallow, brackish-water stretch along the seashore (0-10 m depth) plays a key role in the mobilization of nutrients and energy transfer in the lower levels of trophic webs, and serves as nursery ground for many marine fish and shrimp species. However, additional research is needed to improve understanding and quantify this role.

The existence and the capacity of this near-coastal zone to fulfill its role is highly dependent on inputs from the neighbouring mangrove and associated habitats. The mangrove is very well represented in the region, where it dominates a major part of the shore, but it is possible that not

all portions of the coast would have the same importance, as some processes may perhaps be concentrated in certain areas, possibly in estuaries. Ecological research is needed to identify such "critical" zones with a view to their conservation. There seem to be other particularly valuable areas, with a high primary production, like the "lixeira", in front of the Amazon estuary. Research on the processes taking place in these areas is required as well, for the elaboration of an appropriate management strategy.

Fishing gears can alter, in a more or less persistent way, the habitats of fish populations. It is not generally known what the different species exactly require in order to complete successfully the different steps of their life cycle. But, it is known that habitats have to fulfill different functions such as shelter (hiding from predators), foraging area for food, breeding area, nursery area, and the capacity to fulfill one or more of these functions can be impaired by damage provoked by fishing gear action, with the damage being on the seabed, the benthos, or on the water quality (Charlier, 2001).

3.3.2 Socio-economic Consequences

The continued degradation of "critical" zones or habitats and the unsustainable exploitation of fisheries and other living resources in the sub-region could lead to unemployment and reduced incomes and consequent deterioration in the quality of life among coastal communities.

3.3.3 Linkages with Other Transboundary Problems

The removal of mangroves and associated habitats as well as the degradation of nearshore areas by trawls and other destructive fishing gear could lead to changes in composition and decline in fish populations.

3.3.4 Immediate Causes

The immediate causes for the destruction of mangroves and associated habitats, which serve as shelter, foraging area for food, breeding area and nursery area for many marine species and shrimp, are:

- Removal for energy/fuel, clearing for agriculture (rice), aquaculture (shrimp culture) and other development activities.

3.3.5 Underlying causes

The underlying causes can be attributed to:

- Inadequate land use policies;
- The need to produce crops for food (nutrition) and export; and
- Limited job and income earning opportunities in other sectors.

3.3.6 Socio-economic, legal and political root causes

The root cause can be attributed to:

- Lack of integrated development strategies, with sectoral planning giving insufficient consideration to the effects on other economic activities or on the environment.

3.3.7 Knowledge gaps

Additional research is required to improve on the knowledge of the role that the entire shallow, brackish-water stretch along the seashore (0-10 m depth) plays in the mobilization of nutrients and energy transfer in the lower levels of trophic webs, and providing nursery grounds for many marine fish and shrimp species.

3.3.8 Proposed Options

The continued degradation of "critical" zones or habitats (mangroves, corals) and the unsustainable exploitation of fisheries and other living resources could lead to a deterioration of the quality of life in coastal communities, and, as such, needs to be addressed. Among the interventions required are:

(i) Strengthening of the institutional framework for integrated coastal management.
(ii) Improved land use policies.
(iii) Improved knowledge of the role that the entire shallow, brackish-water stretch along the seashore plays in the mobilization of nutrients and energy transfer in the lower levels of trophic webs, and providing nursery grounds for many marine fish and shrimp species and the impacts on these areas by human activities.
(iv) Creation of reserves to protect ecologically sensitive coastal ecosystems (e.g. mangroves).

It should be noted that Brazil, Guyana, Suriname and Venezuela, along with Bolivia, Colombia, Ecuador and Peru, are developing a Project for support by GEF, entitled "Integrated and Sustainable Management of Transboundary Water Resources in the Amazon River Basin", with the overall objective being to strengthen the institutional framework for planning and executing in a coordinated and coherent manner, activities for the protection and sustainable management of land and water resources of the Amazon River Basin. The project recognizes the close linkages between integrated water resource management and the protection of marine habitats. Also, Brazil is seeking GEF support for the biodiversity project "Strengthening the Effective Conservation and Sustainable use of Mangrove Ecosystems in Brazil through its National System of Conservation Units", with the aim of the project being to develop conservation and sustainable management of mangrove ecosystems in Brazil to conserve globally significant biodiversity and key environmental services and functions important for national development and well-being of traditional and marginalized coastal communities (Heileman. In press).

4 STAKEHOLDERS ANALYSIS

Preliminary assessments of the responses provided on the CLME Project Template, devised by the CLME Unit and CLME TTT, by the CLME Inter-ministerial Committees of Brazil, Guyana and Suriname (Appendices I, II & III), are presented in this section. It is noted that this Section will be updated as information requested from each of the countries in the sub-region is received.

The CLME Technical Task Team and Unit identified and advanced three key areas of concern as affecting sustainability of transboundary living marine resources, specifically, Overfishing;

Pollution and Contamination; and Habitat Degradation. Brazil and Guyana agreed with these areas of concern, but did not identify any others, while Suriname included Illegal Fishing. Pollution and contamination were ranked first by Brazil and Suriname, and overfishing third. Guyana's primary area of concern was overfishing, with pollution and contamination listed in third place. Both Brazil and Guyana indicated that habitat degradation was the second most important area of concern to them. Suriname listed illegal fishing and habitat degradation in second and fourth place respectively. However, having identified habitat degradation as an area of concern, Suriname did not provide further details in the Template on this area.

From the answers provided it would appear that there are areas of commonality in relation to the origins and causes of the named areas of concern. With regards to overfishing, two-thirds of the respondents identified the origin of their concern to be overcapacity and IUU fishing. Also identified were excessive population growth, with concentrated occupation near the coast; poverty and hunger; and increasing demand for fish products. The causes for this concern included inadequate fisheries management planning; insufficient enforcement of conservation and management measures; inadequate skills; unsustainability of fish stocks; and the impacts on the livelihood of fishers.

Pollution from gold mining (mercury); agricultural (pesticides, herbicides and fertilizers) and human waste were common origins advanced by the parties relative to pollution and contamination. Industrial residuals; oil spills, air pollution and contaminants from ships and fishing trawlers were also listed. The causes of pollution and contamination were indicated as poor infrastructure in urban coastal areas; inadequate enforcement of environmental regulations in relation to industrial and agricultural activities; and impacts on the ecosystems.

Urban development on the shore line, destructive fishing methods, over-fishing, deforestation and destruction of key habitats, namely estuaries, mangrove forests and coral reefs were indicated as origins of habitat degradation. Causes for this area of concern were given to be poor physical planning and inadequate enforcement of environmental regulations; seacoast pollution; and mangrove destruction.

Suriname cited inadequate control and surveillance at sea by the relevant authorities as the cause for illegal fishing in the EEZ.

All three respondents indicated that neighbouring countries contributed to the identified areas of concern in their respective countries. In Brazil's case, the impact was noted to be minor in the case of pollution and contamination; major in the case of habitat degradation and major to severe in the case of overfishing. Overfishing and habitat degradation in Guyana were indicated to be severely impacted by its neighbouring countries. However, while it was noted that Guyana's neighbours contributed to their concern of pollution and contamination the extent of the impact was not known. Suriname noted its neighbours' impact on overfishing and illegal fishing as major to severe, but was unable to rank their impact in terms of pollution and contamination.

With regard the respondents' impacts on their neighbours, Brazil and Guyana indicated that they contributed to the concerns of over-fishing, pollution and contamination and habitat degradation in neighbouring territories, while Suriname noted that it impacted its neighbours in the areas of

illegal fishing and pollution and contamination. Guyana was unable to rate their impact in all three cases, while Brazil rated the level of impact on its neighbours as major to severe in the case of over-fishing; major in relation to habitat degradation and minor in the case of pollution and contamination. Suriname noted that it did not impact its neighbours in the area of overfishing. It was unable to rank its impact on its neighbours in the case of pollution and contamination but rated its impact as minor in the case of illegal fishing.

In response to the identified area of concern of overfishing Brazil noted its current collaborative study on the biology of billfishes and oceanic sharks involving universities in Brazil, Venezuela and USA, as well other key research and management projects dealing with the estimation of living resources in the Brazilian Exclusive Economic Zone; controls on fishery concessions; satellite trace of fishing boats; on-board observer programmes; by-catch reduction; and licensing and registration of professional fishers. Planned activities include a marine living resources monitoring programme; enhanced management of conflicts between artisanal and industrial fishery; and improved control of fishery fleets. Guyana for current activities, under overfishing indicated its ongoing participation in the FAO/WECAFC and CRFM activities for the sub-region and MCS by their Coast Guard. Suriname noted its current observer programme and their plan to introduce vessel monitoring systems.

Research being undertaken by Brazil to address the concern of pollution and contamination is comprised of studies/projects in coastal management and marine pollution, including the effects of oil spills. In addition, they are implementing plans such as the National Plan for Prevention, Preparation and Fast Response for Environmental Emergency with Hazard Chemist Products (P2R2); the Plan for Preservation and Recuperation of Environmental damage related to the Oil Industry; and one addressing ballast water. Suriname is currently implementing activities/projects including the preparation of a draft oil spill contingency plan; baseline study regarding Ballast water (Globallast Project), training in the use of pesticides in agriculture; ratification of Protocol 96, preparation of draft regulations regarding waste dumping in sea and a draft Environmental Act in the pollution and contamination. The country's planned activities in this area of concern include training in wastewater management and sanitation and ratification of the Cartagena and Basel Conventions.

In an effort to address the concern of habitat degradation, Brazil indicated its involvement in the following programmes and projects – Hydrological Basin Management; Sanitation for Everyone; Social Action on Sanitation; Urban Solid Residue Programme; Environmental Management of Fragile Habitats; Coastal Management National Plan; Oceanfront Project; and Conscious Conduct on Coral Reef Areas.

Regarding habitat degradation and pollution and contamination, Guyana identified current and planned activities in the areas of education (public awareness) and monitoring respectively.

In relation to additional potential solutions that could assist with addressing the concern of overfishing, Brazil indicated that there was need for better enforcement of management measures; a more participatory decision-making process; and the use of innovative management tools such as marine protected areas to assist stock recovery. Suriname suggested that there is need for adequate management of the resources; improved MCS and more research, while

Guyana suggested a reduction in fishing effort and the use of management tools like closed seasons and closed areas.

The three countries identified improved monitoring and enforcement of environmental regulations as a potential solution to pollution and contamination, with Brazil also indicating the need for greater investments in urban sewage treatment; Guyana improved collaboration; and Suriname capacity strengthening and increased awareness. In the instance of habitat degradation, Brazil identified the need for the establishment of marine protected areas to conserve fragile ecosystems (e.g. mangrove forests and coral reefs) and improved integrated coastal management. Guyana suggested public awareness and enforcement.

In terms of types of information most needed to assist in addressing the areas of overfishing, pollution and contamination all three countries indicated that scientific data was required. In relation to habitat degradation, both Brazil and Guyana indicated that scientific data was required. In addition, Brazil identified the need for socio-economic and demographic data in all three areas while Guyana indicated the need for social and economic data in the case of habitat degradation. Suriname noted the need for economic and social data in regards to illegal fishing and pollution and contamination.

The parties acknowledged that interventions in the areas of data and information; monitoring and enforcement; private and NGO involvement and decisions implementation were very important to absolutely necessary. The data, captured in Table 2, also show that the countries recognized that the need for greater collaborative efforts with neighbouring/other countries in the area of over-fishing was absolutely necessary. The need for more laws seem to be somewhat important across the board for Brazil, while for Guyana, it is only somewhat important for overfishing; very important for pollution and contamination and absolutely necessary for habitat degradation. In the case of Suriname, more laws are somewhat important for pollution and contamination; and very important for overfishing.

With regards to more inter-ministerial level decision-making, Brazil indicated that this was very important across the board, while for Guyana it ranged from very important to absolutely necessary. Suriname noted that for pollution and contamination it was somewhat important while it was absolutely necessary for overfishing and illegal fishing.

Suriname has noted that all the suggested interventions were very important to absolutely necessary in dealing with the concern of illegal fishing.

5 GOVERNANCE ANALYSIS

Five countries (Brazil, Suriname, Guyana, Venezuela, Trinidad and Tobago) and one dependency (French Guiana) border the Guianas–Brazil sub-region need to address the key transboundary living marine resources issues existing in it. The fragmented nature of coastal and marine resource management is a legacy of the colonial past. The languages and cultures of the foreign colonizers (Portugal, France, the Netherlands, Great Britain and Spain) were different, as were the management systems and laws they passed on to these territories, five of which are now independent democracies. These countries are party to several international environmental

agreements, for example CBD, UNFCCC, UNCLOS, MARPOL and Ramsar Convention on Wetlands. However, there is presently a lack of coordinated support among them for ecosystem monitoring and management.

The coming into force of the UNCLOS and recent international initiatives in fisheries, such as Agreement to Promote Compliance of International Conservation and Management Measures by Fishery Vessels on the High Seas (Compliance Agreement), The Code of Conduct for Responsible Fisheries, Agenda 21 of the United Nations Conference on Environment and Development (UNCED) and the Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of Sea of 10 December 1982 Relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks (UN Fish Stocks Agreement) have made it necessary for the countries of the Guianas-Brazil sub-region to revise their legislation.

For example, in Brazil, Article 187 of the Federal Constitution of Brazil provides for the definition of an agriculture policy and explicitly includes agro-industrial activities, agriculture and livestock, fisheries and forestry, while Article 225 identifies a number of principles that concerns the environment. Included among these principles, are the protection of fauna and the ecological management of species and ecosystems, with both these principles implicitly including fisheries. The responsibility for the application of these principles lies with the "Poder Publico" (the Government). French Guiana as an overseas department of France is covered by the common fisheries policy of the European Union, which came into effect in January 1983. Among other things, the policy calls for common rules for fishing in the maritime waters and co-ordination of structural policies of Member States to promote harmonious and balanced development of the fishing industry (Council Regulation (EEC) No. 101/76) (Chakalall *et al,* 2002).

In Guyana, the fisheries are being regulated by the Fisheries Act 2002 (replaced the 1959 Fisheries Act and portions of the 1977 Marine Boundaries Act), which includes a number of new provisions, such as authorizing the Minister to promote the development and management of fisheries to ensure the optimum utilization of fisheries resources; mandating the Chief Fisheries Officer to prepare and keep under review a plan for the management and development of fisheries, including consultations with fishermen and others stakeholders and the creation of a Fisheries Advisory Committee (DOF, 2006). In Suriname, fisheries are regulated by the Decree on Marine Fishery, Decree C-14, in force since 1st January 1981. This legislation has been revised and a new fisheries law was drafted in 1992, which, when it comes into force would stipulate the elaboration of annual management plans for the fishery types, in which all regulatory measures will be established. This approach should allow fisheries managers to adapt to the changing conditions of exploitation.

In Trinidad and Tobago, the existing legislation, the Fisheries Act of 1916, was found to be inadequate as a legal basis upon which a modern fisheries management system can be structured, so in June 1995, a draft Fisheries Management Act and Policy Directions for Marine Fisheries in Trinidad and Tobago in the 1990s were prepared. The Act provides the framework for the management of both local and foreign fishing activity in the waters under the jurisdiction of Trinidad and Tobago, with one of the major objectives as outlined in the draft National Marine

Fisheries Policy being to provide for a move from a system of uncontrolled, free access to the fisheries resources towards a system of controlled access. The Policy would be dependent upon the preparation of Fishery Management Plans based on the best available scientific and socio-economic information, and the revised legislation would take into consideration the Government's participation in international agreements and national responsibilities for management of the resources of the Exclusive Economic Zone.

In Venezuela, trawl fisheries have been regulated by the joint resolutions of the Ministry of Agriculture (MAC/DGSPA/No. 46) and Ministry of the Environment (MARNR/DAA/No. 103) from 30th January 1980. The fishing areas for the trawling fleet and the ones reserved to the artisanal fishers are specified, both in the coastal zone and in the island territories. A second resolution (MAC/DGSPA/No. 391) from 13th December 1990 (Annex III) regulates the activity of the trawling fleet in the Gulf of Venezuela. All these resolutions are under study, in order to establish up-to-date norms for this fishery (Chakalall, *et al* 2002).

For the countries of the Guianas–Brazil sub-region, fisheries administration is under the Ministry of Agriculture in all the countries except Brazil, where the responsibility is shared between the Ministry of Agriculture, responsible for development, issuing of licences and for the economic aspects, and IBAMA (Instituto Brasiliero do Meio Ambiente e dos Recursos Naturais Renovaveis), responsible for conservation and management and for enforcement. In most countries fisheries research is also conducted by the national fisheries administration, which is under the Ministry of Agriculture. Brazil and Venezuela have delegated fisheries research to specialised agencies. In Brazil CEPNOR (Centro de Pesquisa e Extensão Pesqueira do Norte do Brasil) is responsible for research in the North of Brazil (Atlantic Ocean and Amazon Basin), while in Venezuela FONAIAP (Fondo Nacional de Investigaciones Agropecuarias), a specialised research agency under the Ministry of Agriculture has the responsibility for fisheries research. In French Guiana, IFREMER (Institute Français pour l' exploitation de la mer) is responsible for research and it provides scientific advice on all aspects of fisheries to the French Ministry of Agriculture, which is responsible for conservation and management, including monitoring control and surveillance.

In most countries, the navy, air force, army, coast guard or police have been delegated the responsibility for monitoring, control and surveillance. This is done in collaboration with the national fisheries administrations, through agreements with the appropriate line agencies, which is the Ministry of Agriculture in most countries and IBAMA in Brazil (Chakalall, *et al* 2002).

Following on the decisions taken at the 1996 Fourth Meeting of WECAFC Ad Hoc Shrimp and Groundfish Working Group of the Guianas–Brazil Shelf and CFRAMP Shrimp and Groundfish Subproject Specification Workshop, WECAFC in partnership with CFRAMP (now CRFM) conducted a series of workshops on the assessment and management of shrimp and groundfish fisheries on the Guianas–Brazil Shelf from 1997 to 2000 for the countries bordering the sub-region. This series of workshops culminated in a meeting of fisheries managers and ministers of the sub-region in 2001, and the First Regional Conference on the Sustainability of Fisheries Resources in the Brazil–Guianas Shelf in 2002, which sought to involve both resource managers and users. This approach to promoting fisheries resource assessment and management in the sub-

region was viewed as an effective one, despite some shortcomings, and its continuation recommended (FAO/WECAFC 2001).

The legal and institutional arrangements on integrated coastal management and environmental management at the national and sub-regional levels should have been reviewed, but such information was not readily available.

UNCLOS and recent international initiatives in fisheries have made it necessary for the countries in the Guianas–Brazil sub-region to revise their policies and legal frameworks for fisheries management and development. To this effect, Brazil, French Guiana and Guyana have put the necessary legislation in place, while Suriname, Trinidad and Tobago and Venezuela were in the process of doing so. In general, the legislation in place or being put in place promotes the ecosystems based approach to management and calls for the development, implementation and regular evaluation of fisheries management and development plans, based on the best available scientific and socio-economic information, in consultation with the stakeholders involved in the various fisheries.

In most instances, fisheries administration and research fall under the umbrella of the Ministry of Agriculture of the countries of the sub-region, except in Brazil, where fisheries administration is shared between the Ministry of Agriculture and IBAMA, with research being delegated to CEPNOR and, in Venezuela, where research has been delegated to FONAIAP. In general, MCS is delegated to the navy, air force, army, coast guard or police. In many of these countries some level of institutional reform is taking place to better enable the fisheries administrations to carry out their mandates, as many of them are faced with such problems as insufficient staff to fulfill essential functions; poor communication between different levels and interest groups; and no clear decision-making procedures and responsibilities, with insufficient funding being an important factor in these problems (FAO/WECAFC, 2001).

Regional and sub-regional organizations such as the FAO/WECAFC and CRFM having been actively promoting fisheries management and development in the Guianas–Brazil sub-region. The Member States of FAO/WECAFC include Brazil, French Guiana (EU/France), Suriname, Guyana, Venezuela and Trinidad and Tobago, while those of the CRFM include Suriname, Guyana and Trinidad and Tobago.

As they seek to address the key transboundary living marine resource issues for the Guianas–Brazil sub-region, the countries may need to strengthen and/or develop mechanisms for sub-regional collaboration and cooperation in areas such as assessment and management; harmonization of legislation; development of a sub-regional database for fisheries and related data; establishment of mechanisms for strengthening MCS at the national and sub-regional levels; stakeholders' involvement in the management process; and building public awareness.

6 SUMMARY AND CONCLUSIONS

As with other sub-regions of the Wider Caribbean, the living marine resources of the Guianas-Brazil sub-region hold significant cultural, economic, environmental and spiritual value. Due to the shared nature of these resources, the major transboundary areas of concern identified in this

report require urgent attention at the regional and sub-regional levels that can be implemented at the national and local levels.

As described above, overexploitation of the shrimp and groundfish resources combined with excessive by-catch and discards and destructive fishing practices and IUU fishing due to inadequate fisheries management and enforcement could lead to further loss of income, employment, food supply and foreign exchange in the sub-region. As such, interventions focusing on an enhancement of the all stages of the policy cycle - ranging from the filling of critical information gaps to shared decision-making - should be urgently addressed.

Heavy metal pollution from mining and agro-chemical pollution, if not effectively managed, could lead to degradation of the coastal marine ecosystems and in the case of mercury, could affect the health of miners and other members of the community should it enter the food chain. This issue, when coupled with the high dependence of the sub-region on fish as a protein source poses a significant challenge to the countries in the sub-region and within the Insular Caribbean, given the extensive range of dispersal of sediments from the major rivers in the sub-region.

The synergistic impacts of the continued degradation of "critical" zones or habitats (mangroves, corals), pollution and the unsustainable exploitation of fisheries and other living resources present considerable challenges for the countries and people of the Caribbean Large Marine Ecosystem and the adjacent Guianas-Brazil Shelf. While the immediate and underlying causes of these negative impacts may be sector-specific in certain instances, the priority interventions for dealing with these concerns address common socio-economic, legal and political root causes. Given the multiple, long-term benefits which can be accomplished by focusing on the sources of these problems, as opposed to just their symptoms, the design and implementation of actions aimed at the sustainable management of these shared living marine resources through regional, LME-wide collaboration as proposed in the CLME Project are urgently required.

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ACRONYMS AND ABBREVIATIONS

BW	Ballast Water
CARICOM	Caribbean Community
CBD	Convention on Biological Diversity
CEPNOR	Centro de Pesquisa e Extensao Pesqueira do Norte do Brasil
CFRAMP	CARICOM Fisheries Resource Assessment and Management Programme
CLME	Caribbean Sea Large Marine Ecosystem
CLME TTT	CLME Technical Task Team
CRFM	Caribbean Regional Fisheries Mechanism
DOF	Department of Fisheries
EEC	European Economic Community
EEZ	Exclusive Economic Zone
EU	European Union
FAO	Food and Agriculture Organization of the United Nations
FONAIAP	Fondo Nacional de Investifaciones Agropecuarias
GDP	Gross Domestic Product
GEF	Global Environmental Facility
GIWA	Global International Waters Assessment
IAS	Invasive Alien Species
IBAMA	Instituto Brasiliero do Meio Ambiente e dos Recursos Naturais Renovaveis
IFREMER	Institute Français pour l'exploitation de la mer
IMO	Internacional Maritime Organization
IUCN	International Union for the Conservation of Nature and Natural Resources (The World Conservation Union)
IUU	Illegal, Unregulated and Unreported
LME	Large Marine Ecosystem
LMR	Large Marine ecosystem Resources
MARPOL	The International Convention for the Prevention of Pollution of Ships
MCB	Marine Catchment Basin
MCS	Monitoring, Control and Surveillance
MIS	Marine Invasive Species
MSY	Maximum Sustainable Yield
NBC	North Brazil Current
SPAW	Specially Protected Areas and Wildlife
UNCED	United Nations Convention on Environment and Development
UNCLOS	United Nations Convention on the Law of the Sea
UNDP	United Nations Development Programme
UNFCCC	United Nations Framework Convention on Climate Change
UNIDO	United Nations Industrial Development Organization
WCR	Wider Caribbean Region
WECAFC	Western Central Atlantic Fishery Commission

TABLES

Table 1: Selected Socio-Economic Statistics for the Countries in the Guianas-Brazil Sub-region

Country	Population (x 1000)	Infant mortality rate	GDP/cap (USD)	HDI level	Per capita fish consumption (kg)
Brazil	188,078[1]	28.60[1]	8,600.[1]	M (69)[1]	5.56[4]
French Guiana	195[2]	12.07[2]	8,300.[3]	Na	na
Guyana	767[1]	32.19[1]	4,700.[1]	M (103)[1]	45.7[3]
Suriname	439[1]	23.02[1]	7,100.[1]	M (88)[1]	16.9[5]
Trinidad and Tobago	1,065[1]	25.05[1]	19,700.[1]	H (57)[1]	7.0[5]
Venezuela	25,730[1]	21.54[1]	6,900.[1]	M (72)[1]	18.1[6]

Sources: CIA World Factbook; Food and Agriculture Organization Website; Answers .com and Yahoo Education

[1] 2006 estimates [2] 2005 estimates
[3] 2003 estimates [4] 2000 estimates
[5] 1998 estimates [6] 2001 estimates

Table 2. Interventions required to address the Identified Areas of Concern.

Area of Intervention	Area of Concern									
	Brazil			Guyana			Suriname			
	Over-fishing	Pollution & Contamination	Habitat Degradation	Over-fishing	Pollution & Contamination	Habitat Degradation	Over-fishing	Pollution & Contamination	Habitat Degradation	Illegal Fishing
More data and information	3	2	3	3	3	3	3	3		2
More monitoring and enforcement	3	3	2	3	2	3	3	3		3
More laws	1	1	1	1	2	3	2	1		2
More inter-ministerial level decision-making	2	2	2	2	2	3	3	1		3
More private and NGO involvement	3	2	2	3	2	3	2	3		3
Better implementation of decisions	3	3	3	3	2	3	2	3		3
Collaborative effort with neighbouring /other countries	2	1	1	3	2	3	3	3		3

Key

0 - not important
1 - somewhat important
2 - very important
3 - absolutely necessary
9 - don't know

FIGURES

Figure 1. The Caribbean and Adjacent Large Marine Ecosystems

Figure 2. North Brazil Shelf LME (LME #17: North Brazil Shelf)

Figure 3. North Brazil Current as represented by the Mariano Global Surface Velocity Analysis (MGSVA).
Source: http://oceancurrents.rsmas.miami.edu/atlantic/north-brazil.html

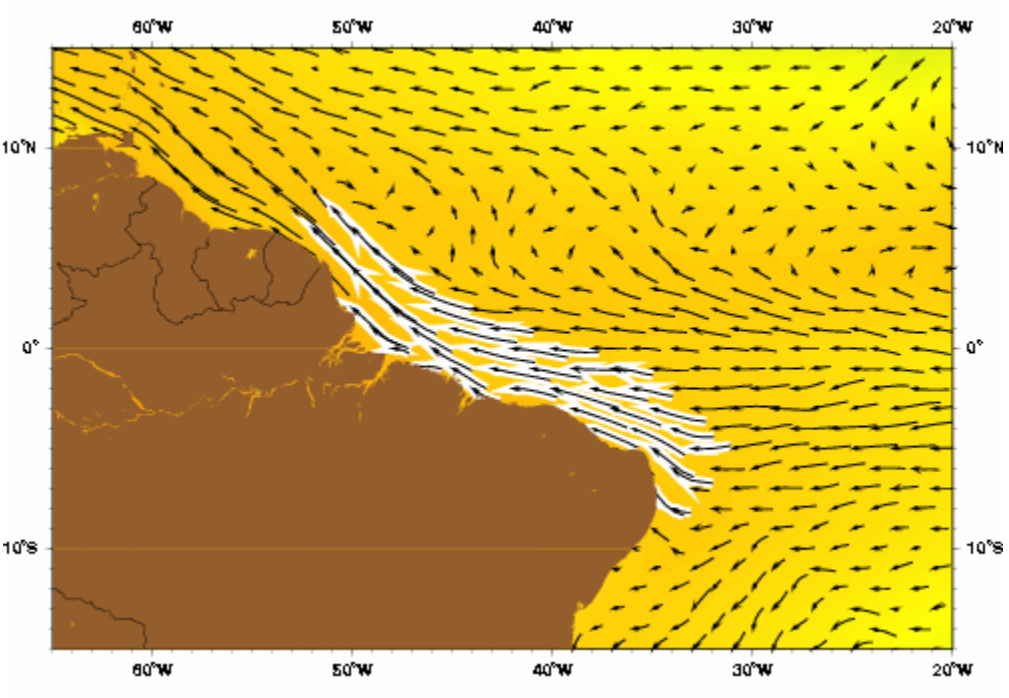


Figure 4. Amazon Plume estimated at 380 kilometres wide on September 8, 2000
(Source: NASA)

Figure 5. Annual fish landings in the North Brazil Shelf LME (Sea Around Us 2006)

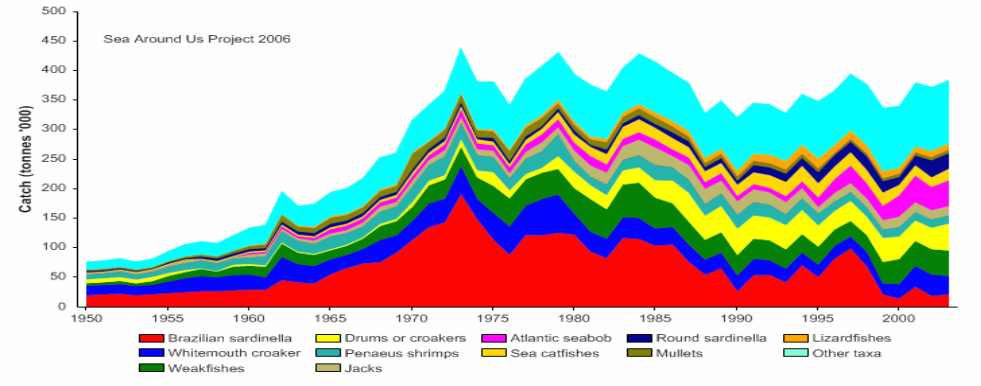


Figure 6. Value of fish landings in the North Brazil Shelf LME (Sea Around Us 2006)

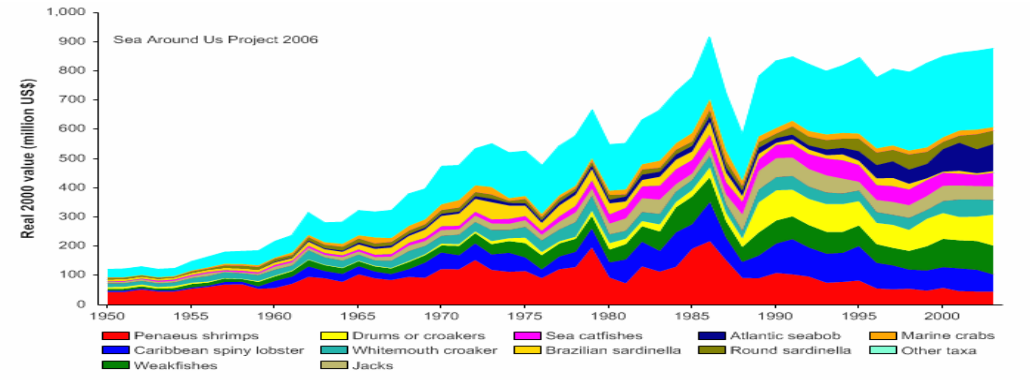


Figure 7. Primary production required by the catches by countries in the North Brazil shelf LME (Sea Around Us 2006)

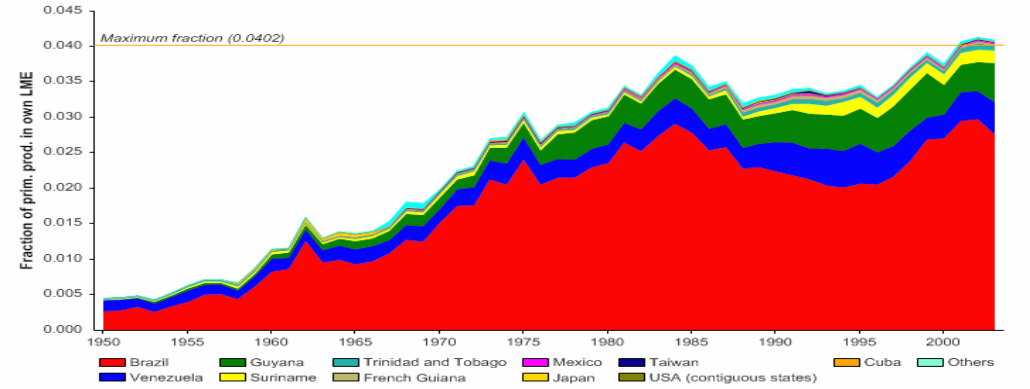


Figure 8. Marine Trophic Index (top) and Fishing in Balance Index (bottom) in the North Brazil Shelf LME (Sea Around Us 2006)

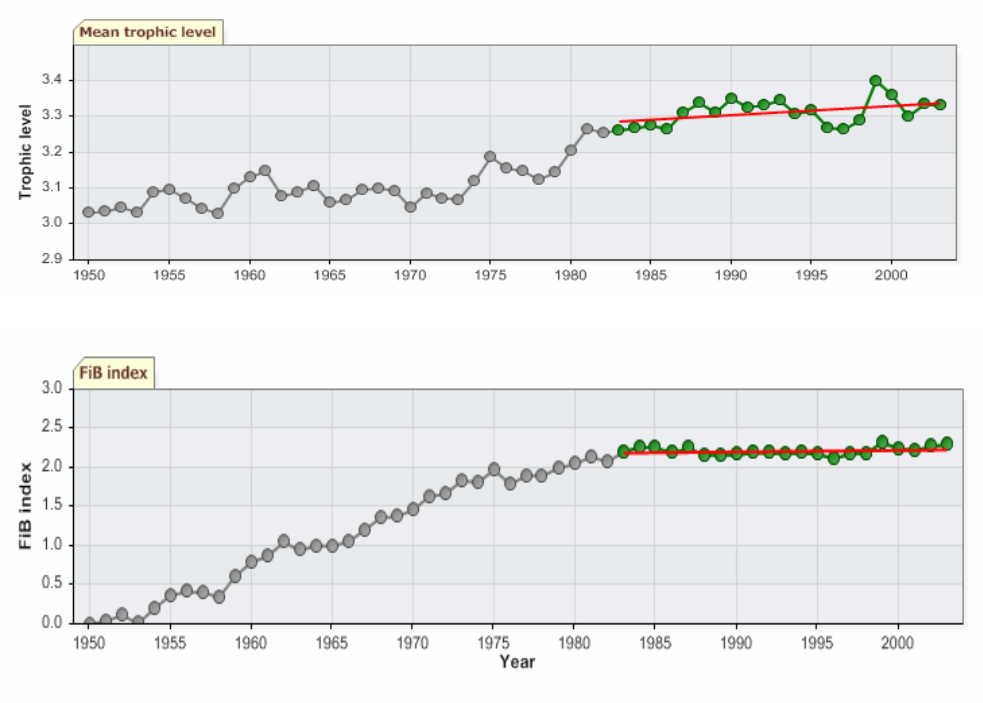
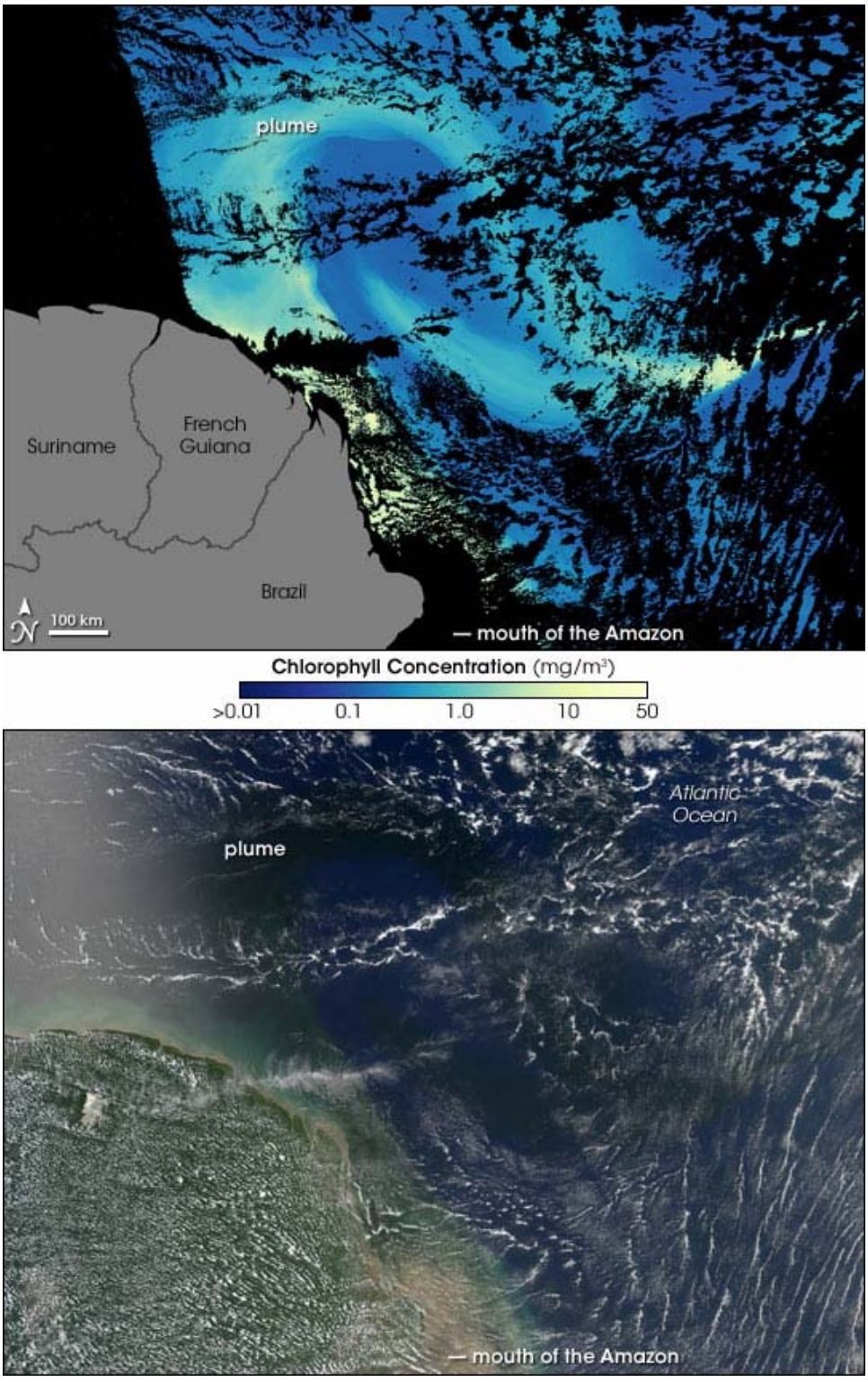


Figure 9. Transboundary Nature of Amazon Plume in the Guianas-Brazil Sub-region
(Source: http://earthobservatory.nasa.gov/Newsroom/NewImages/images.php3?img_id=17426)



Appendix I: CLME Project Template - Brazil

1. **General information**.

a) Name of Country or Organization: **Brazil** – Ministry of Science and Technology - MCT
Secretariat of Research and Development Policies and Programs – SEPED
Coordination for Marine and Antarctica Sciences and Technology CMA

b) Composition of CLME Inter-Ministerial/Intersectoral Committee:

i) Identify National Government Ministries:
Aquaculture and Fisheries Special Secretary - SEAP
Environmental Ministry - MMA

ii) Identify any other levels of government:
Secretary of the Marine Resources Interministerial Commission –SeCIRM
Institute for Environmental Protection – IBAMA

iii) Identify any non-government members: Guyana Private Trawlers Owners and Seafood Processing Universities.

iv) Identify Chairmanship of the Committee: Coordination for Marine and Antarctica Sciences and Technology/

SEPED/MCT
SEAP
MMA
SeCIRM
IBAMA
University representation

c) Total # of members on the Committee __6___

d) Does the Committee deal with matters other than the CLME Project? As a Committee, no.
Matters related to the CLME project? List.

2. Major areas of concern

The following areas of concern have been identified as affecting the sustainability of transboundary living marine resources in a number of regions: *Over-Fishing; Pollution and Contamination; Habitat Degradation*.

What are your country's perceived **major** areas of concern regarding your **transboundary living marine resources**? Please rank in order of importance where 1 is greatest:

1__Pollution and Contamination_____

2__Habitat degredation_____

3__Over-fishing_____

4_____

3. Origin and Causes

For your top three areas of concern, please identify where, in your opinion, the concern originated and the causes for the concern:

Origin of Area of Concern #1: Urban sewage; industrial residuals, including heavy metals and persistent contaminants; oil spilling; mercury, form mining activities; and agricultural defensives, including both pesticides and herbicides, as well as fertilizers.

Causes for Area of Concern #1: Lack of proper systems for sewage treatment, weak control and enforcement of environmental regulations on industrial and agricultural activities.

Origin of Area of Concern #2: Pollution and contamination, as identified in Area of Concern #1, above; human occupation of the shore line, through urban development; destructive fishing methods; deforestation, particular along the course of rivers, destruction of estuaries, mangrove forests and coral reefs.

Causes for Area of Concern #2: Economic development without a parallel infra-structure for control of human activities and enforcement of environmental regulations.

Origin of Area of Concern #3: Excess of fishing capacity; lack of compliance with conservation and management measures adopted; poverty and hunger; excessive growth of population, combined with a trend of human occupation to concentrate near the coast; increasing demand for fish products; exhaustion of fish stocks.

Causes for Area of Concern #3: Bad planning for development for the fisheries sector; deficiencies in mechanism for control and enforcement of conservation and management measures; the maximum productive capacity of seas and oceans is already being approached.

4. **Maritime Neighbours**:

a) How many neighbouring countries share **transboundary living marine resources** with your country? _____6_____

b) Please identify countries___Venezuela, Guyana, Suriname, French Guyana, Uruguay and Argentina, although

only the first four are pertinent in the context of Caribbean Large marine Ecosystem (CLME and Adjacent Regions.

5. **With respect to area of concern #1 identified in question 2 above**,

i) Are any of your neighbouring countries contributing to this area of concern? Yes__X__; No_____

If yes, please provide a brief explanation? For instance, if the concern is pollution, it would be useful to know what kind of pollution, e.g. sediments, oils…..If overfishing, useful to know the species.

The neighbouring countries are affected by similar problems, like deforestation, pollution by urban sewage, industry, oil exploitation and mining, and agriculture.

If yes, please indicate the severity of impact on the environment, the economy and on society on a scale of 0 to 3, where 0 means no impact, 1 means minor impact, 2 means major impact and 3 means severe impact. Please check 9 for "don't know":

- Environmental impacts: 0 __ 1_X__ 2___ 3__ 9___ (Don't know)
- Economic impacts: 0 __ 1_X__ 2___ 3__ 9___ (Don't know)
- Social impacts: 0 __ 1_X__ 2___ 3__ 9___ (Don't know)

ii) Is your country having an impact on any of your neighbouring countries? Yes__X__; No_____

If yes, please provide a brief explanation? For instance, if the concern is pollution, it would be useful to know what kind of pollution, e.g. sediments, oils…..If overfishing, useful to know the species.

Several activities carried out in Brazil, like deforestation, pollution by urban sewage, industry, oil exploitation and mining, and agriculture have a direct impact in the neighbouring countries, particularly due to the northward direction of prevailing currents.

If yes, please indicate the severity of impact on the environment, the economy and on society on a scale of 0 to 3, where 0 means no impact, 1 means minor impact, 2 means major impact and 3 means severe impact. Please check 9 for "don't know":

- Environmental impacts: 0 __ 1_X__ 2___ 3___ 9__ (Don't know)
- Economic impacts: 0 __ 1_X__ 2___ 3___ 9__ (Don't know)
- Social impacts: 0 __ 1_X__ 2___ 3___ 9__ (Don't know)

iii) Using the template provided at the back of this questionnaire, please identify any actions being taken by your country to address the area of concern?

- Key Ongoing Projects/Activities, including joint projects with neighbouring/other countries
- Resources committed
- Stakeholders involved (primary; secondary)
- Beneficiaries

• Effectiveness of actions

1. Marine Science Program - Bilateral Cooperation Brazil-Germany

Research Project Public Selection (CNPq/MCT)

Themes:

- Coastal Management
- Marine Pollution
- Live Resources
- Ports

Stakeholders involved (primary; secondary):
Brazilian Ministry of Science and Technology
German Federal Ministry of Education and Research (BMBF)
National Council for Scientific and Technological Development - CNPq

Beneficiaries:
Research Community and Brazilian Society

Resources committed:
U$ 761.682,00

2. **Environmental Sensibility Letter for Oil Spill in Marine Coastal Zone**
Research Project Public Selection (CNPq/MCT)
   - **Research Project**

Resources committed:
U$ 280.373,00

Stakeholders involved (primary; secondary):
Brazilian Ministry of Science and Technology
Brazilian Ministry of Environment
National Council for Scientific and Technological Development – CNPq

Beneficiaries:
Research Community and Brazilian Society

3. **National Plan of Prevention, Preparation and Fast Response for Environmental Emergency with Hazard Chemist Products (P2R2)**

Building of Institutional Structure for the activities of prevention, preparation and fast response to environmental emergencies with chemical hazard products.

Stakeholders involved (primary; secondary):
Brazilian Ministry of Environment

Beneficiaries: Brazilian Society

4. **Preservation and Recuperation of Environmental damage related to Oil Industry**
Implementation and monitoring of Emergency Individual Plans (PEIs), Area Plans (PAs) and National Contingence Plane (PNC), according to the Brazilian Federal Law nº 9.966/2000.

Stakeholders involved (primary; secondary):
Brazilian Ministry of Environment

Beneficiaries:

Brazilian Society

5. Ballast Water

Please see:
(http://www.mma.gov.br/index.php?ido=conteudo.monta&idEstrutura=78&idMenu=2720&idConteudo=5272)

Stakeholders involved (primary; secondary):
Brazilian Ministry of Environment
Brazilian Ministry of Science and Technology
National Council for Scientific and Technological Development – CNPq

Beneficiaries:
Research Community and Brazilian Society

iv) Using the template provided at the back of this questionnaire, please identify any known additional activities planned to be undertaken by your country

- Resources (financial, technical, human)
- Timescale
- Stakeholders involved (primary; secondary)
- Beneficiaries
- Likely outputs

v) Please identify any additional potential solutions that can assist with addressing the area of concern.

One of the most important measures to be undertaken in order to mitigate the problem is a massive investment on urban sewage treatment. Better monitoring of pollution sources, as well as enforcement of the environmental regulations in places are also very much needed.

vi) Please identify types of information (scientific, economic and/or social) **most** needed to assist with addressing the area of concern.

The most needed information is related to the quality of the water, particularly near the coast and river mouth, including the monitoring of primary productivity, biochemical oxygen demand, dissolved oxygen, phosphate, nitrate, nitrite, and heavy metals. From the socio-economic point of view, it is important to estimate the index of human development of costal communities, including the level of sewage treatment. An inventory of the main pollution sources along the coast is also needed.

vii) Please indicate where you think interventions would be most successful in addressing the area of concern, using a scale of 0 to 3, where 0 means not important, 1 means somewhat important, 2 means very important and 3 means absolutely necessary. Please check 9 for "don't know":

- More data and information 0 __ 1___ 2_X__ 3_ 9___ (Don't know)
- More monitoring and enforcement 0 __ 1___ 2___ 3_X_ 9_ (Don't know)
- More laws 0 __ 1_X_ 2___ 3___ 9___ (Don't know)
- More inter-ministerial level decision-making 0 __ 1___ 2_X_ 3___ 9_ (Don't know)

• More private and NGO involvement 0 __ 1___ 2_X__ 3__ 9___ (Don't know)

• Better implementation of decisions 0 __ 1___ 2___ 3_X_ 9___ (Don't know)

• Collaborative effort with neighbouring/other countries 0 __ 1_X__ 2___ 3__ 9___ (Don't know)

• Other (please explain)

Continuity of the actions: There is no effectiveness if the monitoring and enforcement are not perennial.

6. With respect to area of concern #2 identified in question 2 above,

i) Are any of your neighbouring countries contributing to this area of concern? Yes__X__; No_____

If yes, please provide a brief explanation? For instance, if the concern is pollution, it would be useful to know what kind of pollution, e.g. sediments, oils…..If overfishing, useful to know the species.

The neighboring countries are affected by similar problems, like intense use of the shoreline and urban development, resulting in embankments, dredging, oil drilling, destruction of estuaries, mangroves and coral reefs (climate changes: greenhouse effect, acidification, etc), destructive fishing methods (deep water trawling, ghost fishing, etc).

If yes, please indicate the severity of impact on the environment, the economy and on society on a scale of 0 to 3, where 0 means no impact, 1 means minor impact, 2 means major impact and 3 means severe impact. Please check 9 for "don't know":

• Environmental impacts: 0 __ 1_X__ 2___ 3__ 9___ (Don't know)

• Economic impacts: 0 __ 1___ 2_X__ 3__ 9___ (Don't know)

• Social impacts: 0 __ 1___ 2_X__ 3__ 9___ (Don't know)

ii) Is your country having an impact on any of your neighbouring countries? Yes__X__; No_____

If yes, please provide a brief explanation? For instance, if the concern is pollution, it would be useful to know what kind of pollution, e.g. sediments, oils…..If overfishing, useful to know the species.

The same problems pointed out in 6.i, above, apply also here.

If yes, please indicate the severity of impact on the environment, the economy and on society on a scale of 0 to 3, where 0 means no impact, 1 means minor impact, 2 means major impact and 3 means severe impact. Please check 9 for "don't know":

• Environmental impacts: 0 __ 1___ 2_X__ 3___ 9__ (Don't know)

• Economic impacts: 0 __ 1___ 2_X__ 3___ 9__ (Don't know)

• Social impacts: 0 __ 1___ 2_X__ 3___ 9__ (Don't know)

iii) Using the template provided at the back of this questionnaire, please identify any actions being taken by your country to address the area of concern?

• Key Ongoing Projects/Activities, including joint projects with neighbouring/other countries

• Resources committed

- Stakeholders involved (primary; secondary)
- Beneficiaries
- Effectiveness of actions

1. **Hydrological Basin Management** :
   Research Project Public Selection (CNPq/MCT)
   - Sediment impact on estuarine zones

   Resources committed:
   U$ 233.644,00

   Stakeholders involved (primary; secondary):
   Brazilian Ministry of Science and Technology
   National Council for Scientific and Technological Development - CNPq

   Beneficiaries:
   Research Community and Brazilian Society

2. **Sanitation For Everyone Program :**
   (Ministry of Environment - MMA)

   Stakeholders involved (primary; secondary):
   Brazilian Ministry of Environment

   Beneficiaries:
   Brazilian Society

3. Social Action on Sanitation Program:
   (Ministry of Environment - MMA)
   - ***Sponsored by BID***

   Stakeholders involved (primary; secondary):
   Brazilian Ministry of Environment

   Beneficiaries:
   Brazilian Society

4. Urban Solid Residue Program:
   (Ministry of Environment - MMA)
   - ***To increase the covering and efficiency of urban cleaning service***

   Stakeholders involved (primary; secondary):
   Brazilian Ministry of Environment

   Beneficiaries:
   Brazilian Society

5. Support for Environmental Management on Fragile Habitats:
   (Ministry of Environment - MMA)
   - Reduce of environmental risks in vulnerability habitat on urban area. (Cooperation with UN-Habitat, PNUMA and Ministry of Cities)

   Stakeholders involved (primary; secondary):

Brazilian Ministry of Environmental
UN-Habitat,
PNUMA
Ministry of Cities

Beneficiaries:
Brazilian Society

6. Coastal Management National Plan:
(Ministry of Environment - MMA)
Stakeholders involved (primary; secondary):
Brazilian Environment Ministry – MMA
Secretary of the Marine Resources Interministerial Commission – SeCIRM
Institute for Environmental Protection – IBAMA

Beneficiaries:
Brazilian Society

7. Oceanfront Project (Projeto Orla)
Please see:
(http://www.mma.gov.br/index.php?ido=conteudo.monta&idEstrutura=11**)**

Stakeholders involved (primary; secondary):
Brazilian Environment Ministry – MMA
Institute for Environmental Protection – IBAMA
Ministry of Cities

Beneficiaries:
Research Community and Brazilian Society

8. Conscious Conduct on Coral Reef Areas
Please see:
(http://www.mma.gov.br/index.php?ido=conteudo.monta&idEstrutura=48&idMenu=1776**)**

Stakeholders involved (primary; secondary):
Brazilian Environmental Ministry – MMA
Institute for Environmental Protection – IBAMA

Beneficiaries:
Brazilian Society

iv) Using the template provided at the back of this questionnaire, please identify any known additional activities planned to be undertaken by your country

- Resources (financial, technical, human)
- Timescale
- Stakeholders involved (primary; secondary)
- Beneficiaries
- Likely outputs

Actually, the INTERREG is an initiative which congregates researchers in efforts to study the Amazon coastal region. One of the tools is the Remote Sensing.

v) Please identify any additional potential solutions that can assist with addressing the area of concern.

The creation of marine protected areas is very important to conserve particularly fragile ecosystems, such as mangrove forests and coral reefs. Better monitoring and enforcement of environmental regulations is also needed. Aquaculture activities must be carried out in a sustainable manner and urban planning must allow for minimization of human impact, particularly in the proximity of more sensitive coastal ecosystems.

vi) Please identify type of information (scientific, economic and/or social) **most** needed to assist with addressing the area of concern.

Human population and main economic activities in coastal communities; density of mangrove forests and coral reefs; biodiversity; community structure; trophic relations; long term variability; etc.

vii) Please indicate where you think interventions would be most successful in addressing the area of concern, using a scale of 0 to 3, where 0 means not important, 1 means somewhat important, 2 means very important and 3 means absolutely necessary. Please check 9 for "don't know":

- More data and information 0 __ 1___ 2___ 3_X_ 9___ (Don't know)
- More monitoring and enforcement 0 __ 1___ 2_X__ 3__ 9___ (Don't know)
- More laws 0 __ 1_X__ 2___ 3__ 9___ (Don't know)
- More inter-ministerial level decision-making 0 __ 1___ 2_X__ 3__ 9___ (Don't know)
- More private and NGO involvement 0 __ 1___ 2_X__ 3__ 9___ (Don't know)
- Better implementation of decisions 0 __ 1___ 2___ 3_X_ 9___ (Don't know)
- Collaborative effort with neighbouring/other countries 0 __ 1_X__ 2___ 3__ 9___ (Don't know)
- Other (please explain)

Continuity of the actions: There is no effectiveness if the monitoring and enforcement are not perennial.

7. With respect to area of concern #3 identified in question 2 above,

i) Are any of your neighbouring countries contributing to this area of concern? Yes__X__; No_____

If yes, please provide a brief explanation? For instance, if the concern is pollution, it would be useful to know what kind of pollution, e.g. sediments, oils…..If overfishing, useful to know the species.

The main species caught are shrimp, spiny lobster, red snapper, mackerels, billfishes and dolphin fish. The main causes of overfishing include overcapacity and illegal fishing.

If yes, please indicate the severity of impact on the environment, the economy and on society on a scale of 0 to 3, where 0 means no impact, 1 means minor impact, 2 means major impact and 3 means severe impact. Please check 9 for "don't know":

- Environmental impacts: 0 __ 1___ 2_X__ 3___ 9__ (Don't know)
- Economic impacts: 0 __ 1___ 2___ 3_X__ 9__ (Don't know)
- Social impacts: 0 __ 1___ 2___ 3_X__ 9__ (Don't know)

ii) Is your country having an impact on any of your neighbouring countries? Yes____; No____ Don't know

If yes, please provide a brief explanation? For instance, if the concern is pollution, it would be useful to know what kind of pollution, e.g. sediments, oils…..If overfishing, useful to know the species.

The main species are indicated above.

If yes, please indicate the severity of impact on the environment, the economy and on society on a scale of 0 to 3, where 0 means no impact, 1 means minor impact, 2 means major impact and 3 means severe impact.

Please check 9 for "don't know":

- Environmental impacts: 0 __ 1___ 2_X__ 3___ 9__ (Don't know)
- Economic impacts: 0 __ 1___ 2___ 3_X__ 9__ (Don't know)
- Social impacts: 0 __ 1___ 2___ 3_X__ 9__ (Don't know)

iii) Using the template provided at the back of this questionnaire, please identify any actions being taken by your country to address the area of concern?

- Key Ongoing Projects/Activities, including joint projects with neighbouring/other countries
- Resources committed
- Stakeholders involved (primary; secondary)
- Beneficiaries
- Effectiveness of actions

Universities Projects:

There are, for instance, researches between the UFRPe (Pernambuco Federal Rural University) and Oriente University, Venezuela, Miami University, Florida University and National Marine Fisheries Service/ NOAA – USA for studies of biology of Istiophoridae family; *Xiphias gladius* and oceanic sharks.

ICCAT – International Com. Conservation of Atlantic Tuna

MMA – UCN network implementation to the conservation of some species related to the red list (merlo, pargo etc);

Key Projects:

1. Potential Estimate of Living Resources in the Brazilian Exclusive Economic Zone – REVIZEE Program:

Resources Committed:
REVIZEE (1996-2006) - U$ 14.500.000,00

Stakeholders involved (primary; secondary):
Brazilian Ministry of Science and Technology

The National Council for Scientific and Technological Development - CNPq
Brazilian Environment Ministry – MMA
Secretary of the Marine Resources Interministerial Commission – SeCIRM
Institute for Environmental Protection – IBAMA
Universities

Beneficiaries:
Research Community and Brazilian Society
Fishery Companies
Aquaculture and Fisheries Special Secretary - SEAP

2. New control on concession of fishery permission:

Stakeholders involved (primary; secondary):
Aquaculture and Fisheries Special Secretary - SEAP

Beneficiaries:
Brazilian Society

3. National Program of satellite trace for fishing boats:

Stakeholders involved (primary; secondary):
Aquaculture and Fisheries Special Secretary - SEAP
Brazilian Environmental Ministry – MMA
Institute for Environmental Protection – IBAMA
Brazilian Navy

Beneficiaries:
Brazilian Society
Fishery companies

4. National Program of on board observers:

Stakeholders involved (primary; secondary):
Aquaculture and Fisheries Special Secretary - SEAP
Brazilian Environmental Ministry – MMA
Institute for Environmental Protection – IBAMA

Beneficiaries:
Brazilian Society

5. Implantation and maintenance of permanent committees for fishery resources management:
Resources committed:
Sustainable Development of Fishery Program
U$ 10.157.405,00
U$ 9.218.199,00

Stakeholders involved (primary; secondary):
Aquaculture and Fisheries Special Secretary - SEAP

Beneficiaries:
Brazilian Society
Fisheries

6. Diffusion and collection of the mechanism of incidental fishery reduction:

Resources committed:
Fishery Policies Management
U$ 4.700.166,00

Stakeholders involved (primary; secondary):
Aquiculture and Fisheries Special Secretary - SEAP
Institute for Environmental Protection – IBAMA
Brazilian Environmental Ministry

Beneficiaries:
Research Community and Brazilian Society

7. Adoption of actions to avoid the fast and serious fish supply depletion:

Stakeholders involved (primary; secondary):
Aquaculture and Fisheries Special Secretary - SEAP
Institute for Environmental Protection – IBAMA
Brazilian Environmental Ministry

Beneficiaries:
Research Community and Brazilian Society

8. Professional fishers re-registration:

Resources committed:
Forbidden Fishing Insurance
U$ 140.000.000,00

Stakeholders involved (primary; secondary):
Aquaculture and Fisheries Special Secretary – SEAP

Beneficiaries:
Research Community and Brazilian Society

9. Strengthened of research:

Stakeholders involved (primary; secondary):
Aquaculture and Fisheries Special Secretary - SEAP

Beneficiaries:
Research Community and Brazilian Society

10. Archipelago and Oceanic Islands Program:
(Research Project Public Selection (CNPq/MCT)
Resources committed:
U$ 467.289,00

Stakeholders involved (primary; secondary):
Brazilian Science and Technology Ministry
National Council for Scientific and Technological Development (CNPq)
Secretary of the Marine Resources Interministerial Commission – SeCIRM

Beneficiaries:
Research Community and Brazilian Society

iv) Using the template provided at the back of this questionnaire, please identify any known additional activities planned to be undertaken by your country

- Resources (financial, technical, human)
- Timescale
- Stakeholders involved (primary; secondary)
- Beneficiaries
- Likely outputs

The actions planned for 2007, without resources committed:

- **Marine Living Resources Monitoring Program (REVIMAR)**
- **To Open a new production series**
- **New routes of controlled fishery fleets**
- **Management of conflicts between artesian and industrial fishery**
- **Actions to enhance fishery research**

v) Please identify any additional potential solutions that can assist with addressing the area of concern.

The main measure to improve the present condition of fish stocks in the region, many of which are overfished, is a better enforcement of conservation and management measures. A more participative decision making process is also essential. Innovative fisheries management tools, such as marine protected areas, are also important to assist stock recovery.

vi) Please identify type of information (scientific, economic and/or social) **most** needed to assist with addressing the area of concern.

Oceanographic (SST, salinity, nutrient), biological (age and size structure of the fish caught, reproductive stage, feeding habits, etc) and fisheries data (catch and effort). Socio-economic information on fishing fleet and fishermen is also very important.

vii) Please indicate where you think interventions would be most successful in addressing the area of concern, using a scale of 0 to 3, where 0 means not important, 1 means somewhat important, 2 means very important and 3 means absolutely necessary. Please check 9 for "don't know":

- More data and information 0 __ 1___ 2___ 3_X_ 9___ (Don't know)
- More monitoring and enforcement 0 __ 1___ 2__ 3_X__ 9___ (Don't know)
- More laws 0 __ 1_X_ 2__ 3___ 9___ (Don't know)
- More inter-ministerial level decision-making 0 __ 1___ 2_X_ 3___ 9___ (Don't know)
- More private and NGO involvement 0 __ 1___ 2__ 3_X__ 9___ (Don't know)

• Better implementation of decisions 0 __ 1___ 2__ 3_X__ 9___ (Don't know) • Collaborative effort with neighbouring/other countries 0 __ 1___ 2_X_ 3___ 9___ (Don't know) • Other (please explain)
8. Please indicate below any relevant documents, including national development plans, sectoral plans and policies, country-specific information, etc. you think the CLME Project Task Team should be aware of when developing the Transboundary Diagnostic Analysis and Project Concept Paper for the member countries of the CLME Project.

Appendix II: CLME Project Template - Guyana

1. **General information**.

a) Name of Country or Organization: The Co-operative Republic of Guyana

b) Composition of CLME Inter-Ministerial/Intersectoral Committee:

i) Identify National Government Ministries: Ministry of Agriculture, Ministry of Fisheries, Crops and Livestock.
- Fisheries Department, N.A.R.I., Environment Protection Agency, Forestry Commission.

ii) Identify any other levels of government: Guyana Coast Guard, Guyana Marine Police, Lands and Surveys, Ministry of Works and Transport

iii) Identify any non-government members: Guyana Private Trawlers Owners and Seafood Processing Association, Guyana Marine Turtle Conservation Society, UG and GSA

iv) Identify Chairmanship the Committee: N.A.R.I - Robin Austin

c) Total # of members on the Committee __12___

d) Does the Committee deal with matters other than the CLME Project? Matters related to the CLME project? List. Coastal zone monitoring and climate

2. Major areas of concern

The following areas of concern have been identified as affecting the sustainability of transboundary living marine resources in a number of regions: *Over-Fishing; Pollution and Contamination; Habitat Degradation*.

What are your country's perceived **major** areas of concern regarding your **transboundary living marine resources**? Please rank in order of importance where 1 is greatest:

1__Over-fishing_____

2__Habitat degredation_____

3__Pollution and contamination_____

4_____

5_____

3. Origin and Causes

For your top three areas of concern, please identify where, in your opinion, the concern originated and the causes for the concern:

Origin of Area of Concern #1: Illegal fishing and excess capacity.

Causes for Area of Concern #1: Effect on sustainability of fishing stocks and the effect on the livelihood of Fishing.

Origin of Area of Concern #2: Overfishing and sealine pollution.

Causes for Area of Concern #2: Effects on ecological balance, seacoast pollution and mangrove destruction

Origin of Area of Concern #3: Contaminants from ships, fishing trawlers, pollution from mining, agricultural activities and humans.

Causes for Area of Concern #3: Because of its effects on the ecosystem and fish stocks.

4. **Maritime Neighbours**:

a) How many neighbouring countries share **transboundary living marine resources** with your country?

_____5_____

b) Please identify countries___Venezuela, Trinidad and Tobago, Suriname, Brazil, Barbados____

_____

5. **With respect to area of concern #1 identified in question 2 above**,

i) Are any of your neighbouring countries contributing to this area of concern? Yes__X__; No_____

If yes, please provide a brief explanation? For instance, if the concern is pollution, it would be useful to know what kind of pollution, e.g. sediments, oils…..If overfishing, useful to know the species.

Shrimp - P. brasiliensis, P. notialis, P. suptilis, P. schmitti
Southern red snapper - L. purpures
Ground fish - SCIAEIDAE (family)

If yes, please indicate the severity of impact on the environment, the economy and on society on a scale of 0 to 3, where 0 means no impact, 1 means minor impact, 2 means major impact and 3 means severe impact. Please check 9 for "don't know":

- Environmental impacts: 0 __ 1___ 2___ 3_X_ 9___ (Don't know)
- Economic impacts: 0 __ 1___ 2___ 3_X_ 9___ (Don't know)
- Social impacts: 0 __ 1___ 2___ 3_X_ 9___ (Don't know)

ii) Is your country having an impact on any of your neighbouring countries? Yes__X__; No_____

If yes, please provide a brief explanation? For instance, if the concern is pollution, it would be useful to know what kind of pollution, e.g. sediments, oils…..If overfishing, useful to know the species.

SCIAEIDAE family

If yes, please indicate the severity of impact on the environment, the economy and on society on a scale of 0 to 3, where 0 means no impact, 1 means minor impact, 2 means major impact and 3 means severe impact. Please check 9 for "don't know":

- Environmental impacts: 0 __ 1___ 2___ 3___ 9_X_ (Don't know)
- Economic impacts: 0 __ 1___ 2___ 3___ 9_X_ (Don't know)
- Social impacts: 0 __ 1___ 2___ 3___ 9_X_ (Don't know)

iii) Using the template provided at the back of this questionnaire, please identify any actions being taken by your

country to address the area of concern?

- Key Ongoing Projects/Activities, including joint projects with neighbouring/other countries
- Resources committed
- Stakeholders involved (primary; secondary)
- Beneficiaries
- Effectiveness of actions

iv) Using the template provided at the back of this questionnaire, please identify any known additional activities planned to be undertaken by your country

- Resources (financial, technical, human)
- Timescale
- Stakeholders involved (primary; secondary)
- Beneficiaries
- Likely outputs

v) Please identify any additional potential solutions that can assist with addressing the area of concern.
Close season and closed areas regulation along with reduced capacity.

vi) Please identify types of information (scientific, economic and/or social) **most** needed to assist with addressing the area of concern. **Scientific**

vii) Please indicate where you think interventions would be most successful in addressing the area of concern, using a scale of 0 to 3, where 0 means not important, 1 means somewhat important, 2 means very important and 3 means absolutely necessary. Please check 9 for "don't know":

- More data and information 0 __ 1___ 2___ 3_X_ 9___ (Don't know)
- More monitoring and enforcement 0 __ 1___ 2___ 3_X_ 9___ (Don't know)
- More laws 0 __ 1_X_ 2___ 3___ 9___ (Don't know)
- More inter-ministerial level decision-making 0 __ 1___ 2_X_ 3___ 9___ (Don't know)
- More private and NGO involvement 0 __ 1___ 2___ 3_X_ 9___ (Don't know)
- Better implementation of decisions 0 __ 1___ 2___ 3_X_ 9___ (Don't know)
- Collaborative effort with neighbouring/other countries 0 __ 1___ 2___ 3_X_ 9___ (Don't know)
- Other (please explain)

6. With respect to area of concern #2 identified in question 2 above,

i) Are any of your neighbouring countries contributing to this area of concern? Yes__X__; No_____

If yes, please provide a brief explanation? For instance, if the concern is pollution, it would be

useful to know what kind of pollution, e.g. sediments, oils…..If overfishing, useful to know the species.

Human and fishing activities
By using wrong fishing gear
By engaging in illegal, unreported and unregulated fishing (IUU)

If yes, please indicate the severity of impact on the environment, the economy and on society on a scale of 0 to 3, where 0 means no impact, 1 means minor impact, 2 means major impact and 3 means severe impact. Please check 9 for "don't know":

- Environmental impacts: 0 __ 1___ 2___ 3_X_ 9___ (Don't know)
- Economic impacts: 0 __ 1___ 2___ 3_X_ 9___ (Don't know)
- Social impacts: 0 __ 1___ 2___ 3_X_ 9___ (Don't know)

ii) Is your country having an impact on any of your neighbouring countries? Yes__X__; No_____

If yes, please provide a brief explanation? For instance, if the concern is pollution, it would be useful to know what kind of pollution, e.g. sediments, oils…..If overfishing, useful to know the species.

Fishing activities

If yes, please indicate the severity of impact on the environment, the economy and on society on a scale of 0 to 3, where 0 means no impact, 1 means minor impact, 2 means major impact and 3 means severe impact. Please check 9 for "don't know":

- Environmental impacts: 0 __ 1___ 2___ 3___ 9_X_ (Don't know)
- Economic impacts: 0 __ 1___ 2___ 3___ 9_X_ (Don't know)
- Social impacts: 0 __ 1___ 2___ 3___ 9_X_ (Don't know)

iii) Using the template provided at the back of this questionnaire, please identify any actions being taken by your country to address the area of concern?

- Key Ongoing Projects/Activities, including joint projects with neighbouring/other countries
- Resources committed
- Stakeholders involved (primary; secondary)
- Beneficiaries
- Effectiveness of actions

iv) Using the template provided at the back of this questionnaire, please identify any known additional activities planned to be undertaken by your country

- Resources (financial, technical, human)
- Timescale
- Stakeholders involved (primary; secondary)
- Beneficiaries
- Likely outputs

v) Please identify any additional potential solutions that can assist with addressing the area of concern.
Education and law enforcement on sea and sealine pollution and degradation.

vi) Please identify type of information (scientific, economic and/or social) **most** needed to assist with addressing the area of concern. Scientific, economic and social.

vii) Please indicate where you think interventions would be most successful in addressing the area of concern, using a scale of 0 to 3, where 0 means not important, 1 means somewhat important, 2 means very important and 3 means absolutely necessary. Please check 9 for "don't know":

- More data and information 0 __ 1___ 2___ 3_X_ 9___ (Don't know)
- More monitoring and enforcement 0 __ 1___ 2___ 3_X_ 9___ (Don't know)
- More laws 0 __ 1___ 2___ 3_X_ 9___ (Don't know)
- More inter-ministerial level decision-making 0 __ 1___ 2___ 3_X_ 9___ (Don't know)
- More private and NGO involvement 0 __ 1___ 2___ 3_X_ 9___ (Don't know)
- Better implementation of decisions 0 __ 1___ 2___ 3_X_ 9___ (Don't know)
- Collaborative effort with neighbouring/other countries 0 __ 1___ 2___ 3_X_ 9___ (Don't know)
- Other (please explain)

7. With respect to area of concern #3 identified in question 2 above,

i) Are any of your neighbouring countries contributing to this area of concern? Yes__X__; No_____

If yes, please provide a brief explanation? For instance, if the concern is pollution, it would be useful to know what kind of pollution, e.g. sediments, oils…..If overfishing, useful to know the species.

Forestry products, plastic, plastic nets, contaminants from mining activities

If yes, please indicate the severity of impact on the environment, the economy and on society on a scale of 0 to 3, where 0 means no impact, 1 means minor impact, 2 means major impact and 3 means severe impact. Please check 9 for "don't know":

- Environmental impacts: 0 __ 1___ 2___ 3___ 9_X_ (Don't know)
- Economic impacts: 0 __ 1___ 2___ 3___ 9_X_ (Don't know)
- Social impacts: 0 __ 1___ 2___ 3___ 9_X_ (Don't know)

ii) Is your country having an impact on any of your neighbouring countries? Yes____; No____ Don't know

If yes, please provide a brief explanation? For instance, if the concern is pollution, it would be useful to know what kind of pollution, e.g. sediments, oils…..If overfishing, useful to know the species.

If yes, please indicate the severity of impact on the environment, the economy and on society on a scale of 0 to 3, where 0 means no impact, 1 means minor impact, 2 means major impact and 3 means

severe impact. Please check 9 for "don't know":

- Environmental impacts: 0 __ 1___ 2___ 3___ 9_X_ (Don't know)
- Economic impacts: 0 __ 1___ 2___ 3___ 9_X_ (Don't know)
- Social impacts: 0 __ 1___ 2___ 3___ 9_X_ (Don't know)

iii) Using the template provided at the back of this questionnaire, please identify any actions being taken by your country to address the area of concern?

- Key Ongoing Projects/Activities, including joint projects with neighbouring/other countries
- Resources committed
- Stakeholders involved (primary; secondary)
- Beneficiaries
- Effectiveness of actions

iv) Using the template provided at the back of this questionnaire, please identify any known additional activities planned to be undertaken by your country

- Resources (financial, technical, human)
- Timescale
- Stakeholders involved (primary; secondary)
- Beneficiaries
- Likely outputs

v) Please identify any additional potential solutions that can assist with addressing the area of concern.

Better collaboration and monitoring

vi) Please identify type of information (scientific, economic and/or social) **most** needed to assist with addressing the area of concern.

Scientific data

vii) Please indicate where you think interventions would be most successful in addressing the area of concern, using a scale of 0 to 3, where 0 means not important, 1 means somewhat important, 2 means very important and 3 means absolutely necessary. Please check 9 for "don't know":

- More data and information 0 __ 1___ 2___ 3_X_ 9___ (Don't know)
- More monitoring and enforcement 0 __ 1___ 2_X_ 3___ 9___ (Don't know)
- More laws 0 __ 1___ 2_X_ 3___ 9___ (Don't know)
- More inter-ministerial level decision-making 0 __ 1___ 2_X_ 3___ 9___ (Don't know)
- More private and NGO involvement 0 __ 1___ 2_X_ 3___ 9___ (Don't know)
- Better implementation of decisions 0 __ 1___ 2_X_ 3___ 9___ (Don't know)

• Collaborative effort with neighbouring/other countries 0 __ 1___ 2_X_ 3___ 9___ (Don't know) • Other (please explain)
8. Please indicate below any relevant documents, including national development plans, sectoral plans and policies, country-specific information, etc. you think the CLME Project Task Team should be aware of when developing the Transboundary Diagnostic Analysis and Project Concept Paper for the member countries of the CLME Project.

Current Activities to Address Area of Concern

Area of Concern	Activity/Project	Resources Committed	Project Timescale	Key Beneficiaries	Possible Evaluation of Effectiveness of actions
Overfishing	WECAFC CRFM Scientific Working Group Resource Assessment with Venezuela, Suriname and French Guiana. Policing of Water	Staff Financial Coast Guard	On going	Fisheries Ministry of Agriculture FAO Government of Guyana Coast Guard	Fair
Habitat Degradation	Education	Time Staff Money	On going		Fair
Pollution and Contamination	Education	Time Staff Money	On going		Fair

Planned Activities to Address Area of Concern

Area of Concern	Activity/Project and Projected Timescale	Resources Committed	Partners Involved	Key Beneficiaries	Likely Outputs
Overfishing	MCS – Ongoing Policing	Financial Technical Human	Coast Guard Marine Police Fisheries Department	Fishers Government of Guyana	Improved monitoring capabilities and data collection. More interception and seizures
Habitat Degradation	Monitoring	Financial Technical Human	Marine Turtle Conservation Transport and Harbours Department (T.H.D) W.W.F. Ministry of Agriculture Sea Defense	Fishers Government of Guyana	Data to be acted upon
Pollution and Contamination	Monitoring	Financial Technical Human	Government agency	Fisheries Government of Guyana Coastal Dwellers	Cleaner and safer beaches and coastlines.

Appendix III: CLME Project Template - Suriname

CLME Project Template: Please return to CLME Project Unit by December 29, 2006

1. **General information**.

a) Name of Country or Organization: **SURINAME**

b) Composition of CLME Inter-Ministerial/Intersectoral Committee:

i) Identify National Government Ministries: **Ministry of Labor, Technological Development and Environment/ Ministry of Agriculture, Animal Husbandry and Fisheries/ Ministry of Defense/ Ministry of Spatial Planning, Land and Forest Management/Ministry of Natural Resources**

ii) Identify any other levels of government: **Maritime Authority Suriname/ / National Institute for Environment and Development**

iii) Identify any non-government members: **University of Suriname**

iv) Identify Chairmanship the Committee:

c) Total # of members on the Committee**: 9**

d) Does the Committee deal with matters other than the CLME Project? Matters related to the CLME project? List.

2. Major areas of concern

The following areas of concern have been identified as affecting the sustainability of transboundary living marine resources in a number of regions: *Over-Fishing; Pollution and Contamination; Habitat Degradation*.
What are your country's perceived **major** areas of concern regarding your **transboundary living marine resources**? Please rank in order of importance where 1 is greatest:

1__**POLLUTION AND CONTAMINATION**_____

2__ILLEGAL FISHING _____

3__OVERFISHING_____

4__HABITAT DEGRADATION_____

3. Origin and Causes

For your top three areas of concern, please identify where, in your opinion, the concern originated and the causes for the concern:

Origin of Area of Concern #1: POLLUTION AND CONTAMINATION

Causes for Area of Concern #1:

- **Waste: Solid (garbage) and Waste water coming from : Agriculture, industrial, municipal and mining activities**
- **Ballast waste from ships**
- **Air pollution from ships**

Origin of Area of Concern #2: ILLEGAL FISHING

Causes for Area of Concern #2**: No adequate control and surveillance at sea by the authority**

Origin of Area of Concern #3: OVERFISHING

Causes for Area of Concern #3: **Improper management of the resource by the Fisheries department**
Lack of adequate skills
Not able to control concern #2

4. **Maritime Neighbours**:

a) How many neighbouring countries share **transboundary living marine resources** with your country? __5_____

b) Please identify countries : **Venezuela, Guyana, French Guiana, Brazil, Trinidad & Tobago**_____
_____

5. **With respect to area of concern #1 identified in question 2 above**,

i) Are any of your neighbouring countries contributing to this area of concern? Yes *; No *

If yes, please provide a brief explanation? For instance, if the concern is pollution, it would be useful to know what kind of pollution, e.g. sediments, oils…..If overfishing, useful to know the species.

Sediments

Concern for oil spills and ballast water

If yes, please indicate the severity of impact on the environment, the economy and on society on a scale of 0 to 3, where 0 means no impact, 1 means minor impact, 2 means major impact and 3 means severe impact. Please check 9 for "don't know":

- Environmental impacts: 0 __ 1___ 2___ 3___ 9__*_ (Don't know)
- Economic impacts: 0 __ 1___ 2___ 3___ 9_*__ (Don't know)
- Social impacts: 0 __ 1___ 2___ 3___ 9__*_ (Don't know)

ii) Is your country having an impact on any of your neighbouring countries? Yes__*___; No__*____
and of pollution, e.g. sediments, oils…..If overfishing, useful to know the species.

Don't know

If yes, please indicate the severity of impact on the environment, the economy and on society on a scale of 0 to 3, where 0 means no impact, 1 means minor impact, 2 means major impact and 3 means severe impact. Please check 9 for "don't know":

- Environmental impacts: 0 __ 1___ 2___ 3___ 9__*_ (Don't know)
- Economic impacts: 0 __ 1___ 2___ 3___ 9_*__ (Don't know)
- Social impacts: 0 __ 1___ 2___ 3___ 9_*__ (Don't know)

iii) Using the template provided at the back of this questionnaire, please identify any actions being taken by your country to address the area of concern?

- Key Ongoing Projects/Activities, including joint projects with neighbouring/other countries
- Resources committed
- Stakeholders involved (primary; secondary)
- Beneficiaries

- Effectiveness of actions

iv) Using the template provided at the back of this questionnaire, please identify any known additional activities planned to be undertaken by your country
  - Resources (financial, technical, human)
  - Timescale
  - Stakeholders involved (primary; secondary)
  - Beneficiaries
  - Likely outputs

v) Please identify any additional potential solutions that can assist with addressing the area of concern.

Awareness raising, capacity strengthening (policy and executive level), Monitoring

vi) Please identify types of information (scientific, economic and/or social) **most** needed to assist with addressing the area of concern.

All 3

vii) Please indicate where you think interventions would be most successful in addressing the area of concern, using a scale of 0 to 3, where 0 means not important, 1 means somewhat important, 2 means very important and 3 means absolutely necessary. Please check 9 for "don't know":

- More data and information 0 __ 1___ 2___ 3 * 9___ (Don't know)
- More monitoring and enforcement 0 __ 1___ 2___ 3 * 9___ (Don't know)
- More laws 0 __ 1 * 2___ 3__ 9___ (Don't know
- More inter-ministerial level decision-making 0 __ 1 * 2___ 3___ 9___ (Don't know)
- More private and NGO involvement 0 __ 1__ 2___ 3 * 9___ (Don't know)
- Better implementation of decisions 0 __ 1___ 2___ 3 * 9___ (Don't know)
- Collaborative effort with neighbouring/other countries 0 __ 1___ 2___ 3 * 9___ (Don't know)
- Other (please explain) **Financial assistance**

6. With respect to area of concern #2 identified in question 2 above,

i) Are any of your neighbouring countries contributing to this area of concern? Yes * No_____

If yes, please provide a brief explanation? For instance, if the concern is pollution, it would be useful to know what kind of pollution, e.g. sediments, oils…..If overfishing, useful to know the species.

Venezuelan vessels enter our EEZ to fish on Snappers and Kingfish

Guyanese fishermen do fish the same species the local fishermen fished on. Species such as, Scianids, Arriids, Snappers

Brazilian Fishermen

If yes, please indicate the severity of impact on the environment, the economy and on society on a scale of 0 to 3, where 0 means no impact, 1 means minor impact, 2 means major impact and 3 means severe impact. Please check 9 for "don't know":

- Environmental impacts: 0 __ 1___ 2___ 3__ 9 X_ (Don't know)
- Economic impacts: 0 __ 1___ 2___ 3 * 9___ (Don't know)
- Social impacts: 0 __ 1___ 2___ 3 * 9___ (Don't know)

ii) Is your country having an impact on any of your neighbouring countries? Yes * No_____

If yes, please provide a brief explanation? For instance, if the concern is pollution, it would be useful to know what kind of pollution, e.g. sediments, oils…..If overfishing, useful to know the species.

Local fishermen do enter French Guiana EEZ, but when they are caught, high penalties are paid

If yes, please indicate the severity of impact on the environment, the economy and on society on a scale of 0 to 3, where 0 means no impact, 1 means minor impact, 2 means major impact and 3 means severe impact. Please check 9 for "don't know":

- Environmental impacts: 0 __ 1___ 2___ 3___ 9 * (Don't know)
- Economic impacts: 0 __ 1* 2___ 3___ 9___ (Don't know)
- Social impacts: 0 __ 1* 2___ 3___ 9___ (Don't know)

iii) Using the template provided at the back of this questionnaire, please identify any actions being taken by your country to address the area of concern?

- Key Ongoing Projects/Activities, including joint projects with neighbouring/other countries **X**
- Resources committed **X**
- Stakeholders involved (primary; secondary) **X**
- Beneficiaries
- Effectiveness of actions

iv) Using the template provided at the back of this questionnaire, please identify any known additional activities planned to be undertaken by your country

- Resources (financial, technical, human) **X**
- Timescale
- Stakeholders involved (primary; secondary) **X**
- Beneficiaries
- Likely outputs

v) Please identify any additional potential solutions that can assist with addressing the area of concern.

Establishment of a good functioning Coast guard
High penalties for those in breach

vi) Please identify type of information (scientific, economic and/or social) **most** needed to assist with addressing the area of concern. **Economic and Social**

vii) Please indicate where you think interventions would be most successful in addressing the area of concern, using a scale of 0 to 3, where 0 means not important, 1 means somewhat important, 2 means very important and 3 means absolutely necessary. Please check 9 for "don't know":

- More data and information 0 __ 1___ 2_* 3___ 9___ (Don't know)
- More monitoring and enforcement 0 __ 1___ 2___ 3 * 9___ (Don't know)
- More laws 0 __ 1___ 2 * 3___ 9___ (Don't know)
- More inter-ministerial level decision-making 0 __ 1___ 2___ 3* 9___ (Don't know)
- More private and NGO involvement 0 __ 1___ 2___ 3 * 9___ (Don't know)
- Better implementation of decisions 0 __ 1___ 2___ 3* 9___ (Don't know)
- Collaborative effort with neighbouring/other countries 0 __ 1___ 2__ 3_* 9___ (Don't know)
- Other (please explain)

7. With respect to area of concern #3 identified in question 2 above,

i) Are any of your neighbouring countries contributing to this area of concern? Yes X___; No_____

If yes, please provide a brief explanation? For instance, if the concern is pollution, it would be useful to know what kind of pollution, e.g. sediments, oils…..If overfishing, useful to know the species.

As a result of illegal fishing and bad management of fishing licenses some species are being fished at a level that the stock can not be maintain and they become at risk.

Guyanese fishermen fished for the same species as Surinamese fishers. Seabob, all Scianids, Arrids and others.

If yes, please indicate the severity of impact on the environment, the economy and on society on a scale of 0 to 3, where 0 means no impact, 1 means minor impact, 2 means major impact and 3 means severe impact. Please check 9 for "don't know":

- Environmental impacts: 0 __ 1___ 2* 3___ 9___ (Don't know)
- Economic impacts: 0 __ 1___ 2___ 3 * 9___ (Don't know)
- Social impacts: 0 __ 1___ 2___ 3* 9___ (Don't know)

ii) Is your country having an impact on any of your neighbouring countries? Yes_____; No*

If yes, please provide a brief explanation? For instance, if the concern is pollution, it would be useful to know what kind of pollution, e.g. sediments, oils…..If overfishing, useful to know the species.

If yes, please indicate the severity of impact on the environment, the economy and on society on a scale of 0 to 3, where 0 means no impact, 1 means minor impact, 2 means major impact and 3 means severe impact. Please check 9 for "don't know":

- Environmental impacts: 0 __ 1___ 2___ 3___ 9___ (Don't know)
- Economic impacts: 0 __ 1___ 2___ 3___ 9___ (Don't know)
- Social impacts: 0 __ 1___ 2___ 3___ 9___ (Don't know)

iii) Using the template provided at the back of this questionnaire, please identify any actions being taken by your country to address the area of concern?

- Key Ongoing Projects/Activities, including joint projects with neighbouring/other countries **X**
- Resources committed **X**
- Stakeholders involved (primary; secondary) **X**
- Beneficiaries
- Effectiveness of actions

iv) Using the template provided at the back of this questionnaire, please identify any known additional activities planned to be undertaken by your country

- Resources (financial, technical, human) **X**
- Timescale
- Stakeholders involved (primary; secondary) **X**
- Beneficiaries
- Likely outputs

v) Please identify any additional potential solutions that can assist with addressing the area of concern.

Adequate management of the Resources
More Control and Surveillance
More Research

vi) Please identify type of information (scientific, economic and/or social) **most** needed to assist with addressing the area of concern. **Scientific information**

vii) Please indicate where you think interventions would be most successful in addressing the area of concern, using a scale of 0 to 3, where 0 means not important, 1 means somewhat important, 2 means very important and 3 means absolutely necessary. Please check 9 for "don't know":

• More data and information	0 __ 1___ 2___ 3 * 9___ (Don't know)
• More monitoring and enforcement	0 __ 1___ 2___ 3 * 9___ (Don't know)
• More laws	0 __ 1___ 2 * 3___ 9___ (Don't know)
• More inter-ministerial level decision-making	0 __ 1___ 2___ 3* 9___ (Don't know)
• More private and NGO involvement	0 __ 1___ 2 * 3___ 9___ (Don't know)
• Better implementation of decisions	0 __ 1___ 2* 3___ 9___ (Don't know)
• Collaborative effort with neighbouring/other countries	0 __ 1___ 2___ 3 * 9___ (Don't know)
• Other (please explain)	

8. Please indicate below any relevant documents, including national development plans, sectoral plans and policies, country-specific information, etc. you think the CLME Project Task Team should be aware of when developing the Transboundary Diagnostic Analysis and Project Concept Paper for the member countries of the CLME Project. **National Biodiversity Strategy and Policy paper of the Ministry of Environment**

Current Activities to Address Area of Concern

Area of Concern	Activity/Project	Resources Committed	Projected Timescale	Key Beneficiaries	Possible Evaluation of Effectiveness of actions
POLLUTION AND CONTAMINATION	**- Draft Oilspills Contingency Plan** **- Baseline study regarding ballastwater (Globallast Project)** **- training on the use of pesticides in agriculture** **- ratification to Protocol 96- Draft regulations regarding waste dumping in sea has been prepared** **- Draft Environmental Act**	**Ministry of Environment** **Ministry of Agriculture** **Ministry of Environment**	**2 years** **Ongoing** **2 year**	**- Oil Companies** **- Environmental Organizations** **- All living aquatic organisms** **- farmers/ cultivators** **Population of Suriname**	
ILLEGAL FISHING	**- Observers programme** **- surveillance at sea**	**Adequate management and safety**	**- Once every month** **- 3 times ayear**	**Fishing companies**	**- Numbers of vessels are reduced** **- saver fishing grounds**
OVERFISHING	**Observers programme**	**Sustainable use of the resources**	**- Once every month**	**fishing companies**	**- Production will increase** **- income for fshermen and suriname through export.**

Planned Activities to Address Area of Concern

Area of Concern	Activity/Project and Projected Timescale	Resources Committed	Partners Involved	Key Beneficiaries	Likely Outputs
POLLUTION AND CONTAMINATION	**- Waste water management and Sanitation training** **- ratification of the Cartagena Convention** **-Ratification of the Basel Convention**	**Ministry of Environment /University of Suriname** **- Min. of Environment** **- Min. of Environment**	**UNEP/UNESCO** **National Institute for Environment/ Min of Spatial planning, land and forest management** **- Public private partnerships**	**Population of Suriname** **Population of Suriname** **-Population of Suriname**	**Module to be incorporated in the curriculum of the university**
ILLEGAL FISHING					
OVERFISHING	**Introduction of vessel monitoring system**				**Sustainable use of the resources**