PROJECT BRIEF

1. IDENTIFIERS

PROJECT NUMBER:	
GEF ID:	1346
PROJECT TITLE:	**Integrated Assessment and Management of the Gulf of Mexico Large Marine Ecosystem**
PROJECT DURATION:	Four years
GEF AGENCY:	UNIDO
OTHER COOPERATING AGENCIES:	SEMARNAT (México)
REQUESTING COUNTRIES:	México, United Stated of America
ELIGIBILTY:	Both countries are GEF members. Mexico is eligible for GEF financial support under paragraph 9(b) of the GEF Instrument
GEF PROGRAMMING:	GEF IW Strategic Objective 1 (To foster international, multi-state cooperation on priority transboundary water concerns through more comprehensive, ecosystem-based approaches to management) and GEF4 IW Strategic Program 1 - Restoring and sustaining coastal and marine fish stocks and associated biological diversity**.**

2.PROJECT SUMMARY

The distinctive biophysical characteristics of the Gulf of Mexico Large Marine Ecosystem (GoM LME) make it one of the most productive marine ecosystems in the world and an important global reservoir of biodiversity. However, this high productivity is at risk from a suite of anthropogenic threats that include excessive fishing effort, destruction of critical coastal and marine habitats, and nutrient-enrichment resulting in a "Dead Zone" of over 18,000 km^2 that forms every year – one of the largest hypoxic zones of water in the world. Additionally, the LME is the focus of extensive oil and gas production as well as a rapidly increasing tourism industry.

Many stocks in the Gulf of Mexico are over fished, or are at (or close to) their maximum yield. Intensive fishing, the primary force driving biomass changes in the GoM LME, is compounded by two other significant factors. Habitat modification, including loss of critical habitats and connectivity, resulting from poorly planned growth in coastal and urban areas along the GoM, coast translates into a trend of urban growth at the expense estuaries, marshes, seagrasses, coral reefs, mangroves and other vital ecotones. According to data from the FAO, in the last 30 years Mexico has lost more than half of its mangrove coverage on both coasts. Depletion and impacts on fish stocks affects both countries given that many stocks are shared, migratory, or connected via egg or larval transport. Loss of habitats impacts on the life cycles of over 90% of GoM coastal and marine species, as does the increasing pollutant and nutrient loads. Economic activities in the GoM are significant for both countries, with 85 % of Mexico's oil extraction originating in the region as well as 72 % of the U.S. offshore petroleum production.

These growing anthropogenic threats evidence tight interdependencies in terms of causes and effects, and an LME-wide, ecosystem-based management approach is required to effectively mitigate them in the long-term. However, existing management approaches are not consistent with an ecosystem-based perspective and there are currently no agreed bi-national programmes for managing the GoM resources taking into account ecosystem-based requirements. Furthermore, the two countries have institutional frameworks for coastal and marine resources protection, but no effective regional inter-sectoral project coordination mechanism currently exists. In the absence of GEF intervention, fragmented efforts with a national and an often sectoral focus will continue to be the norm.

The proposed GEF alternative will, through a TDA-SAP process, remove identified constraints and barriers, develop common mechanisms and tools, and promote reforms and investments, to set the bases for application of the ecosystem approach in the management of the GoM LME. This will be complemented by discrete capacity-building activities and pilot projects in three critical aspects of the ecosystem approach: productivity, conservation and adaptive management, and robust monitoring and evaluation frameworks, as well as cross-sectoral engagement. The transition towards the ecosystem-based management of the GoM LME will depend on a greater convergence of policy tools including long-term joint programs and actions, a clearer distribution of competencies at all three levels of government, and a robust monitoring and evaluation program. This will require a truly regional GoM initiative supported through a combination of GEF financing and co-financing including a reoriented baseline.

Within this integrated approach, the project will address specific IW Priorities, in particular reduction of nutrient over-enrichment from land-based pollution that creates anoxic "dead" zones in coastal waters, and restoration and maintenance of costal and marine fish stocks and associated biological diversity, complemented by efforts to address degradation of coastal resources and processes. In particular, the "dead zone" that forms every year in the Gulf of Mexico in critical areas for commercial and recreational fisheries will require cross-sectoral, integrated suites of measures and reforms to address this issue as detailed in the IW Strategy. The project will also develop mechanisms and undertake reforms for maintaining fisheries resources to within safe biological limits, and encourage the sustainable use of all exploited living marine resources in the GOM LME. As an OP9 initiative, it emphasizes the multi-focal connections that characterize the system. The project seeks to create a co-operative framework, together with the necessary capacities, thereby enabling Mexico and the U.S. to address both imminent threats to the water body and develop joint ecosystem-based management approaches

The *long-term development/environmental goal* of the project is the enhanced sustainable development of the Gulf of Mexico LME through ecosystem-based management approaches. The *project objective* is: to set the foundations for LME-wide ecosystem-based management approaches to rehabilitate marine and coastal ecosystems, recover depleted fish stocks, and reduce nutrient overloading.

3. COSTS AND FINANCING

		Amount (US$)
GEF	Full Project (including IA Fee)	4,502,500
	PDF-B	473,000
TOTAL GEF		4,975,500
Co-Financing for Full Project:		
	Government (in kind and cash)	96,774,780
TOTAL Co-financing		96,774,780
TOTAL PROJECT COSTS		$101,750,280

4. GEF Operational Focal Point Endorsement

Name	Claudia Grayeb Bayata
Position	Director for International Financial Organizations
Organization	Secretary of the Treasury, Mexico
Date	June 18th, 2007

5. Implementing/Executing Agency Contact

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LIST OF ACRONYMS

APR	Annual Project Report
AWP	Annual Work Plan
CAE	Country Assistance Evaluation
CARICOMP	Caribbean Coastal Marine Productivity
CBO	Community Based Organizations
CCRF	Code of Conduct for Responsible Fisheries
CEC	Commission for Environmental Cooperation
CECADESU	Centro de Capacitación para el Desarrollo Sustentable (Human Resource Developing Center for the Sustainable Development)
CENAPRED	Centro Nacional de Prevención de Desastres (National Center for Disasters Prevention)
CEO	Chief Executive Officer
CCRF	Code of Conduct for Responsible Fishers
CIMIOC	Commission for the Integrated Management of Oceans and Coasts
CIMOIC	Comisión Intersecretarial para el Manejo Integrado de Océanos y Costas (Inter-ministerial Commission for the Integrated Management of Oceans and Coasts)
CINVESTAV	Centro de Investigación y de Estudios Avanzados del IPN (Research and Advanced Studies Center, National Polytechnic Institute)
CIP	Centro de Investigaciones Pesqueras (Fisheries Research Investigation Center)
CNA	Comisión Nacional del Agua (National Water Commission)
CNHP	National Commission for Priority Wetlands
CONABIO	Comisión Nacional para el Uso y Conocimiento de la Biodiversidad (National Commission on the Use and Knowledge of Biodiversity)
CONAGUA	Comisión Nacional del Agua (National Commission for Water)
CONANP	Comisión Nacional de Áreas Naturales Protegidas (National Commission of Natural Protected Areas)
CONAPESCA	Comisión Nacional de Acuacultura y Pesca (National Commission of Aquaculture and Fisheries)
CONAFOR	Comisión Nacional Forestal (National Forestry Commission)
CTA	Chief Technical Advisor
DGIRA	Dirección General de Impacto y Riesgo Ambiental (General Directorship for Environmental Impact and Risks Assessment)
DGPAIRS	Dirección General de Política Ambiental Integración Regional y Sectorial (General Directorship for Environmental Policy, Regional and Sectoral Integration)
DGVS	Dirección General de Vida Silvestre (General Directorship for Wildlife)
DGZFMTAC	Dirección General de Zona Federal y Ambientes Costeros (General Directorship of Federal Coastal Zones)
DIM	Data and Information Management
ES	Environmental Studies
EBA	Ecosystem Based Approach
EBM	Ecosystem Based Management
EcoQOs	Ecosystem Quality Objectives
ENOETMC	Estrategia Nacional para el Ordenamiento Ecológico del Territorio en Mares y Costas (National Strategy for the Ecological Land Use Planning of the Territorial Oceans and Coasts)
EPA	Environmental Protection Agency

EPOMEX	Centro de Ecología, Pesquerías y Oceanógrafa del Golfo de México -Universidad Autónoma de Campeche (Ecology, Fishery and Oceanographic Centre of the Gulf of Mexico - University of Campeche)
EEZ	Exclusive Economic Zone
ERP	Enterprise Resource Planning
FAO	Food and Agriculture Organization
FONDEN	Fondo de Desastres Naturales (National Fund for Natural Disasters)
FSP	Full Size Project
GEF	Global Environment Facility
GIS	Geographic Information System
GoM	Gulf of Mexico
GPA	Global Programme of Action
HABs	Harmful Algal Blooms
IGO	Intergovernmental Organizations
IGoMC	Interim Gulf of Mexico Commission
IMTA	Instituto Mexicano de Tecnología del Agua (Mexican Institute of Water Technology)
INE	Instituto Nacional de Ecología (National Institute of Ecology)
INEGI	Instituto Nacional de Estadística, Geografía e Informática (National Institute of Statistics, Geography and Informatics)
INP	Instituto Nacional de la Pesca (National Fisheries Institute)
IOC	Comisión Oceanográfica Intergubernamental de la UNESCO (Intergovernmental Oceanographic Commission of UNESCO)
IOCARIBE	Subcomisión para el Gran Caribe de la Comisión Oceanográfica Intergubernamental de la UNESCO (Sub-Commission for the Greater Caribbean of the Intergovernmental Oceanographic Commission of UNESCO)
ISC	Intersectoral Committee
IW	International Waters
LBS	Land Based Sources of Pollution
LME	Large Marine Ecosystem
LOE	Letter of Endorsement
LUP	Land Use Planning
MAB	Man and Biosphere
MEXUS	United States-Mexico Fisheries Cooperation Program
MSAR	Magnuson-Stevens Fishery Conservation and Management Act Reauthorization
MOU	Memorandum of Understanding
MPA	Marine Protected Area
NASA	National Aeronautic and Space Administration
NAFTA	North American Free Trade Agreement
NAP	National Action Programme
NCDDC	National Coastal Data Development Center
NEPSDOC	National Environmental Policy for the Sustainable Development of Oceans and Coasts
NGO	Non Governmental Organization
NMFS	National Marine Fisheries Services
NOAA	National Oceanic and Atmospheric Administration
NPA	Natural Protected Areas
OP	Operational Programme
P	Process
PAG	Project Advisory Group
PAH	Polynuclear Aromatic Hydrocarbons

PANDSOC	Política Ambiental Nacional para el Desarrollo Sustentable de Océanos y Costas (National Environmental Policy for the Sustainable Development of Oceans and Coasts)
PCB	Polychlorinated Biphenyl
PCU	Project Coordination Unit
PDF	Project Development Facility
PEMEX	Petróleos Mexicanos (Mexican Oil Company)
PIR	Project Implementation Review
PPCU	Pilot Project Coordination Unit
PROFEPA	Procuraduría Federal de Protección al Ambiente (General Federal Attorney Agency for Environmental Protection)
QA	Quality Assurance
QC	Quality Control
RAMSAR	Ramsar Convention on Wetlands
RCU	Regional Coordinating Unit
ROAR	Results Oriented Annual Report
RPA	Regional Programme of Action
RPA-YUCATAN	Regional Programme of Action for the Yucatan Peninsula
R-TAG	Regional Technical Advisor Committee
SAGARPA	Secretaría de Agricultura, Ganadería, Desarrollo Rural, Pesca y Alimentación (Ministry of Agriculture, Livestock, Rural Development, Fisheries and Food)
SAP	Strategic Action Programme
SC	Steering Committee
SEAMAP	Southeast Area Monitoring and Assessment Program
SeaWiFS	Sea-viewing Wide Field of View Sensor
SECTUR	Secretaría de Turismo (Ministry of Tourism)
SEDESOL	Secretaría de Desarrollo Social (Ministry of Social Development)
SEFSC	Southeast Fisheries Science Centre
SEGOB	Secretaría de Gobernación (Ministry of the Interior)
SEMAR	Secretaría de Marina (Ministry of the Navy)
SEMARNAT	Secretaría de Medio Ambiente y Recursos Naturales (Ministry of Environment and Natural Resources)
SEP	Secretaría de Educación Pública (Ministry of Public Education)
SCT	Secretaría de Comunicaciones y Transportes (Ministry of Transport and Communications)
SGP	Small Grants Programme
SNIB	Sistema Nacional de Información sobre Biodiversidad de México (Biodiversity National System of Information)
SO	Strategic Objective
SPAW	Specially Protected Areas and Wildlife
SR	Stress Reduction
SSPyPA	Subsecretaría de Planeación y Política Ambiental (Undersecretariat of Planning and Environmental Policy)
STAP	Scientific and Technical Advisory Panel
TDA	Transboundary Diagnostic Analysis
TOR	Terms of Reference
TPR	Tripartite Review
TTT	Technical Task Team
UN	United Nations

UNAM-ICMyL	Universidad Nacional Autónoma de México Instituto de Ciencias del Mar y Limnología (National Autonomous University of Mexico Sea Science and Limnology Institute)
UNCLOS	United Nations Convention of the Law of the Sea
UNEP	United Nations Development Programme
UNDP	United Nations Development Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNESCO-IOC	UNESCO- Intergovernmental Oceanographic Commission
UNFCCC	United Nations Framework Convention on Climate Change
UNIDO	United Nations Industrial Development Organization
USA	United States of America
USACE	US Army Corps of Engineers
USGS	US Geological Survey
WECAFC	Western Central Atlantic Fishery Commission
WSSD	World Summit on Sustainable Development

1.0 Project Descriptions: BACKGROUND AND CONTEXT

1.1 Introduction

The Gulf of Mexico is a deep marginal sea located at the southeastern corner of North America. It is the ninth largest body of water in the world with a surface area of 1.51 x 10^6 km^2 and a volume of 2.43 x 10^6 km^3 representing 0.4 % and 0.2 % of the surface area and volume of the world's oceans, respectively. Figure 1 shows the system boundaries for the Gulf of Mexico Large Marine Ecosystem (GoM LME). The Gulf is connected to the Caribbean Sea through the Yucatan channel and to the North Atlantic Ocean though the Straits of Florida. The basin is surrounded by three continental shelves: Florida, to the East; Texas-Louisiana, to the Northwest; and Campeche and Yucatan, to the South.

The GoM LME is an important centre of marine biodiversity, marine food production as well as oil and gas production. The distinctive bathymetry, hydrography, productivity and trophodynamics combine to make it a highly productive system with a mean annual productivity of 300g C/m^2/yr.

Figure 1: Geographical boundaries of the Gulf of Mexico LME

The Gulf is bordered by five states of the United States of America (USA) to the north (Florida, Alabama, Mississippi, Louisiana, and Texas), six Mexican states to the south and west (Tamaulipas, Veracruz, Tabasco, Campeche, Yucatan and Quintana Roo), and the island of Cuba to the southeast. The Gulf is connected to the Caribbean Sea through the Yucatan channel and to the North Atlantic Ocean though the Straits of Florida. The basin is surrounded by three continental shelves: Florida, to the East; Texas-Louisiana, to the Northwest; and Campeche and Yucatan, to the South. The easternmost boundary is the western edge of the Loop Current, which overlaps with the EEZ of Cuba.

Drainage into the Gulf of Mexico is extensive and includes 20 major river systems covering over 3.8 million km^2 of the continental USA. Annual freshwater inflow to the Gulf is approximately 10.6 x 10^{11} m^3

per year and 85 % of this flow comes from the USA, with 64 % originating from the Mississippi River alone. Additional freshwater inputs originate from the Grijalva-Usumacinta river system (which represents approximately 35 % of Mexico's total freshwater runoff) and the Yucatan Peninsula in Mexico, and Cuba.

The Gulf of Mexico exhibits great habitat complexity that supports a very high level of biological diversity due to the presence of cosmopolitan and endemic species. Both marine and estuarine ecosystems are considered as reserves of high micro- and macro-biologic diversity. Some communities, including mangroves, coral reefs and marine grasses, possess high species richness.

This high biodiversity is by no means a product of chance. The Gulf of Mexico lies between two major biogeographic areas, the Neartic and the Neotropical. Added to this, the topographic landscape of the Gulf is represented by almost all kinds of geomorphological features, producing a great number of habitats. In this respect, the GoM's eco-regions, terrestrial and marine, are among the most diverse in the world. Consequently a recent inventory of the coastal and oceanic area has listed 20,796 species, 340 of which are endemic[1].

Although the littoral countries of the Gulf of Mexico all share its natural heritage, the Gulf of Mexico faces serious environmental problems, many of which are transboundary in nature. Therefore, although these countries have very different economic and political conditions that complicate environmental management and natural resource protection, all have become increasingly aware of threats to, and issues associated with, the management of the GoM LME. These include:

- Increasing harmful algal blooms, oxygen depletion events, oil spills, vessel groundings on delicate coral reefs, coastal subsidence due to hydrocarbon extraction, ongoing petrogenic energy exploration, and production both offshore and in coastal areas with its attendant pollution risks that threaten coastal and marine biodiversity and contribute to the need for Marine Protected Areas;
- Serious degradation of coastal areas adjacent to urban centers of the region as a result of pollution (quite possibly including persistent toxic substances), habitat loss and unsustainable exploitation of marine and coastal natural resources;
- Unsustainable use of marine biomass and species by both artisanal and industrial fisheries in the absence of an agreed long-term regional strategy for the sustainability of economic yields;
- High vulnerability to storm events and fluctuating climate conditions which may pose serious problems requiring different management practices in the LME's coastal and marine areas;
- Climate change in relation to the Loop Current and the advection of nutrients and transport of Mississippi Drainage Basin effluents is also likely to threaten the GoM. The basin is highly vulnerable to storm events and their predicted increase could pose serious problems to management of the coastal and marine areas; and
- An increase in the frequency of marked environmental changes in the ecosystem manifesting themselves through fluctuations in abundance and distribution of fish, birds and mammals.

THREATS, ROOT CAUSES AND BARRIERS ANALYSIS

Approximately 55 million people live in the coastal states of the GoM, 40 million in the USA and 15 million in Mexico. The Gulf of Mexico LME is a major asset to these countries, in terms of fisheries, tourism, agriculture, oil, infrastructure, trade and shipping. Commercial fishing and seafood processing are a vital component of the LME's economy, with the most important species being brown, white and

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[1] Mexican National Commission for the Knowledge and Use of the Biodiversity (CONABIO), Biodiversity National System of Information (SNIB), (NOM-ECOL-059/2001)

pink shrimp, menhaden, red snapper, tuna species, and red grouper. The infrastructure for oil and gas production in the Gulf of Mexico (including oil refineries, petrochemical and gas processing plants, liquid natural gas processing facilities, supply and service bases for offshore oil and gas production, platform construction yards and pipeline yards) is concentrated in the coastal regions of both the USA and Mexico. The Gulf of Mexico LME contains major shipping lanes, and the volume and value of shipping and port activities has increased in the region.

The preliminary Gulf of Mexico LME Transboundary Diagnostic Analysis (TDA), formulated by Mexico and the USA during the PDF-B phase, has analyzed the various transboundary environmental problems, major root causes, transboundary impacts and consequences (please refer to Appendix A for the full document). The TDA identified 5 key priority transboundary problems out of a candidate list of 24 based on the LME approach. These included both transboundary *environmental* problems and transboundary *socio-economic* and *governance* issues. These are presented in the Table below.

Priority Transboundary Problems for the Gulf of Mexico LME and their associated LME Modules

LME Module	Priority Transboundary Problem
(i) Productivity (ii) Pollution & Ecosystem Health	Eutrophication and HABs
(ii) Pollution & Ecosystem Health	Habitat modification (wetland loss, connectivity, loss of resilience)
(iii) Fish and Fisheries	Overfishing of (shared, migratory, connected) stocks
(iv) and (v) Socioeconomics & Governance	No single TB problem was identified, but the absence of a regional overarching framework that provides for structured and integrated cooperation and coordination on the basis of ecosystem-based management approaches limits integrated responses to the above issues

These threats are cause for concern. A few are already being addressed jointly between the GoM LME states. Others are growing in importance with demographic change and increased coastal zone activity in the stakeholder countries. These transboundary threats to ecosystem health are caused by human activities and natural variations that are part of the ecosystems, and some threats could be mitigated through efficient early warning systems. In order to address them it is important to move from single species to ecosystem-based management assessments and approaches, informed by an adequate assessment of the value of environmental goods and services.

Several actions that need to be addressed were identified during the preparatory phase of the GoM LME. These included *inter alia*: weak monitoring and assessment; poor transboundary fisheries stock management; a lack of transboundary pollution reduction and control; depletion of coastal resources; heightened risks and vulnerability to climate changes; lack of property rights and resource allocation; underestimation of the complexity of coastal ecosystems; absence of legal frameworks and policies devoted specifically to coastal problems; promotion of intersectoral approaches; and weak coordination and conflict resolution mechanisms.

In order to develop a Strategic Action Programme (SAP) fully congruent with GEF approaches, the proposed project aims to develop a SAP and NAPs that address the key transboundary *environmental* problems in the GoM, by addressing the underlying socio-economic and governance failures or 'root causes'. The three transboundary environmental problems identified in the preliminary TDA were: (1)

Pollution including eutrophication and harmful algal blooms (HABs); (2) Habitat modification (wetland loss, connectivity, loss of resilience); and (3) Overfishing of shared, migratory and connected fish stocks. A key natural driver of these problems was considered to be climate change and system variability. Each transboundary problem is described in more detail below.

Pollution including eutrophication and HABs

Eutrophication and harmful algal blooms: Along the US coast of the GoM LME, coastal eutrophication is growing. This has resulted in an increase in the frequency and extent of harmful algal blooms and oxygen depletion events affecting fish and invertebrates.

In the Mexican portion of the Gulf, practically all the coastal populations discharge their domestic waste into the rivers, estuaries, coastal lagoons and the sea without any treatment. Consequently the coastal lagoons of the Gulf of Mexico are highly stressed. In addition, the Gulf of Mexico also suffers from eutrophication, particularly in bays, estuaries and coastal lagoons, as a result of direct discharges from the increasing coastal population and nutrient inputs from agricultural runoff. This has resulted in the presence of a large seasonal “dead zone” at the mouth of the Mississippi river, and the increasing frequency of red and brown tides along the coast of the Gulf of Mexico.

The Dead Zone is largely caused by excess nitrogen and phosphorus entering the Gulf from the Mississippi River. These nutrients result in huge algae and phytoplankton blooms. As the blooms die, they drop to the ocean floor and decompose. The stratification of the ocean water that occurs during the summer in the Gulf prevents the deepest water from becoming re-oxygenated. As a direct result, oxygen levels fall below 2 mg/l, a level at which most marine life, including all commercial fish, crab and shrimp species, cannot survive. In the last 5 years hypoxic events have affected an area of 14,128 km^2 off the coast of the state of Louisiana alone. The Dead Zone is now one of the largest hypoxic zones of water in the world. Research has indicated that the excess nutrients (nitrogen and phosphorus) result from human activities in the upstream Mississippi River watershed. The principal areas contributing nutrients to the Mississippi River, and ultimately to the Gulf, are streams draining the Corn Belt states, particularly Iowa, Illinois, Indiana, Ohio, and southern Minnesota. The average concentration of nitrate-nitrogen in the main stem of the Mississippi River has doubled since 1950. Commercial fertilizer is the single largest contributor. Others include animal wastes from intensive livestock rearing plants (pigs and cattle), municipal and domestic waste, and atmospheric deposition. In addition to the Mississippi Dead Zone, there is potential for development of another dead zone off the large Grijalva-Usumacinta River system in the southern Gulf of Mexico as population and land use pressures increase in the drainage area.

Oil Pollution: The oil industry is the single most important economic sector in Mexico. Oil extraction is particularly important in the states of Tabasco and Campeche, the reserves of which are considered to be amongst the most important in the Western Hemisphere. Approximately 85 % of the oil extraction (an average of 1.5 million barrels of crude oil per day) and 90 % of the natural gas production of Mexico originates in the Gulf and its coastal plain[2]. As of 2005, Mexico was the world’s sixth-largest oil producer, its ninth largest oil exporter, and oil and gas revenues provided about one-third of all Mexican Government revenue. The Gulf also produces 72 % of the U.S. offshore petroleum production[3]. Current production is approximately eight million barrels per day, well below the peak production of 11.5 million barrels per day in the early 1970's. Waste from both ships and oil rigs, which punctuate the continental shelf of both the United States and Mexico, contributed to the Gulf being labeled the “dumping ground

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[2] Sanchez-Gil, P., Yanez-Arancibia, A., Ramirez-Gordillo. J., Day, J.W., Templet, P.H., 2004, Ocean and Coastal Management 47(2004) 581-596.

[3] *Preparing for a Changing Climate: Gulf Coast Region*, 2003, Gulf Coast Climate Change Assessment Council

for a hemisphere's trash."

Oil extraction and transport are of great concern for ecosystem health in the Gulf of Mexico. In Mexico in particular there is an ongoing debate about the effect of the oil industry on fisheries, particularly the pink shrimp fishery, which has had a drastic reduction in catch in recent years. Environmental effects of oil extraction have been documented for the southern Gulf of Mexico[4] but transboundary effects are less well studied. However, the Ixtoc-I oil-well spill in Mexican waters in 1979 reached the US coast in Texas.

Trace metals and organic pollution: Contamination from trace metals (including mercury levels in fish), persistent organic compounds (pesticides, PCBs and PAHs) from urban areas, industry and agriculture, and mercury levels in fish and human health concerns are also potentially significant and have human health consequences. For example, the presence of metals and persistent organic compounds and hydrocarbons has been detected in the silts of the main coastal lagoon systems.

Groundwater quality issues: There is an increasing risk of overexploitation of already scarce water resources, given that coastal ecosystems of the Yucatan Peninsula are hydrologically controlled by the discharges of subterranean water and coastal-oceanic interactions. There is evidence that anthropogenic activities including urbanization, agriculture, industry and aquaculture are all resulting in water quality deterioration[5]. Consequently, the upper layer of the aquifer is severely contaminated. The risk to the coastal zone in the Yucatan Peninsula from human activities is increased because the underlying rocks are fractured by weathering, which results in rapid water flow through the aquifer. The consequence of this is that there is little time for microbial or other processes to depurate contamination. This region has been selected for a pilot project for the Global Program of Action (Regional Plan of Action for the Yucatan Peninsula RPA-YUCATAN), and close cooperation with the Gulf of Mexico project is foreseen.

Habitat modification (wetland loss, connectivity, loss of resilience)

Poorly planned growth in coastal and urban areas along the Gulf of Mexico coast has resulted in a trend of urban growth at the expense of critical habitats, a trend that needs to be halted and reversed to restore degraded estuaries, marshes, seagrasses, coral reefs, mangroves and other vital ecotones supporting natural ecosystem services vital to ecosystem health.

Infrastructure development, especially for the tourism industry, which often represents an economic boost for the local economy through the provision of jobs and services[6], is increasingly displacing critical habitats such as mangroves and sea grass beds, sand dunes, and coastal wetlands. This also generates both functional and structural changes in coastal ecosystems that can seriously impair their function as nursery grounds for many species, including commercially important ones, and also increase their vulnerability to extreme climatic events, such as storms or hurricanes. Among the main problems of concern are: the loss of habitats in intertidal areas, loss of dunes or cliffs due to deforestation, climate change effects including sea level rise and subsidence from oil extraction; changes of land use as a result of urban, port, mineral extraction and tourist developments; the disappearance or decrease of wetlands (swamps, mangrove, and

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[4] Caso M, Pisanty I y Ezcurra E (Compiladores). 2004. *Environmental Diagnostic of the Gulf of Mexico*. SEMARNAT, INE, Instituto de Ecología, Harte Research Institute for Gulf of Mexico Studies.

[5] Regional Action Program for the Yucatan Peninsula, SEMARNAT, 2006

[6] For example there are over 1,794 hotels with 71,254 rooms (22 % of the national total) in the coastal resorts of Mexico. In the US, it is estimated that the Gulf of Mexico supports a tourist industry worth over $20 billion annually. In 2001, more than three million marine recreational participants took more than 22.8 million trips and caught a total of 163 million fish in an area that provides a breeding ground for about 75% of the migratory waterfowl traversing the United States.

“petenes”) due to changes in land use or by sedimentation as a result of alterations of the watershed.

Of further concern to habitat modification and pollution are marine transport and port activities. The Gulf of Mexico is one of the world's most concentrated ocean shipping areas. More than 75 % of Mexico's shipping and cruise traffic currently moves through the Gulf ports. Seven of the United States top 10 ports and two of the world’s top seven ports (as measured by tonnage or cargo value) are located in the Gulf of Mexico.

While habitat degradation is currently more severe in developing countries, some of the most extensive habitat modification has previously occurred in developed countries. The Midwestern US states have drained the equivalent of 14.1 million ha of wetlands in the Mississippi River Basin over the past 200 years. Furthermore, from 1990 to 2000, the Gulf Coast region of the US experienced a loss of over 3,100 ha of estuarine wetlands with a projected long-term average decadal coastal wetlands loss rate of 2.5%.

The Gulf of Mexico provides critical feeding, spawning, and nursery habitats for a rich assemblage of fish, wildlife, and plant species. Gulf wetlands provide essential habitat for shorebirds, colonial nesting birds, and migratory waterfowl. The Gulf is also home to an incredible array of indigenous flora and fauna, including endangered species such as sea turtles, the Gulf sturgeon, the Perdido Key beach mouse, the manatee, the white-topped pitcher plant, and the red-cockaded woodpecker. Gulf Coast estuaries support submerged aquatic vegetation communities that stabilize shorelines from erosion, reduce non-point source loadings, improve water clarity, and provide wildlife habitat. Estuaries in the Gulf of Mexico are among the most productive natural systems, producing more food per hectare than highly productive farmland.

Two noteworthy habitats that are at particular risk are the seagrass and mangrove ecosystems. These are widely recognized as some of the most productive benthic habitats in estuarine, coastal and nearshore waters of the Gulf of Mexico. Seagrass meadows provide food for wintering waterfowl and important spawning and foraging habitat for several species of commercially important finfish and shellfish. Physical structure provided by seagrasses affords juveniles refuge from predation and allows for attachment of epiphytes and benthic organisms. Seagrass communities also support several endangered and threatened species, including some sea turtles and manatees. Changes in seagrass distribution can reflect the health of a water body, and losses of seagrasses may signal water-quality problems in coastal waters. Losses of seagrasses in the northern Gulf of Mexico over the last five decades have been extensive -from 20% to 100% for most estuaries, with only a few areas experiencing natural increases or showing signs of restoration and recovery. The coverage of mangrove forests on the coasts of Mexico has been affected considerably in recent decades. According to data from the FAO, in the last 30 years Mexico has lost more than half of its mangrove coverage on both coasts. Mexican figures provided by SEMARNAT, indicate that the annual rate of loss of mangroves in the Gulf of Mexico and Caribbean region is 2.8%. Considering these rates and trends, by the year 2025 50% of actual calculated surface could be lost[7]. In the US, mangrove forests are concentrated in Florida where they are generally protected, although there was much habitat conversion in past decades and current human development landward of mangroves is now a threat.

Overfishing of shared, migratory and connected fish stocks

The commercial fishing industry represents an important economic resource for the countries of the Gulf of Mexico LME. In Mexico, 45% of shrimp catch, 90% of oysters, and 50% of domestic fish are harvested from the Gulf. The commercial fishery harvest from the Gulf of Mexico represents almost 22% of the national total landings in Mexico and 20% of the US total (with an estimated annual value of more

[7] *Environmental Management in Mexico,* SEMARNAT 2006

than $1 billion).

Many stocks in the Gulf of Mexico are over fished, or are at (or close to) their maximum yield. Capture yields of the majority of key fisheries resources have also shown a marked decrease over time. Consequently, between 1999 and 2003, fishery production decreased by 12 % in Mexico. Furthermore US commercial catches in the Gulf of Mexico, which were valued at $2 billion in 1994, had reduced to about $1 billion by 2003 (landings remained relatively stable, but ex-vessel prices declined dramatically).

In US coastal waters, the most valuable species in the Gulf of Mexico are brown shrimp (*Penaeus aztecus*), white shrimp (*Penaeus setiferus*), pink shrimp (*Penaeus duorarum*), oysters (*Crassostrea virginica*), menhaden (*Brevoortia patronus*), and blue crab (*Callinectes sapidus*). The fish stocks are impacted by excessive recreational and commercial fishing pressure, and several fisheries have reached their harvesting limits or are overfished. While overfishing is considered the primary cause of the sharp decline observed in the shrimp catch in Mexico, pollution and freshwater runoff during heavy rainfall years have stressed shrimp development and contributed to a decline in the harvest. In Mexican coastal waters, most fisheries resources are under management schemes, with the most impacted fisheries being pink and white shrimp, red snapper (*Lutjanus campechanus)*, and red grouper (*Epinephelus morio)*. Consequently, in the Campeche area, declines in pink shrimp have resulted in fisheries focusing on other, less valuable species, such as finfish and octopus. Commercial catches in the USA portion of the Gulf of Mexico LME were valued at $2 billion in 1994 were down to about $1 billion in 2003 (Figure 2).

The primary causes of overfishing include an overcapitalized fishing industry and a lack of enforcement of policies and regulations. The depletion of fish stocks and lack of sustainable yields from fisheries in Mexico and the United States are problems requiring immediate remedial action. This is particularly important for stocks shared between two or more countries, or stocks that are migratory or connected via egg or larval transport.

Intensive fishing is the primary force driving biomass changes in the Gulf of Mexico LME. However, this change is aggravated by two other significant factors. Firstly, over 90% of Gulf Coast commercial and recreational species spend some part of their life cycle in estuarine wetlands, which are currently heavily stressed by human activities (see Section above). Secondly, whilst overfishing is considered the primary cause of the sharp decline observed in the shrimp catch, pollution and freshwater runoff during heavy rainfall years have stressed shrimp development and contributed to a decline in the harvest.

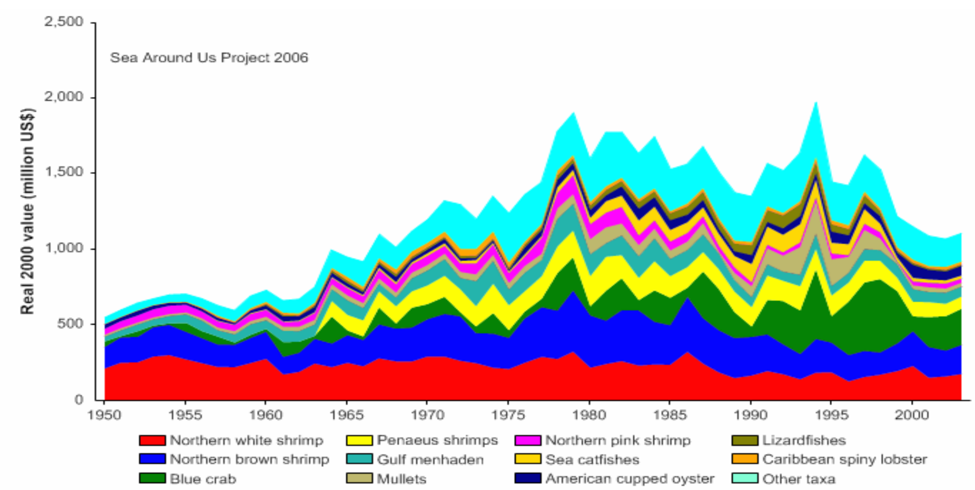

Figure 2 Gulf of Mexico LME multi-decadal fish catch by value (SeaAroundUs Project at www.seaaroundus.org)

Climate change and system variability

Demands on coastal and marine resources in the GoM are rapidly increasing, and as coastal areas develop, the vulnerability of human settlements to hurricanes, storm surges, and flooding events also increases. The GoM LME is an important distributor of heat, and this heat distribution is strongly influenced by changes in global climate. Sea-level rise is projected to accelerate, with dramatic impacts in those regions where subsidence and erosion problems already exist. Climate change may also affect the frequency and intensity of extreme events such as hurricanes.

Scientific investigations indicates that Mexico has a remarkable vulnerability to changes that are likely to occur during the present century, including risks related to natural disasters such as hurricanes, cyclones, and storms, and to issues critical to sustainable development including public health, food productivity, energy security, water availability, ecosystem integrity and their capacity to provide services and goods, as well as security for human settlements and large manmade infrastructures. The Mexican littoral states in the Gulf of Mexico are the most likely to be directly impacted by climate change as a result of sea level rise. Climate change could compromise most of the environmental goods and services provided by natural ecosystems and may result in significant risks for human beings. The impacts of Katrina on New Orleans are a sobering reminder of this. In addition there will be a higher risk of forest fires, desertification, carbon release to the atmosphere and biodiversity loss, particularly species with limited capacity to migrate. There is also likely to be a reduction of appropriate zones to produce primarily food production and modifications to agriculture, cattle, forestry, and fisheries production.

The elevation of sea level and modification of coastal ecosystems such as mangroves and wetlands, will also bring changes to the distribution and availability of fisheries resources, especially those most sensitive to temperature variations and those associated with oceanic currents. The intensity of hurricanes, storms and other oscillatory phenomena are also likely to increase in number and force, and in this context the Gulf of Mexico is expected to be affected.

INSTITUTIONAL, SECTORAL AND POLICY CONTEXT

Long-term planning for the LME should be based on the identification of emerging environmental issues and problems, as well as the identification of critical areas for the long-term economic, social and environmental sustainability of the Gulf. Science must be applied to determine the unknowns and to define the management parameters for the LME, as well as common goals that will contribute to the coherence and effectiveness of policies and strategies. Policy and institutional frameworks need to be strengthened in order to provide the requisite enabling environment for new management approaches.

Bi-national and Regional Institutional Arrangements and Legal Considerations

Although bi-national frameworks for cooperation exist at various levels, ranging from NAFTA to technical cooperation agreements, there is no overarching framework that provides for structured and integrated cooperation and coordination on the basis of ecosystem-based management approaches. Additionally, both countries have an array of policies and strategies relevant to the sustainable management of the Gulf of Mexico resources, but these are not harmonized. Therefore one of the principal objectives of the GoM LME project is to harmonize these policies into a coherent mosaic that will support ecosystem based management and the recovery of depleted fish stocks, the reduction of coastal pollution and the restoration of damaged habitats. The transition towards the ecosystem-based management of the GoM LME will depend on a greater convergence of policy tools including long-term, joint programs and actions, a clearer distribution of competencies at all three levels of government in each country, and a robust monitoring and evaluation program.

Both countries have signed a suite of multilateral international laws, treaties and agreements. In addition to that, there are important bi-national cooperation agreements upon which this project will build:

- United States-Mexico Fisheries Cooperation Program (MEXUS-Gulf)
- US-Mexican bilateral fisheries talks
- Memorandum of Understanding between the Agriculture Department of the United States and SEMARNAT.
- Joint contingency plan between Mexico and the United States regarding pollution of the environment by discharges of hydrocarbons or other hazardous materials.
- Agreements within the Commission for Environmental Cooperation of the North American Free Trade Agreement (NAFTA)
- Treaty on Maritime Boundaries between the United States of Mexico and the United States of America (Caribbean Sea and Pacific Ocean) 4 May 1978
- Agreement between the Government of the United States of America and the Government of the United States of Mexico on maritime search and rescue
- Treaty between the Government of the United States of America and the Government of the United States of Mexico on the Delimitation of the Continental Shelf in the Western Gulf of Mexico beyond 200 Nautical Miles, 9 June 2000.

Also noteworthy is the Gulf of Mexico Alliance, the a result of a shared vision for a healthy and resilient Gulf of Mexico coast, in which the Gulf states of Alabama, Florida, Louisiana, Mississippi, and Texas, supported by thirteen federal agencies, participate. In 2004, the Alliance developed the *Governors' Action Plan for Healthy and Resilient Coasts*, which was released at the State of the Gulf of Mexico Summit on March 28, 2006. The five U.S. Gulf States are working through the Gulf of Mexico States Accord to facilitate involvement of the six Mexican states in the Alliance. The Accord of the States of the Gulf of Mexico was signed in the city of Campeche, Mexico on May 13, 1995 by the representatives of the eleven states of the United States and Mexico that share the Gulf of Mexico region. The Accord brings together public officials, entrepreneurs, investors, scientists and educators from the eleven states in a collaborative effort aimed at enhancing the welfare and the quality of life of the citizens of their respective communities, and, as a result, benefiting the Gulf of Mexico region as a whole. It is hoped that the Alliance will work to become a model for regional and international collaboration.

The policy framework for the GoM LME for both countries shares some similarities stemming from the fact that both are federal states, although the range of institutions with relevant mandates varies. Both Mexico and the US have national policies for ocean governance applied through a number of different instruments. In Mexico, actors include state and municipal governments, State Secretaries for the Environment, Tourism and Agriculture, legislative commissions, municipal committees, watershed and coastal councils, fisheries commissions, research centers, protected areas management units and land-management plans. In the US, direct policy actors in the GoM include Federal agencies (including Departments of Commerce and Interior and the Environmental Protection Agency), State governments and multi-state consortia (including the Gulf of Mexico Fishery Management Council and the Gulf States Marine Fisheries Commission), and instruments and exercises such as the Southeast Data Assessment and Review and the Coastal Condition Report.

Policy and Institutional Context in Mexico

Mexico's environmental policy is committed to sustainable development as embodied in the Physical Land Use Planning (LUP) and the General Law of Ecological Equilibrium and Environmental Protection (Ley General del Equilibrio Ecológico y Protección al Ambiente). The LUP is an environmental policy and planning instrument with the objective of promoting the preservation and sustainable use of natural resources while protecting the natural environment. These and a number of other policies and instruments provide the framework for the sustainable use, management, and protection of both terrestrial and marine areas and their natural resources.

Of particular importance is the *National Environmental Policy for the Sustainable Development of Oceans and Coasts* (NEPSDOC), which establishes public policy guidelines and strategies in an effort to reinforce integrated management of the coastal zone through structural reform, effective inter-institutional coordination, and wide ranging public participation. This policy represents a mainstreaming of effort between SEMARNAT and other secretariats and federal institutions responsible for the different national economic sectors. This requires joint participation and responsibility from the authorities of the three levels of government, as well as from all the social sectors directly involved in the use and appropriation of the coastal zone and its resources. These efforts also seek to guarantee effective access to justice on environmental matters; apply integrated management approaches to watersheds and coasts; recognize the economic and social value of natural resources and environmental services; and provide a framework for economic development and improved quality of life for the inhabitants based on a better knowledge of the oceans and coasts.

The *National Strategy for Ecological Use Planning of Oceans and Coasts* of 2007 sets out the Federal Government's goals towards oceans and coasts. It provides the overall strategic framework for the conservation of oceans and coasts and includes guidelines to strengthen public policies to ensure efficient management of coastal and marine natural resources based on ecosystem management approach, including scientific knowledge and broad public participation. Thus, it strives to reach consensus among sectors and governmental levels, to generate regional strategies, execute local actions and enhance regional and local capacities as well as to reach consensus in transboundary shared marine ecosystems.

The National Strategy is setting in place key tools to further enhance the effectiveness and reach of these new policy regimes. A major development is the creation of the permanent Inter-ministerial Commission for the Integrated Management of Oceans and Coasts (CIMIOC). This approach represents a paradigm shift from a short-term, sectoral perspective to a long-term integrated management regime that recognizes the interconnections between biological systems and economic and social systems. The CIMIOC will generate a framework that will ensure close coordination and communication between the different economic sectors and spheres of government, in order to develop integrated management actions based on the ecosystem approach. The CIMIOC will guide the design, development and maintenance of a system of decisions and actions at different government levels, based on a continuous planning process with the participation of the population and economic agents with interests in coastal and marine resources.

Coastal and ocean management at the regional and sub-regional and local levels is evolving in Mexico. For instance, the *Agreement for the Coordination of the Regional Marine Ecological Zoning Plan for the Gulf of Mexico and Caribbean Sea* brings together federal and local governments to improve coastal zone management in this region. The Agreement was signed by the six Gulf States (Tamaulipas, Veracruz, Tabasco, Campeche, Yucatán, and Quintana Roo) and 11 federal entities and this process has formally installed its Executive and Technical Steering Committee where government and society at large is widely participating.

The current environmental policy framework includes domestic legislation (laws, regulations, norms, and codes), international treaties and agreements, and bilateral cooperation agreements. Responsibility for the management of coastal areas and the ocean lies with federal, state, and municipal agencies. SEMARNAT is the principal government agency responsible for the environment, and is constituted by five decentralized entities: the National Water Commission (CONAGUA), the National Commission for Protected Areas (CONANP), the Mexican Institute of Water Technology (IMTA), the General Federal Attorney Agency for Environmental Protection (PROFEPA), and the National Institute of Ecology (INE). Other federal agencies with responsibility for the environment (including coastal and marine areas and natural living resources) include the Secretary of Agriculture, Livestock Production, Rural Development, Fisheries and Food (SAGARPA).

At present, the federal agency responsible for fisheries management, monitoring, and enforcement is the National Commission of Aquaculture and Fisheries. The highest ranking and more specific instrument of Mexican fisheries legislation is the Federal Fisheries Law, the objective of which is to promote the conservation, preservation and rational use of fisheries resources and establish the basis for their adequate development and management. Stemming from this general law is the Fisheries Regulation, prepared by the Executive on the basis of the general guidelines given in Federal Law. A recently implemented instrument in Mexican fisheries management is the National Fisheries Chart elaborated by the National Fisheries Institute and published as an Official Decree in 2000. This chart, which can be updated regularly, defines levels of fishing effort applicable to species and groups of species in specific areas and provides guidelines, strategies, and provisions for conservation, protection, restoration, and management of aquatic resources that could affect their habitats. There are also specific policies and programs for the protection of specific resources, for example, those relating to marine mammals, tunas and dolphins, and marine turtles. Also of relevance to coastal and marine living resources are the Law of National Waters and its Regulation and the establishment of marine protected areas.

Policy and Institutional Context in the United States

Within Federal waters, the U.S. has sovereign rights for the purpose of exploring, exploiting, conserving, and managing the living and nonliving natural resources of the seabed and subsoil and the surface and subsurface of the waters. The Federal government also has jurisdiction over the establishment and use of artificial structures, islands, and installations that have economic purposes, and the protection and preservation of the ocean environment. Associated with these authorities is the Federal government's responsibility to ensure that ocean activities are managed for the benefit of the public. Activities towards these ends are closely coordinated with individual State governments.

The management of offshore activities by Federal agencies is a mixed picture. A variety of agencies are involved, the main ones being the Departments of Commerce (which encompasses NOAA), Defense, Interior, and Transportation, the Environmental Protection Agency (EPA), and the Marine Mammal Commission. Some activities, such as fishing (under NOAA) or offshore oil and gas development (under Interior), are governed according to well-developed regulatory regimes established in accordance with specific legislative mandates while others, such as marine bioprospecting, are essentially unmanaged in federal waters. Other new and emerging ocean uses, such as offshore aquaculture or wind energy, are subject to regulation by a number of authorities executing varying responsibilities, but are not managed by any comprehensive federal law. There are efforts underway to develop a coordinated offshore management regime, as recommended by the US Commission on Ocean Policy. Established in 2004 the Commission presented its final report "An Ocean Blueprint for the 21st Century". The report contained 212 recommendations aimed at realizing a far-reaching and comprehensive ocean policy, and emphasized the role of ecosystem-based management in the attainment of that goal. In response, the President established a permanent Committee on Ocean Policy with a subsequent Ocean Action Plan designed to implement the Commission's recommendations. The Committee consists of the Secretaries of 11 cabinet-level departments as well as the heads of numerous other Federal agencies to provide for coordination of ocean-related matters "in an integrated and effective manner and to facilitate coordination and consultation at all government levels as well as the private sector, foreign governments, and international organizations."

For the purposes of this project, the lead agency is NOAA, specifically the National Marine Fisheries Service (NMFS), and the main legislative driver is the Magnuson-Stevens Fishery Conservation and Management Act Reauthorization (MSAR) of 2007. In essence, MSAR confirmed the need for established national standards for fishery conservation and management in U.S. waters and strengthened the role of science in determining allowable catches for managed species. The MSAR extended eight Regional Fishery Management Councils composed of state and federal officials and fishing industry representatives that prepare and amend fishery management plans for certain fisheries (including transboundary fisheries) requiring conservation and management. The MSAR also requires that fishery management plans identify essential fish habitat and protection and conservation measures for each managed species. In 1996, the Sustainable Fisheries Act amended the original Magnuson-Stevens Fishery Conservation and Management Act of 1976 to require NMFS to undertake a number of science, management, and conservation actions to prevent overfishing, rebuild overfished stocks, protect essential fish habitat, minimize bycatch, enhance research, and improve monitoring.

There are several Federal-State cooperative initiatives to achieve these desired outcomes, including the MSAR-extended Gulf of Mexico Fishery Management Council, the Gulf States Fisheries Management Commission (which coordinates activities of State fishery agencies), and the newly-formed Gulf of Mexico Alliance (a partnership of the states of Alabama, Florida, Louisiana, Mississippi and Texas, and thirteen Federal agencies which goal is to increase regional collaboration).

Socioeconomic Considerations

The Gulf of Mexico LME is a major asset to Mexico and the U.S. in terms of fisheries, tourism, agriculture, oil, infrastructure, trade and shipping. Commercial and recreational fishing, and seafood processing are an important component of the LME's economy. The infrastructure for oil and gas production in the Gulf of Mexico (oil refineries, petrochemical and gas processing plants, supply and service bases for offshore oil and gas production units, platform construction yards and pipeline yards) are concentrated in the coastal US and Mexico. The Gulf of Mexico LME contains major shipping lanes, and the volume and value of shipping has increased in the region. Port facilities contribute to important sources of employment.

Infrastructure Development and Coastal tourism: Coastal environments are strongly affected by the development of activities that are frequently incompatible with each other. Most of the current and potential threats to marine biodiversity happen in the coastal area and they are directly related to human demographic trends. Nearly 70 % of the USA population lives in coastal, or within 60 km of it; in Mexico only around 16 % of the population lives on the coast, but the coastal population is growing much faster than the total population at a rate of 2.8%. The rapid development of certain economic activities such as the oil industry, energy generation, tourism, agricultural development and marine transport have resulted in poorly planned growth in coastal and urban areas along the Gulf of Mexico coast.

Tourism is a significant sector for the U.S. and Mexican economies along the Gulf Coast. Around 40 million people visit the Gulf Coast on both countries annually. The 22% of the national hotel room capacity in Mexico is situated in the Gulf Coast. The Gulf Coast is one of the major recreational regions of the United States, especially for sport fishing and beach-related activities. The recreational fishing economy alone supports an expansive network of motels and sport and bait shops, as well as boat building, boat charters and gear manufacturing; the total economic impact is estimated at USD 17 billion annually.

Marine Transport and Ports: The Gulf of Mexico is one of the world's most concentrated ocean shipping areas. Cargo received and shipped through Texas ports in 1990 totaled more than 335 million tons, of which 321 million tons was handled by thirteen major ports. More than 75 % of Mexico's shipping and cruise traffic currently moves through the Gulf ports. This is an increase of nearly 13 % over the previous five years. The Mississippi River system transports over 312 million tons of cargo per year between its upper reaches in Minnesota and its lower parts into the Gulf of Mexico[8]. Seven of the top 10 ports in the U.S. and two of the world's top seven ports (as measured by tonnage or cargo value) are located in the GoM.

Oil and gas: The infrastructure for oil and gas production in the Gulf of Mexico is the most developed in the world and includes oil refineries, petrochemical and gas processing plants, supply and service bases for offshore oil and gas production units, platform construction yards, pipeline yards, and other industry-related installations. The Gulf produces 72% of the U.S. offshore petroleum production and 85% of the Mexican crude petroleum (an average of 1.5 million barrels of crude oil per day). 90% of the natural gas production of Mexico originates in the Gulf of Mexico and its coastal plain. In addition, the Gulf oil and gas industry supports an enormous complement of land-based companies and facilities including chemical production, oil field equipment dealers, cement suppliers, drilling tool and equipment suppliers, helicopter services, caterers, and divers; platform fabrication yards and shipyards. Texas and Louisiana in the U.S. and Veracruz, Tabasco and Campeche in Mexico are home to most of these companies and facilities.

Agriculture and forestry: Agriculture is another mainstay of the Gulf coastal region. The total value of this sector on the U.S. Gulf Coast was nearly USD 28 billion in 1997. In addition to the strong agricultural sector in the five US Gulf states (e.g. total tonnage of Florida's citrus production is almost 33% higher than that of all the rest of the fruit produced in the entire United States), the agricultural production of the corn belt states along the Mississippi River also contribute significantly to nutrient and pollutant loads in the GoM. In Mexico, the Gulf and Caribbean region accounts for about 21% of total Mexican national meat production, yet also contains more than 65% of Mexican coastal plain forest reserves.

STAKEHOLDER ANALYSIS

Stakeholder involvement has been recognized as an integral part of the development phase of the GoM LME project, and will continue to be emphasized during the implementation of this project. In this regard, the project (Project Development Phase) commissioned a preliminary Stakeholder Assessment[9], in order to identify the key stakeholders at national, regional, and international levels; describe ongoing initiatives/projects/programs that are relevant to the project's objectives and outcomes; assess their roles and responsibilities; and assess their capacity to carry out their potential roles in transboundary fisheries governance at national and regional levels. The full Stakeholder Assessment, contained in Appendix B, outlines the Stakeholder Involvement Plan requirements.

[8] U.S. Waterway Transportation System – Transportation Facts, USACE, December 2005

[9] The current Stakeholder Assessment did not have the benefit of direct consultation with stakeholders, and it is recommended that in the full-sized project, extensive consultations with stakeholders be conducted right at the start, in order to refine the list of key stakeholders, identify more clearly their respective roles, and develop a concrete stakeholder engagement plan.

Stakeholders were organized into four broad categories: (i) Resource users; (ii) Institutions and organizations at national level grouped according to principal functions (e.g. policy and decision-making/management; research/academic; non-governmental organization) by country; (iii) Institutions and organizations at regional level; and (iv) institutions and organizations at the international level. Identification of local level stakeholders was not undertaken.

The large number and great diversity of stakeholders identified in the GoM LME, at all levels, present a challenge for this project and for a holistic approach to the governance of the LME in general. However, this situation also presents valuable opportunities for enriching and enhancing the project through engaging the key stakeholders in the project, as well as for ensuring the sustainability of project outcomes in the post-project period. A key finding of the Stakeholder Assessment was that key stakeholders in the GoM LME project should be included as active participants or in other appropriate role in order to ensure the effectiveness of project implementation and to improve the sense of ownership of the project.

Consequently, this project aims to have a highly participatory approach with regard to stakeholders. From the inception of the project and throughout its life, wide consultation and extensive participatory workshops will be encouraged. The project is designed to ensure the active participation of the following stakeholder groups:

- Respective Governments of the two participating countries, at federal, state, and local levels;
- Private sector, including oil and gas, tourism, fisheries, and port industry;
- GoM coastal cities;
- River basin management authorities;
- Local communities and populations in the respective areas;
- Scientific community;
- Representatives of civil society, represented by NGOs and other groups of interest (religious groups, professional associations, syndicates, etc.); and
- Representatives of the donor community represented by the implementing agencies and other international cooperation organizations.

Often, industry is reluctant to be involved in environmental projects because environmental improvement is seen as contradictory and incompatible with production and economic activity. As a result, failure to engage with this key sector can result in poor implementation of the project through the SAP and NAPs. Therefore engagement with the private sector is considered to be a key process during the execution of the Full Project.

This wide participation of stakeholders will ensure that they not only understand and support the SAP, but also will ensure their commitment to its implementation. The stakeholder participation plan for the GoM LME Program indicates how the various stakeholders will be involved and at what stages. In order to attain sustainability, the activities are designed to address interests of large groups of stakeholders, and a significant portion of the budget is designed for this task.

During the proposed Full Project, it will be necessary to strengthen and or create specific consultative mechanisms for the GoM/LME such as the *Consejo Consultivo Regional sobre el Desarrollo Sustentable* (Consultative Regional Council on Sustainable Development) in Mexico, and the public hearings and public testimony sessions employed for the Gulf fisheries management councils in the US. These mechanisms will allow decision makers to identify and define the most effective, socially inclusive and viable alternatives to address the issues surrounding the GoM LME's management. Full stakeholder participation will also help to limit top-down processes of ocean governance decision-making, and will contribute to the transition from participatory planning to participatory management.

BASELINE ANALYSIS

National Programming Context

The Mexico and the U.S. have very different social, economic and political conditions. However, in both countries, economic development has often taken place largely at the expense of the living marine resources and the environment. The absence of adequate ecological and economic evaluation of habitats and the goods and services they provide has resulted in development decisions being made on the basis of short-term economic gains. This has been a significant barrier to implementing a more ecosystem-based and-sustainable mode of development.

However, numerous actions are taking place at the national and regional levels to address the environmental problems that have occurred over the last decade. Although fragmented to varying degrees, they provide for considerable baseline information and activities. Furthermore, both the U.S. and Mexico have national research institutes and academic institutions that have a long history of undertaking oceanographic, fisheries, ecological and, pollution assessments in the region and care will be taken to work with these institutions in order to make best use of their comparative advantage where appropriate.

In Mexico, the National Fisheries Institute (INP/SEMARNAP, now CONAPESCA) has laboratories in the Gulf and recently has been able to assess the status of the main marine fisheries (Sustainability and Responsible Fisheries, Assessment and Management). It has also moved into a more integrated environmental and institutional arrangement. One of the products of this activity is a publication on the federal register of the National Fisheries Chart, which serves as a link between the stakeholders' concerns and the fisheries administration. National Fisheries Institute (INP) scientists have participated with Cuban and US scientists in bilateral co-operative fishery assessments.

In the United States, the Gulf States Marine Fisheries Commission unites with the State and Federal Governments in providing science input to fisheries management concerns (including habitat) in state waters. NOAA's Southeast Fisheries Science Centre with state and university partners does likewise for offshore management through the Gulf of Mexico Fishery Management Council. The EPA-led Gulf of Mexico programme and Gulf of Mexico Alliance are co-coordinating mechanisms for the US states and the various Federal Agencies with responsibility in the region. Currently, one of the focal points is on nutrient enrichment impacts causing the "dead zone" of hypoxia off the Mississippi River mouth as well as harmful algal blooms coast-wide.

There are currently national monitoring programmes in Mexico and the United States, but a regionally coordinated programme is needed to address Gulf-wide problems. The U.S. has a number of world-recognized organizations that currently monitor the waters of the Gulf of Mexico for U.S. National programmes. NOAA's National Marine Fisheries Service coordinates the joint Federal-State SEAMAP (Southeast Area Monitoring and Assessment Program) surveys of fishery resources and water quality in the Gulf of Mexico. NOAA's National Status and Trends Program is designed to evaluate and detect changes in the environmental quality of the nation's estuarine and coastal waters by monitoring of contaminants and other environmental conditions at approximately 350 sites nationwide. The EPA's Environmental Monitoring and Assessment Program monitors and assesses the status and trends of national ecological resources for nearshore and estuarine waters. The EPA's National Estuary Program was established to monitor and improve the quality of estuaries of national importance. The U.S. Fish and Wildlife Service Coastal Program provides assessment and planning tools to identify priorities for habitat protection and restoration, conserves pristine coastal habitats through voluntary conservation easements and locally initiated land acquisition, and forms partnerships to restore degraded habitat. The U.S.

Geological Survey (USGS) operates the National Water Quality Assessment, which uses a regional focus to study status and trends in water, sediment, and biota in major river basins and aquifer systems. The USGS also runs the National Wetlands Research Center that, in addition to understanding the structure, functions and processes of wetland systems, includes studies that will guide the conservation of wetland-dependent flora and fauna, as well as the development of technologies that will aid natural resource managers (Federal, State, and private) in determining the status and trends of wetland habitats.

In response to the large hypoxic zone in the coastal waters of the Gulf of Mexico, the United States established in 1997 the Mississippi River/Gulf of Mexico Watershed Nutrient Task Force consisting of numerous Federal and State agencies (including NOAA, the U.S. Departments of Agriculture and Interior, U.S. Army Corps of Engineers, and the EPA). The Task Force, charged to develop both a scientific assessment of the causes and consequences of Gulf hypoxia, issued an Action Plan in 2001 that is currently being revised to incorporate recent findings and to evaluate best management practices in light of recent trends. Within NOAA, a Gulf of Mexico Hypoxia Watch has been established among the National Marine Fisheries Service (NMFS), the National Coastal Data Development Center (NCDDC), and the CoastWatch-Caribbean/Gulf of Mexico Regional Node. The objective of Hypoxia Watch is to develop new near-real time data and map products using shipboard measurements of bottom dissolved oxygen and to disseminate them over the Internet. These products form the basis for summertime advisories on anoxic and hypoxic conditions in the North-central Gulf of Mexico.

In Mexico, there are limited national coastal monitoring programs although a regional exercise was done in the Yucatan Peninsula as part of the coastal planning program for the State of Yucatan. However, the state-owned oil company, PEMEX, has a strong environmental protection programme in the Gulf of Mexico since most of its production is carried in the Gulf and in the littoral states. Consequently it has a monitoring program of the Gulf of Mexico marine waters, with yearly cruises that cover over 75% of the Mexican Gulf. PEMEX has offered to help fund a monitoring programme for the Mexican portion of the Gulf of Mexico as a contribution to the coastal management programme currently being developed for this region by SEMARNAT. Finally, the North American Commission for Environmental Cooperation (CEC) is currently funding and coordinating a series of activities to implement Mexico's National Monitoring Programme. Cooperation with the National Coastal Condition program in the United States is expected within the full phase of this project.

Mexico also has a strong system of marine protected areas, coordinated by SEMARNAT, along the Gulf coast, with nine federal protected areas under different protection schemes. In addition, the Mexican Tourism Secretary (SECTUR) is increasingly aware of the value of tourism in the coastal zone, and is strengthening its environmental protection programme to ensure that new infrastructure is environmentally sustainable.

There are national contingency plans to deal with spills of oil and other harmful substances, and a bilateral agreement between Mexico and the United States to deal with spills in the ocean. These plans need to be strengthened and more closely coordinated. After the Ixtoc I oil spill an agreement was signed between the United States and Mexico to coordinate actions to prevent and control spills of oil and other harmful substances. On the Mexican side the Navy is legally in charge of the coordination of the National Response Plan to Oil Spills, that involves many other ministries and agencies. Each naval region coordinates the actions for that region and executes periodic training exercises. On the United States side the Coast Guard plays a similar role.

On a broader geographic scale, quantitative ocean-wide data are provided by the Sea-viewing Wide Field of view Sensor (SeaWiFS) project. The SeaWiFS Mission is a part of NASA's Earth Science Enterprise, and was designated to develop and operate a research data system to gather, process, archive, and distribute data derived from satellite observation. SeaWiFS data are being used to help clarify the magnitude and variability of chlorophyll and primary production, and to determine the distribution and timing of spring blooms in US coastal waters. NOAA's polar orbiting satellites also routinely provide sea surface temperature data and imagery for the Gulf of Mexico. In the Gulf of Mexico, a coastal monitoring program titled the Caribbean Coastal Marine Productivity (CARICOMP) Programme is also operating. CARICOMP conducts long-term, region-wide comparative studies of the biodiversity and productivity of Wider Caribbean coastal ecosystems. Monitoring sites in the Gulf of Mexico are found in Campeche, Cancún, and Celestún. CARICOMP institutions in Mexico are UNAM-ICMyL, CINVESTAV-IPN (Merida), and EPOMEX. Monitoring of coral reefs is presently conducted by the International Coral Reef Initiative and Reefcheck Foundation at a number of reef monitoring sites in both the US and Mexican parts of the Gulf of Mexico.

There are a number of international coordinating efforts taking place that, by being strengthened and enhanced, can serve as building blocks in Gulf of Mexico Large Marine Ecosystem Programme. The National Fisheries Institute (INP) in Mexico and Center for Fisheries Research (CIP) in Cuba, have carried out joint scientific cooperation on fisheries assessment since 1974. INP and the US Southeast Fisheries Science Centre (SEFSC) have an international agreement (Mexus-Golfo) that has allowed the exchange of fishery science study results and the undertaking of co-operative work, since 1976. For example in 1998 a coordinated shark long-line cruise covered waters in the US, Mexico and Cuba under the Mexus-Golfo aegis. Annual US - Mexican Fisheries Talks provide a basis for exchange of information and co-operation and management enforcement, and Mexican officials attend meetings of the US Gulf of Mexico Fishery Management Council and regularly exchange information.

The North American Free Trade Agreement has a Good Neighbor Environment Committee, which addresses priority cross transboundary pollution issues between the US and Mexico together with a Commission for Environmental Co-operation. The EPA led Gulf of Mexico Programme which co-ordinates environmental quality efforts in the US Gulf of Mexico has reached out and invited Mexican and Cuban participation in events such as a LME symposium.

Finally, both countries belong to IOCARIBE, the UNESCO-IOC Sub-commission for the Wider Caribbean (which includes the Gulf of Mexico), the Western Central Atlantic Fishery Commission (WECAFC) of FAO and UNEP's Wider Caribbean Environment Program, coordinated from Kingston, Jamaica. IOCARIBE serves as a coordinating organization for ocean science in the region, providing the basis for management decisions. The network that IOCARIBE has established is strong, but the lack of financial resources has prevented extensive, science-based products for management. WECAFC has served as a forum for discussion and exchange on fishery management, but lacks the capacity for implementation. UNEP's Wider Caribbean Regional Sea Programme covers a very large geographical area (33 States and Territories) and has funding constraints but has negotiated important legal agreements including the Cartagena Convention for the Protection and Development of the Marine Environment in the Wider Caribbean Region, adopted in 1983 and entering into force in 1986. This Convention has been supplemented by three Protocols, namely: Co-operation in Combating Oil Spills in the Wider Caribbean Region; Specially Protected Areas and Wildlife (SPAW) in the Wider Caribbean Region; and Marine Pollution from Land-Based Sources and Activities (LBS).

In the absence of a GEF intervention, it is probable that the present types of single-country, sectoral-based interventions, which have been demonstrated during the past twenty years as being ineffective in halting the pace of environmental degradation, will continue. Without a concerted ecosystem-based regional approach to environmental management it is unlikely that the present rates of pollution, habitat degradation and living marine resources depletion will be slowed. The likely consequence of such a scenario is the reduction or impairment of ecosystem services and functions, loss of globally significant biological diversity during the next century, combined with collapse of fish stocks and significant economic difficulties in the region (particularly for Mexico).

Regional Programming Context

Recognizing the continuous negative changes in the health and productivity of the Gulf of Mexico LME resulting from human impact and appreciating that living marine resources and pollutants in coastal and marine environments respect no political boundaries and few geographical ones, the countries have resolved to work together to address their common concerns through suitable management options. In addition, there has been a common realization that historical national and sectoral approaches to management have failed to bring about the needed changes to the environment and living resources. Consequently it has been accepted that GEF interventions that adopt a holistic and multi-sectoral approach (embodied in the large marine ecosystem concept) are required.

Accordingly, GEF made available a project preparation and development facility grant (PDF-B) to enable the countries to prepare the necessary analyses and reviews. The main objective of the PDF-B project was to identify the priority transboundary multiple focal area problems of the Gulf of Mexico LME, its coastal area, and associated tributary basins, in an integrated fashion. In accordance with the GEF Operational Strategy, a preliminary Transboundary Diagnostic Analysis (TDA) was prepared.

The full GEF intervention will address the agreed priority transboundary environmental problems of the Gulf of Mexico LME by rehabilitating marine and coastal ecosystems, recovering depleted fish stocks and reducing nutrient overloading to the Gulf of Mexico Large Marine Ecosystem through the use of an assessment and management approach that considers LME productivity, fish and fisheries, pollution and ecosystem health, socioeconomics and governance. In order to achieve this, the project will: Revise and update the Transboundary Diagnostic Analysis (TDA); formulate the full Strategic Action Programme (SAP) and associated National Action Programmes, and facilitate their initial implementation; undertake strategic demonstration projects designed to be replicable and intended to demonstrate how concrete actions can lead to significant improvements; and develop a mechanism to objectively measure effects of management actions.

The project will carry out these actions through 5 key outcomes. These are:

Outcome 1	Transboundary issues analyzed and priorities defined
Outcome 2	Country agreement on and commitment to regional and national policy, legal and institutional reforms to address the agreed priority transboundary issues
Outcome 3	LME-wide ecosystem-based management approaches encouraged and strengthened through the successful implementation of the Pilot Projects
Outcome 4	Monitoring and Evaluation System for the Project and the GoM LME established
Outcome 5	Effective project coordination

It is not anticipated that the proposed full project will carry out novel research and monitoring exercises. A key principle of the project is to build upon, coordinate, and enhance existing approaches, information and data.

2.0 RATIONALE OF GEF INTERVENTION

Despite existing bi-national agreements between Mexico and the U.S., the shared resources of the GOM are unsustainably exploited. Existing management approaches are not consistent with ecosystem-based management and there are currently no agreed bi-national programmes for managing the GOM resources from an ecosystem-based perspective. Furthermore, the two countries have institutional frameworks for coastal and marine resources protection, but no effective regional intersectoral project coordination mechanism currently exists.

This proposed GEF initiative is required in order to remove identified constraints and barriers to the use of the ecosystem approach in the management of the GOM LME, through discrete capacity-building activities and pilot projects in three critical aspects of the ecosystem approach: productivity, conservation and adaptive management, as well as cross-sectoral engagement. The transition towards the ecosystem-based management of the GOM LME will depend on a greater convergence of policy tools including long-term joint programs and actions, a clearer distribution of competencies at all three levels of government, and a robust monitoring and evaluation program. This will require a truly regional GOM initiative supported through a combination of GEF financing and co-financing including a reoriented baseline.

This proposed GEF project expands foundational capacity building to a highly strategic international water body and is therefore fully consistent with the GEF Strategy and Priorities for International Waters, and in particular Strategic Objective 1. As an OP9 initiative, it emphasizes the multi-focal connections that characterize the system. The project seeks to create a co-operative framework, together with the necessary capacities, thereby enabling Mexico and the U.S. to address both imminent threats to the water body and develop joint ecosystem-based management approaches.

Within this integrated approach, the project will address specific IW Priorities, in particular land-based pollution and depletion of coastal/marine fisheries. A hypoxic zone of over 18,000km^2 forms every year in the Gulf of Mexico in critical areas for commercial and recreational fisheries. Cross-sectoral, integrated suites of measures and reforms are required to address this issue as detailed in the IW Strategy. The project will also develop mechanisms and undertake reforms for maintaining fisheries resources to within safe biological limits, and encourage the sustainable use of all exploited living marine resources in the GOM LME. As called for in the IW Strategy, this LME suffers from fisheries depletion but the stocks and associated biodiversity are not yet too degraded.

In keeping with GEF guidance, the project will finalize the preliminary TDA developed during the PDF-B phase. This constitutes the basis for a robust Strategic Action Programme (SAP) that will define the policy/legal/institutional reforms and priority investments, as well as on-the-ground pilots, needed to set in place regional collaboration on priority transboundary concerns for the Gulf of Mexico Large Marine Ecosystem.

Conformity

The project is fully compliant with the priorities identified for International Waters under GEF 4 and with Strategic Objective 1 (SO1): ***To foster international, multi-state cooperation on priority transboundary water concerns through more comprehensive, ecosystem-based approaches to management,*** as its focus is on the development of response and mitigation measures to address identified priorities: land-based sources of marine pollution that create anoxic “dead” zones in coastal waters, depletion of fisheries, and degradation of coastal resources and processes. In terms of SO1, the project expands foundational capacity building to a highly strategic international water body and, moreover, constitutes the first GEF Large Marine Ecosystem project in Latin America and the Caribbean.

In terms of Strategic Programs in the international waters focal area for GEF 4, the project conforms to both SP1 and SP2. Strategic Program 1 is concerned with ***restoring and sustaining coastal and marine fish stocks and associated biological diversity***. Strategic Program 2 focuses on ***reducing nutrient over-enrichment and oxygen depletion from land-based pollution of coastal waters in LMEs consistent with the GPA***.

As called for in the ***International Waters Focal Area Strategy and Strategic Programming for GEF4***, land-based sources of pollution that create anoxic "dead" zones are a priority for the project given the Mississippi-Atchafalaya River Basin and Gulf of Mexico hypoxic zone of over 18,000km^2 that forms every year in the Gulf of Mexico. The project addresses the cross-sectoral collaboration and synergies required in order to coordinate regional efforts to address the distribution, dynamics and causes of hypoxia. The project will also develop mechanisms and undertake reforms for maintaining fisheries resources to within safe biological limits, and encourage the sustainable use of all exploited living marine resources in the GOM LME. These efforts will complement activities and reforms geared at reducing ecosystem stress on critical coastal areas including bays, estuaries, and wetlands. Based on the development of integrated, ecosystem-based management approaches, the necessary reforms, frameworks and investments will be undertaken to support SAP objectives. It is therefore fully in conformity with identified GEF 4 strategic objectives, priorities and programmes.

Through the International Waters focal area, the GEF has helped establish management and policy frameworks in large marine ecosystems that provide the necessary foundation for marine protected areas to be successful. One of the pilots in the project specifically focuses on the rehabilitation and restoration of coastal areas and critical habitats

As an Operational Programme 9 (OP9) initiative, it emphasizes the multi-focal connections that characterize the system, and seeks to create a co-operative framework, together with the necessary capacities, thereby enabling riparian countries that share the ecosystem to address both imminent threats to the water body and develop joint ecosystem-based management approaches.

The proposed project will incorporate the priorities delineated in the relevant environmental agreements and international conventions and practices to which any or all of the participating countries are involved including the United Nations Convention on the Law of the Sea (UNCLOS), the FAO Code of Conduct for Responsible Fisheries (CCRF), and the Global Programme of Action for the Protection of the Marine Environment from Land-based Activities (GPA).

3.0 SUMMARY OF PROJECT PREPARATORY PHASE

The project preparatory phase was undertaken under the implementation of UNDP and the execution of UNIDO. Funding for execution was made effective in the second semester of 2005. After the recruitment of the Regional Coordinator and establishment of the project coordination office in Merida, Mexico, the inception workshop took place in January 2006. The inception workshop and subsequent technical and Steering Committee meetings were not attended by Cuba, in spite of the continuous efforts by both the IA and EA to facilitate the active participation of the country in all project activities. In February 2007, the Cuban Vice-Minister of the Ministry for Foreign Investment and Economic Collaboration (MIN VEC), Mr. Orlando Requeijo Gual, on behalf of the Government of Cuba officially informed the project partners of its decision not to participate in the project. In its decision, the Government of Cuba indicated that the project did not fit within the framework of the environmental priorities established in the country's Estrategia Ambiental Nacional (National Environmental Strategy). The GEF Agencies and the participating countries recognize that Cuba exercised its sovereign right to determine whether to participate in this initiative. Throughout the implementation of the preparatory phase, UNDP, UNIDO and the Mexican Government made continuous efforts to elicit the participation of Cuba in all project activities. Informal consultations were also carried out. Both the USA and Mexico have stated that Cuba's participation in the project would be beneficial, and that their reincorporation at any point in the process would be welcome. In the project launch workshop and subsequent steering committee meetings, the US and Mexican Delegations made statements regarding the "open door" policy for Cuban participation in the project, if the country decides to reincorporate itself in the process.

During PDF-B implementation, UNDP recommended that the TDA and SAP be integrated on a provisional basis, to be completed during the FSP execution phase. This allowed for the preparatory phase to be focused on the preparation of the Project Brief for inclusion in the GEF Work Programme for 2007. Mexico and the US accepted this recommendation as an informed decision drawn from the experience of similar GEF LME projects. With the guidance provided by the GEF agencies, a preliminary TDA (Appendix A) was drawn in order to provide the scientific basis for the priority issues to be addressed in the FSP and subsequent SAP.

The timing of the preparatory phase coincided with extensive and substantial reforms within the framework of the GEF operational policies and project cycle. For the inclusion of the project in the GEF 2007 Work Plan, and adhering to the new GEF policies, the Government of Mexico decided to finalize the preparatory phase and to continue the FSP with UNIDO as the sole GEF agency. This issue was addressed directly between the Mexican Focal Point and Council Member and the CEO and Chairperson of the GEF during the week of 25 June 2007.

4.0 PROJECT OBJECTIVES, OUTPUTS AND ACTIVITIES

4.1 Long-term Objective

The long-term development/environmental objective of the project is: ***Sustainable development of the Gulf of Mexico LME enhanced through ecosystem-based management approaches***.

The Project Objective is: To set the foundations for LME-wide ecosystem-based management approaches to rehabilitate marine and coastal ecosystems, recover depleted fish stocks, and reduce nutrient overloading.

4.2 Specific Project Objectives

In order to achieve this objective, the specific project objectives of this project are:

1) Update the Transboundary Diagnostic Analysis (TDA)
2) Formulate a Strategic Action Programme (SAP) and associated National Action Programmes (NAPs)
3) Undertake pilot projects that set the basis for SAP implementation. The SAP will consist of a series of actions to monitor and assess the changing condition of the GOM-LME with a focus on restoring and sustaining fisheries and fish stocks, and reducing and controlling nutrient enrichment of the Gulf of Mexico Large Marine Ecosystem to safe ecosystem health levels.

These actions will be supported by appropriate legal, policy and institutional reforms and investments to address the priority transboundary issues identified in the TDA and NAP formulation process. The project will also facilitate the initial implementation of the SAP to manage shared coastal and marine resources and achieve sustainable development for the GOM LME. This will involve the definition of an appropriate regional body and the implementation of pilot demonstration projects. It is noted that although Cuba endorsed the PDF-B project document their experts did not subsequently participate in PDF-B activities, and the relevant government authorities indicated in a letter dated 27 February 2007 that they would not participate in the Full-Size Project.

A key principle of the project is to build upon, coordinate, and enhance existing approaches. For example, considerable work has been undertaken in the Mississippi river basin by different universities and state agencies, and in the Yucatan Peninsula under the GPA, as well as by various agencies in the Gulf of Mexico LME such as EPA and NOAA. Such activities are at a national level and one of the outputs of the project will be to replicate or scale up such activities to encompass the whole LME.

4.3 Expected Outcomes and Activities

OUTCOME 1: Transboundary issues analyzed and priorities defined

Rationale: A Transboundary Diagnostic Analysis (TDA) is an objective process for analyzing the causes of transboundary environmental problems affecting the goods and services of the LME from an ecosystems perspective. The TDA provides the scientific and technical basis for consideration and evaluation of possible actions to be proposed in the SAP and NAPs.

This component will continue the development of the GoM TDA initiated during the PDF-B phase. This will require the identification of capacities and information gaps (including fisheries, eutrophication, pollution assessment, biodiversity, socio-economic conditions, legal/regulatory review, stakeholder analysis, hot spots, contaminant levels), and the provision of training, as necessary.

Outputs:

- Capacities and gaps in regional monitoring methods/standards identified
- Key ecosystem assessment and management gaps identified
  - Biodiversity hot spots in the GoM LME assessed and key knowledge gaps identified
  - Existing information and data on status and trends in fisheries assessed
  - Ecosystem-wide nutrient over-enrichment and contaminant sources, flows and levels assessed
  - Environmental impacts of transboundary pollution on the GoM ecosystem assessed
  - Information on nutrient over-enrichment and related HABs collected and integrated
- Governance analysis of relevant policy and regulatory frameworks completed
- Analysis of the socioeconomic impacts of priority transboundary issues, including a preliminary LME wide economic valuation of near shore and marine goods and services, undertaken
- TDA revised, finalized, published and disseminated

OUTCOME 2: Country agreement on and commitment to regional and national policy, legal and institutional reforms to address the agreed priority transboundary issues

Rationale: A Strategic Action Programme (SAP) and associated National Action Programmes (NAPs) are processes that enable LME wide agreement on priorities for identified transboundary problems of the GoM LME at national and regional levels. The process provides for the definition of harmonized approaches for policy, legal and institutional reforms for addressing priority transboundary issues, and for rendering them effective through reforms and investments at the national level. Strong interaction with the private sector including the oil and gas, fisheries, tourism and other industries, is important. Together with the TDA, the SAP is a living document that needs to be incorporated into the LME adaptive management approach.

The SAP will enable the littoral states to reach a consensus on ecosystem priorities, targets, governance reforms, programmes and projects to protect, manage, restore and sustain the shared resources of the GoM LME. It will include an estimation of the required financial resources and a strategy to mobilize these resources. The SAP will play a key role in ensuring that global environmental benefits are provided in tandem with facilitating sustainable and environmentally sound economic development in the LME over the coming decades.

The development of the SAP will be underpinned by the initiation of a series of capacity building and institutional strengthening activities, some of which are entirely co-financed by the countries. These are indicated in the Outputs below as *Fully Co-Financed*.

Outputs:

2.1 Strategies and actions for the reduction and control of nutrient over-enrichment, HABs and for the elimination of dead zones developed.

- Regional Plan of Action for the Yucatan Peninsula RPA-YUCATAN developed by Mexico as a major contribution to reduce land based sources of pollution into the GoM LME, implemented- *Fully Co-Financed*
- Strategic Partnerships between GoM LME programme and institutions responsible for integrated management of the major GoM river basins, as well as the main coastal cities, developed
- Stocktaking of the Papaloapan watershed Commission to define opportunities for replication in the Grijalva-Usumacinta and Panuco river basins in order to provide for strong inter-linkages between watershed management authorities and coastal managers
- Strategies for harmonizing legislative, policy and regulatory frameworks on agricultural practices at LME wide levels developed, building upon the Gulf of Mexico Governors Alliance

2.2 Strategies and actions formulated for sustainable management and use of exploited living marine resources, and for the recovery of depleted fish stocks to within safe biological limits formulated.

- Bi-lateral initiatives for regional surveying of productivity and oceanography, stock assessment and population assessments encouraged and strengthened- *Fully Co-Financed*
- Review effectiveness of compliance measures with existing fisheries legal and regulatory frameworks in both countries, especially with regards to IUU, excessive fishing capacity, and enforcement and surveillance, and propose appropriate reforms and measures.
- Develop fisheries management plans for selected key commercial fisheries

2.3 Establishment of representative marine protected areas (MPAs)

- Recovery plans for depleted priority non-commercial species and associated marine flora and fauna developed for additional species not currently addressed
- Management and capacity building requirements to restore degraded marine coastal wetlands defined
- Marine and coastal spatial zoning processes in individual countries strengthened and implemented, thus enhancing sectoral links among sectoral users in marine and coastal zones- *Fully Co-Financed*
- LME-wide strategies for conserving biodiversity and habitats in the coastal zones of GoM LME supported and harmonized at a regional level.

2.4 The Strategic Action Programme (SAP) and National Action Programmes (NAPs) formulated and endorsed at the highest level.

2.5 Commitments to SAP implementation obtained and sustainable financing arrangements formulated.

OUTCOME 3: LME-wide ecosystem-based management approaches encouraged and strengthened through the successful implementation of the Pilot Projects

Rationale: A priority focus within the overall project is to deliver tangible global benefits within the participating countries through the selection and implementation of 'on-the-ground' activities. Consequently, clearly defined regional and national pilot demonstration projects to advance SAP implementation will be undertaken during the execution of the full project. Three priority pilot projects were jointly identified by participating countries. The pilot projects were integrated through targeted stakeholder consultations and shared criteria of Mexico and the USA. They directly respond to the issues identified in the TDA workshop carried out in Merida, Yucatan, in August 2006. The demonstrations were vetted in different stages by USEPA, NOAA, the Mexican Fisheries Institute, SEMARNAT, and the Mexican Navy. The STAP review highlights their relevance for attaining the project goals. The pilot projects are fully incremental and will assist Mexico to participate more robustly in ongoing programmes undertaken by the United States, and both countries to strengthen regional approaches to ecosystem-based management of the LME. The pilot projects identified by this process are outlined in more detail below and presented in full in the Pilot Project Appendix C:

The pilots are all sited in the same area, Terminos Lagoon, in order to achieve greater cost-effectiveness, maximize synergies and set the foundations for integrated, ecosystem-based approaches to natural resource management. By setting the pilots in the same location, the pilot strategies will generate practical experiences to address a complex baseline of overlapping policies and competencies for protected area conservation, social and economic development and threats to terrestrial, coastal and marine biodiversity. The harmonized development of the three pilots will moreover contribute to defining a stronger baseline, and help enable the development of validated integrated approaches that will facilitate upscaling to other States and at a national level. Options for replication beyond the project area will also be enhanced.

Additionally, a State Biodiversity Study and Strategy is currently under preparation in a partnership between the Campeche State Government, the National Commission on Biodiversity Knowledge and Use (CONABIO) and the Small Grants Program. The Strategy plans to identify the current level of knowledge on biodiversity in the state, identify threats and priorities and proposals for public policies that contribute to meeting the 2010 goals of the Convention of Biological Diversity and the Millennium Development Goals regarding ecosystems. The pilot projects will complement this strategy by contributing baseline information on the current state of marine and coastal biodiversity and by identifying trends and emerging issues on the sustainable use of the goods and services of the GoM LME.

Pilot Project 1: Enhanced natural habitat conservation in the coastal and marine areas of the Gulf of Mexico LME

In the Gulf of Mexico there are extensive coastal wetlands, which are critical ecosystems for the exceptional productivity of fish and shellfish. Wetlands (particularly salt marshes and mangroves) provide essential habitat for shorebirds, colonial nesting birds, and migratory waterfowl. They are home to an incredible array of indigenous flora and fauna, including endangered species such as sea turtles, manatee, crocodiles, and orchids. Moreover, the estuaries and coastal wetlands are recognized as vital in providing food and shelter for wildlife, improving water quality, sediment filtration, and flood and erosion control.

Currently, there are a number of opportunities to protect these fragile habitats. These include the use available data to assess the present coastal land use patterns, to define and protect healthy ecosystems and to conduct restoration in areas with degraded or lost coastal habitats. Furthermore there are opportunities to protect key urban and rural natural sites through purchase or government designation and placement under local control with citizen involvement. The United States has developed much expertise in both conducting various types of habitat restoration (particularly with salt marshes, sea grasses, and mangroves) and in bringing stakeholders at all levels to consensus in designing and implementing habitat projects. This expertise will be made available to Mexico in order to increase opportunities and chances of success.

The objective of this project is to promote the ecosystem approach for conservation and management of wetlands, particularly mangrove ecosystems, sea grass beds and sand dunes in order to maintain their functional and structural integrity, to conserve associated biodiversity, and to ensure economic and social benefits of future generations. The overall outcomes of the project are to develop strategies and actions for natural habitat conservation at Terminos Lagoon in the Mexican part of the GoM LME using the ecosystem approach. This will result in: the restoration of deteriorated coastal areas and habitats with an emphasis on critical coastal habitats such as mangrove ecosystems, wetlands, sea grass beds, and coastal sand dunes; the development of mangrove monitoring methods; and the development of cost-effective strategies to mitigate impacts such as erosion due to extreme meteorological events and inappropriate coastal infrastructure.

The project will contribute to achieving objectives and strategies set out in Mexico's National Strategy for the Ecological Use Planning of Oceans and Coasts, oriented to strengthening its public policies and actions towards efficient habitat conservation and management of natural resources in coastal and marine areas. Thus, the project will provide the overall strategic framework for the conservation and sustainable use of coastal and marine natural resources. The project will include the guidelines to articulate public and sectoral policies, following the ecosystem based management approach, which is holistic, adaptive, and multi-sectoral, and which will enhance a wider public participation.

Pilot Project 2: Enhancing Shrimp Production through Ecosystem Based Management

Gulf fisheries are some of the most productive in the world and shrimp are one of the most highly valued species for both the USA and Mexico, where the value of landings reached $424 million dollars for the USA in the year 2003. Currently, over-exploitation of fish stocks is a common problem in Mexico due to the great demand for food and jobs, the use of modern technologies making fishing effort more efficient, and non-selective fishing gear resulting in bycatch of non-target species, discards, and habitat damage. Coastal and marine habitat modifications also contribute to the depletion of fish stocks. The close relationship of the life history of shrimp with coastal lagoons and estuaries is clearly known; this relationship also exists for more than 80% of other commercially important species.

The object of this pilot project is to contribute to the recovery of depleted species through an ecosystem based management approach, focusing mainly on the shrimp fishery. The overall outcomes of the project will: strengthen the capacities for improved stock assessments and data collection for future ecosystem-level analysis; establish baseline information, including available environmental variability information, for tracking improvements in stock status and fisheries abundance as new regulatory and management practices are implemented; ensure fully-informed and fully-involved stakeholders representing all involved sectors and interests; employ coherent project planning and implementation through an effective communication process; establish effective and coordinated surveillance and enforcement mechanisms and enhanced capacities for enforcing compliance of regulations; achieve an enhanced understanding of the interactions of fishery species and protected species with higher and lower components of the food web, including human extractive activities, for assessing the potential impacts of fishing in non target species; and make a contribution to the benefits represented by other commercially important species.

The project will demonstrate that through ecosystem-based management stress to coastal lagoons and estuaries can be diminished favoring shrimp production (and other commercially important finfish fisheries). Baseline information will be gained to improve stock status, regulations, and enforcement activities, and to help design SAP strategies to harmonize legislative policy and regulatory frameworks across all levels of government. A full ecosystem model will be generated to better understand interactions of fishery species and human extractive activities and the potential impact on non-target species.

Pilot Project 3: Joint Assessment and Monitoring of Coastal Conditions in the Gulf of Mexico

Coastal degradation is one of the main transboundary problems identified for the Gulf of Mexico. Degradation, together with an absence of ecosystem-based management information relating to fisheries, environmental quality, and other aquatic resources, makes management of the Gulf of Mexico Large Marine Ecosystem challenging. Without a consistent and comprehensive LME-wide regional monitoring system, informed management actions remain largely site specific.

The object of this pilot project is to strengthen capacities for joint monitoring, assessment and evaluation of the coastal environment in support of the Gulf of Mexico Large Marine Ecosystem management goals and objectives. The overall outcomes of the project include: the development of a set of coastal ecosystem health indicators; strengthened capacity and enhanced integrated ecosystem based management; completed baseline sampling for the determination of the ecological condition of the adjoining estuarine and coastal environments of Terminos Lagoon; active participation of regional and local management authorities, scientists, and other stakeholders; an evaluation of the potential for extending sampling protocols to adjacent states or systems in Mexico; and the preparation and dissemination of a *State of the Coast of the Gulf of Mexico.*

This proposed project will build upon the substantial knowledge and track record of coastal conditions monitoring in the U.S. portion of the Gulf of Mexico (EPA’s National Coastal Assessment, NOAA’s SEAMAP), creating a complimentary ecological monitoring system in Mexico’s portion of the Gulf of Mexico. This joint monitoring and assessment survey will contribute to meeting the Project objective by creating a consistent baseline of environmental information throughout the LME that will be used to better define required regulatory and policy reforms as well as to target restoration areas.

This pilot activity will provide the basis for bilateral cooperation, establish a consistent and comprehensive design for LME-wide monitoring of coastal conditions, and initiate this monitoring in the Mexican portion of the Gulf. Establishing a common set of environmental condition (or health) indicators and a common sampling design framework that takes advantage of the extensive experience and activities used for monitoring the USA portion of the Gulf of Mexico will create the informational basis necessary for the development of mutual management decisions.

Outputs:

3.1 Pilot Project on Natural Habitat and Ecosystem Conservation of Coastal and Marine Zones of the Gulf of Mexico: Wetlands, Mangroves, Sea Grass Beds and Sand Dunes effectively implemented
3.2 Pilot Project on Enhancing Shrimp Production through Ecosystem Based Management effectively implemented
3.3 Pilot Project on Joint Assessment and Monitoring of Coastal Conditions in the Gulf of Mexico effectively implemented

OUTCOME 4: Monitoring and Evaluation System for the Project and the GoM LME established

Rationale: Effective monitoring and evaluation (M&E) is recognized as an indispensable tool in project and program management. The Gulf of Mexico M&E plan and the process, stress reduction, and environmental status indicators developed as part of it in accordance with GEF guidance, will serve both as a corrective function during the project cycle, enabling timely adjustments, and as a guide to structuring future projects more effectively.

In order to ensure that the M&E mechanism and indicators are populated with high quality data, a regional Data and Information Management (DIM) system will be developed, building on existing systems within the region. Furthermore, standards and protocols for the collection, processing, analysis and compilation of data and GIS information will also be created and mechanisms for sharing of data and information input into the DIM System will be initiated. A key output of this particular Outcome will be a regular bi-annual regional status report on large-scale ecosystem impacts in the GoM LME.

Outputs:

4.1 Monitoring & Evaluation mechanisms set up including an M & E system for the project.
4.2 Suite of GEF M&E indicators developed (process, stress reduction, and environmental and socioeconomic status) to monitor SAP implementation.
4.3 GoM LME Environmental Information System developed.
4.4 Bi-annual regional status report developed on large-scale ecosystem impacts in the GoM LME.

OUTCOME 5: Effective project coordination

Rationale: This component will develop a sustainable institutional network to address the GoM LME environmental problems and root causes, and help implement the transfer of institutional arrangements from the support of GEF to ownership by the region. The Project Coordination Unit (PCU) and Steering committee will be instrumental in coordinating the implementation of all project activities as well as in securing transnational and cross-institutional collaboration (through the development of intersectoral committees in both countries) in order to successfully implement the Project and ensure its sustainability beyond the life of the project.

A Regional Technical Advisory Group (R-TAG) will be established and a regional coordination mechanism building upon existing bi-national initiatives will be jointly defined.

Outputs:

Regional Project Coordination Unit set up
5.2 Steering Committee and Regional Technical Advisory Group (R-TAG) established
5.3 Intersectoral coordination established through the development of Intersectoral Committees (ISCs) or their equivalent in both countries, including with private sector involvement
5.4 An appropriate regional coordination mechanism jointly defined
5.5 Information needs within the relevant sectors identified and addressed in order to ensure active and informed participation
5.6 Robust public awareness strategies targeted at the different stakeholder levels and groups developed

Expected Results

The major expected results from completing the above five outcomes and outputs can be summarized as follows:

- An objective, scientific and technical Transboundary Diagnostic Analysis (TDA) defining the transboundary environmental problems and their root causes affecting the goods and services of the LME from an ecosystems perspective.

- Nationally endorsed SAP and NAPs with accompanying sustainable financing plans which will pave the way towards continued incremental improvement to the GOM LME based on a solid foundation of regional commitment and consensus.
- Improved legal/management/planning structures for addressing the priority transboundary problems within the framework of the ecosystem approach, including sustainable fisheries management, protection of coastal habitats, and land- and sea-based pollution reduction through the application of strategic partnerships.
- Successfully completed demonstration projects that will serve as a basis for replication in the region and outside the region, as concrete steps towards achieving agreed ecosystem quality objectives (or EcoQOs) as set out in the SAP.
- Improved institutional structure to address priority regional problems, including an appropriate regional coordination mechanism, and other regional and national bodies for conducting effective regional interventions for fisheries, habitat conservation and pollution prevention and control.

In addition to the major expected results above, the project will also result in:

- Improved assessment and actions resulting in the incremental recovery and sustainability of the ecological status of the GOM LME, including shared fish stocks and other priority transboundary problems
- Enhanced regional political and stakeholder commitment to address priority transboundary problems through the development and implementation of the regional SAP and associated NAPs
- Private sector engagement and involvement in the process
- Improved public participation in planning and implementing activities to address the priority transboundary problems in the GOM LME
- Increased ability to sustainably manage and harvest living marine resources in the GOM LME through improved legal capacity, the development and implementation of fisheries monitoring, assessment and management plans, improved regional agreements, and strengthened institutional capacity
- Improved conservation and protection of biodiversity and critical marine and coastal habitats in the GOM LME through the development of Integrated National Ocean Policies and Integrated Coastal Zone Management plans, increased stakeholder participation, demonstration projects, strengthened institutional capacity and an enhanced legal basis
- Enhanced regional capacity to develop mitigation strategies for restoring deteriorated marine coastal areas and habitats
- Improved regional capacity to address land and sea-based pollution in the GOM LME including development of strategic partnerships with relevant coastal cities and river basin management authorities
- Effective coordination of project activities and preliminary SAP implementation through the establishment of the PCU, Steering Committee, R-TAG and the definition of an appropriate regional coordination mechanism
- Enhanced national and regional capacity for monitoring, data and information storage, and dissemination of information to support decision-making

5.0 RISKS, SUSTAINABILITY AND COMMITMENTS

5.1 Possible Risks: Political willingness

There are several risks inherent in this project. Acknowledgement of these and the level of risk posed provide a gauge for project assessment. The long-term success of regional-scale marine ecosystem management programs, such as the one proposed here, largely depend upon: the political willingness of the participating countries to cooperate; their willingness to continue project programs and approaches after the life of the GEF intervention; and the extent to which activities successfully engage the stakeholders that are the subject of intervention. In relation to political willingness, when compared with other IW projects addressing similar sized water bodies, the risks may be lower in the GoM LME, due to the small number of countries participating. Specific risks identified in the Logical Framework are outlined below.

Risks

The risks confronting the project were evaluated during the project preparation stage, and risk mitigation measures have been designed. Four main risks have been identified, and are summarized below:

Table 2: Risk Mitigation Measures

Risk		Risk Mitigation Measure
Governments at all levels and key stakeholder groups do not remain committed to undertaking required sectoral, institutional, legal and economic reforms, nor do they remain financially and politically committed to a regional management framework	L	Approval by the governments of this project reflects support from the different levels (federal, state and municipal). However national commitment to needed sectoral, institutional, legal and economic reforms needs to be forthcoming and effective delivery of the project will only occur if there is country commitment and the project has effectively communicated its role and expected outputs. The reliance on the intersectoral committees as well as the clear requirement for national financial commitments through the NAPs shall be stressed through out the project and will be key to overcoming this risk. Moreover the project builds upon a strong suite of existing bi-national initiatives, and these will contribute to laying the bases for effective development and implementation of the SAP and associated NAPs
Relevant government agencies not willing to share and provide data and information	L	It is important that scientific and technical groups providing inputs are committed to joint work and that there is reasonable access to national data and information. National data can often be sensitive to the countries involved but to ensure the SAP process proceeds successfully, there is a need for countries and organizations to be committed to providing the necessary data and information. An understanding of the value of a regional Data and Information Management (DIM) system, and a growing appreciation of its benefits, should encourage stakeholders to be forthcoming with information and data.
LME-wide objectives may conflict with local/national interests	M	Infrastructure development for tourism, the commercial fishing industry, the oil industry and agriculture are all important economic activities for the countries. Local and national resistance and objections to proposed changes to these sectors are likely to arise. Broad stakeholder participation and support, achieved through targeted awareness and information strategies, as well as stepwise consensus building will be

Risk		Risk Mitigation Measure
		required and are built into the project as critical components. Routine and effective involvement of stakeholders in planning, management and decision-making can only be accomplished by on-going encouragement, strengthened capacities, and financial commitment by the project, donors and the countries themselves
Effective private sector involvement is difficult to achieve	M	For the long-term sustainability of the GoM LME Program, the project aims to demonstrate to productive sectors the long-term benefits to be derived from any jointly defined regional coordination mechanism that is established and that their own further investment in the project will be less than the costs which would accrue to them if these mechanisms were not in place. Although there may be specific niches within the productive sectors that are non-responsive, current high levels of CSR and investment in environmental projects, such as by PEMEX, indicate that this risk is low.
[Rating: L = Low Risk; M = Medium Risk; H= High Risk]		

5.2 Sustainability

This project will be sustained through the far-reaching support mechanisms that are being incorporated into its development. It will bring together the private sector, civil society representatives, and government agencies at all levels and donors interested in supporting work within the region. This will serve to provide an initial incentive to the countries to continue and strengthen their support of the project, as the gains are realized. Once the demonstration projects have been implemented, both national and local stakeholders will enjoy the economic and social benefits of these so that there is an incentive to replicate these efforts. Within the demonstration projects, there are built-in mechanisms for sustaining the outcomes after project support is complete, as well as monitoring and evaluation that emphasizes acquiring improvements throughout the process and in subsequent implementation. The improved coordination of institutions at all levels with mandates that impact on the GoM LME, and that will ultimately benefit from the improvements in terms of productivity, landscape values and ecosystem services and functions, are a keystone of this project. In addition, the project builds upon a strong baseline as reflected in the fact that the pilot demonstration projects seek to strengthen opportunities, expertise and know-how so that Mexican counterparts can better participate in, and contribute to, ongoing efforts by the U.S. in the region. The project will catalyze the already dynamic relationship between the U.S. and Mexico in the GoM LME within a jointly defined, ecosystem-based vision that will provide the foundation for enhanced cooperation.

The development of the SAP and the NAPs includes devising mechanisms for commitments of regional and national support to support the project activities and to reach the objectives of the SAP. The creation of institutional mechanisms through the GoM LME as well as a country-formed regional coordination mechanism will also ensure that the efforts initiated under this project are national and regionally supported and will continue after the conclusion of the project's activities. Attention to issues through an initial environmental valuation of goods and services in the LME will also ensure that domestic policy makers are aware of the imperative of long-term sustainable management strategies and of the benefits of robust ecosystem-based management approaches. Local stakeholders will also garner benefits at the local level through the public involvement activities and it is expected that other communities also seeking to gain similar benefits will be able to replicate the activities in order to benefit substantially.

5.3 Commitments

Over the last four decades the countries have demonstrated a willingness to co-operate in matters relating to the environment of the Gulf of Mexico both through bilateral programmes and active participation in regional programmes. These include:

1. International agreements such as Mexus-Gulf between INP and the US Southeast Fisheries Science Centre (SEFSC) established in 1976;
2. Annual U.S. - Mexican Bilateral Fisheries Talks providing a basis for exchange of information and co-operation as well as management of enforcement;
3. Attendance of Mexican officials at meetings of the U.S. Gulf of Mexico Fishery Management Council with subsequent information exchange;
4. The North American Free Trade Agreement Good Neighbor Environment Committee and General Committee on Environmental Co-operation, which addresses priority cross transboundary pollution issues between the U.S. and Mexico;
5. The EPA led Gulf of Mexico Programme which co-ordinates environmental quality efforts in the U.S. Gulf of Mexico and has reached out and invited Mexican and Cuban participation in events such as a large marine ecosystem symposia.
6. Northern Border Environmental Programme

Both countries belong to IOCARIBE, the UNESCO-IOC Sub-commission for the Wider Caribbean (which includes the Gulf of Mexico), the Western Central Atlantic Fishery Commission (WECAFC) of FAO, and UNEP's Wider Caribbean Environment Program, coordinated from Kingston, Jamaica. IOCARIBE serves as a coordinating organization for ocean science in the region to provide the basis for management decision. The network that IOCARIBE has established is strong, but the lack of financial resources has prevented extensive, science-based products for management. WECAFC has served as a forum for discussion and exchange on fishery management, but lacks the capacity for implementation. UNEP's Wider Caribbean Regional Sea Programme covers a very large geographical area (33 States and Territories) and has funding constraints but it has negotiated important legal agreements including the 1985 Cartagena Convention and its protocols on oil spills, land based sources (LBS), and Specially Protected Areas and Wildlife (SPAW) to which both states are party.
The countries' ownership of the project is also shown by the endorsement of the GEF Project Brief. The countries have committed significant financial resources in support of the project, including in-kind contributions. The governments will also provide necessary scientific expertise to the GoM LME project from national organizations, at-sea facilities for data collection, ship time, and meeting space as required.

Potential donors and private sector will be involved in all stages of the SAP formulation process to ensure that the SAP is responsive to donor requirements. In addition, the SAP will include a detailed financing strategy. The strategy will determine traditional and innovative mechanisms (inter-governmental, governmental, non-governmental, private and financial institutions) for financing the priority activities identified in the SAP. The project will focus on identifying these mechanisms from the outset. In particular, the role of the private sector towards long-term sustainability will be explored.

Commitment of Mexico

The Government of Mexico is fully committed to this project, as stated above. In particular, Mexico is committed to give US$ 8, 854, 780 as cofinancing, of which US$ 6,854, 780 are cofinancing for the three pilot projects, and US$ 2,000,000 are for project management.

6.0 STAKEHOLDERS PARTICIPATION AND IMPLEMENTATION ARRANGEMENTS

6.1 Stakeholders Participation

The preliminary assessment (see Appendix B) has revealed the substantial numbers and wide diversity of stakeholders in the GoM LME. This multiplicity of stakeholders represents a significant human resource and potential for opportunities to enrich the GoM LME project as well as a means to ensure the sustainability of its expected outcomes. The need to engage stakeholders in natural resource management is increasingly being recognized, and a wide range of processes and mechanisms have evolved, and are still evolving, to bring about this change in conventional management approaches. Increasing stakeholder participation requires, among other things, increasing environmental/ecological literacy, strengthening capacities, forging strategic partnerships between the major stakeholders, and establishing the institutional and legal basis for active stakeholder participation at all levels. While not all stakeholders can be active participants in the project, there is a need for information to flow to them on the issues of concern in the LME and how they contribute to the problems or are impacted by them. In addition, there should be channels of communication for stakeholders to have easy access to information about the project's objectives and achievements, and to provide feedback and articulate their concerns.

In order for stakeholders to play an effective role in the sustainable use and management of the living marine resources of the GoM LME, they must have the required capacity, which may need to be developed or enhanced. The focus on human capacity development in fisheries management is increasing in importance, partly because of the development of new approaches to fisheries management (e.g. EBM), and partly because of changes in the international development context driven by the limited success of many previous development initiatives and the realization of the key role that capacity development must play in supporting sustainable development.

6.1.a Resources Users

There is growing realization of the need for increased participation by resource users in the management of natural living resources. Participative governance and the co-management systems in which responsibility for management is shared between the state and user groups can be seen in a wide range of policies and programs worldwide. As mentioned in the literature, the following are some of the benefits of inclusion of all stakeholders in this type of governance system:

- The diversity and multiplicity of stakeholders increases the knowledge and experience available;
- Involving stakeholders in governance ensures better problem definition, and hence better images and visions;
- Legitimacy of governance decisions is enhanced, and could mean reduced costs of enforcement and compliance, which are usually the most expensive aspects of governance;
- The greater the number and diversity of ideas and solutions, the higher the probability of innovations being generated;
- A diverse, interconnected, and multiple stakeholder group working together may be better equipped to deal with the diverse, complex, and dynamic nature of natural resource exploitation and management;
- Stakeholders have the opportunity to exercise their democratic right to be heard and to have the means to inform and influence processes in which they are involved or which they impact.

Among the resource management functions that could be enhanced by the joint action of users and government resource managers are: (i) data gathering; (ii) logistical decisions such as who can harvest and when; (iii) allocation decisions; (iv) protection of resource from environmental damage; (v) enforcement of regulations; (vi) enhancement of long-term planning; and (vii) more inclusive decision-making.

As a key user of the living marine resources of the GoM LME, the fishing sector has an important role in the project and beyond, not only in the provision of knowledge (including traditional knowledge), data (e.g. on catch and effort), and information, but also in helping with surveillance and realizing their potential role as stewards of the GoM resources. Most fisheries scientists and managers perceive that in Mexico, industrial fishermen are well organized and represented, while artisanal fishermen are fragmented, which reduces their power as group. It is argued that if they were more empowered and knowledgeable, they would be more likely to act more responsibly and accept and adhere to fisheries regulations. The GoM LME project would greatly benefit from the involvement of this important group of stakeholders and every attempt will be made to fully engage them in the process by enhancing awareness among them and strengthening their capacities.

The following strategies for engaging user groups will be used during the project:

- Building awareness in a number of areas, for example, the importance of the GoM ecosystem in the provision of specific ecosystem goods and services that these groups depend on or impact negatively; the impact of their activities (individually and collectively) on the ecosystem (including transboundary impacts), and consequences for sustainable socio-economic development;
- Clearly articulating the project's expected goals and outcomes, emphasizing the potential benefits to these stakeholders;
- Developing public education materials for all levels (including schools);
- Developing mechanisms for public education and outreach, and regular information dissemination (e.g. public awareness campaigns, including for consumers; establishment of an information center(s) in strategic locations and information networks; engaging the mass media and educating and building the capacity of journalists);
- Creating fora for dialogue between stakeholder groups such as newsletters, information services, and networking opportunities, and improving the opportunities for various stakeholder groups to dialogue to resolve conflicts;
- Developing a website and making all stakeholders aware of it, to provide project information and updates, as well as public education materials;
- Promoting 'champions' from among the various groups (and persons who already have the trust and respect of the various communities), who will then assist in broadening the stakeholder engagement process;
- Designating a Focal Point for the GoM-LME project at local/sectoral level to encourage continuity in interest, participation, and cooperation;
- Convening regular stakeholder fora for open discussion and exchange of information;
- Providing incentives for stakeholders to become involved in the project, and to sustain their participation;
- Demonstrating with examples from other projects and regions instances of good practices in collaborative management of living marine resources, and the benefits that have so accrued to the stakeholders involved;
- Helping certain groups of stakeholders to become better organized (e.g. artisanal fishers in fishing associations), so that they are more empowered and thus can be more effective as a group;
- Enhancing stakeholders' awareness of their responsibility towards society and future generations, and of their potential to influence decisions and processes that affect them;

- Making use of the experience of national NGOs who have already been working with stakeholders in other projects;
- Developing the capacity of the appropriate groups for specific tasks (e.g. assistance in monitoring through informal monitoring networks) and involvement in the pilot projects;
- Creating opportunities for the contribution and use of traditional knowledge;
- Developing linkages between the key stakeholder groups in the two countries.

6.1.b National Governments

Both the Governments of Mexico and the U.S. are the natural leaders in the sustainable use and management of the nations' coasts and oceans. They play the principal role in policy setting, decision-making, management and regulation at the national level, and also have a major role to play during the GoM LME project, as well as in ensuring the sustainability of project outcomes in the post-project period. There is a multitude of agencies that engage in programmes in the GoM, which are of high relevance to the GoM LME project, and their involvement in the project needs to be effectively coordinated.

In both countries, ecosystem-based management is rapidly evolving. For example, in Mexico the "Oceans and Coasts National Strategy for Ecological Use Planning" sets out the Government's goals towards oceans and coasts. The Government aims to strengthen its public policies for an efficient management of natural resources in coastal and marine areas based on scientific knowledge and public participation. The policies are grounded on ecosystem–based management approach and enhance a wider public involvement. In the U.S. the Pew Oceans Commission, the U.S. Commission on Ocean Policy, and the President's U.S. Ocean Action Plan each provide different models for an overarching framework for national ocean governance and different degrees of federal involvement with regional approaches. The two countries also have much to offer the project in the way of sharing of experiences and lessons learned in developing EBM approaches to ocean governance.

The Governments have an important role in developing the required overarching, cross-sectoral institutional and legislative framework for improved LME governance using EBM, at the regional, national, and state/municipal levels. These requirements have been widely discussed. At the regional level, both Governments have a role in promoting a common bilateral agenda for addressing the numerous transboundary problems confronting the GoM environment, including negotiating and formalizing the required mechanisms and instruments for implementing this agenda, and strengthening capacities for developing and implementing bilateral and international agreements. To date, bi-national efforts on the Gulf, while useful, have lacked adequate resources on both sides, and need sustained political commitment and continuity of participation. Formalization of the bi-national nature of these partnerships could help provide government officials with a mechanism for ensuring a greater measure of political buy-in and continuity. These bi-national mechanisms and processes are important for ensuring project success in addressing transboundary living marine resources issues.

At the national/local level, there are significant gaps in capacity for EBM of the GoM LME. The barriers to effective management of coastal and marine living resources are widely recognized in both Mexico and the U.S.. The study "Priorities for Capacity Building in Environmental Management in Mexico, in Support of the North American Agreement for Environmental Cooperation" revealed the need for, among other things, significant changes in sector-based policies, to allow institutions and instruments responsible for environmental policy to have an effective influence on the entire sector-based structure of the economy, for efficient use of financial resources, and for the promotion of creative financial solutions for environmental projects.

These limitations are also pertinent to the management of the GoM LME, and include, among other things: gaps in knowledge (particularly at the ecosystem level and multidisciplinary and interdisciplinary studies that integrate ecological, social, and economic dimensions); inadequate human and financial resources; lack of capacity for transboundary monitoring and assessments (including transboundary environmental impact analysis); the tendency for sectoral and single-species approaches to living marine resources management; limited interagency collaboration; a lack of coordination across jurisdictional levels; a suite of laws that are too often conflicting, overlapping, and confusing; lack of adaptive management approaches; inadequate capacity for adoption of new technologies; and limited participation by key stakeholders in the decision-making process.

The GoM LME project aims to have a highly participatory approach with regard to stakeholders. Both countries already have some mechanisms and processes in place for stakeholder involvement in natural resources management, for example, the Regional Consultative Councils on Sustainable Development in Mexico and the public hearings and public testimony sessions employed by the Gulf fisheries management councils in the U.S. The project will help to strengthen these mechanisms. Overall, co-management is held to embody several attributes of good governance: democracy, transparency, legitimacy, accountability, and subsidiarity. If co-management initiatives are to be successful, the establishment of an appropriate government administrative structure and an enabling legal environment is an essential component in efforts to promote and sustain existing local level fisheries management systems and/or to develop new co-management systems. This project could begin to strengthen national capacity to undertake some of the reforms needed in terms of institutions, mores, and values, in order to move towards more effective participatory management of the GoM living marine resources.

In the two countries, the competent national agencies have an important role to play in the implementation of the relevant project components, and for continuation of these activities (e.g. assessment, monitoring). In addition, the national Governments will play an important role in implementation of the SAP, including evaluation and adaptive management.

The project will strengthen the development and implementation of an EBM framework for living marine resources at the appropriate scales in both countries. Developing and implementing this framework is a challenging task, requiring firm and long-lasting commitment, learning by doing, development of the required scientific, legal, and other capacity, and the building of strategic partnerships both within and between countries as well as with agencies and other LME projects that are more advanced in EBM in order to share experiences and knowledge, and help build the required capacity. The formation of these partnerships will be facilitated through the project. Movement towards EBM does not have to occur all at once, but can result from cumulative, incremental change over time. Identification of incremental modifications is desirable since such changes are easier to adopt and implement than more radical changes and, cumulatively, may still have substantial effects. Capacities built and experiences gained through the project will be an important stepping-stone towards EBM of the GoM LME.

Of the 16 respondents to the Questionnaire (Appendix B), six are government agencies responsible for natural resource management and regulation, although they also have departments that engage in other activities such as scientific research. One of the respondents (Florida Department of Agriculture and Consumer Services, Division of Aquaculture) is involved in the regulation of aquaculture and leasing of submerged state lands for aquaculture activities, while three are involved in the management and regulation of fisheries (Florida Fish and Wildlife Conservation Commission, Gulf of Mexico Fishery Management Council, and Gulf States Marine Fisheries Commission), and one is engaged in the management of a marine sanctuary (Florida Keys National Marine Sanctuary). The National Water Commission of Mexico (Spanish acronym CAN) is responsible for the management and monitoring of freshwater resources and of residual waters that enter the rivers and the sea. Most of the respondents in this group have some concern about transboundary issues/resources.

In their responses to the survey, all but one of these agencies have indicated a potential role for themselves in the GoM LME project. The majority of the respondents could share data and information and scientific expertise and opinion, while the Florida Keys Marine Sanctuary could contribute to the regional SAP, and could serve as a "sentinel site" for ecosystem-based management in the GoM LME. In terms of capacity for their potential roles, most have available human and technical capacity, as well as data and information. However, in some cases, human and financial resources for participating in the project are limited.

The following strategies for engaging government stakeholders will be used in the project:

- Conducting a more detailed assessment of Government Agencies' capacity, followed by targeted capacity building and financial support as necessary;
- Clearly articulating the anticipated benefits and expected outcomes of the project to key representatives of the relevant Government ministries, so that this stakeholder group can see why it has an interest or investment in it;
- Convening workshops and seminars for the appropriate Government agencies on the 5–module LME approach and ecosystem based management of living marine resources, in order to promote better understanding of the need for these approaches and what changes are required (institutional, etc.) to adopt them;
- Developing and disseminating training and educational material at the appropriate level for Government agencies and representatives;
- Encouraging greater strategic linkages between Government agencies and other stakeholders, both within and between countries.

6.1.c Academic/research/advisory institutions

Both countries possess significant academic and research capability related to coastal and marine living resources. Many of these institutions have a long history of activity in the GoM, and their work provides an important foundation on which the project can build through strategic partnerships. Academic and research institutions have an important role during the project and in the post-project period to strengthen the scientific basis for decision-making. In addition to providing the required scientific data and information, these institutions are also well placed to develop programs for capacity building in the area of EBM, including developing multidisciplinary and interdisciplinary programmes. However, the capacity of these institutions needs to be enhanced, particularly for integrated and multidisciplinary research. In general, raising the technical standards of research institutions to provide a better basis for decision-making and management will be a high priority.

An evaluation of the Mexican National Fisheries Institute (Spanish acronym INP) conducted by FAO revealed that among the priorities for capacity building for fisheries research in Mexico were: capacity for evaluating alternative management decisions under conditions of risk and uncertainty; integration of bio-ecological, bio-economic, and socio-economic evaluation of fisheries; capacity in geographic information systems and database management; training in community development with a focus on self-management and technical assistance to support artisanal fishers and training workshops with fishers and fisheries managers. A strong cooperation link between INP and academic institutions is still missing.

The project and the two countries also stand to benefit from greater sharing of data and information with the wider scientific community, and communicating such information in a form that is understandable by and of utility to decision-makers. As such, there is a greater need for strengthening partnerships between academic and research institutions and government agencies, as well as with resource user communities, and creating mechanisms for the sharing and dissemination of information. In addition to providing scientific data and information, academic and research institutions have an important role in interfacing with both decision-makers and the public in order to enhance their environmental literacy and raise awareness and improve understanding about the project and its objectives.

Eleven of the 16 respondents to the Questionnaire are governmental and non-governmental academic/research/advisory entities engaged in activities with a particular emphasis on the long-term sustainable use and conservation of the GoM. These range from State universities (e.g. Texas A & M; University of Quintana Roo; University of Tamaulipas) to national research centers (e.g. EPOMEX), a regional research center (Harte Research Institute for Gulf of Mexico Studies), and a large-scale ocean observation system (Gulf of Mexico Coastal Ocean Observing System, Oceanography Department, Texas A & M University). Research areas range from a specific group of animals (Center for Shark Research, Mote Marine Laboratory) to fisheries (e.g. ECOSUR, IPN), coastal zone management (e.g. EPOMEX), marine pollution and ecosystem restoration (e.g. ECOSUR; EPA Gulf Ecology Division National Health and Environmental Effects Research Laboratory). The NOAA Coastal Data Development Center provides access to coastal data and information. The universities and research centers also have academic and educational programs. All of these institutes are engaged in collaborative programs with other institutes within country, while some have collaborative programs with the other country. All the respondents in this group are either working on transboundary issues/resources (e.g. migratory sharks), consider their work to be of transboundary significance, or have concerns about transboundary impacts. Some of the respondents are also working on ecosystem-based assessment and management programs.

In their response to the survey, all of these institutes have indicated a potential role for themselves in the GoM LME project, in accordance with their respective focal areas and mandates. The majority of the respondents could share data and information and scientific expertise on a variety of topics relevant to the LME and assist with collection of data or with analyses and capacity building, while others could also assist with policy analysis and the development of decision-making mechanisms. In terms of capacity for their potential roles, most have available human and technical capacity, as well as data and information. However, some have indicated that their human and financial resources for participating in the project are limited.

The following strategies for engaging the scientific community will be used in the project:

- Creating fora for dialogue between the project and the scientific community (both within and between the countries);
- Clearly articulating the anticipated benefits of the project and expected outcomes to the scientific community, so that they are aware why they have an interest or investment in it, and exploring with them ways in which they could most effectively participate in the project (given their existing and potential capacity), including in the pilot projects;
- Identifying key academic/research institutions that already possess some capacity for ecosystem-based assessment and management of living marine resources, so that the project can build on this existing capacity;
- Identifying opportunities to build capacity where required and sources of financial support for their involvement in the project;
- Convening workshops and seminars on EBM and with multidisciplinary teams from the major institutions;
- Increasing awareness of the multidisciplinary and interdisciplinary approach needed for effectively addressing the transboundary fisheries management and environmental challenges facing the GoM ecosystem, including the need to incorporate and integrate natural and social science perspectives;
- Identifying or creating opportunities for greater networking and strategic partnerships (e.g. for capacity building and data and information sharing) both within and between countries;

- Enhancing the involvement of these institutions in public education and outreach programs, in order to build ecological and environmental literacy, and thus promote sustainability.

6.1.d NGOs (national and international)

NGOs are a recognized force and play multiple roles in affecting behavior and public policy. They are becoming more evident in political activity at local, national, and international levels. They actively and purposefully seek to influence public policy and behaviour relating to a very wide range of issues, including natural living resources use and conservation. National, regional and international NGOs have been very effective in implementing programmes to address environmental and conservation issues, in mobilizing funding from both international sources and the private sector, and in promoting effective collaboration with other stakeholders. Thus, NGOs can affect ecosystem use patterns. The existence of major national, regional, and international NGOs (including the world's largest, IUCN) already actively engaged in programmes in both countries in general, and in the GoM in particular, bodes well for the future of the project, in that these NGOs have already laid a certain foundation for management of the GoM and have a wealth of experience, capability, databases, and in some cases, access to funding for particular projects that could complement the work of the GoM LME project

The following strategies for engaging NGOs will be used in the project:

- Holding seminars for NGOs on the project's objectives and activities specifically outlining where their inputs would be most effective;
- Showing to NGOs how the project could complement their work, and *vice versa*;
- Liaising with bilateral donors to increase their awareness of the project's activities involving civil society;
- Engaging key national and regional NGOs with the relevant experience to assist with public education and awareness and outreach campaigns;
- Identifying opportunities for synergies and collaborative efforts with NGOs and exploring ways to make these operational (both within and between countries);
- Involving NGOs in the pilot projects;
- Including an NGO representative on the project Steering Committee, elected to this position by democratic means across the region;
- Enhancing collaborative efforts between NGOs, scientists, and the private sector.

6.1.e Regional and international organizations

These organizations have an important potential role in the project, which could greatly benefit from the their experience, networks, databases, and capacity in their respective areas of responsibility. The participation of these stakeholders in the project is crucial for its success. They provide a mechanism for bridging gaps and facilitating greater collaboration and information sharing between the two countries, and the foundation they have established will be valuable building blocks for the project.

The following strategies for engaging this group of stakeholders will be used during the project:
- Establishing a mechanism for continuous dialogue with these organizations;
- Making use of their meetings, conferences, and other fora to create awareness of the project, provide updates, and explore opportunities for collaboration;
- Finding means of building synergies with them, and avoiding duplication of effort;
- Working with the organizations that are responsible for the relevant regional and international environmental agreements (binding and non-binding) to identify ways in which the project could assist in implementation of these instruments at the national level;
- Participating in the IOC-UNESCO Annual LME Consultation, to create awareness about the

project and share experiences with other LME projects, as well as to identify opportunities for strategic partnerships;
- Seeking opportunities for parallel financing.

6.2 Training and capacity building

The participating countries, Mexico and the United States of America, have widely different development levels, socio-economic and political structures, and thus different capabilities to handle the complex issues involved in the sustainable use of living and non-living resources of the GoM LME. The U.S. has a long history of dealing with environmental management, sustainable use, environmental monitoring and assessment, etc. This project emphasizes the collaboration between the U.S. and Mexico to transfer the experience, techniques and methodologies used in the U.S. to Mexico, to ensure that Mexico is a full participant and partner in the ongoing activities foe sustainable use of the GoM already in place on the U.S. side of the Gulf. The long history of collaboration between the two countries means that a number of collaborative arrangements and institutions are already in places that allow the transfer of experiences between the two countries.

The pilot projects foresee a number of training sessions and workshops in subjects closely related to the activities in the pilot projects and the full project. State of the art techniques for sampling design, fishery assessment and evaluation, coastal rehabilitation techniques, etc. are planned in these pilot projects, and will be transferred by U.S. experts from NOAA, EPA and leading universities to their Mexican counterparts. This will ensure Mexico's full participation in the project.

6.3 Implementation arrangements

The GEF Agency for the project will be the United Nations Industrial Development Organization (UNIDO). UNIDO will be responsible for both the implementation and the execution of the project. SEMARNAT will also participate in the execution of the project.

Regional co-ordination and collaboration will be facilitated through a Regional Project Coordination Unit (PCU), which will be located in Mexico. A Chief Technical Advisor (CTA) will be hired to facilitate the successful technical execution of project activities and will be housed in the PCU. The PCU will have other staff working part-time/full-time. A Regional Project Steering Committee, consisting of high-level official country representatives from the U.S. and Mexico and relevant stakeholders, will oversee the implementation / execution of the project. It will meet at least once a year, A Regional Technical Advisory Group (R-TAG) will be established that will advise the Steering Committee and the PCU on GoM technical issues and ensure coordination in support of ecosystem-based management approaches. Finally, each country will have an Inter-Sectoral Committee (ISC) or its equivalent, to assure broad intersectoral coordination and broad government stakeholder participation.

7.0 INCREMENTAL COSTS AND PROJECT FINANCING

A. PROJECT BACKGROUND

Broad Development Objectives:
The long-term development/environmental goal of the project is: ***Sustainable development of the Gulf of Mexico LME enhanced through ecosystem-based management approaches.*** The Project Objective is: ***To set the foundations for LME-wide ecosystem-based management approaches to rehabilitate marine and coastal ecosystems, recover depleted fish stocks, and reduce nutrient overloading.***

In order to achieve this objective, the purpose of this project will be to update the Transboundary Diagnostic Analysis (TDA), formulate a Strategic Action Programme (SAP) and associated National Action Programmes (NAPs) and undertake pilot projects that set the basis for SAP implementation. The SAP will consist of a series of actions to monitor and assess the changing conditions of the Gulf of Mexico Large Marine Ecosystem (GOM-LME) with a focus on restoring and sustaining fisheries and fish stocks, and reducing and controlling nutrient enrichment of the GOM-LME to safe ecosystem health levels. These actions will be supported by appropriate legal, policy and institutional reforms and investments to address the priority transboundary issues identified in the TDA formulation process. The project will also facilitate the initial implementation of the SAP to manage shared coastal and marine resources and achieve sustainable development for the GOM LME. This will involve the definition of an appropriate regional body and the implementation of three pilot demonstration projects. It is noted that although Cuba endorsed the PDF-B project document, their experts did not subsequently participate in PDF-B activities, and the relevant government authorities indicated in a letter dated 27 February 2007 that they would not participate in the Full-Size Project.

A key principle of the project is to build upon, coordinate, and enhance existing approaches. For example, considerable work has been undertaken in the Mississippi river basin by different universities and state agencies, and in the Yucatán Peninsula under the GPA, as well as by various agencies in the Gulf of Mexico LME such as EPA and NOAA. Such activities are at a national level and one of the outputs of the project will be to provide a framework for coordination and harmonization at the bi-national level and to replicate or scale up such activities to encompass the whole LME.

B. INCREMENTAL COST ASSESSMENT

Baseline

Approximately 55 million people live in the coastal states of the GOM, 40 million in the USA and 15 million in Mexico. The Gulf of Mexico LME is a major asset to these countries, in terms of fisheries, tourism, agriculture, oil, infrastructure, trade and shipping. Commercial fishing and seafood processing are an important component of the LME’s economy, with the most important species being brown, white and pink shrimp, and red grouper. The infrastructure for oil and gas production in the Gulf of Mexico (including oil refineries, petrochemical and gas processing plants, supply and service bases for offshore oil and gas production, platform construction yards and pipeline yards) is concentrated in the coastal regions of both the USA and Mexico. The Gulf of Mexico LME contains major shipping lanes, and the volume and value of shipping and port activities has increased in the region.

The five states that make up the Gulf Region in Mexico contribute approximately 10% of the gross domestic product for the agriculture and livestock, forestry and fisheries sector. The environmental cost of this production, based on national averages is equivalent to 11.8% of the regional GDP, without taking into account the aspects of global relevance in the Gulf of Mexico ecosystem. It is also likely that the national average of environmental costs is lower than in the Gulf States given the intensity of agricultural and livestock related activities in Veracruz, Tamaulipas and especially Tabasco.

Habitat conservation and restoration
CONANP will continue to declare protected areas, mostly terrestrial, aside from special reserves such as the soon-to-be announced expansion of the Yum Balam (largely land-based) reserve to include a marine sanctuary for an emblematic species in Holbox Island, the whale shark, or the manatee sanctuary established in Chetumal Bay on the southern border with Belize. However, it is unlikely that productive marine systems outside of landscape, biodiversity (coral reefs) or keystone species considerations would be established. PEMEX will continue to support the implementation of management plans for the protected areas in the company’s operational zone such as Pantanos de Centla and Laguna de Términos.

CONAFOR will also continue to support mangrove restoration efforts under its competitive subsidy program, without taking into consideration strategic nature of factors such as primary productivity, climate change adaptation, etc. Ramsar resolution on marine protected areas is consistent with national policies but in the absence of GEF support would not be considered as a priority nor would synergies between coastal and marine ecosystems be actively sought. This baseline is estimated at US$ **21 million.**

Pollution
CNA will continue to monitor simple parameters to report on beach water conditions, harmful algal blooms will be reported and monitored, although with no systematic information sharing protocols with the USA. Water sanitation and treatment facilities will be built and operated by CNA and the municipal governments. The US action plan on hypoxia will continue to be implemented in the Mississippi Delta, however in the absence of GEF support, Mexico will have no systematic way assimilate relevant knowledge generated in the US and replicate in relevant programs such as RPA-YUCATAN (see below). In the absence of the ecosystem approach, agricultural run-off and nutrient loading will continue to be viewed as a result of seasonal fluctuations in the Gulf. The oil industry is the single most important economic sector in Mexico. Oil extraction is particularly important in the states of Tabasco and Campeche, the reserves of which are considered to be amongst the most important in the Western Hemisphere. PEMEX will continue to operate its environmental management and industrial security program, including pollution mitigation practices, emergency protocols and restoration. Mexico – through SEMARNAT- will continue to prepare its National Implementation Plan for the Stockholm Convention on POPS, including abatement measures for unintentional releases. This region has been selected for a pilot project for the Global Program of Action (Regional Plan of Action for the Yucatan Peninsula RPA-YUCATAN), and close cooperation with the Gulf of Mexico project is foreseen. This baseline is estimated at US$ **100 million.**

Policy Framework
Mexico has made important advances in consolidating its environmental policy, and the past and current administrations have placed importance on mainstreaming of the environment through cross-sector planning and budgeting. In 2006, SEMARNAT adopted a National Environmental Policy for the Sustainable Development of Oceans and Coasts, which establishes public policy guidelines and strategies in an effort to reinforce integrated environmental management of the coastal zone through structural reform, effective inter-institutional coordination and wide ranging public participation. Mexico published a National Fisheries Chart at the end of the 1994-2000 administration and although new versions were published in 2004 and 2006, it that was not taken on board by subsequent administrations as a result of which several fishing stocks were depleted. Most recently, fundamental modifications have been made to several official standards and it is expected that further fine-tuning of the legal and policy framework would continue to take place. However in the absence of GEF support, it is unlikely that a harmonized policy framework for the LME between Mexico and the USA, as well as between the Mexican Federal Government and the State and Municipal governments, would be achieved. This component of the baseline is estimated at US$ **8 million**.

Regional coordination efforts
Bilateral activities will continue to be carried in the Gulf of Mexico out on a wide-ranging number of issues including wildlife, habitat, shipping, petroleum industry-related emergency contingency plans, shared watersheds, etc. Nevertheless, these efforts are predominately sectoral in nature, and do not contemplate a shared approach, nor do they provide an enabling environment for synergies through the ecosystem approach. The baseline is estimated at US$ **20 million**.

Sustainable Livelihoods
SAGARPA currently provides limited support to riparian communities in the form of extension programs, some rural aquaculture initiatives, and subsidized seeds, fertilizers and other inputs for subsistence

farming. In spite of the limited support for aquaculture, there is no real institutional effort made to provide alternative income to rural coastal fisher communities. CONAFOR operates several subsidy programs principally for reforestation and commercial plantations, and is the main financial source for restoration of ecosystems (see above in habitat). PEMEX through the National Indigenous Commission and other institutions provides some support for productive alternatives in agriculture. CONANP allows for productive activities in the influence and buffer zones of the region's protected areas but does not provide any financial support, and the management plans are not also linked to potential financiers. Also, full stakeholder participation in the identification of these productive alternatives is still somewhat limited in spite of important efforts in public outreach and awareness-raising. The baseline is estimated at US**$ 15 million**.

Table 6: Summary of Baseline Investment

Issue	Detail	Cost US$
1	Habitat conservation and restoration	21,000,000
2	Pollution	100,000,000
3	Policy Framework	8,000,000
4	Regional coordination efforts	20,000,000
5	Sustainable livelihoods	15,000,000
Total	**Total Baseline Expenditures (4 years)**	**164,000,000**

Global Environmental Objective

The principal global benefit of the project is an enhanced understanding of LME functions, to serve as input into LME management strategies through the TDA and SAP processes, and to establish an enabling environment and ecosystem-based management practices that will contribute to the protection and maintenance of ecosystem functions and services. The Gulf of Mexico LME's primary productivity supports an important global reservoir of biodiversity and biomass of fish, sea birds and marine mammals. The LME supplies a diverse range of goods and services to the global community but these stand threatened by human-induced pressures, including overfishing. These threats are transboundary in nature, and cannot be effectively abated through stand-alone national initiatives. Global benefits can be secured through the institution of an LME ecosystem-based management framework, allowing the countries to strengthen the management of LME living resources, and address land-based and marine pollution including the reduction of nutrient loads that contribute to hypoxic zones in the LME.

The expected result of the set of interventions will be to reduce coastal pollution, restore damaged habitats, and restore depleted stocks. The Project will make an important contribution by providing the needed building blocks such as information systems and exchange, reinforced capacity and mechanisms for stakeholder participation. An enhanced knowledge of the oceanography of the Gulf of Mexico LME will assist the countries in addressing uncertainty regarding ocean-atmosphere links.

Alternative

The proposed GEF Alternative is directed at removing identified constraints and barriers to the use of the ecosystem approach in the management of the GOM LME, including discrete capacity-building activities, pilot projects in three critical aspects of the ecosystem approach: productive, conservation and adaptive management, as well as cross-sectoral engagement. The transition towards the ecosystem-based management of the GOM LME will depend on a greater convergence of policy tools including long-term, joint programs and actions, a clearer distribution of competencies at all three levels of government, and a robust monitoring and evaluation program. Five outcomes have been mutually identified, to be supported through a mix of GEF financing and co-financing including reoriented baseline.

Outcome 1: transboundary issues analyzed and priorities defined
An objective, scientific and technical Transboundary Diagnostic Analysis (TDA) defining the transboundary environmental problems affecting the goods and services of the LME from an ecosystems perspective will be revised and disseminated. The TDA will respond to the priority issues identified by both countries including transboundary pollution mitigation, reduction and control; weak transboundary fisheries stock management; coastal resource degradation; incomplete knowledge on the LME's biodiversity, a non-comprehensive legal and policy framework; and the lack of a coordinated approach for the LME management and conflict resolution issues for the Gulf of Mexico. Under the alternative, GEF resources and co-financing will be used to finalize the development of the TDA through a capacity needs and information gap assessment on the priority issues, as well as targeted training, as needed. This will include the identification of biodiversity hotspots, ecosystem-wide sources of contaminants, and preliminary economic valuation of the LME goods and services.

(**US$ 427,500 GEF, US$ 24,700,000 Co-finance**)

Outcome 2: The SAP and associated NAPS are formulated and adopted at ministerial level
Nationally endorsed SAP and NAPs with accompanying sustainable financing plans will pave the way towards continued incremental improvement in the GOM LME based on a solid foundation of regional commitment and consensus. GEF resources will leverage considerable co-financing to identify and promote strategic partnerships within the SAP to address underlying socio-economic and governance failures for the sustainable management of the LME. Domestic and global co-benefits will be generated through LME-wide agreements on improved legal and policy frameworks; the incorporation of additional globally relevant protected areas, including marine protected areas; targeted capacity building and institutional strengthening activities and concerted action on ecosystem priorities and targets. The SAP and NAPs will also include the creation or strengthening of existing institutional mechanisms for the regional coordination of LME-implemented activities.

(**US$ 1,130,000 GEF - US$ 9,000,000 Co-finance**)

Outcome 3: demonstration projects successfully implemented
Three priority pilot projects were jointly identified by participating countries to advance SAP implementation and to set the basis for its long-term sustainability. The pilot projects are fully incremental, will leverage significant co-financing and will contribute to the adoption of ecosystem-based management of the LME by assisting Mexico and the US to coordinate conservation, fisheries and monitoring activities. The pilot strategies will generate practical experiences to address a complex baseline of overlapping policies and competencies for protected area conservation, social and economic development, and threats to terrestrial, coastal and marine biodiversity. The harmonized development of the three pilots will contribute to defining a stronger baseline, and help enable the development of validated integrated approaches that will facilitate upscaling and replication to other States and at a national level. Successful implementation of the pilots will also provide concrete steps forward towards achieving the ecosystem goals to be established in the SAP.

(**US$ 2,160,000 GEF - US$ 41,674,780 Co-finance**)

Outcome 4: Monitoring and Evaluation System for the Project and the GOM LME established
Effective monitoring and evaluation (M&E) is recognized as an indispensable tool in project and program management. The Gulf of Mexico M&E plan and the process, stress reduction, and environmental status indicators developed as part of it in accordance with GEF guidance, will serve both as a corrective function during the project cycle, enabling timely adjustments, and as a guide to structuring future projects more effectively. GEF resources will mobilize co-financing to harmonize the currently disparate monitoring efforts in the LME, with agreed bi-national standards and protocols for the collection,

processing, analysis and compilation of data and GIS information including the preparation of a regular bi-annual regional status report on large-scale ecosystem impacts in the GOM LME.

(**US$ 469,000 GEF - US$ 19,400,000 Co-finance**)

Outcome 5: Effective project coordination

The GEF alternative proposes improved regional mechanisms to meet and address the coordination needs and gaps that currently inhibit the carrying out of system-wide interventions in the LME. By the end of the project, it is expected that both countries will define an appropriate long-term regional coordination mechanism. This will include joint definition of a long-term regional coordination mechanism building upon existing bi-national initiatives and the establishment of a Regional Technical Advisory Group (R-TAG). Incremental support will help promote the transfer of institutional arrangements from the support of GEF and other donors to ownership by the region. GEF funding will also identify and apply best practices for public awareness and involvement in order to mobilize regional political and stakeholder commitments to the broader development goals of the LME

(**US$ 316,000 GEF - US$ 2,000,000 Co-finance**)

Systems Boundary

Incremental costs have been assessed temporally, over the planned four-year implementation of GEF-supported activities, and geographically, through the marine and coastal waters of 5 Mexican Gulf States as well as the target sites of the pilot projects. In this particular project only Mexico is eligible for GEF financing, however some baseline information has been included for the United States of America. The analysis also covers the suite of thematic issues identified in the TDA process, some building on past and present bilateral efforts.

Summary of Costs

The baseline, comprising activities that would be pursued irrespective of project investment, has been estimated at US$ 164,000,000. Incremental Costs amount to US$ 101,277,280, of which the GEF would fund US$ 4,502,500. The total Alternative is US$ 265,277,280. The GEF contribution amounts to 4.6 % of the cost of the total Incremental Cost and 1.7% of the cost of the Alternative. The GEF will provide funding for activities that generate clear global benefits, and could not be justified solely on domestic benefits.

Table 7: Summary Of GEF And Other Donors Investment – The Overall Incremental Cost

Outcome		Total	GEF	Co-finance
1	TDA finalized	25,127,500	427,500	24,700,000
2	SAP finalization and implementation	10,130,000	1,130,000	9,000,000
3	Pilot projects	43,834,780	2,160,000	41,674,780
4	Monitoring and evaluation	19,869,000	469,000	19,400,000
5	Coordination	2,316,000	316,000	2,000,000
Total		**101,277,280**	**4,502,500**	**96,774,780**

Table 8: Incremental Cost Analysis per Outcome

Outcome	Baseline	GEF	Co-Funding	Increment	Alternative
1. Transboundary issues analyzed and priorities defined	$48,000,000	$427,500	$24,700,000	$25,127,500	$73,127,500
2. Country agreement / commitment to reforms x priority tb issues defined	$41,000,000	$1,130,000	$9,000,000	$10,130,000	$51,130,000
3. LME-wide EBM approaches encouraged x Pilot Projects defined	$33,000,000	$2,160,000	$41,674,780	$43,834,780	$76,834,780
4. M&E System for the Project and the GOM LME established	$34,000,000	$469,000	$19,400,000	$19,869,000	$53,869,000
5. Effective project coordination	$8,000,000	$316,000	$2,000,000	$2,316,000	$10,316,000
Total	**$164,000,000**	**$4,502,500**	**$96,774,780**	**$101,277,280**	**$265,277,280**

Table 9: Outcome 3 - Pilot Projects

Outcome	Baseline	GEF	Total Co-finance	Increment	Alternative
1. Natural Habitat and Ecosystem Conservation	$ 9,000,000	670,000	$12,408,448	$13,078,448	$22,078,448
2. Enhancing Shrimp Production through EBM	$ 5,000,000	720,000	$17,866,332	$18,586,332	$23,586,332
3. Joint Assessment & Monitoring	$ 19,000,000	770,000	$11,400,000	$12,170,000	$31,170,000
TOTAL	**$33,000,000**	**$2,160,000**	**$41,674,780**	**$43,834,780**	**$76,834,780**

Table 10: Incremental Cost Matrix

<table>
<tr><th>Component</th><th>Baseline</th><th>Increment</th><th>Alternative</th></tr>
<tr><td>Overall Objective: To set the foundations for LME-wide ecosystem-based management approaches to rehabilitate marine and coastal ecosystems, recover depleted fish stocks and reduce nutrient overloading</td><td>$ 164,000,000</td><td>GEF: $ 4,502,500
NOAA/EPA: 80,000,000
SEMARNAT/PEMEX: 16,774,780

Total: $ 101,277,280</td><td>Total Alternative: $265,277,280</td></tr>
<tr><td colspan="4">Explanatory note:
A financial baseline for the project has been set at $ 164 million, over 4 years, established using a ‘business as usual’ scenario where, despite existing bi-national agreements on fisheries such as MEX-US Gulf, the shared resources of the GOM are unsustainably exploited. In the absence of the GEF intervention, fragmented management approaches not consistent with ecosystem-based management will continue within the two countries and in particular Mexico. Currently there are no agreed bi-national programmes for managing the GOM resources from an ecosystem-based perspective and although the two countries have institutional frameworks for coastal and marine resources protection, no effective regional intersectoral project coordination mechanism exists.

The proposed GEF alternative is required in order to remove identified constraints and barriers to the use of the ecosystem approach in the management of the GOM LME, through discrete capacity-building activities and pilot projects in three critical aspects of the ecosystem approach: productivity, conservation and adaptive management, as well as cross-sectoral engagement. The transition towards the ecosystem-based management of the GOM LME will depend on a greater convergence of policy tools including long-term joint programs and actions, a clearer distribution of competencies at all three levels of government, and a robust monitoring and evaluation program. This will require a truly regional GOM initiative supported through a combination of GEF financing and co-financing including a reoriented baseline.

Within this integrated approach, the project will address specific IW Priorities, in particular land-based pollution and depletion of coastal/marine fisheries. In particular, the “dead zone” that forms every year in the Gulf of Mexico in critical areas for commercial and recreational fisheries will require cross-sectoral, integrated suites of measures and reforms to address this issue as detailed in the IW Strategy. The project will also develop mechanisms and undertake reforms for maintaining fisheries resources to within safe biological limits, and encourage the sustainable use of all exploited living marine resources in the GOM LME. As called for in the IW Strategy, this LME suffers from fisheries depletion but the stocks and associated biodiversity are not yet too degraded.

The alternative scenario includes financing from GEF, SEMARNAT and NOAA.</td></tr>
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<table>
<tr><td>Outcome 1: Transboundary issues analyzed and priorities defined</td><td>$ 48,000,000</td><td>GEF: $ 427,500
NOAA/EPA: $24,000,000
SEMARNAT: $700,000

Total: $ 25,127,500</td><td>Total Alternative:
$ 73,127,500</td></tr>
<tr><td colspan="4">Explanatory note:
A financial baseline for this Outcome has been set at $ 48 million, over 4 years, established using a ‘business as usual’ scenario where bi-lateral activities will continue to be carried in the Gulf of Mexico out on a wide-ranging number of issues including wildlife, habitat, shipping, petroleum industry-related emergency contingency plans, shared watersheds, etc. However, current initiatives are predominantly country driven and are regionally fragmented with limited global benefits. Both countries at present have their own approach to monitoring, standards are not uniform throughout the region and there are many gaps in environmental monitoring in Mexico. In addition, there is currently little integration of results on ecosystem health between the countries again resulting in limited global benefits. Existing benefits include common work on some listed species (CITES) and the North American Biodiversity Network.

Under the alternative, GEF resources and co-financing will be used to finalize the development of the TDA through a capacity needs and information gap assessment on the priority issues, as well as targeted training as needed. This will include the identification of biodiversity hotspots, ecosystem-wide sources of contaminants, and preliminary economic valuation of the LME goods and services. This will result in: increased strategic focus of the bilateral programs in the Gulf of Mexico; greater convergence of policy tools including long-term joint programs and actions; enhanced national and regional capacity for monitoring, data and information storage, and dissemination of information to support decision-making; and improved legal/management/planning structures for addressing the priority transboundary problems within the framework of the ecosystem approach, including sustainable fisheries management, protection of coastal habitats, and land- and sea-based pollution.</td></tr>
<tr><td>Outcome 2: Country agreement on and commitment to regional and national policy, legal and institutional reforms to address the agreed priority transboundary issues</td><td>$ 41,000,000</td><td>GEF: $ 1,130,000
NOAA/EPA: $6,000,000
SEMARNAT: $3,000,000

Total: $ 10,130,000</td><td>Total Alternative:
$ 51,130,000</td></tr>
<tr><td colspan="4">Explanatory note:
The financial baseline for Outcome 2 has been set at $ 41 million, over 4 years, and has been established using a ‘business as usual’ scenario. It is expected that the Regional Plan of Action for the Yucatan Peninsula RPA-YUCATAN will still be developed by Mexico as a major contribution to reduce land based sources of pollution into the GOM LME. However, agricultural subsidies will continue to favor the intensive use of agro-chemicals and continue to load the Gulf ecosystem with nutrients in its drainage system. Recovery plans for depleted priority non-commercial species and associated marine flora and fauna are unlikely to be addressed. State-level and federal protected areas will continue to be declared in the absence of any shared assessment of biodiversity hotspots and transboundary and migratory species habitats. Habitat restoration programs will continue as reforestation or commercial plantation initiatives in the absence of broader</td></tr>
</table>

biodiversity goals and ecosystem criteria. Some action plans currently under preparation for climate change adaptation will be developed, as will piecemeal mangrove programs. Mexico's Protected Area System will continue to incorporate new PA (mostly territorial) based on ecosystem representativity. Ultimately, the lack of a comprehensive ecosystem approach will fail to generate significant global benefits. Under the alternative, GEF resources and co-financing will be used to develop a programmatic approach for action plans with inter-agency agreements and processes, including the development of a Strategic Action Programme (SAP) and associated National Action Programmes (NAPs). This will result in harmonized approaches for policy, legal and institutional reforms for addressing priority transboundary issues including consensus on ecosystem priorities, targets, governance reforms, programmes and projects to protect, manage, restore and sustain the shared resources of the GOM LME. Other incremental benefits will include: the development of strategies for harmonizing legislative, policy and regulatory frameworks on agricultural practices at LME wide levels, thus building upon the Gulf of Mexico Governors Alliance; the formulation of strategies and actions for the sustainable management and use of exploited living marine resources, and for the recovery of depleted fish stocks to within safe biological limits; the development of Strategic Partnerships between GOM LME program and institutions responsible for integrated management of the major GOM river basins, as well as the main coastal cities. Additional global benefits will be generated by addressing the balance of the protected areas at the systemic level, while advancing the implementation of resolution IX.4 of the Ramsar convention as well as strengthening Mexico's globally relevant Protected Area System (SINAP) through the addition of MPAs.			
Outcome 3: LME-wide ecosystem-based management approaches encouraged and strengthened through the successful implementation of the Pilot Projects	$ 33,000,000	GEF: $ 2,160,000 NOAA/EPA: 33,600,000 SEMARNAT: 6,874,780 PEMEX: 1,200,000 Total: $ 43,834,780	Total Alternative: **$ 76,834,780**
Explanatory note: The financial baseline for Outcome 2 has been set at $ 33 million, over 4 years, and has been established using a 'business as usual' scenario. Currently, there are a number of national efforts to conserve natural habitats in the coastal and marine areas of the GOM but they are generally uncoordinated. Fisheries management practices are used by Mexico but do not use the ecosystem approach. There is currently no 'joined up' coastal assessment monitoring programme in Mexican waters, similar in scope that undertaken by the U.S. It is expected that a number of activities similar in ambit to the proposed pilot projects would be undertaken under the baseline to try to rectify this situation. However, many are likely to be promoted without considering the ecosystem perspective and without scoping and prioritization. Under the alternative, GEF resources and co-financing will be used to develop pilot projects that will deliver tangible global benefits within the participating countries through the selection and implementation of 'on-the-ground' activities. The three pilot projects are fully incremental and will assist Mexico to participate more robustly in ongoing programmes undertaken by the United States, and both countries to strengthen regional approaches to ecosystem-based management of the LME. The pilots are all sited in the same area, Terminos Lagoon, in order to achieve greater cost-effectiveness, maximize synergies and set the foundations for integrated, ecosystem-based approaches to natural resource management. By setting the pilots in the same location, the pilot strategies will generate practical experiences to address a complex baseline of overlapping policies and competencies for protected area conservation, social and economic development and threats to terrestrial, coastal and marine biodiversity. The harmonized development of the three pilots will moreover contribute to defining a stronger baseline, and help			

enable the development of validated integrated approaches that will facilitate upscaling to other States and at a national level. Successfully completed demonstration projects will also serve as a basis for replication in the region and outside the region and will provide concrete steps towards achieving agreed ecosystem quality objectives (or EcoQOs) as set out in the SAP.			
Outcome 4: Monitoring and Evaluation System for the Project and the GOM LME established	$ 34,000,000	GEF: $ 469,000 NOAA/EPA: 16,400,000 SEMARNAT: 3,000,000 Total: $ 19,869,000	Total Alternative: **$ 53,869,000**
Explanatory note: The financial baseline for Outcome 2 has been set at $ 34 million, over 4 years, and has been established using a 'business as usual' scenario. Under the present situation, monitoring activities are carried out by diverse government actors at principle locations on the Mexican Gulf Coast, with additional monitoring and evaluation of diverse sites by academic and NGO actors, according to institutional interests. Both countries have national environmental data centres, but there is no regional information system and only limited sharing of data. There are unequal capacities amongst the government agencies and civil society to accurately monitor and evaluate the state of the Gulf ecosystem, and there is an absence of a programmatic approach to monitoring and evaluation, which results in a limited capacity to understand the LME dynamics. Under the alternative, GEF resources and co-financing will be used to develop a comprehensive monitoring and evaluation system that supports the ecosystem-based approach for managing the GOM LME and which is relevant and readily available for all stakeholders. In order to ensure that the M&E mechanism and indicators are populated with high quality data, a regional Data and Information Management (DIM) system will be developed, building on existing systems within the region. This will increase the understanding of the LME and aid in quantifiably valuing the goods and services it provides. Additional global benefits will be generated through monitoring ecosystem health to protect globally relevant coastal and marine biodiversity.			
Outcome 5: Effective project coordination	$ 8,000,000	GEF: $316,000 SEMARNAT: $ 2,000,000 Total: $ 2,316,000	Total Alternative: **$ 10,316,000**

Explanatory note:

The financial baseline for Outcome 2 has been set at $ 8 million, over 4 years, and has been established using a 'business as usual' scenario. Under the baseline situation, there are currently no regional coordination mechanisms in existence so there are only limited opportunities to address transboundary and biodiversity issues using an ecosystem approach. Intersectoral coordination exists to a lesser or greater degree in the GoM and principally occurs only at the national level. Active and informed participation of the relevant sectors in Mexico is patchy. Some sectors are highly engaged whilst others are not. Furthermore, existing stakeholders at the national level are not well identified or organized for addressing priority GoM LME issues. This lack of uniformity of stakeholder participation in environmental decision-making generates disparate public buy-in for environmental actions.

Under the alternative, GEF resources and co-financing will be used to develop a regional coordination mechanism to help countries harmonize policies and legislation and to share experiences and best practices in protecting their coastal and marine resources. An intersectoral coordination mechanism will help to ensure an effective multisectoral approach to developing and implementing the project at both the national level and throughout the GOM LME and will help ensure sustainable multi-country ecosystem based management and implementation. Stakeholder strengthening will increase both the national impact of stakeholder inputs to national environmental issues and will help stakeholders better understand the transboundary context of their actions throughout the entire LME. Ultimately, improved capacity within relevant sectors regarding the transboundary problems affecting the LME will help ensure active and informed participation in the project and will have global benefits by helping reduce or minimize the transboundary environmental problems affecting the for the GOM LME.

8.0 MONITORING, EVALUATION AND DISSEMINATION

8.1 Monitoring and Evaluation

Project Inception Phase

A *Project Inception Workshop* will be conducted with the full project team, relevant government counterparts including the national executing agency, key stakeholder group representatives, and UNIDO.

A fundamental objective of this Inception Workshop will be for the project team to understand and take ownership of the project's goals and objectives, as well as finalize preparation of the project's first annual work plan on the basis of the project's logframe matrix. This will require reviewing the logframe (indicators, means of verification, assumptions), imparting additional detail as needed, and on the basis of this exercise finalize the Annual Work Plan (AWP) with precise and measurable performance indicators, and in a manner consistent with the expected outcomes for the project.

Additionally, the purpose and objective of the Inception Workshop will be to: (i) introduce the project staff to UNIDO's and SEMARNAT's staff working on the project; (ii) detail the roles, support services and complementary responsibilities of UNIDO and SEMARNAT staff vis à vis the project team; (iii) provide a detailed overview of UNIDO's reporting and monitoring and evaluation (M&E) requirements, with particular emphasis on the Annual Project Implementation Reviews (PIRs), IW Results Templates and related documentation, Tripartite Review Meetings, as well as mid-term and final evaluations. Equally, the Workshop will provide an opportunity to inform the project team on UNIDO's project related budgetary planning, budget reviews, and mandatory budget rephasings.

The Workshop will also provide an opportunity for all parties to understand their roles, functions, and responsibilities within the project's decision-making structures, including reporting and communication lines, and conflict resolution mechanisms. The Terms of Reference for project staff and decision-making structures will be discussed again, as needed, in order to clarify for all concerned, each party's responsibilities during the project's implementation phase.

Monitoring responsibilities and events

A detailed schedule of project review meetings will be developed by the project management, in consultation with project implementation/execution partners and stakeholder representatives, and will be incorporated into the Project Inception Report. Such a schedule will include: (i) tentative time frames for Tripartite Reviews, Steering Committee Meetings, and relevant advisory and/or coordination mechanisms, and (ii) project related Monitoring and Evaluation activities.

Day to day monitoring of implementation progress will be the responsibility of the Project CTA based on the project's Annual Work Plan and its indicators. The Project Team will inform UNIDO of any delays or difficulties faced during implementation so that the appropriate support or corrective measures can be adopted in a timely and remedial fashion.

The CTA and UNIDO will fine-tune the progress and performance/impact indicators of the project in consultation with the full project team at the Inception Workshop. Specific targets for the first year implementation progress indicators together with their means of verification will be developed at this Workshop. These will be used to assess whether implementation is proceeding at the intended pace and in the right direction and will form part of the Annual Work Plan. Targets and indicators for subsequent years will be defined annually as part of the internal evaluation and planning processes undertaken by the project team

Measurement of impact indicators related to global benefits will occur according to the schedules defined in the Inception Workshop and tentatively outlined in the indicative Impact Measurement Template. The measurement, of these will be undertaken through subcontracts or retainers with relevant institutions or through specific studies that are to form part of the projects activities or periodic sampling

Periodic monitoring of implementation progress will be undertaken by UNIDO through quarterly meetings, or more frequently as deemed necessary. This will allow parties to take stock and to troubleshoot any problems pertaining to the project in a timely fashion to ensure smooth implementation of project activities

UNIDO's Office in Mexico (UOM) will conduct yearly visits to the project's field sites to assess first-hand project progress, or more often based on an agreed schedule to be detailed in the project's Inception Report / Annual Work Plan. Any other member of the Steering Committee can accompany UOM, as decided by the Steering Committee. A Field Visit Report will be prepared by UOM and circulated no less than one month after the visit to the project team, all Steering Committee members, and the UNIDO project management staff.

Annual Monitoring will occur through the Steering Committee meetings. This is the highest policy-level meeting of the parties directly involved in the project's implementation/execution. The project will also be subject to a Tripartite Review (TPR) at least once every year, undertaken according to UNIDO's procedures. The first such meeting will be held within the first twelve months of the start of full implementation. UNIDO's project management staff will prepare an Annual Project Report (APR) and submit it for review and comments at the TPR.

The harmonized APR/PIR will be used as one of the basic documents for discussions in the TPR meeting. UNIDO's project management staff will present the APR/PIR at the TPR, highlighting policy issues and recommendations for the decision of the TPR participants. UNIDO's project management staff will also inform the participants of any agreement reached by stakeholders during the APR preparation on how to resolve operational issues. Separate reviews of each project component may also be conducted if necessary.

The final Steering Committee meeting will be held in the last month of project operations. UNIDO project management staff will prepare the Terminal Report. It shall be prepared in draft at least two months in advance of the terminal TPR in order to allow review, and will serve as the basis for discussions at the terminal TPR. The terminal TPR will consider the implementation of the project as a whole, paying particular attention to whether the project has achieved its stated objectives and contributed to the broader environmental objective. It decides whether any actions are still necessary, particularly in relation to sustainability of project results, and acts as a vehicle through which lessons learnt can be captured to feed into other projects under implementation of formulation.

Project Monitoring Reporting

The Project CTA in conjunction with UNIDO's project management staff will be responsible for the preparation and submission of the following reports that form part of the monitoring process.

The Inception Report (IR): A Project Inception Report will be prepared immediately following the Inception Workshop. It will include a detailed First Year/ Annual Work Plan divided into quarterly timeframes detailing the activities and progress indicators that will guide implementation during the first year of the project. This Work Plan will include the dates of specific field visits, support missions from consultants or UNIDO, as well as timeframes for meetings of the project's decision-making structures. The Report will also include the detailed project budget for the first full year of implementation, prepared on the basis of the Annual Work Plan, and will include any monitoring and evaluation requirements to effectively measure project performance during the targeted 12 months time-frame.

The Inception Report will include a more detailed narrative on the institutional roles, responsibilities, coordinating actions and feedback mechanisms of project related partners. In addition, a section will be included on progress to date on project establishment and start-up activities and an update of any changed external conditions that may effect project implementation.

When finalized, the report will be reviewed by UNIDO's project management staff and then will be circulated to project counterparts who will be given one month in which to respond with comments or queries.

The Annual Project Report (APR) & Project Implementation Review (PIR): The merged APR / PIR development process will be managed by the PCU. The PIR is an annual monitoring process mandated by the GEF. It has become an essential management and monitoring tool for project managers and offers the main vehicle for extracting lessons from ongoing projects. The APR / PIR process will come into effect once the project has been under implementation for a year. The APR / PIRs will provide a key input to the Tripartite Project Review. They will be prepared prior to the Tripartite Project Review, to reflect progress achieved in meeting the project's Annual Work Plan and to assess performance of the project in contributing to intended outcomes through outputs and partnership work. The format for the APR / PIRs will include the following:

- An analysis of project performance over the reporting period, including outputs produced and, where possible, information on the status of the outcome
- The constraints experienced in the progress towards results and the reasons for these
- The three (at most) major constraints to achievement of results
- Annual Work Plans (AWP) and other expenditure reports (Enterprise Resource Planning (ERP) generated)
- Lessons learned
- Clear recommendations for future orientation in addressing key problems in lack of progress
- The GEF International Waters Project Performance Results Template

The focal area PIRs are discussed in the GEF Interagency Focal Area Task Forces in or around November each year and consolidated reports by focal area are collated by the GEF Independent M&E Unit based on the Task Force findings. The GEF M&E Unit provides the scope and content of the PIR.

Quarterly Progress Reports: Short reports outlining main updates in project progress will be provided quarterly to the UNIDO's office in Mexico by the project team.

Periodic Thematic Reports: As and when called for by UNIDO or SEMARNAT, the project team will prepare specific Thematic Reports, focusing on specific issues or areas of activity. The request for a Thematic Report will be provided to the project team in written form by SEMARNAT or UNIDO and will clearly state the issue or activities that need to be reported on. These reports can be used as a form of lessons learnt exercise, specific oversight in key areas, or as troubleshooting exercises to evaluate and overcome obstacles and difficulties encountered. UNIDO will minimize its requests for Thematic Reports, and when such are necessary will allow reasonable timeframes for their preparation by the project team.
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Project Terminal Report: During the last three months of the project the project team will prepare the Project Terminal Report. This comprehensive report will summarize all activities, achievements and outputs of the project, lessons learnt, objectives met or not achieved, structures and systems implemented, etc. and will be the definitive statement of the project's activities during its lifetime. It will also lay out recommendations for any further steps that may need to be taken to ensure sustainability and replicability of the project's activities. It will be submitted to the terminal TPR for review by its participants.

Technical Reports: Technical Reports are detailed documents covering specific areas of analysis or scientific specializations within the overall project. As part of the Inception Report, the project team will prepare a draft Reports List, detailing the technical reports that are expected to be prepared on key areas of activity during the course of the Project, and tentative due dates. Where necessary this Reports List will be revised and updated, and included in subsequent APRs. Technical Reports may also be prepared by external consultants and should be comprehensive, specialized analyses of clearly defined areas of research within the framework of the project and its sites. These technical reports will represent, as appropriate, the project's substantive contribution to specific areas, and will be used in efforts to disseminate relevant information and best practices at local, national and international levels.

Project Publications: Project Publications will form a key method of crystallizing and disseminating the results and achievements of the project. These publications may be scientific or informational texts on the activities and achievements of the project, in the form of journal articles, multimedia publications, etc. These publications can be based on Technical Reports, depending upon the relevance, scientific worth, etc. of these reports, or may be summaries or compilations of a series of Technical Reports and other research. The project team will determine if any of the Technical Reports merit formal publication, and will also (in consultation with UNIDO, the government and other relevant stakeholder groups) plan and produce these publications in a consistent and recognizable format. Project resources will need to be defined and allocated for these activities as appropriate and in a manner commensurate with the project's budget.

Independent Evaluation

In accordance with UNIDO's procedures, the project will be subjected to at least two independent external evaluations as follows:

Mid-term Evaluation: An independent Mid-Term Evaluation will be undertaken at the end of the second year of implementation. The Mid-Term Evaluation will determine progress being made towards the achievement of outcomes and will identify course correction if needed. It will focus on the effectiveness, efficiency and timeliness of project implementation; will highlight issues requiring decisions and actions; and will present initial lessons learned about project design, implementation and management. Findings of this review will be incorporated as recommendations for enhanced implementation during the final half of the project's term. The organization, terms of reference and timing of the mid-term evaluation will be decided after consultation between the parties to the project document. The Terms of Reference for this Mid-term evaluation will be prepared by UNIDO.

Final Evaluation: An independent Final Evaluation will take place three months prior to the terminal tripartite review meeting, and will focus on the same issues as the mid-term evaluation. The final evaluation will also look at impact and sustainability of results, including the contribution to capacity development and the achievement of global environmental goals. The Final Evaluation will also provide recommendations for follow-up activities. The Terms of Reference for this evaluation will be prepared by UNIDO.

8.2 Dissemination of Results

Results from the project will be disseminated within and beyond the project intervention zone through a number of existing information sharing networks and fora. In addition:

- The project will identify and participate, as relevant and appropriate, in scientific, policy-based and/or any other networks, which may be of benefit to project implementation though lessons learned.

- The project will participate (from project funds) in the GEF Biennial International Waters Conferences and will sponsor participation of one representative from the Government of Mexico.

- The project will identify, analyze, and share lessons learned that might be beneficial in the design and implementation of similar future projects. Identifying and analyzing lessons learned is an on-going process, and the need to communicate such lessons as one of the project's central contributions is a requirement to be delivered not less frequently than once every 12 months. UNIDO shall provide a format and assist the project team in categorizing, documenting and reporting on lessons learned. To this end a percentage of project resources will need to be allocated for these activities.

9.0 FINDINGS AND RECOMMENDATIONS

9.1 Findings

Mexico and the U.S. have very different social, economic and political conditions. However, in both countries, economic development has often taken place largely at the expense of the living marine resources and the environment. The absence of adequate ecological and economic evaluation of habitats and the goods and services they provide has resulted in development decisions being made on the basis of short-term economic gains. This has been a significant barrier to implementing a more ecosystem-based and-sustainable mode of development.

However, numerous actions are taking place at the national and regional levels to address the environmental problems that have occurred over the last decade. Although fragmented to varying degrees, they provide for considerable baseline information and activities. Furthermore, both the U.S. and Mexico have national research institutes and academic institutions that have a long history of undertaking oceanographic, fisheries, ecological and, pollution assessments in the region and care will be taken to work with these institutions in order to make best use of their comparative advantage where appropriate.

In Mexico, the National Fisheries Institute (INP/SEMARNAP, now CONAPESCA) has laboratories in the Gulf and recently has been able to assess the status of the main marine fisheries (Sustainability and Responsible Fisheries, Assessment and Management). It has also moved into a more integrated environmental and institutional arrangement. One of the products of this activity is a publication on the federal register of the National Fisheries Chart, which serves as a link between the stakeholders' concerns and the fisheries administration. National Fisheries Institute (INP) scientists have participated with Cuban and US scientists in bilateral co-operative fishery assessments.

In the United States, the Gulf States Marine Fisheries Commission unites with the State and Federal Governments in providing science input to fisheries management concerns (including habitat) in state waters. NOAA's Southeast Fisheries Science Centre with state and university partners does likewise for offshore management through the Gulf of Mexico Fishery Management Council. The EPA-led Gulf of Mexico programme and Gulf of Mexico Alliance are co-coordinating mechanisms for the US states and the various Federal Agencies with responsibility in the region. Currently, one of the focal points is on nutrient enrichment impacts causing the "dead zone" of hypoxia off the Mississippi River mouth as well as harmful algal blooms coast-wide.

There are currently national monitoring programmes in Mexico and the United States, but a regionally coordinated programme is needed to address Gulf-wide problems. The U.S. has a number of world-recognized organizations that currently monitor the waters of the Gulf of Mexico for U.S. National programmes. NOAA's National Marine Fisheries Service coordinates the joint Federal-State SEAMAP (Southeast Area Monitoring and Assessment Program) surveys of fishery resources and water quality in the Gulf of Mexico. NOAA's National Status and Trends Program is designed to evaluate and detect changes in the environmental quality of the nation's estuarine and coastal waters by monitoring of contaminants and other environmental conditions at approximately 350 sites nationwide. The EPA's Environmental Monitoring and Assessment Program monitors and assesses the status and trends of national ecological resources for nearshore and estuarine waters. The EPA's National Estuary Program was established to monitor and improve the quality of estuaries of national importance. The U.S. Fish and Wildlife Service Coastal Program provides assessment and planning tools to identify priorities for habitat protection and restoration, conserves pristine coastal habitats through voluntary conservation easements and locally initiated land acquisition, and forms partnerships to restore degraded habitat. The U.S. Geological Survey (USGS) operates the National Water Quality Assessment, which uses a regional focus to study status and trends in water, sediment, and biota in major river basins and aquifer systems. The USGS also runs the National Wetlands Research Center that, in addition to understanding the structure, functions and processes of wetland systems, includes studies that will guide the conservation of wetland-dependent flora and fauna, as well as the development of technologies that will aid natural resource managers (Federal, State, and private) in determining the status and trends of wetland habitats.

In response to the large hypoxic zone in the coastal waters of the Gulf of Mexico, the United States established in 1997 the Mississippi River/Gulf of Mexico Watershed Nutrient Task Force consisting of numerous Federal and State agencies (including NOAA, the U.S. Departments of Agriculture and Interior, U.S. Army Corps of Engineers, and the EPA). The Task Force, charged to develop both a scientific assessment of the causes and consequences of Gulf hypoxia, issued an Action Plan in 2001 that is currently being revised to incorporate recent findings and to evaluate best management practices in light of recent trends. Within NOAA, a Gulf of Mexico Hypoxia Watch has been established among the National Marine Fisheries Service (NMFS), the National Coastal Data Development Center (NCDDC), and the CoastWatch-Caribbean/Gulf of Mexico Regional Node. The objective of Hypoxia Watch is to develop new near-real time data and map products using shipboard measurements of bottom dissolved oxygen and to disseminate them over the Internet. These products form the basis for summertime advisories on anoxic and hypoxic conditions in the North-central Gulf of Mexico.

In Mexico, there are limited national coastal monitoring programs although a regional exercise was done in the Yucatan Peninsula as part of the coastal planning program for the State of Yucatan. However, the state-owned oil company, PEMEX, has a strong environmental protection programme in the Gulf of Mexico since most of its production is carried in the Gulf and in the littoral states. Consequently it has a monitoring program of the Gulf of Mexico marine waters, with yearly cruises that cover over 75% of the Mexican Gulf. PEMEX has offered to help fund a monitoring programme for the Mexican portion of the Gulf of Mexico as a contribution to the coastal management programme currently being developed for this region by SEMARNAT. Finally, the North American Commission for Environmental Cooperation (CEC) is currently funding and coordinating a series of activities to implement Mexico's National Monitoring Programme. Cooperation with the National Coastal Condition program in the United States is expected within the full phase of this project.

Mexico also has a strong system of marine protected areas, coordinated by SEMARNAT, along the Gulf coast, with nine federal protected areas under different protection schemes. In addition, the Mexican Tourism Secretary (SECTUR) is increasingly aware of the value of tourism in the coastal zone, and is strengthening its environmental protection programme to ensure that new infrastructure is environmentally sustainable.

There are national contingency plans to deal with spills of oil and other harmful substances, and a bilateral agreement between Mexico and the United States to deal with spills in the ocean. These plans need to be strengthened and more closely coordinated. After the Ixtoc I oil spill an agreement was signed between the United States and Mexico to coordinate actions to prevent and control spills of oil and other harmful substances. On the Mexican side the Navy is legally in charge of the coordination of the National Response Plan to Oil Spills, that involves many other ministries and agencies. Each naval region coordinates the actions for that region and executes periodic training exercises. On the United States side the Coast Guard plays a similar role.

On a broader geographic scale, quantitative ocean-wide data is provided by the Sea-viewing Wide Field of view Sensor (SeaWiFS) project. The SeaWiFS Mission is a part of NASA's Earth Science Enterprise, and was designated to develop and operate a research data system to gather, process, archive, and distribute data derived from satellite observation. SeaWiFS data are being used to help clarify the magnitude and variability of chlorophyll and primary production, and to determine the distribution and timing of spring blooms in US coastal waters. NOAA’s polar orbiting satellites also routinely provide sea surface temperature data and imagery for the Gulf of Mexico. In the Gulf of Mexico, a coastal monitoring program titled the Caribbean Coastal Marine Productivity (CARICOMP) Programme is also operating. CARICOMP conducts long-term, region-wide comparative studies of the biodiversity and productivity of Wider Caribbean coastal ecosystems. Monitoring sites in the Gulf of Mexico are found in Campeche, Cancún, and Celestún. CARICOMP institutions in Mexico are UNAM-ICMyL, CINVESTAV-IPN (Merida), and EPOMEX. Monitoring of coral reefs is presently conducted by the International Coral Reef Initiative and Reefcheck Foundation at a number of reef monitoring sites in both the US and Mexican parts of the Gulf of Mexico.

There are a number of international coordinating efforts taking place that, by being strengthened and enhanced, can serve as building blocks in Gulf of Mexico Large Marine Ecosystem Programme. The National Fisheries Institute (INP) in Mexico and Center for Fisheries Research (CIP) in Cuba, have carried out joint scientific cooperation on fisheries assessment since 1974. INP and the US Southeast Fisheries Science Centre (SEFSC) have an international agreement (Mexus-Golfo) that has allowed the exchange of fishery science study results and the undertaking of co-operative work, since 1976. For example in 1998 a coordinated shark long-line cruise covered waters in the US, Mexico and Cuba under the Mexus-Golfo aegis. Annual US - Mexican Fisheries Talks provide a basis for exchange of information and co-operation and management enforcement, and Mexican officials attend meetings of the US Gulf of Mexico Fishery Management Council and regularly exchange information.

The North American Free Trade Agreement has a Good Neighbor Environment Committee, which addresses priority cross transboundary pollution issues between the US and Mexico together with a Commission for Environmental Co-operation. The EPA led Gulf of Mexico Programme which co-ordinates environmental quality efforts in the US Gulf of Mexico has reached out and invited Mexican and Cuban participation in events such as a LME symposium.

Finally, both countries belong to IOCARIBE, the UNESCO-IOC Sub-commission for the Wider Caribbean (which includes the Gulf of Mexico), the Western Central Atlantic Fishery Commission (WECAFC) of FAO and UNEP's Wider Caribbean Environment Program, coordinated from Kingston, Jamaica. IOCARIBE serves as a coordinating organization for ocean science in the region, providing the basis for management decisions. The network that IOCARIBE has established is strong, but the lack of financial resources has prevented extensive, science-based products for management. WECAFC has served as a forum for discussion and exchange on fishery management, but lacks the capacity for implementation. UNEP's Wider Caribbean Regional Sea Programme covers a very large geographical area (33 States and Territories) and has funding constraints but has negotiated important legal agreements including the Cartagena Convention for the Protection and Development of the Marine Environment in the Wider Caribbean Region, adopted in 1983 and entering into force in 1986. This Convention has been supplemented by three Protocols, namely: Co-operation in Combating Oil Spills in the Wider Caribbean Region; Specially Protected Areas and Wildlife (SPAW) in the Wider Caribbean Region; and Marine Pollution from Land-Based Sources and Activities (LBS).

In the absence of a GEF intervention, it is probable that the present types of single-country, sectoral-based interventions, which have been demonstrated during the past twenty years as being ineffective in halting the pace of environmental degradation, will continue. Without a concerted ecosystem-based regional approach to environmental management it is unlikely that the present rates of pollution, habitat degradation and living marine resources depletion will be slowed. The likely consequence of such a scenario is the reduction or impairment of ecosystem services and functions, loss of globally significant biological diversity during the next century, combined with collapse of fish stocks and significant economic difficulties in the region (particularly for Mexico).

9.2 Actions Required

Recognizing the continuous negative changes in the health and productivity of the Gulf of Mexico LME resulting from human impact and appreciating that living marine resources and pollutants in coastal and marine environments respect no political boundaries and few geographical ones, the countries have resolved to work together to address their common concerns through suitable management options. In addition, there has been a common realization that historical national and sectoral approaches to management have failed to bring about the needed changes to the environment and living resources. Consequently it has been accepted that GEF interventions that adopt a holistic and multi-sectoral approach (embodied in the large marine ecosystem concept) are required.

Accordingly, GEF made available a project preparation and development facility grant (PDF-B) to enable the countries to prepare the necessary analyses and reviews. The main objective of the PDF-B project was to identify the priority transboundary multiple focal area problems of the Gulf of Mexico LME, its coastal area, and associated tributary basins, in an integrated fashion. In accordance with the GEF Operational Strategy, a preliminary Transboundary Diagnostic Analysis (TDA) was prepared.

The full GEF intervention will address the agreed priority transboundary environmental problems of the Gulf of Mexico LME by rehabilitating marine and coastal ecosystems, recovering depleted fish stocks and reducing nutrient overloading to the Gulf of Mexico Large Marine Ecosystem through the use of an assessment and management approach that considers LME productivity, fish and fisheries, pollution and ecosystem health, socioeconomics and governance. In order to achieve this, the project will: Revise and update the Transboundary Diagnostic Analysis (TDA); formulate the full Strategic Action Programme (SAP) and associated National Action Programmes, and facilitate their initial implementation; undertake strategic demonstration projects designed to be replicable and intended to demonstrate how concrete actions can lead to significant improvements; and develop a mechanism to objectively measure effects of management actions.

The project will carry out these actions through 5 key outcomes. These are:

Outcome 1	Transboundary issues analyzed and priorities defined
Outcome 2	Country agreement on and commitment to regional and national policy, legal and institutional reforms to address the agreed priority transboundary issues
Outcome 3	LME-wide ecosystem-based management approaches encouraged and strengthened through the successful implementation of the Pilot Projects
Outcome 4	Monitoring and Evaluation System for the Project and the GoM LME established
Outcome 5	Effective project coordination

It is not anticipated that the proposed full project will carry out novel research and monitoring exercises. A key principle of the project is to build upon, coordinate, and enhance existing approaches, information and data.

10.0 PROJECT BUDGET AND WORK PLAN

Costs of the GEF Alternative represent baseline and incremental costs totalling US$430,499,780. New and additional incremental resources required to achieve project objectives are US$102,499,780. Of this, a request is made from GEF for US$ 5.0 million (including IA fee) while US$97,954,780 has been raised as co-funding. A summary of project financing is presented in the Table below.

PROJECT COSTS SUMMARY

Project Components/Outcomes	*Co-financing ($)*	***GEF ($)***	**Total ($)**
1. Transboundary issues analyzed and priorities defined	24,700,000	427,500	25,127,500
2. Country agreement on and commitment to regional and national policy, legal and institutional reforms to address agreed priority transboundary issues	9,000,000	1,130,000	10,130,000
3. LME-wide ecosystem-based management approaches encouraged and strengthened through the successful implementation of Pilot Projects	41,674,780	2,160,000	43,834,780
4.Monitoring and Evaluation System for the Project and the GoM LME established	19,400,000	469,000	19,869,000
5. Effective project coordination	2,000,000	316,000	2,316,000
	96,774,780	4,502,500	101,277,280

PROJECT MANAGEMENT UNIT BUDGET:

LOCALLY RECRUITED CONSULTANTS: It is estimated that 1,020 weeks of consultants are needed for the project. This is equivalent to 5 people over the 4 years of the project, including the Chief Technical Advisor for the project, one technical assistant, an administrator, one specialist in database management and geographic information systems, and a specialist on socio-economics and stakeholder analysis. Salaries for locally recruited consultants were estimated at USD $ 1,000 per week.

INTERNATIONALLY RECRUITED CONSULTANTS: No international consultants will be hired for project management.

OFFICE FACILITIES, EQUIPMENT, VEHICLES, ETC.: This includes $250,000 for office space (at $5,000 per month over four years), $100,000 for office equipment and supplies etc., $50,000 for adaptation of office space, $280,000 for vehicles, which includes two vehicles for the use of the project coordinating unit ($35,000 each one – only one of these vehicles will be purchased with GEF funds, and with appropriate justification), one vehicle for field work (mainly for the pilots, $60,000), a small boat for field work ($50,000), and the use of ships of opportunity for coastal work and collections of offshore samples ($100,000). It is calculated that $100,000 will be spent for communications (internet, fax, telephone, etc.) over the four years of the project, and $30,000 per year on office maintenance for a total of $120,000.

TRAVEL. Since the project involves two countries and three pilot projects, travel to Mexico City (4 trips per year x 4 years at $2,000 each totals $32,000) and Miami (2 travels per year x 4 years at $2,000 each totals $16,000) to coordinate with the national focal points for the project are expected. Also travel to Corpus Christi (Texas) (2 trips per year x 4 years at $2,000 each totals $16,000) to coordinate with the Harte Research Institute and the Texas A&M University campus there. Visits to the pilot projects in the field (4 trips per year x 4 years at $4,000 each totals $64,000), attendance to workshops (4 trips per year x 4 years at $3,500 each totals $56,000) and training courses (4 trips per year x 4 years at $4,000 each totals $64,000) etc., have also been considered.

MISCELLANEOUS. Expenses other than those mentioned above are considered here, particularly funds for unexpected expenditures.

Component	*Estimated consultant weeks*	*GEF ($)*	*Other sources ($)*	*Project total ($)*
Locally recruited consultants	1,020	316,000	700,000	1,016,000
Internationally recruited consultants*	0	0	0	0
Office facilities, equipment, vehicles and communications		0	900,000	900,000
Travel		0	250,000	250,000
Miscellaneous		0	150,000	150,000
Total		316,000	2,000,000	2,316,000

CONSULTANTS WORKING FOR TECHNICAL ASSISTANCE COMPONENTS:

838 weeks of national consultants will be hired for the technical assistance components, and 212 weeks of international consultants. A relatively small amount funds have been allocated to international consultants, since the United States has offered technical assistance and technology transfer in the cofinancing letter. Additionally, national consultants will be hired to coordinate the three pilot projects. Since these will be part time consultants, half the number of weeks is given. The duration of the conservation and fisheries pilots is four years (216 weeks), so 108 weeks are allocated, and the monitoring pilot is for three years (162 weeks), so 81 weeks are allocated. Salaries for locally recruited consultants were estimated at $ 1,000 per week, and for internationally recruited consultants the salary was $ 2,500 per week.

Component	*Estimated consultant weeks*	*GEF ($)*	*Other sources ($)*	*Project total ($)*
Local consultants	2,135	1,092,500	1,042,500	2,135,000
International consultants	812	330,000	1,700,000	2,030,000
Total	2,947	1,422,500	2,742,500	4,165,000

CO-FINANCING SOURCES

Co-financing Sources				
Name of co-financier (source)	Classification	Type	Amount ($)	Status
SEMARNAT	National Government	In kind	15,574,780	Confirmed
	National Government	Cash		Confirmed
PEMEX	National Government	In kind	1,200,000	Confirmed
	National Government	Cash		Confirmed
NOAA	National Government	In kind	78,400,000	Confirmed
	National Government	Cash		Confirmed
EPA	National Government	In kind	1,600,000	Confirmed
	National Government	Cash		Confirmed
Sub-total co-financing			96,774,780	

Table 11: Total Budget

Award ID:						
Project Title: Integrated Assessment and Management of the Gulf of Mexico Large Marine Ecosystem						
GEF Outcome	**Sub-components**	**Amount ($) Year 1**	**Amount ($) Year 2**	**Amount ($) Year 3**	**Amount ($) Year 4**	**Total ($) All Years**
1. Transboundary issues analyzed and priorities defined	1.1 Capacities and gaps in regional monitoring methods/standards identified	20,000				20,000
	1.2 Key ecosystem assessment and management gaps identified	60,000	60,000			120,000
	1.3 Governance analysis of relevant policy and regulatory frameworks completed [as a basis for 2.1.4]	30,000	30,000	27,500		87,500
	1.4 Analysis of the socioeconomic impacts of priority transboundary issues, including a preliminary LME wide economic valuation of near shore and marine goods and services, undertaken	30,000	70,000	50,000		150,000
	1.5 TDA revised, finalized, published and disseminated			50,000		50,000
	Sub-total	**140,000**	**160,000**	**127,500**		**427,500**
2. The SAP and associated NAPS are formulated and adopted	2.1 Strategies and actions for the reduction and control of nutrient over-enrichment, HABs and for the elimination of dead zones developed	160,000	40,000	40,000		240,000
	2.2 Strategies and actions formulated for sustainable management and use of exploited living marine resources, and for the recovery of depleted fish stocks to within safe biological limits formulated	150,000	70,000	50,000	40,000	310,000
	2.3 Establishment of representative MPA	130,000	200,000	50,000	50,000	430,000
	2.4 The SAP and NAPs formulated and endorsed			70,000	50,000	120,000
	2.5 Commitments to SAP implementation obtained and sustainable financing arrangements formulated				30,000	30,000
	Sub-total	**440,000**	**310,000**	**210,000**	**170,000**	**1,130,000**
3. LME-wide ecosystem-based management approaches encouraged and strengthened through the successful implementation of the Pilot Projects	3.1 Enhanced Natural Habitat and Ecosystem Conservation of Coastal and Marine Zones of the Gulf of Mexico: Wetlands, Mangroves, Sea Grass Beds and Sand Dunes achieved through pilot project	70,000	225,000	225,000	150,000	670,000
	3.2 Shrimp Production Enhanced through Ecosystem Based Management	200,000	300,000	150,000	70,000	720,000
	3.3 Joint Assessment and Monitoring of Coastal Conditions in the Gulf of Mexico undertaken	170,000	560,000	40,000		770,000
	Sub-total					**2,160,000**
4. Monitoring and Evaluation System for the Project and the GoM LME established	4.1 M&E mechanisms set up including an M & E system for the project	56,000	70,000	70,000	60,000	256,000
	4.2 Suite of GEF M&E indicators developed (process, stress, environmental status) to monitor SAP implementation.	55,000				55,000
	4.3 GoM LME Environmental Information System developed	54,000	69,000			123,000
	4.4 Bi-annual regional status report developed on large scale ecosystem impacts in the GoM LME		17,500		17,500	35,000
	Sub-total	**165,000**	**156,500**	**70,000**	**77,500**	**469,000**
5. Effective project coordination	5.1 Regional Project Management Unit	63,000	63,000	63,000	61,000	250,000
	5.2 Steering Committee established and meeting	4,000	4,000	4,000	4,000	16,000

	5.3 Intersectoral coordination established through the development of Intersectoral committees (ISCs) in both countries, including with private sector involvement						**0**
	5.4 Appropriate regional coordination mechanism jointly defined, including the possibility of establishment of an R-TAG or a Gulf of Mexico Commission (GoMC)						**0**
	5.5 Information needs within the relevant sectors identified and addressed in order to ensure active and informed participation						**0**
	5.6 Robust public awareness strategies targeted at the different stakeholder levels and groups developed			20,000	20,000	10,000	50,000
		Sub-total	**67,000**	**87,000**	**87,000**	**75,000**	**316,000**
		Total					**4,502,500**

COST-EFFECTIVENESS

The project has been designed to ensure that outcomes are achieved in a cost-effective manner. The design includes three pilot projects that are all sited in the same area, Terminos Lagoon, in order to achieve greater cost-effectiveness, maximize synergies, and set the foundations for integrated, ecosystem-based approaches to natural resource management. Setting the pilot projects in the same location ensures that they will generate practical experiences to address a complex baseline of overlapping policies and competencies for protected area conservation, social and economic development and threats to terrestrial, coastal and marine biodiversity. Thus, the pilot projects will contribute to testing cost-efficiency models from a variety of different angles including ones focused on fisheries management and productive uses, habitat restoration and management, and robust M&E tools. Overall, efforts to establish functional and effective ecosystem-based management approaches are themselves cost-effective as the complex linkages and feedback mechanisms between natural systems, productive uses, governance frameworks, impacts on the LME from associated land-use activities are addressed in an integrated and comprehensive manner.

WORK PLAN

The Work Plan for the Components detailed above is presented below. A full implementation plan will be developed by the staff of the PMU immediately upon beginning its operation and will be submitted to the project Steering Committee for adoption.

Component and Activities	Year 1				Year 2				Year 3				Year 4			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Outcome 1 Transboundary issues analyzed and priorities defined																
1.1 Capacities and gaps in regional monitoring methods/standards identified																
1.2 Key ecosystem assessment and management gaps identified																
1.2.1 Biodiversity hot spots in GoM LME assessed and key knowledge gaps identified																
1.2.2 Existing information and data on status and trends in fisheries assessed																
1.2.3 Ecosystem-wide nutrient over-enrichment and contaminant sources, flows and levels assessed																
1.2.4 Environmental impacts of transboundary pollution on the GoM ecosystem assessed																
1.2.5 Information on nutrient over-enrichment and related HABs collected and integrated																
1.3 Governance analysis of relevant policy and regulatory frameworks completed [as a basis for 2.1.4]																
1.4 Analysis of the socioeconomic impacts of priority transboundary issues, including a preliminary LME wide economic valuation of near shore and marine goods and services, undertaken																
1.5 TDA revised, finalized, published and disseminated																
Outcome 2: Country agreement on and commitment to regional and national policy, legal and institutional reforms to address the agreed priority transboundary issues																
2.1 Strategies and actions for the reduction and control of nutrient over-enrichment, HABs and for the elimination of dead zones developed																
2.1.1 Regional Plan of Action for the Yucatan Peninsula RPA-YUCATAN developed by Mexico as a major contribution to reduce land based sources of marine pollution into the GoM LME, implemented.																
2.1.2 Strategic Partnerships between GoM LME programme and institutions responsible for integrated management of the major GoM river basins, as well as the main coastal cities, developed																

2.1.3 Stocktaking of the Papaloapan watershed Commission to define opportunities for replication in the Grijalva-Usumacinta and Panuco river basins in order to provide for strong inter-linkages between watershed management authorities and coastal managers.																
2.1.4 Strategies for harmonizing legislative, policy and regulatory frameworks on agricultural practices at LME wide levels developed, building upon the Gulf of Mexico Governors Alliance.																
2.2 Strategies and actions formulated for sustainable management and use of exploited living marine resources, and for the recovery of depleted fish stocks to within safe biological limits formulated																
2.2.1 Bi-lateral initiatives for regional surveying of productivity and oceanography, stock assessment and population assessments encouraged and strengthened																
2.2.2 Review effectiveness of compliance measures with existing fisheries legal and regulatory frameworks in both countries, especially with regards to IUU, excessive fishing capacity, and enforcement and surveillance, and propose appropriate reforms and measures.																
2.2.3 Develop fisheries management plans for selected key commercial fisheries																
2.3 Establishment of representatives marine protected areas (MPA) as a basis for meeting WSSD targets																
2.3.1 Recovery plans for depleted priority non-commercial species and associated marine flora and fauna developed for additional species not currently addressed																
2.3.2 Management and capacity building requirements to restore degraded marine coastal wetlands defined																
2.3.3 Marine and coastal spatial zoning processes in individual countries strengthened and implemented thus enhancing sectoral links among sectoral users in marine and coastal zones																
2.3.4 LME-wide strategies for conserving biodiversity and habitats in the coastal zones of GoM LME supported and harmonized at a regional level Marine and coastal spatial zoning processes in individual countries strengthened and implemented, thus enhancing sectoral links among sectoral users in marine and coastal zones																
2.4 The Strategic Action Programme (SAP) and National Action Progammes (NAPs) formulated and endorsed The SAP and NAPs formulated and endorsed																
2.5 Commitments to SAP implementation obtained and sustainable financing arrangements formulated																

Outcome 3: LME-wide ecosystem-based management approaches encouraged and strengthened through the successful implementation of the Pilot Projects																
3.1 Pilot Project on Natural Habitat and Ecosystem Conservation of Coastal and Marine Zones of the Gulf of Mexico: Wetlands, Mangroves, Sea Grass Beds and Sand Dunes																
3.2 Enhancing Shrimp Production through Ecosystem Based Management																
3.3 Joint Assessment and Monitoring of Coastal Conditions in the Gulf of Mexico																
Outcome 4: Monitoring and Evaluation System for the Project and the GoM LME established																
4.1 M&E mechanisms set up including an M & E system for the project																
4.2 Suite of GEF M&E indicators developed (process, stress, environmental status) to monitor SAP implementation.																
4.3 GoM LME Environmental Information System developed																
4.4 Bi-annual regional status report developed on large scale ecosystem impacts in the GoM LME																
Outcome 5: Effective project coordination																
5.1 Regional Project Coordination Unit set up																
5.2 Steering Committee established and meeting																
5.3 Intersectoral coordination established through the development of Intersectoral committees (ISCs) in both countries, including with private sector involvement																
5.4 An appropriate regional coordination mechanism jointly defined																
5.5 Information needs within the relevant sectors identified and addressed in order to ensure active and informed participation																
5.6 Robust public awareness strategies targeted at the different stakeholder levels and groups developed																

11.0 ADDITIONAL INFORMATION

11.1 Agreements

Endorsement from México

SECRETARIA
DE
HACIENDA Y CREDITO PUBLICO

SUBSECRETARÍA DE HACIENDA Y CRÉDITO PÚBLICO
UNIDAD DE ASUNTOS INTERNACIONALES DE HACIENDA
DIRECCIÓN GENERAL ADJUNTA DE AMÉRICA DEL NORTE, ASIA-PACÍFICO Y EL CARIBE

Oficio 347.A.-007

México, D.F. a 25 de junio de 2007.

SRA. MONIQUE BARBUT
Director Ejecutivo y Presidente
Fondo para el Medio Ambiente Mundial
1818 H Street, NW, MSN G 6-602
Washington, DC 20433 USA

Hago referencia al proyecto regional "Análisis Diagnóstico Transfronterizo y Programa de Acción Estratégico del Gran Ecosistema Marino del Golfo de México", que se encuentra en programación para ser desarrollado mediante un esquema Full Size Project con recursos del Fondo para el Medio Ambiente Mundial (GEF, por sus siglas en inglés) con la colaboración entre México y Estados Unidos de América.

Sobre el particular, me permito comentarle que el Gobierno de México después de analizar las ventajas comparativas de las agencias del GEF ha decidido desarrollar el proyecto únicamente con el apoyo de la Organización de las Naciones Unidas para el Desarrollo Industrial (ONUDI).

Asimismo, se considera necesario mantener el proyecto para su inclusión en el programa de trabajo del próximo mes de julio, por lo que le solicito atentamente realizar las gestiones correspondientes.

Sin otro particular, reitero a usted las seguridades de mi más atenta y distinguida consideración.

A t e n t a m e n t e ,
La Directora General Adjunta,

Claudia Grayeb Bayata

Claudia Grayeb Bayata

Ccp Unidad de Asuntos Internacionales de Hacienda.- SHCP.- Presente.
Subdirección de Estadísticas y Proyectos Agropecuarios y Ambientales.- SHCP.- Presente.

Co-financing commitment from Mexico

SUBSECRETARIA DE PLANEACIÓN Y POLÍTICA AMBIENTAL
DIRECCIÓN GENERAL DE POLÍTICA AMBIENTAL
E INTEGRACIÓN REGIONAL Y SECTORIAL

SECRETARÍA DE MEDIO AMBIENTE Y RECURSOS NATURALES

SEMARN

OFICIO NO. DGPAIRS/190/07

Mexico City, June 14, 2007.

Global Environmental Facility (GEF)
To whom it may concern

Mexico has made important advances in consolidating its environmental policy towards oceans and coasts, and the current administrations have placed importance on mainstreaming of the environment through cross-sector planning and budgeting. In 2006, SEMARNAT adopted a National Environmental Policy for the Sustainable Development of Oceans and Coasts, which establishes public policy guidelines and strategies in an effort to strengthened integrated environmental management of the coastal zone through structural reform, effective inter-institutional coordination and wide public participation.

As a member of the Steering Committee representing Mexico´s lead Federal Agency SEMARNAT, I am sure that the Gulf of Mexico Large Marine Ecosystem (GoM-LME) Project will provide with a favorable framework and input for a better ecosystem knowledge, conservation of marine and coastal assets, governance and support informed decision making in the Gulf of Mexico LME.

As the project objective states, there is a strong need to rehabilitate marine and coastal ecosystems, recover depleted fish stocks and to reduce nutrient overloading to the Gom-LME based on an assessment and management approach that considers this LME productivity, fish and fisheries, pollution and ecosystem health, socioeconomics and governance.

In such regard SEMARNAT and the Government of Mexico is convinced that using the ecosystem based approach along with enhanced legal and institutional framework and instruments will be critical to achieve all proposed results for the sustainable development and management of the GoM-LME, a project that includes three synergic demonstration projects that would also lead to craft greater benefits for our project partner country the US and Mexico.

These actions will be supported by appropriate legal, policy and institutional reforms and investments to address the priority transboundary issues identified and those needed to accomplish our commitments, and in order to achieve this endeavour, Mexico has launched earlier this year, the National Strategy for the Physical Sea and Land Use Planning of the Territory under a key

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t.+52 (55) 5628 0749, 5628 0750 www.semarnat.gob.mx

principle to build upon, coordinated and enhanced existing approaches. Among main tasks provided by this National Strategy is the creation of the permanent Inter-ministerial Commission for the Integrated Management of Oceans and Coasts (CIMIOC) with ten Mexican federal agencies currently involved in marine and coastal issues.

The accomplishment of the project represents a great opportunity to solve the GoM-LME complex issues in its regional context, based on the identification of emerging environmental issues and problems and based on the identification of critical areas for the long-term economic, social and environmental sustainability of the GoM-LME. The project will contribute to the coherence and effectiveness of policies and strategies, where policy and institutional frameworks need to be strengthened in order to provide an enabling environment for new management approaches.

Although bi-national frameworks for cooperation exist at various levels, ranging from NAFTA to technical cooperation agreements, there is no overarching framework that provides for structured and integrated cooperation and coordination on the basis of ecosystem-based management approaches. Additionally, both countries have an array of policies and strategies relevant to the sustainable management of the GoM-LME resources, but these are not harmonized. Therefore one of the main objectives of the GoM-LME project is to harmonize these policies into a coherent mosaic that will support ecosystem based management and the recovery of depleted fish stocks, the reduction of coastal pollution and the restoration of damaged habitats.

For instance, the transition towards the ecosystem-based management of the GoM-LME will depend on a greater convergence of policy instruments, including long-term, joint programs and actions, a clearer distribution of competences at all government levels in each country, and considering a robust monitoring and evaluation program. While the policy framework for the GoM-LME for both countries shares some similarities stemming from the fact that both are federal states, although the range of institutions with relevant mandates varies. Both Mexico and the US have national policies for ocean governance applied through a number of different instruments.

Mexico´s co-finance contribution to this GoM-LME GEF project are based and included in several government programs, actions and process lead by SEMARNAT and other participating government agencies and institutions as shown in Annex A of this document.

DR. ANTONIO DÍAZ DE LEÓN CORRAL
THE GENERAL DIRECTOR

C.c.p.- Dr. Fernando Tudela Abad. Subsecretario de Planeación y Política Ambiental. Presente.
Mtro. César Rafael Chávez Ortíz. Director General de Fomento Ambiental, Urbano y Turístico. Presente.

PAT/

OFICIO NO. DGPAIRS/190/07

ANNEX A

Mexico´s co-finance contribution to the Gulf Of Mexico Large Marine Ecosystem GEF Project

	GOM project components				
Co-finance component	Total US$	ProDoc	Pilot 1	Pilot 2	Pilot 3
ProDoc Outcome 1 Transboundary issues analysed and priorities defined	700000	700000			
ProDoc Outcome 2 Country agreement on and commitment to regional and national policy, legal and institutional reforms to address the agreed priority transboundary issues	3,000,000	3,000,000			
ProDoc Outcome 4 Monitoring and Evaluation System for the Project and the GoM LME established	3,000,000	3,000,000			
ProDoc Outcome 5 Effective project coordination	2,000,000	2,000,000			
Outcome 3 LME-wide ecosystem-based management approaches encouraged and strengthened through the successful implementation of the Pilot Projects					
Mapping and Selection of Target Restoration Sites	213,600		213,600		
Implementing Capacity building program for the integrated ecosystem based management	828,768		828,768		
Pilot Restoration and Rehabilitation Actions	1,068,000		1,068,000		
Public Awareness and Education Outreach	427,200		427,200		
Adaptive Management and Best Management Practices	170,880		170,880		
Stock evaluations and development of multi-species and full ecosystem models for shrimp fisheries integrated management	466,332			466,332	
Coastal ecosystem health indicators	3,700,000				3,700,000
Total US$	15,574,780	8,700,000	2,708,448	466,332	3,700,000

Co-financing commitment from the United States of America

UNITED STATES DEPARTMENT OF COMMERCI
National Oceanic and Atmospheric Administrati
NATIONAL MARINE FISHERIES SERVICE

Southeast Fisheries Science Center
75 Virginia Beach Drive
Miami, Florida 33149

June 25, 2007

Mr. Pablo Huidobro
Chief, Water Management Unit
UNIDO
Vienna International Centre
Vienna, Austria

Dear Mr. Huidobro:

It has been a pleasure interacting with the project team during the development of the Gulf of Mexico Large Marine Ecosystem program. I believe work completed to date on the Transboundary Diagnostic Analysis, pilot project conceptualizations, and the Project Document, itself, amply demonstrates the need for a Gulf of Mexico LME program and the benefits likely to accrue to participating nations. As a member of the Steering Committee representing the lead NOAA agency coordinating U.S. involvement, I believe the project offers important opportunities for cooperative and synergistic Gulf-wide studies, successful implementation of which will lead to improved science and management of marine resources throughout the Gulf of Mexico.

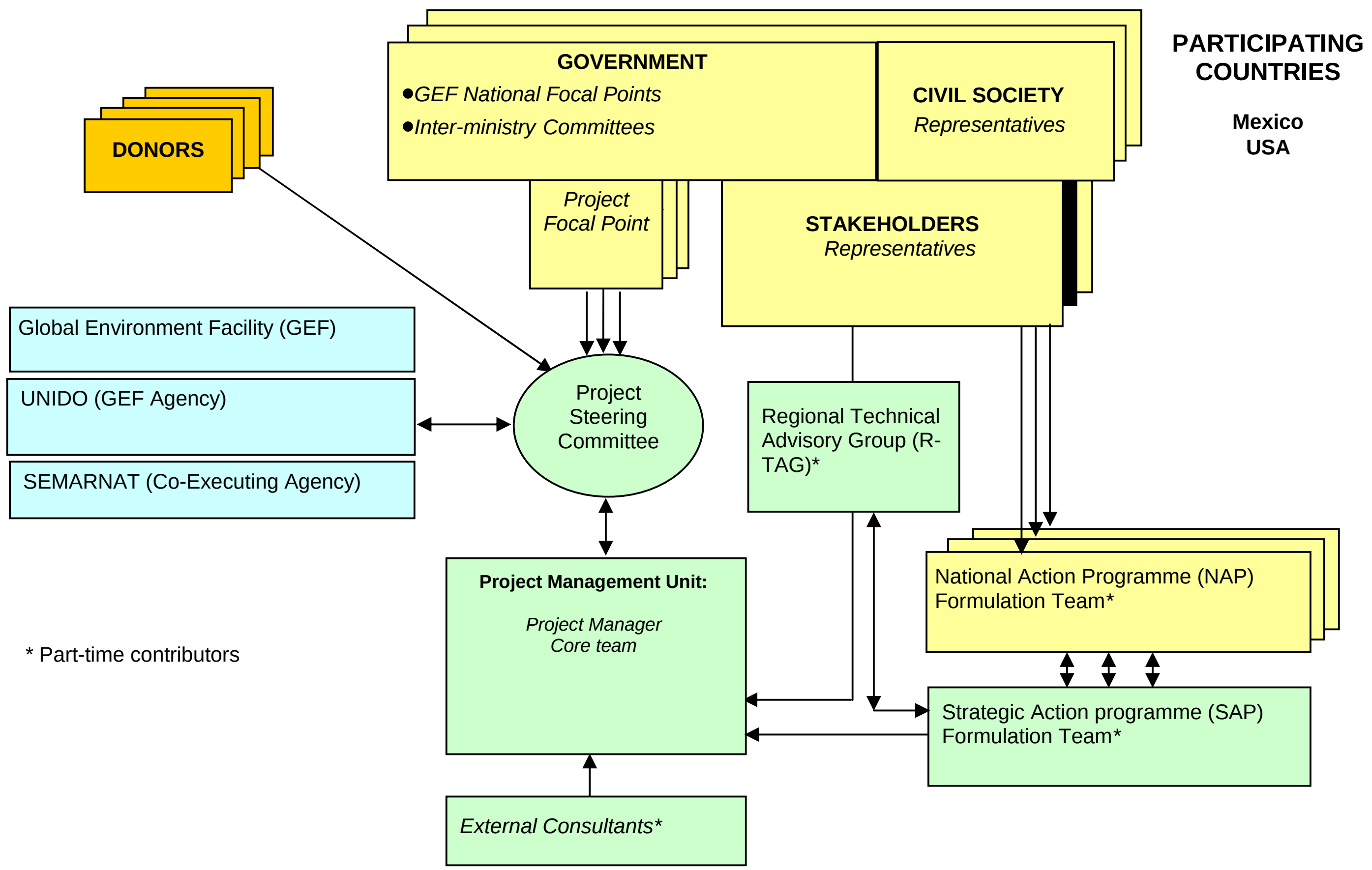
NOAA Fisheries currently conducts significant research and management operations designed to monitor populations and harvests of fishery resources in the Gulf of Mexico, to understand and protect marine mammals, sea turtles, and other depleted species, and to study the value and role of coastal wetlands and other habitats in the maintenance of sustainable populations of fish and shellfish. NOAA Fisheries works closely with other parts of NOAA, individual states, universities, and other federal agencies to address additional issues of concern in the Gulf of Mexico, including nutrient enrichment of coastal waters resulting in eutrophication and episodes of hypoxia, harmful algal blooms, invasive species, wetland restoration, coral reef productivity, and potential impacts of ports and energy development. For example, the U.S. EPA will be an active partner in this LME by assisting in the transfer and application of water quality analysis methodologies and monitoring strategies to key inshore waters of Mexico. We stand ready to engage other U.S. organizations, as necessary and as the program evolves, to ensure that appropriate skills and expertise are available to advance the goals of the program.

Many of the activities currently undertaken by NOAA Fisheries and the U.S. EPA are directly applicable to the Gulf of Mexico LME, and as such, form the basis of co-funding commitments to the fully developed project (SAP Phase). The following is a comprehensive list of subject matter in-kind contributions. Not included is the anticipated direct involvement of U.S. scientists and managers in specific activities such as pilot project workshops and training sessions, technology development and transfer, and attendance at various LME meetings. NOAA Fisheries and the U.S. EPA will contribute the following on an annual basis during the five-year life of the project: Fishery-Independent Monitoring Surveys (SEAMAP) - \$3.0M, and associated NOAA Vessel costs - \$4.0M; Fishery-Dependent Data Collections - \$2.0M; Fishery Observer Programs - \$4.0M; Stock Assessments (Shrimp and finfish) - \$2.0M; Habitat Research and Restoration - \$3.0M; Marine Protected Area Research - \$1.0M; EPA Water Quality Monitoring - \$1.6M. Funding of an unknown magnitude also will be provided to enhance fishery economics studies and sociological assessments of fishing communities. In addition, NOAA will make satellite remote sensing data (e.g., sea surface temperature, ocean color) available to the project on an as needed basis. Total annual co-financing approximates \$20.0M.

Sincerely,

Alex Chester, Acting Director

11.2 Organigram of Project



11.3 Stakeholder Analysis

The full Stakeholder Assessment and Involvement Plan appears in Appendix B

Gulf of Mexico Stakeholders: Directly and indirectly-related use sectors

Fisheries/aquaculture sector		
Stakeholder; website	**Status/function**	**Relevant activities/impacts in GoM**
American Sportfishing Association	Private trade association representing the American sportfishing community	Recreational fishing
Aquaculture industry association	Represents aquaculture interests	Aquaculture is an important economic activity (esp. in the U.S. GoM coast), with potential for severe environmental impacts (habitat destruction, pollution)
Fishing associations U.S. e.g. Southeastern Fisheries Association, Inc. (450 seafood companies, 85% located in Florida)	Represents fishing interests	Fish harvesting and processing
National Chamber for the Fishery and Aquaculture Industry (Mexico)	Trade association representing industrial fishers	Industrial fishing. Unsustainable practices contribute to overfishing
National Federation of Fishery Cooperatives (Mexico)	Trade association representing artisanal fishers	Artisanal fishing. Unsustainable practices contribute to overfishing
PROPEMEX	Parastatal entity; Processing/marketing	
Industrial/business sector		
Stakeholder/website	**Status/function**	**Relevant activities/impacts in GoM**
American Petroleum Institute; www.api.prg	National trade association representing all aspects of America's oil and natural gas industry	Works with the public, government, and others to develop and use natural resources in an environmentally sound manner
Chambers of Commerce; Rotary Club	Private associations of industries, businesses (e.g. Florida Chamber of Commerce; Mexico??). Represent businesses and industries	Some businesses are dependent on the natural GoM resources, and could also have negative environmental impacts. Also support environmental programs
Oil companies (BP Amoco, ExxonMobil, Chevron, Shell, etc.)	Petroleum exploration, production, refining	Petroleum industry (offshore and land-based) has high potential for severe environmental and living resources degradation. Companies engage in environmental monitoring, providing support for coastal and offshore conservation programs and projects, environmental training and awareness programs
PEMEX (Petróleos Mexicanos); www.pemex.com	A decentralized public entity of the Mexican Government; Petroleum exploration, production, refining, and petrochemicals	Potential for severe environmental and living resources degradation. Company engages in prevention, surveillance, monitoring and evaluation of the environmental impacts of PEMEX's activities

Shipping sector		Maritime transport and associated activities (ports, harbours, shipping). Impacts include pollution and introduction of exotic species
Tourism sector		Coastal infrastructure, pleasure craft, cruise ships, etc. Impacts include habitat degradation and pollution
Agroforestry sector		
Stakeholder/website	**Status/function**	**Relevant activities/impacts in GoM**
Farmers cooperatives in Mexican Gulf coast	Represents farmers	Agriculture and livestock farming are important activities in the drainage basin, and combined with deforestation, cause drastic changes in the GoM coastal areas from high nutrient, freshwater, and sediment runoff
Industry Led Solutions (US)	Coalition of leading producers of corn, soybean, rice, cotton, dairy, cattle, pork, poultry	Assists producers in addressing Clean Water Act issues. Develops, leads, and carries out a voluntary local basin wide strategy of non-point source nutrient management in each State's critical watersheds, ultimately reducing the delivery of excess nutrients to the Gulf of Mexico
National Council of Farmer Cooperatives (US)	Private cooperative	National representative and advocate for America's farmer-owned cooperative businesses. Farming in watershed could have severe impacts on the GoM (e.g. pollution)
Coastal residents		
Stakeholder/website	**Status/function**	**Relevant activities/impacts in GoM**
Coastal residents associations (e.g. Home Owners Associations,	Represent coastal and other concerned residents	Quality of life of coastal residents dependent on condition of coastal and marine areas. Urbanization and population encroachment in coastal areas are having a negative impact on nearshore habitats

Gulf of Mexico stakeholders: Policy/management/regulatory bodies (national level)
(* respondents to questionnaire)

Mexico		
Stakeholder; website	**Status/Function**	**Relevant activities in GoM**
Federal Agency for Environmental Protection (Procuraduría Federal de Protección al Ambiente - PROFEPA); http://www.profepa.gob.mx	Gov't agency. Environmental enforcement agency	Has coastal zone inspectors charged with enforcement of environmental norms and laws
National Commission for Aquaculture and Fishing	Gov't agency. Facilitates the	Fisheries and aquaculture are important economic sectors in

(Comisión Nacional de Acuacultura y Pesca - CONAPESCA) http://www.conapesca.gob.mx/	commercialization of fisheries products in international markets; promote national fisheries development through international cooperation. Falls under SAGARPA	GoM
National Commission for Protected Areas (Comisión Nacional de Áreas Protegidas -CONANP); http://www.conanp.gob.mx/	Gov't agency. Directs administrative policy for natural protected areas	Responsible for Protected Areas in GoM (e.g. Terminos Lagoon)
National Water Commission (Comisión Nacional de Agua – CNA) http://www.cna.gob.mx/	Gov't agency. Administration, enforcement; preserving Mexican national waters	Responsible for preservation of quality and quantity of national waters, including inland waters that may impact the GoM through drainage
Secretariat for Agriculture, Animal Production, Rural Development, Fisheries and Food (Secretaría de Agricultura, Ganadería, Desarrollo Rural, Pesca y Alimentación- SAGARPA); http://www.sagarpa.gob.mx/	Gov't agency. Supports the development of the agriculture and fisheries sectors. The National Fisheries Institute falls under SAGARPA	Fisheries (and to lesser extent aquaculture) is a major economic sector in GoM
Secretariat for Communications and Transportation (Secretaría de Comunicaciones y Transportes) Port Authorities; http://www.sct.gob.mx	Gov't agency. Regulates port operations	A number of major ports are located in the GoM
Secretariat for the Environment and Natural Resources (Secretaría de Medio Ambiente y Recursos Naturales-SEMARNAT); http://www.semarnat.gob.mx/	Gov't agency responsible for the environment and sustainable development throughout Mexico	Mandate covers GoM environment and natural resources
Secretariat for the Navy (Secretaría de Marina Armada de México); http://www.semar.gob.mx	National military/naval sectors	Has installations and operations in GoM
Tourism Board; http://www.visitmexico.com/wb2/Visitmexico/Visi_Home	Gov't agency. Designs and operates tourism promotion strategies; promotes ecotourism	Tourism a major economic activity in GoM
United States		
Stakeholder; website	**Status/Function**	**Relevant activities in GoM**
Agriculture Department; http://www.usda.gov	Gov't agency responsible for food, agriculture, natural resources, and related issues	Program in natural resources and environment, incl. issues related to water quality and agriculture
Environmental Protection Agency; http://www.epa.gov	Gov't agency. Leads the U.S. environmental science, research, education and assessment efforts; Develops and enforces regulations that implement environmental laws enacted by U.S. Congress.	Involved in a number of initiatives in the GoM to control nutrient inputs and restore coastal habitats. Partner in Gulf of Mexico Program, Gulf Ecological Management Site program, Gulf Estuaries program. Established the Mississippi River/Gulf of Mexico Watershed Nutrient Task Force, in partnership with a number of other federal and state agencies

*Florida Fish and Wildlife Conservation Commission; http://myfwc.com	Gov't agency. Conducts research, monitors and manages marine and estuarine fish and wildlife resources and their habitats and develops and implements techniques for restoring plant and animal species. FWC's Law Enforcement Division enforces state and federal fish and wildlife regulations	Mandate includes GoM
*Florida Keys Marine Sanctuary; http://floridakeys.noaa.gov	Marine Sanctuary. Manages the Florida Keys National Marine Sanctuary	Sanctuary located in GoM
*Florida Department of Agriculture and Consumer Services, Division of Aquaculture; http://www.floridaaquaculture.com	Gov't agency. Regulation of aquaculture and leasing of submerged state lands for aquacultural activities	Aquaculture is an important economic activity in the GoM, esp. in the U.S. Concerned about water quality, red tide, pollution
Gulf of Mexico Alliance; http://www.dep.state.fl.us/gulf/	A partnership among the five U.S. Gulf States	Objective is to protect and restore the environment of the GoM through greater regional cooperation. Priority issues are: improvements in water quality; restoration and conservation of coastal wetlands; environmental education; identification and classification of habitats for management; and reductions in nutrient loading. The Alliance released the Governors' Action Plan for Healthy and Resilient Coasts in 2006. Mexico is being considered as an international partner
*Gulf of Mexico Fisheries Management Council; http://www.gulfcouncil.org	Gov't agency responsible for fisheries management	Develop fishery management plans for fisheries in U.S. federal waters of the GoM
*Gulf States Marine Fisheries Commission; http://www.gsmfc.org	Gov't agency responsible for fisheries management	Fisheries management in the Gulf States. Projects include Southeast Area Monitoring and Assessment Program, Fisheries Information Network, Invasive Species Program, Interjurisdictional Fisheries Program
Minerals Management Service (Gulf of Mexico Offshore Region); http://www.mms.gov	Bureau of the U.S. Department of the Interior; manages mineral resources in an environmentally sound and safe manner.	Conducts extensive environmental studies program in the GoM to assess effects of oil and gas drilling and production on the marine, coastal and human environment (MMS Gulf of Mexico Outer Continental Shelf Region office)
National Marine Fisheries Service (U.S. Department of Commerce, NOAA); http://www.nmfs.noaa.gov	Gov't agency responsible for the management, conservation, and protection of living marine resources within the U.S. EEZ	SE Regional Office deals with U.S. GoM fisheries and habitat conservation. The NMFS Highly Migratory Species Division manages fisheries for transboundary migratory species
Natural Resource Agencies of the 5 U.S. Gulf States: Alabama Department of Conservation and Natural Resources (http://www.outdooralabama.com); Florida Department of Environmental Protection	Lead State agencies for environmental management, regulation and stewardship	Involved in a number of initiatives in the GoM. Florida Department of Environmental Protection is the main architect of the $7.8 billion funding and management plan to restore the Everglades

(http://www.dep.state.fl.us); Louisiana Department of Natural Resources (http://dnr.louisiana.gov); Mississippi Department of Marine Resources (http://www.dmr.state.ms.us); Texas Parks and Wildlife Department(http://www.tpwd.state.tx.us)		
Texas Commission on Environmental Quality; http://www.tceq.state.tx.us	State environmental agency	Regulates activities related to water quality, air quality, and waste, and offers selected programs aimed at pollution prevention in the State, as well as in the Texas-Mexico border region, including in the GoM. Cooperates closely with the EPA and Mexican counterparts (SEMARNAT) in a formal binational environmental program called Border 2012 (http://www.epa.gov/border2012/)
U.S. Army Corps of Engineers; http://www. http://www.usace.army.mil/	Part of the U.S. Army. A public engineering, design and construction management agency	Water resources and environment included in work areas. The Corps and the National Park Service are cooperating on restoring the hydrologic regime for the Everglades. Regulates all work in wetlands and waters of the U.S.
U.S. Department of the Navy; http://www.navy.mil/	Navy/Coast Guard	Naval and coast guard installation and operations in GoM
U.S. Department of Transportation (DoT); http://www.dot.gov	Gov't agency responsible for transportation	The Maritime Administration of DoT is responsible for maritime transportation, and promotes the development and maintenance of the U.S. merchant marine, incl. in the GoM

Gulf of Mexico stakeholders: Academic/research/advisory institutes
(* respondents to questionnaire)

Mexico		
Stakeholder; website	**Status/Function**	**Relevant activities in GoM**
*Autonomous University of Campeche (Universidad Autónoma de Campeche http://www.uacam.mx/ Programa de Ecología, Pesquerías y Oceanografía del Golfo de México - EPOMEX	Education and scientific research	Management of coastal ecosystems, fisheries management, geographic information systems, coastal pollution, aquaculture
Center for Investigation and Advanced Studies, National Polytechnic Institute (Centro de Investigación y de Estudios Avanzados del Instituto Politécnico Nacional -CINVESTAV); http://www.cinvestav.mx	Gov't institute; education and scientific research	Merida Unit of CINVESTAV conducts research on aquaculture, fisheries, biodiversity, coastal zone management, environmental health, marine biology and oceanography; Joint environmental monitoring programs in the GoM (e.g. with PEMEX)
*Colegio de la Frontera Sur (ECOSUR); http://www.ecosur.mx	Gov't institute; education and scientific research	Research on demersal fisheries resources; distribution of molluscan larvae; ecology; management and restoration of mangroves and seagrass beds
Institute of Ecology (Instituto de Ecología - INECOL); http://www.ecologia.edu.mx	Gov't institute; basic and applied scientific research	Ecology and evaluation of natural resources. One of its projects is "A Conceptual Model for Integrated Coastal Management in the Gulf of Mexico: Ecosystem Approach for Sustainable Development of Critical Areas", in collaboration with NOAA
*Institute for Investigation in Engineering (Instituto de Investigación en Ingeniería, Universidad Autónoma de Tamaulipas); http://fians.uat.edu.mx/iii	Gov't institute; scientific research	Studies on dynamics of coastal processes, principally in the Mexico-US coastal front
*National Polytechnic Institute (Instituto Politécnico Nacional –IPN); http://www.ipn.mx	Gov't institute; scientific research	Research on the management of marine resources; coastal zone management
National Fisheries Institute (Instituto Nacional de la Pesca - INP); http://www.inp.sagarpa.gob.mx	Gov't institute; scientific research. Research is conducted through Centros Regionales de Investigación Pesquera (CRIP)	Fisheries assessments (shrimps, groupers, etc), sets regulations (e.g. open and closed seasons), etc. Aquaculture research is conducted through its Centros Regionales de Investigación Pesquera (CRIP). Sponsors MEXUS-GULF, in partnership with the Southeast Fisheries Center
National Commission for Knowledge and Use of Biodiversity (Comisión Nacional para el Conocimiento y Uso de la Biodiversidad - CONABIO); http://www.conabio.gob.mx	Gov't institute; promote sustainable use and studies of biodiversity; disseminate information on biodiversity; focal point for biodiversity-related conventions	
Mexican Petroleum Institute (Instituto Mexicano	Gov't institute; research and technological	Petroleum industry well developed in GoM. Environmental

del Petróleo – IMP); http://www.imp.mx	development in the petroleum sector	impacts of petroleum industry, including in GoM
*Universidad de Quintana Roo; http://www.uqroo.mx	Gov't institute; education and scientific research	Management of natural resources, esp. commercial fisheries, integrating environmental, social, economic, legal and political aspects.
Other universities and affiliated institutes (e.g. UNAM-ICMyL, Universidad Veracruzana)	Research and education	A number of research projects in the GoM in areas incl. environmental variability, ecosystems and ecology, fisheries and aquaculture, population dynamics of marine populations, management and conservation, integrated coastal zone management. UNAM has a research vessel and the ICMyL conducts regular research cruises in the Mexican GoM (incl. on living marine resources)
United States		
Stakeholder; website	**Status/Function**	**Relevant activities in GoM**
*EPA Gulf Ecology Division, Office of Research and Development, National Health and Environmental Effects Research Laboratory; www.epa.gov/ged	Gov't institute; scientific research	Conducts research to support the protection and restoration of coastal ecosystems in the GoM. Engaged with partners in Mexico to improve monitoring and assessment of GoM ecosystems through the National Coastal Assessment and the Harmful Algal Blooms Observing System (HABSOS)
Florida Institute of Oceanography; http://www.marine.usf.edu/FIO/	An independent entity established by the State University System to support and enhance Florida's coastal marine science, oceanography and related management programs through education, research, and public outreach	A number of collaborative research programs in the GoM, e.g. expedition to map and sample Pully Ridge coral reef; plans for a comprehensive regional assessment of marine resources and habitats in all of Florida's waters including the GoM
*Gulf of Mexico Coastal Ocean Observing System (GCOOS); http://www.gcoos.org	Observing system	Developing a long-term coastal ocean observing system for the GoM in the U.S. EEZ to produce observations and products for socioeconomic requirements of stakeholders in the region.
*Harte Research Institute for Gulf of Mexico Studies; http://www.hri.tamucc.edu	Research and education	Conducts science and policy research focused on the long-term sustainable use and conservation of the Gulf of Mexico with all 3 bordering countries, on environmental issues and policy in the GoM. Has Advisory Council members from all 3 countries. One of its projects is GulfBase www.gulfbase.org/
Louisiana Universities Marine Consortium; http://www.lumcon.edu	Research, education	Coordinates and stimulates Louisiana's activities in marine research and education. Focus includes enhancement of fish populations, improvement of water quality, the Mississippi River-Gulf of Mexico continuum, estuarine ecosystems, environmental effects of habitat alterations, and interaction of science and policy

Mississippi River/Gulf of Mexico Watershed Nutrient Task Force; http://www.epa.gov/msbasin/taskforce/index.htm	Task force formed by the EPA, in partnership with other federal and state agencies	Provides executive level direction and support for coordinating the actions of participating organizations working on nutrient management within the Mississippi River/Gulf of Mexico Watershed. A draft Action Plan for Reducing, Mitigating, and Controlling Hypoxia in the Northern GoM has been prepared.
*Mote Marine Laboratory (Center for Shark Research); http://www.mote.org/sharks	Private research and educational organization	Much effort directed toward the Southwest Florida coastal region. Shark research, education, conservation in the U.S., Mexico and Cuba, in collaboration with these countries
*National Oceanic and Atmospheric Administration (U.S. Dept. of Commerce); http://www.noaa.gov	Gov't agency focused on studies and predictions of the condition of oceans and atmosphere	Focal areas: Ecosystems, Climate, Weather and Water, and Commerce and Transportation. Supports fisheries research through the National Sea Grant College Program. The four GoM Sea Grant college programs (Florida Sea Grant, Louisiana Sea Grant, the Mississippi-Alabama Sea Grant Consortium and Texas Sea Grant) are working with state and federal agencies, universities, non-profit organizations, and private industry along the GoM to prioritize research and information needs and to develop a strategic research plan. The Gulf of Mexico Research Plan (GMRP), which highlights the stakeholder-defined research priorities for the region, will be completed in early 2008. Has several initiatives in the GoM, in collaboration with other agencies. NOAA is a major stakeholder and partner in the GoM LME project
*NOAA Coastal Data Development Center; www.ncddc.noaa.gov	Gov't agency. Provides access to coastal data resources	Provide access to coastal data and information using a web-based search capability, metadata creation, data translation, geospatial display and archive. Current programs include Harmful Algal Blooms Observing System (HABSOS), Hypoxia Mapping, Priority Habitat Information System (PHINS)
Sea Grant Gulf of Mexico Offshore Aquaculture Consortium; http://www.masgc.org/oac/	A collaborative, U.S. Gulf-wide, university-based interdisciplinary research program	Address social, environmental, and technological issues related to offshore aquaculture endeavors in the GoM
Southeast Fisheries Science Center;	Gov't agency. Scientific research	Conducts research in support of federal laws and international agreements relating to living marine resources in waters adjacent to the southeastern U.S. (incl. GoM)
*Texas A&M University-Corpus Christi, Division of Nearshore Research; http://lighthouse.tamucc.edu/Main/HomePage	Scientific research and monitoring	Measure water level, meteorology, water current velocities, water quality parameters (Salinity, DO, pH, turbidity) in Texas and Mexico
U.S. Geological Survey (U.S. Dept. of the Interior); http://www.usgs.gov	Gov't agency. U.S.'s largest water, earth, and biological science and civilian mapping agency	Collects, monitors, analyzes, and provides scientific understanding about natural resource conditions, issues and

		problems. Provides scientific information to support management actions intended to reduce excess nutrients in the Mississippi River Basin and hypoxia in the GoM. Participates in the Mississippi River/Gulf of Mexico Watershed Nutrient Task Force
Universities and affiliated research centers (see http://www.gulbase.org)	Education and scientific research	A number of environmental and living marine resource research programs in the GoM

Gulf of Mexico Stakeholders: Major non-governmental organizations (national)

Mexico		
Stakeholder; website	**Status/Function**	**Relevant activities in GoM**
Centro Mexicano de Derecho Ambiental; http://www.cemda.org.mx	Private civil association. Contribute to the strengthening of national efforts in environmental protection	Focus on the sustainable management of natural resources and environmental protection, with emphasis on natural protected areas and species with priority for conservation
Mexican Fund for the Preservation of Nature (Fondo Mexicano para la Conservación de la Naturaleza – FMCN); http://www.fmcn.org	Private civil association for biodiversity conservation	Conservation of biodiversity of Mexico and ensuring sustainable use of its natural resources, through the promotion of strategic actions and medium- to long-term financial support
Pronatura; http://www.pronatura.org.mx	Private civil association. Conservation of flora, fauna, and priority ecosystems	Work program focuses on more than 500,000 ha of wetlands in five reserves in the Yucatan Peninsula, and in conservation, monitoring, environmental education, and creation and strengthening of local capacity. Among Pronatura's branches are Pronatura Península de Yucatán, Pronatura Noreste A.C., and Pronatura-Veracruz
United States		
Stakeholder; website	**Status/Function**	**Relevant activities in GoM**
Gulf of Mexico Foundation; http://www.gulfmex.org	Private non-profit corporation founded by citizens representing agriculture, fisheries, business and industry, tourism, and the environment	Promote wise utilization and conservation of the GoM and its resources, through education, public awareness, research, and leadership programs. One of its projects is the Gulf of Mexico Community-based Restoration Partnership (GCRP), a regional partnership of state and federal governmental entities, non-profit organizations, citizens, and businesses to provide funding and support for coastal habitat restoration projects
Gulf of Mexico States Partnership; http://www.gulfofmexicostatespartnership.com/	Private sector advocacy organization for the GoM border states	Supports the GoM Congressional Caucus in its mission of education, consensus-building and creation of new

		regional initiatives in the areas of transportation, homeland security, energy, environment, economic development, education, and international trade in the border states of the GoM basin
Gulf Restoration Network; http://healthygulf.org/	Network of environmental, social justice, and citizens' groups and individuals	Committed to restoring the GoM to an ecologically and biologically sustainable condition. Formed in 1994 to raise awareness of environmental issues in Gulf States and to increase communication and coordination of member activities across the region. Plays a pivotal role in providing members and others with technical information, Gulf-wide networking opportunities, and communication that empowers local communities to successfully address the environmental threats that they face
The Ocean Conservancy; http://www.oceanconservancy.org/site/PageServer?pagename=home	Non-profit organization dedicated to protecting ocean environments and marine life	Has a regional GoM Office in Texas, and is engaged in programs to address overfishing and restore key fish populations in the GoM

Gulf of Mexico stakeholders: Major regional organizations

Stakeholder; website	Status/Function	Relevant activities in GoM
Accord of the States of the Gulf of Mexico; http://www.gomsa.org	GoMSA was signed in the city of Campeche, Mexico on May 13, 1995 by representatives of the 11 bordering U.S. and Mexican States. It brings together public officials, entrepreneurs, investors, scientists and educators	The objective of the Accord is to establish working partnerships among the 11 States to promote economic and infrastructure development, educational and cultural exchanges
(CARICOMP Programme; http://www.ccdc.org.jm/caricomp_main.html	Conducts long-term, region-wide comparative studies of the biodiversity and productivity of Caribbean coastal ecosystems	Monitoring sites in GoM (Campeche, Cancun, Celustun). CARICOMP institutions in Mexico are UNAM-ICMyL, CINVESTAV (Merida) and EPOMEX
Gulf Ports Association of the Americas; www.gulfportsaa.com/index.htm	Association of a number of port authorities in the Mexican and U.S. Gulf coasts	Provides GoM port users with innovatively managed and environmentally responsible facilities
Gulf and Caribbean Fisheries Institute; www.gcfi.org	Independent non-profit corporation	Promotes exchange of current information and dialogue among scientific, governmental, and commercial sectors, on the use and management of marine resources in the Gulf and Caribbean region
Inter-American Development Bank; http://www.iadb.org	Initiative of the Latin American countries; a regional development financial institution to foster the economic and social development of borrowing member countries	Mexico and U.S. are members of IADB

North American Commission for Environmental Cooperation; http://www.cec.org/home/index.cfm?varlan=english	Created by Canada, Mexico and the U.S. under the North American Agreement on Environmental Cooperation	Addresses regional environmental concerns in North America, helps prevent potential trade and environmental conflicts, and promotes the effective enforcement of environmental law
OLDEPESCA; http://www.oldepesca.org	Organization of Latin American States to promote fisheries development and adequate utilization of fisheries resources. Areas of action for OLDEPESCA cooperation are research into fishery resources, exploitation of fishery resources, industrialization, support infrastructures, aquaculture, technological development, commercialization, training and international cooperation	Mexico is a member of OLDEPESCA
Regional Seas Programme (UNEP) – see International Stakeholders		
WECAFC; http://www.fao.org/fi/body/rfb/wecafc/wecafc_home.htm	Advisory Regional Fisheries Body for the Western Central Atlantic region. Facilitates the coordination of research, encourage education and training, and assist members in establishing rational policies for management of resources that are of interest for two or more countries in the Western Central Atlantic. No regulatory powers	GoM falls within the WECAFC area. Both Mexico and U.S. are members

Gulf of Mexico stakeholders: Major international organizations

International NGOs		
Stakeholder; website	**Status/Function**	**Relevant activities in GoM**
International Coral Reef Initiative (ICRI); http://www.icriforum.org	Partnership among governments, international organizations, and NGOs. Strives to preserve coral reefs and related ecosystems. ICRI operational networks include GCRMN (www.gcrmn.org) and ICRAN (www.icran.org)	A number of reef monitoring sites in the GoM
Reefcheck Foundation; www.reefcheck.org	Non-profit organization dedicated to conservation of tropical coral reefs and California rocky reefs	A number of reef monitoring sites in the GoM
The Nature Conservancy; http://www.nature.org/?src=t1	A conservation organization working worldwide to protect ecologically important lands and waters	TNC has completed an ecoregional plan for the northern GoM, which identified a network of priority sites that represents the marine biological diversity of the coastal waters of this area. The Gulf of Mexico Initiative develops and implements strategies to address the main threats to GoM coastal and marine biodiversity—habitat destruction

		and fragmentation. The initiative focuses on habitat restoration, ecosystem management and regional ocean governance (the latter in partnership with the GoM Alliance)
World Conservation Union; http://www.iucn.org	World's largest and most important conservation network	A number of marine protected areas in the GoM. Mexico and the U.S. fall under the North America Region of the World Commission on Protected Areas. A key partner with NOAA and IOC-UNESCO in developing and promoting the LME approach to management of living marine resources
World Wildlife Fund; http://www.wwf.org	Privately supported international conservation organization, with programs worldwide	WWF and TNC are undertaking a major regional assessment of Central America's Mesoamerican Reef to determine the impacts of climate change on coral reefs
UN Organizations		
Stakeholder; website	**Status/Function**	**Relevant activities in GoM**
FAO; http://www.fao.org	Responsible for agriculture, forestry and fisheries. Fisheries and Aquaculture Department facilitates and secures the long-term sustainable development and utilization of the world's fisheries and aquaculture. Responsible for a fisheries-related non-binding international agreements (e.g. Code of Conduct)	Mexico and U.S. are members of FAO. Implementing/executing agency of GEF project on reduction of environmental impacts from shrimp trawling
IMO; http://www.imo.org	Responsible for maritime develop and maintaining a comprehensive regulatory framework for shipping. Its remit includes safety, environmental concerns, legal matters, technical co-operation, maritime security and shipping efficiency. Responsible for a number of international conventions (e.g. MARPOL, Ballast Water)	Of major relevance to the GoM considering that shipping is a major economic activity. Mexico and U.S. are members of IMO
UNDOALOS; http://www.un.org/Depts/los/index.htm	Responsible for implementation of the UN Convention on the Law of the Sea	Mexico and U.S. are parties to UNLOS Convention
UNDP; http://www.undp.org	Responsible for development at global and national levels	UNDP is the GEF implementing agency for the other project in the region and was implementing agency for the PDF-B of the GoM LME project
UNEP; http://www.unep.org	Responsible for the environment, and administers a number of regional and international environmental conventions (e.g. Cartagena Convention, GPA, CBD, CITES)	UNEP is represented by its Regional Office for Latin America and the Caribbean (Panama) and the Caribbean Regional Coordinating Unit (Jamaica), which administers the Caribbean Environment Programme (one of the UNEP administered Regional Seas Programme) through the Caribbean Action Plan. The GoM falls under the UNEP Regional Seas Programme (part of the Wider Caribbean Regional Sea). The CAR/RCU serves as the secretariat for the Cartagena Convention for the Protection and Development of the Marine Environment of the Wider

		Caribbean. UNEP/RCU is involved in the implementation of the Regional Plan of Action for the Yucatan Peninsula
UNESCO; http://www.unesco.org	Promotes education, science, culture and communication. Intergovernmental Oceanographic Commission (IOC) of UNESCO is responsible for the marine programmes	IOCARIBE is a regional subsidiary body of IOC-UNESCO (IOC Sub-Commission for the Caribbean and Adjacent Regions). IOC is responsible for the regional component of the Global Ocean Observing System, IOCARIBE-GOOS. Everglades National Park is a UNESCO World Heritage Site
UNIDO; http://www.unido.org	Responsible for sustainable industrial growth in countries with developing and transitional economies	UNIDO is the GEF agency for the GoM LME project
	Donor agencies	
GEF; http://www.gefweb.org	An independent financial organization that provides grants to help developing countries protect the global environment. Support projects related to biodiversity, climate change, international waters, land degradation, the ozone layer, and persistent organic pollutants	GEF is funding a number of projects in Mexico, and is a major donor for the GoM LME project. Another GEF project in the GoM is 'Protection of environmental services of coastal wetlands in the Gulf of Mexico to the impacts of climate change'
World Bank; http://www.worldbank.org	An international bank for reconstruction and development, and a source of financial and technical assistance to developing countries. One of the three implementing agencies of the GEF	Supporting the Mesoamerican Barrier Reef project
	Regulatory Body	
Stakeholder; website	**Status/Function**	**Relevant activities in GoM**
ICCAT; http://www.iccat.es	Responsible for the conservation of tunas and tuna-like species in the Atlantic Ocean and adjacent seas, including the GoM	Mandate covers the GoM. U.S. and Mexico are members of ICCAT

11.4 STAP Roster Technical Review and Response to STAP comments

STAP ROSTER TECHNICAL REVIEW OF THE PROPOSED GEF-IW PROJECT:
"INTEGRATED ASSESSMENT AND MANAGEMENT OF THE GULF OF MEXICO LARGE MARINE ECOSYSTEM
(MEXICO AND UNITED STATES OF AMERICA)

by J. A. Thornton PhD PH CLM
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INTRODUCTION

This review responds to a request from the United Nations Development Programme (UNDP) and the United Nations Industrial Development Organization (UNIDO) to provide a technical review of the proposed International Waters project seeking to develop a Strategic Action Program (SAP) for the Gulf of Mexico Large Marine Ecosystem (LME).

I note that I am a designated expert on the STAP Roster of Experts with particular experience and knowledge concerning watershed management and land-ocean interactions. I have served as Government Hydrobiologist with the Zimbabwe Government, Chief Limnologist with the South African National Institute for Water Research, Head of Environmental Planning for the City of Cape Town (South Africa), and, most recently, as Principal Environmental Planner with the Southeastern Wisconsin Regional Planning Commission (USA), a position that I hold concurrent with my position as Managing Director of International Environmental Management Services Ltd, a not-for-profit corporation providing environmental education and planning services to governments worldwide. In each of these positions, I have had oversight of projects and programs designed to assess contaminant loads to aquatic ecosystems from land-based activities, and to develop appropriate and affordable mitigation measures to reduce such loads and minimize their impacts on the aquatic environment, both freshwater and marine.

This review is based upon a thorough review of the UNDP Project Document (74 pages inclusive of the Logical Framework Analysis and Incremental Cost Reasoning), and the three Pilot Project narratives ("Restoring Depleted Shrimp Stocks through Ecosystem-based Management Practices in the Gulf of Mexico Large Marine Ecosystem," 15 pages; "Joint Assessment and Monitoring of Coastal Conditions in the Gulf of Mexico," 16 pages; and, "Habitat and Ecosystem Conservation of Coastal and Marine Zones of the Gulf of Mexico: Wetlands, Mangroves, Sea Grass Beds and Sand Dunes," 34 pages) of the GEF-UNDP/UNIDO International Waters project, entitled: "Integrated Assessment and Management of the Gulf of Mexico Large Marine Ecosystem." Other, relevant documents served as reference sources, including the GEF *Operational Strategy*, *Agenda 21*, and related materials establishing the necessity and priority of land-based activities to control marine pollution as set forth in the Global Program of Action for the Protection of the Marine Environment from Land-Based Activities (GPA).

SCOPE OF THE REVIEW

This review addresses, *seriatim*, the issues identified in the Terms of Reference for Technical Review of Project Proposals.

KEY ISSUES

Key issue 1. Scientific and technical soundness of the project. Overall, the project appears to be scientifically and technically sound. The approach proposed, which includes a further development of the preliminary Transboundary Diagnostic Analysis (TDA), conduct of targeted demonstration projects, formulation of an agreed Strategic Action Program (SAP), and implementation of project management arrangements—including project monitoring and evaluation, designed to contribute to the creation of a formal intergovernmental cooperation mechanism for the transboundary waters of the Gulf of Mexico LME, adequately addresses the needs to initiate multilateral actions to reduce land-based impacts on the Gulf of Mexico LME.

The Gulf of Mexico is a major international waterway. As such, it has been extensively studied by the adjacent countries, at least insofar as their economic interests extend into its waters. Beyond that coastal economic zone, the oceanography of the Gulf has been studied since the Gulf of Mexico forms the point of origin of the Gulf Stream, a major contributor to the global circulation of the North Atlantic Ocean. However, all of these investigations, as is noted in the Project Document have been relatively uncoordinated or sectorally driven. This has resulted in a fragmented knowledge base, focused primarily on the nearshore waters of the Gulf of Mexico LME. Consolidation of this knowledge base would have significant scientific value to the oceanographic community, helping researchers to highlight gaps in knowledge, identify specific areas of research requiring attention, and develop greater insights into this globally-important marine resource.

It also should be noted that the coastal countries have differing capacities to conduct oceanic research and monitoring and differing abilities to respond to threats facing the Gulf of Mexico. Through the conduct of joint research and scientific activities within the framework of this project, it is anticipated that capacities will be strengthened. It is equally likely that the institutional relationships developed as a result of this project will contribute to the development of ongoing relationships between Gulf organizations that will extend beyond the project period. Indeed, it is a stated objective of the project to create not only the framework of an institutional mechanism for the joint management of the Gulf of Mexico but also contribute to a shared understanding the Gulf of Mexico LME.

As one of the first major transboundary ocean basins to evidence anthropogenic hypoxia, the Gulf of Mexico is potentially the forerunner of the future state of many enclosed oceanic basins in proximity to terrestrial nutrient sources, and receiving nutrient-rich runoff from major river systems. In the case of the Gulf of Mexico, the Mississippi River, draining the central portions of the United States of America (US) is the single largest source of nutrient input to the Gulf, but several major rivers draining the US southwest and Mexico also contribute to the development of hypoxia in the Gulf. As a result, this project can also serve as a demonstration project for actions to limit marine pollution from land-based activities, the goal of the Protocol to the United Nations Convention on the Law of the Sea (UNCLoS) of the same name. Lessons learned from this project, when shared through the scientific literature, technical symposia and the IW-LEARN best practices database, amongst others, could contribute to the prevention or management of similar conditions elsewhere in the world.

To this end, the inclusion of three demonstration projects within the proposed Gulf of Mexico project, and focused on the three priority concerns identified during the framework TDA preparation, seek to address specific issues of concern; namely, depleted shrimp stocks through ecosystem-based management practices, joint assessment and monitoring of coastal conditions, and habitat and ecosystem conservation of coastal and marine wetlands, mangroves, sea grasses and sand dunes. Experiences gained through these activities will contribute to the global knowledge base relating to LMEs and their associated drainage areas. The joint assessment and monitoring project will form the basis for ongoing collaboration between the coastal countries, while the shrimp production project will prepare a methodology, embodied in an ecosystem model, which could form the foundation for the development of similar approaches to managing other high value, over-harvested marine organisms within the Gulf (and elsewhere). The siting of all three demonstration projects within the area of the Terminos Lagoon takes advantage of the substantial body of knowledge already acquired on this embayment, in addition to contributing to the synthesis and integration of this knowledge the necessary policy instruments for the efficient and rapid implementation of a fully integrated near shore ocean management program within the project period.

In the end, the marriage of these scientific findings with the institutional, legal and policy instruments that currently exist or that will be developed during the project period will aid in the creation of an appropriate regulatory framework, and creation of the necessary infrastructure to support and sustain the environmentally-sound management of the Gulf of Mexico.

Key issue 2. Identification of global environmental benefits and/or drawbacks of the project, and consistency with the goals of the GEF. The proposed project establishes a framework within which to address the three major causes of environmental stress within the aquatic environment of the Gulf of Mexico; namely, eutrophication, habitat modification, and over-harvest of commercially important species. The activities associated with the development of a Strategic Action Program to address these three principal environmental concerns, identified during project preparation, will have relevance to the human response to these issues in other areas. Based upon the evaluation completed as part of the GEF IW-supported Global International Waters Assessment (GIWA), these three threats represent some of the most commonly occurring threats to the marine environment on a worldwide basis. Consequently, development of mechanisms to mitigate, moderate or manage these impacts is wholly consistent with the GEF IW focal area. Operational Program 9 (OP 9) of the GEF seeks to encourage a broadly based, multisectoral approach to resolving conflicts in the area of international and transboundary waters. Further elaborated as Strategic Objective 1 (SO-1) of the IW portfolio under GEF-4, OP 9 builds multi-state cooperation mechanisms to address priority concerns through an ecosystem-based management strategy.

To this end, the proposed project further addresses two strategic priorities within the GEF IW portfolio; namely, the management of fish stocks and associated biodiversity (SP-1), and the reduction of eutrophication or enrichment of coastal waters caused by anthropogenic nutrient inputs (SP-2). In terms of the former priority, this project would have crosscutting linkages to the protection of marine biodiversity, immediately relative to shrimp and ultimately relative to other species, especially those of economic value.

The participation of the relevant governmental organizations with responsibility for the marine environment, including environmental protection and marine fisheries agencies, would be an important element in ensuring the implementation of the project outcomes. This participation is provided through the relevant national, state, and local government agencies. Establishment of a functional operational agency, as proposed in the project document, also will contribute to achieving this objective.

Finally, true global benefit is presumed as a result of the connection of the Gulf of Mexico with the Atlantic Ocean by means of the Gulf Stream Current. This part of the Atlantic Ocean circulation has significant implications for the European climate, among other benefits.

Key issue 3. Regional context. The Gulf of Mexico is bounded by the landmass of North America. Within this landmass, the nations of Mexico and the United States of America comprise the southern/western and northern extremes of the Gulf, respectively, while the island state of Cuba is located at the eastern extreme of the Gulf. While Cuba was a participant in the project development activities, the country has opted not to participate in the SAP formulation. From a socio-political perspective, this posture does not detract from the conduct of the proposed project, and the emphasis of the GEF IW program on information sharing and dissemination means that the results of the project will be available to the government of Cuba for their consideration. That said, the dominant geographic positions of Mexico and the US are such that the project area encompasses virtually all of the land mass draining to the Gulf.

Both Mexico and the United States are members, *inter alia*, of the North American Free Trade Agreement (NAFTA) area, which entity provides the regional context for this project. Amongst its other provisions, the NAFTA includes environmental provisions that are recognized and supported by this project. In addition, there are numerous other binational and international agreements to which the participating countries are party that contribute to the regional context for this project. One of the binational initiatives that merits noting is the Gulf of Mexico Alliance, comprised of the six Mexican and five US states that border the Gulf and supported by the federal agencies and other stakeholders from both countries. As noted in the project document, this Alliance could provide "a model for regional and international collaboration."

The proposal clearly indicates an intention to disseminate information and results on a regional basis, both within the Gulf of Mexico Basin and elsewhere. In part, this dissemination process will utilize the offices of the national and state governments in both countries. The project also proposes inclusion of other stakeholders, particularly from commerce and industry, nongovernmental organizations (NGOs), and academia, who will also contribute to the regional context within which the project is to be executed.

Key issue 4. Replicability. The implementation of the three demonstration projects is a key feature of this project, and clearly contributes to the potential for replication of beneficial practices and techniques. Further, the inclusion of mechanisms for disseminating information and results achieved fosters replication of effective and successful measures. To this end, the project explicitly includes a variety of stakeholders outside of the governmental bodies noted as participating in the project. As noted above, these stakeholders include the private sector, NGOs, and academia. The inclusion of the latter will promote the use of the project findings within classrooms and in the community. Participation of NGOs and academic institutions will help to disseminate knowledge of the Gulf, share information on best management practices (BMPs), and facilitate public “buy in” with respect to the project outcomes. Similarly, inclusion of the private sector participants will encourage their participation in the implementation of the strategies identified under the SAP.

Outside of the project area, the documentation of project results and dissemination of the outputs through websites, scientific publications, and other media will facilitate replication of the techniques and approaches in other LMEs bounded by significant landmasses. As noted elsewhere, potential areas for replication can be identified in the GIWA inventories; many of the world’s enclosed gulfs and seas would benefit from the integrated land and water resource management approach being proposed for the Gulf of Mexico. To this end, the participation in the project of global and regional NGOs, scientific institutions, corporations and other stakeholders provides a mechanism for targeted dissemination of information leading to possible replication of BMPs in appropriate situations elsewhere in the world.

Key issue 5. Sustainability of the project. A significant element of the sustainability of the project rests upon the participation of the local, state and national governments, their operational agencies, and other civil institutions. This participation is indicated in the project document through tasks to be performed by these (largely unspecified) entities, through the governmental financial commitments to the project (Section III), and through agency participation in project management (Section I, Part III). While there is always a risk that agency budgets may limit participation—this risk being identified in the project document—the likelihood is that these agencies and organizations will continue to maintain an interest in the project outcomes. In the case of this project, the level of risk has been determined to be low to moderate, which seems a reasonable representation of the prevailing situation in the region. Consequently, there is a high likelihood that the project will be sustainable beyond the period of GEF intervention. This likelihood is increased through participation in the project by civil society stakeholders, identified as NGOs, corporations, and local governments. These stakeholders, yet to be identified under most Outcomes except as external consultants in the organigram presented in Section 10.2 of the proposal (with the exception of Outcome 3 as elaborated in the pilot projects in Appendix C, have a more immediate and direct link to a sustainable strategy for the management of the marine resources of the Gulf and its riparian lands. Based upon the stakeholder identified in the Stakeholders Assessment (Appendix B), there is a high likelihood of the project securing sustainable participation in other aspects of the project.

Beyond this factual basis, the target of the project, embodied in at least one of the pilot projects, is sustainable management of high value marine resources; namely, shrimp. Development of resource management plans, a stated output of the project, and the inferred desire of the economic stakeholders for continuation of their livelihoods, would also suggest a strong potential for sustainability of the strategies developed within the framework of the SAP. Dissemination of the outputs of the project as a whole, and not only of the pilot projects, will encourage “buy in” by civil society in a more general sense, leading to sustainable outcomes.

Finally, the project proposes the creation of a bi- or multi-lateral body that would coordinate actions among the Gulf countries that will build from and continue the momentum of the project coordination unit (PCU) and its professional staff. The evolution of the PCU into a coordination mechanism bodes well for the sustainability of the project outcomes.

Key issue 6. Targeted Research Projects. Targeted technical demonstration and capacity building projects are key features envisioned within the GEF International Waters Operational Program. These activities are clearly included as major elements of this proposed project. The interventions proposed under the pilot projects, funded in part by the GEF, strive for sustainability and the continuation of successful interventions beyond the project period. Consequently, it is important that the demonstration projects continue to be monitored, and the results reported using the information dissemination mechanisms previously identified, beyond the project period. Such an approach is totally consistent with the catalytic nature of the GEF, and an essential element to the sustainability of the project.

Capacity building and institutional strengthening, envisioned in the project document, become the basic building blocks upon which this project will succeed or fail, both from the point of view of its sustainability and from its scientific and technical integrity. Inclusion in this aspect of the project of not only governmental entities but also corporate and community stakeholders should form a broad base from which targeted research can be translated to practical experience and hence into replicable BMPs.

SECONDARY ISSUES

Secondary issue 1. Linkage to other focal areas. This project is formulated as an International Waters project under OP 9 of the GEF *Operational Strategy*. While no specific crosscutting areas are identified, the project clearly has linkages to the crosscutting area of protection of aquatic biodiversity in terms of its potential beneficial impact on fisheries, as embodied under Strategic Priority 1 of GEF-4.

Secondary issue 2. Linkages to other proposals. The project constitutes the first LME project in the Latin America and Caribbean (LAC) Region. Consequently, no specific linkages exist between this project and other GEF IW initiatives in the LAC Region. However, the project does propose to make explicit use of the GEF IW-LEARN network as a means of disseminating the results and outputs of the project.

Additionally, the project identifies specific linkages with ongoing initiatives of the United Nations, including: the United Nations Environment Programme (UNEP) Wider Caribbean Regional Seas Programme, the Food and Agriculture Organization of the United Nations (FAO) Western Central Atlantic Fisheries Commission (WECAFC), and the United Nations Education, Scientific and Cultural Organization (UNESCO)-Intergovernmental Oceanographic Commission (IOC) Sub-commission for the Wider Caribbean (IOCARIBE).

The project also recognizes the complementarities between the management of transboundary waters of the Gulf of Mexico and the management of the national coastal waters, linking with national- and state-level programs within each of the participating countries. In addition, the project has complementarities with other (global) projects utilizing land-based actions to minimize degradation of the marine environment as a result of land-based activities under the GPA.

These linkages contribute to a high degree of connectivity within this project, and contribute to the likelihood that the actions undertaken will be sustainable, and that the lessons learned can and will be transferred beyond the project boundaries to other, similar situations and locations.

Secondary issue 3. Other beneficial or damaging environmental effects. The project has no known or obvious damaging environmental impacts associated with the activities that it is proposed to execute. The beneficial impacts of the project have been fully articulated above, and include the implementation of targeted interventions that address both chronic land-based sources and potential, catastrophic ocean-based events that contribute to the degradation of the Gulf of Mexico and its resources.

The provision of trained staff and institutional capacities needed to enforce and enhance existing environmental protection regulations, and the dissemination of successful management measures further contribute to the benefit of the Gulf and its drainage basin in both coastal countries. All of these benefits accrue not only within the project area, but, as a result of their wider dissemination using the electronic and other media provided, also to the wider Caribbean basin and beyond.

In this latter regard, the explicit connections between the project and ongoing national initiatives are noteworthy. Specifically, these connections are embodied in large part within the elements of Outcome 2 that are fully cofinanced.

Secondary issue 4. Degree of involvement of stakeholders in the project. The involvement of stakeholders is extensive, although limited to national-, regional-, and international-level governmental bodies, functional bodies including academia and NGOs, and resource users. Involvement of the wider public is catered for through informational programming inherent in the project dissemination proposals, and through the involvement of NGOs. It should be noted that the proposal states that identification of local level stakeholders was not undertaken. Given the scale of the Gulf and its drainage area, and the potential numbers of such organizations, both governmental and nongovernmental, this decision is not unreasonable. Nevertheless, it is to be hoped that the involvement of national institutions will provide opportunities for these entities to liaise with their counterpart state and local governmental bodies during the course of the project. The exception to this generalization is the pilot projects, which make explicit linkages with such local institutions and organizations. In this regard, the participation of the relevant national regulatory agencies and ministries, NGOs and academic institutions in the execution and implementation of the project activities, including the project's explicit support for capacity building and institutional strengthening with respect to these organizations, is critical to the sustainability of the project and its expansion into areas not specifically involved in the pilot projects.

Secondary issue 5. Capacity building aspects. Capacity building is a critical element of the proposed project. Creation and strengthening of appropriate institutions, conduct of the pilot projects, and recognition of the need for regional level coordination within the Gulf of Mexico form the core of the GEF-financed elements of the project as noted under Outcomes 2, 3 and 5. Dissemination of lessons learned with respect to coastal development policy, fisheries management practices, and environmental information dissemination are essential elements of the GEF-financed pilot project activities (Outcome 3) and the information management system (Outcome 4). These latter elements also should be implemented in conjunction with the IW-LEARN initiative being executed by the UNDP and the UNEP best practices database. These efforts will enable wider dissemination of knowledge of practices that have positive effects. Such knowledge is an essential element in building capacity and strengthening institutions in the region. Institutional "twinning" between agencies of Mexico and the United States could also be considered in this vein.

Secondary issue 6. Innovativeness. Development of appropriate management practices for the management of hypoxia in enclosed and semi-enclosed LMEs, such as the Gulf of Mexico, is a critical element for the protection of the marine environment, within the context of an integrated land- and water-based management program. By creating and strengthening the appropriate human resources, institutions, data acquisition and dissemination systems, and shared management mechanisms, the proposed management program will complement other pollution abatement and "blue water" management measures being implemented by the basin governments and stakeholders. The proposed actions and approaches reflect state-of-the-art practices, and their application in the Gulf of Mexico will significantly advance current practice in this Basin as well as in the wider Caribbean region as a whole. In this manner, the project promotes innovation and development of regionally applicable remedial practices and experiences.

GENERAL CONCLUSION AND RECOMMENDATIONS

Overall, it is the conclusion of this reviewer that the proposed project is wholly consistent with the GEF International Waters operational program, its broader philosophy, and funding criteria. Consequently, this project is recommended for funding.

RESPONSE TO STAP REVIEW

We would like to thank the Reviewer for his very positive STAP Review. This includes his remarks that the proposed Gulf of Mexico LME project is: scientifically and technically sound; the proposed actions and approaches reflect state-of-the-art practices; the approach is strongly participatory in ambit and provides a mechanism for targeted dissemination of information; its BMPs are potentially replicable globally; it is sustainable beyond the period of GEF intervention; and it is consistent with the GEF International Waters Operational Program, its broader philosophy, and funding criteria.

We appreciate the Reviewer's comments that support the aim of the project: namely, to marry its scientific findings with the institutional, legal and policy instruments that currently exist or that will be developed during the project period to assist in the formation of an appropriate regulatory framework, and to develop the necessary infrastructure to support and sustain the environmentally-sound management of the Gulf of Mexico through the LME approach.

The Reviewer further supports the five Outcomes of the project and stresses that the approach proposed adequately addresses the needs to initiate multilateral actions to reduce land-based impacts on the Gulf of Mexico LME. The reviewer is also supportive of the three pilot demonstration projects within the proposed Gulf of Mexico project which focus on the three priority concerns identified during the framework TDA preparation and indicates that experiences gained through these activities will contribute to the global knowledge base relating to LMEs and their associated drainage areas.

The only real criticism leveled at the project by the reviewer relates to the identification of stakeholder groups. Reference is made in the project document that a significant element of the sustainability of the project rests upon the participation of the local, state and national governments, their operational agencies, and other civil institutions. However, the reviewer states that the tasks to be performed under each Outcome will be undertaken by largely unspecified entities.

In response to this, we agree that stakeholder groups have not as yet been identified for specific Outcomes/Outputs (apart from Outcome 3). This is largely because the scale of the GoM LME will require the involvement of diverse stakeholder groups and although key groups have already been identified during the preparatory stage, the project itself will continue to enhance robust and informed stakeholder involvement. In order to ensure full stakeholder participation, the project will aim to identify the specific key stakeholders for each outcome and ensure active and informed participation from the relevant sectors (Output 5.5). It will also ensure that different stakeholder levels and groups are targeted through the development of a robust public awareness strategy (Output 5.6). Key groups will probably participate in more than one Outcome. Additionally, the engagement of other stakeholder groups, such as those working in specific watersheds including the Mississippi river to address land-based sources, will itself be a major undertaking within the project.

It is also noted that the reviewer has indicated that as capacity building is a critical element of the proposed project, the dissemination of lessons learned with respect to coastal development policy, fisheries management practices, and environmental information dissemination are all essential elements of GEF-financed pilot project activities (Outcome 3) and the information management system (Outcome 4). He indicates that they should also be implemented in conjunction with the IW-LEARN initiative being executed by the UNDP and the UNEP best practices database. We acknowledge that these efforts will enable wider dissemination of best practice and consequently have reflected this in the project document.

APPENDIX A- Preliminary Transboundary Diagnostic Analysis (TDA)

Gulf of Mexico Large Marine Ecosystem

Preliminary Transboundary Diagnostic Analysis

A Preliminary Transboundary Analysis for the PDF-B project:

Glossary

CINVESTAV	Centro de Investigación y de Estudios Avanzados (Center for Research and Advanced Studies) (Mexico)
CNA	Comisión Nacional de Agua (National Water Board) (Mexico)
CONABIO	Comisión Nacional para la Biodiversidad (National Commission for Biodiversity) (Mexico)
EPA	Environmental Protection Agency (United States of America)
FAO	Food and Agriculture Organization
GEF	Global Environment Facility
GoM	Gulf of Mexico
INP	Instituto Nacional de la Pesca (National Fisheries Institute) (Mexico)
LME	Large Marine Ecosystem
NOAA	National Oceanic and Atmospheric Administration (United States of America)
SAP	Strategic Action Programme
SEMARNAP	Secretaría de Medio Ambiente, Recursos Naturales y Pesca (Secretariat for the Environment, Natural Resources and Fisheries) (Mexico) now SEMARNAT
SEMARNAT	Secretaría de Medio Ambiente y Recursos Naturales (Secretariat for the Environment and Natural Resources) (Mexico)
TDA	Transboundary Diagnostic Analysis
UNDP	United Nations Development Programme
UNIDO	United Nations Industrial Development Organization

I. Background

I.a Project Background

Groundwork for this project was laid in August 2000 during a workshop in Havana, Cuba, co-hosted by the Cuban Ministry for Science, Technology and the Environment (GEF Operational Focal Point) and UNIDO. Participants also included representatives from INP/SEMARNAP and CINVESTAV (Mexico), NOAA (USA), Environmental Agency, Institute of Oceanology, Institute of Ecology and Systematics, Fisheries Research Centre, Directorate of Environmental Policy, the Ministry for Foreign Investment and Economic Collaboration, and the Ministry of Fishing Industry (Cuba). The project document was signed by the three countries in 2005, and a Regional Coordinator has been appointed.

The participating countries, Mexico and the United States of America have a history of bilateral co-operation and this project will be the first opportunity for the countries to work together on a regional, ecosystem-wide multi-year project. Since the time of the Havana workshop, the Government of Mexico has undergone institutional changes such that the INP has been absorbed into a new institution, the "Comisión Nacional de Pesca" (CONAPESCA), now under the Ministry of Agriculture (SAGARPA). Thus the SERMARNAP is now the Secretaría de Medio Ambiente y Recursos Naturales, or SEMARNAT. This institution remains the Mexican counterpart for the project.

In 2005, the final project document was signed by the governments of the participating countries, UNDP as implementing agency, and UNIDO as executing agency. One of the main activities of this PDF-B project was to conduct a transboundary diagnostic analysis for the Gulf of Mexico Large Marine Ecosystem. The results of that analysis are presented in this document.

I.b Project objectives

The main objective of the Gulf of Mexico Large Marine Ecosystem Project is stated in the Project Development Facility Block "B" (PDF-B) project as follows:

To address top priority multiple focal area issues of the Gulf of Mexico LME, its coastal area, and any tributary basins of concern, in an integrated fashion. The expected outputs of this project are to carry out a Transboundary Diagnostic Analysis and build on pertinent activities already underway. It will also assist with the development of a Regional Strategic Action Programme (SAP) for the GOM/LME, conduct on-the-ground demonstrations as part of SAP implementation along with priority reforms and will develop a project brief for submission to the GEF Council."

I.c Project goals

The ultimate goals of this project, as defined in the Project Document are:

- Build on pertinent activities already underway.
- Assist with the development of a Regional Strategic Action Programme for the GOM/LME.
- Conduct on-the-ground demonstrations as part of SAP implementation along with priority reforms.

I.d Project activities and methodology

As part of the activities leading to the preparation of the TDA, a national workshop was conducted for the Mexican National Experts whom participate in the analysis, held in the Project Coordinating Unit in Merida, Mexico, on May 8-9, 2006. During such workshop participants were familiarized with the GEF methodologies to build a TDA, where a set of preliminary transboundary problems were identified and prioritised. Based on these priority problems the authors for the thematic reports were identified.

On June 12 – 16, a Training Course on the Transboundary Diagnostic Analysis/Strategic Action Programme (TDA/SAP) approach in the GEF International Waters Programme was conducted in the Project Coordinating Unit in Merida, Mexico, according to established GEF methodologies.

On August 22 – 23 a workshop with the National Experts was conducted. The thematic reports on each of the five Large Marine Ecosystems modules (productivity, fish and fisheries, pollution and ecosystem health, socio-economy and governance) produced by the participants were reviewed and discussed. A list of transboundary problems was identified, and then prioritised. Based on these discussions the thematic reports were adjusted. The list of transboundary problems and the priority problems are presented in Section III of this document.

II. Background of the Gulf of Mexico Large Marine Ecosystem

In this section, a general description of the Gulf of Mexico Large Marine Ecosystem is given. The physical setting, including its geology, circulation patterns, among other issues, is described. The biological component is also described, along with productivity and ecosystem health. Finally, a description of fisheries is given. This section is based on the Thematic Reports provided by the National Experts, which are included in this document as annexes. More detailed information is presented in the reports, and they should be consulted if necessary to complement the brief description given here.

II.a Physical setting and currents

The Gulf of Mexico is a deep marginal sea located at the southeastern corner of North America, is the ninth largest body of water in the word. Its surface area is 1.51 X 10^6 km^2 and its volume is 2.43 x 10^6 km^3, 0.4 per cent and 0.2 per cent of the surface area and volume of the world's oceans, respectively (Wiseman and Sturges, 1999).

The Gulf is bordered by the United States to the north (Florida, Alabama, Mississippi, Louisiana, Texas), five Mexican states to the west (Tamaulipas, Veracruz, Tabasco, Campeche, Yucatan), and the island of Cuba to the southeast. The Gulf is connected to the Caribbean Sea trough the Yucatan channel and to the North Atlantic Ocean trough the Straits of Florida (Wiseman and Sturges, 1999). The basin is surrounded by three main areas of continental shelves: The Florida, to the East; Texas-Louisiana, to the Northwest and Campeche and Yucatan, to the South.

II.a.1 Geology

The continental shelves and slopes of the Gulf are complex with maximum water depths of over 3700 m. The shelf edge off the Florida, Alabama and Mississippi ranges in depth 60 to 100 m and 25 to 125 km width. Louisiana and Texas shelf varies in width from less than 20 km to nearly 200 km. Eastern continental shelf of Yucatan Peninsula is 2 km wide, while northern shelf is 250 km. (Monreal-Gómez et al., 2004; Roberts et al., 1999). Approximately 38 per cent of the Gulf is comprised by shallow and intertidal areas (< 20 m deep). The area of the continental shelf (< 180 m) and continental slope (180 - 3,000 m) represent 22 per cent and 20 per cent respectively, and abyssal areas deeper than 3,000 m comprise the final 20 per cent (Gore, 1992).

The continental shelves and slopes of the Gulf are complex geologic provinces that incorporate both terrigenous clastic and carbonate deposition, a wide range of sediment supplies and subsidence rates, complex salt/shale tectonics, and depositional environments. Modern continental shelves of the Gulf basin have been largely shaped by sea level fluctuations during the Pleistocene and the location of active sedimentation from the Mississippi and other rivers. Depositional environments on the continental shelf can generally be categorized as terrigenous on the northern and western shelf areas and carbonate on the broad platforms of the eastern and southern Gulf. This pattern has persisted since late Cretaceous time, when terrigenous influx from tectonically elevated northern and western continental interiors began to overwhelm mainly carbonate environments that encircled the Gulf. Most terrigenous sediment was delivered to the northern margin of the Gulf during the Cenozoic, causing the shelf to prograde southward as much as 300 km from the cretaceous carbonate platform margins to the present shelf edge (Roberts *et al*., 1999).

II.a.2 Currents

The major circulation pattern in the Gulf of Mexico is determinate by Loop Current. It enters the Gulf through the Yucatan Channel (sill depth ~1850 m), turns clockwise, and exits through the Straits of Florida (sill depth ~800 m) to become the Florida Current and later the Gulf Stream. Current speeds may exceed 2 m/sec, and a transport is 0.03 km^3/s (Wiseman and Sturges, 1999).

Portions of the Loop Current often break away forming small filaments and counter-rotating eddies. These rings are as much as 400 km or more in diameter, and they slowly propagate westward or west-southward across the Gulf, at speeds of approximately 5 cm/sec. They carry with them massive amounts of heat, salt, water and conserve their hydrographic properties for long periods of time and, presumably, behave as quasi-isolates ecosystem. The large ring detachment process occurs at an average rate of approximately once every 11 months. As the loop Current penetrates northward into the Gulf, its path becomes unstable and large rings are shed. Similar features have been observed on the inshore edge of the Florida Current (Wiseman and Sturges, 1999).

II.a.3 Meteorology and climatology

From May through mid-August, more than 50 per cent of the time, the northern Gulf is dominated by tropical weather with winds mainly from the south and from mid-September through mid-February, more than 50 per cent of the time is influenced by continental weather with winds from the north (Hsu, 1999).

Superficial temperature in summer is generally between 28 to 29°C, with an increase in superficial waters in the northeaster and southeast zones due to the Loop Current. In winter water temperatures decrease to 19 or 20°C due to cold winds from the north (De Lanza-Espino and Gómez-Rojas, 2004).

The latitudinal variation in air temperature is much more pronounced than the longitudinal. Along given latitude, the difference in air temperature is only 2°C, whereas along the north-south direction it can be over 10°C between the deep Gulf and the northern Gulf coast. Furthermore, the largest decrease in air temperature in winter is found between the continental shelf break and the shore stations (Hsu, 1999).

II.a.4 Rivers and estuaries

Drainage into the Gulf of Mexico is extensive and includes 20 major river systems (>150 rivers) covering over 3.8 million square kilometers of the continental United States (Moody, 1967). Annual freshwater inflow to the Gulf is approximately $10.6x10^{11}$ m^3 per year. 85% of this flow comes from the United States, with 64% originating from the Mississippi River alone. The Mississippi River is the sixth largest river in the world in terms of discharge, with an annual average flow rate of 14,000 m^3/s. Additional freshwater inputs originates in Mexico, the Yucatan Peninsula, and Cuba. The Grijalva-Usumacinta system in Mexico is the second freshwater input to the Gulf of Mexico, with average flow rate of 2154 m^3/s.

The shelves of the Gulf are ringed by a variety of estuarine types ranging from classic drowned river valleys to bar-built estuaries and lagoons, both hyposaline and hypersaline. These estuaries serve not only as a source of nutrients for the shelf, but also as nursery ground for many species that spawn on the shelf (Wiseman and Sturges, 1999). Two large systems deserve somewhat special mention: Laguna de Terminos and Florida Bay. Laguna de Terminos lies on the northeast shore of the Yucatan Peninsula. It receives extensive freshwater input from the Grijalva River system. Tides are mixed diurnal and the typical winds are the northeast trades, although cold air outbreaks during winter are a significant perturbation to the region. Florida Bay appears to be uniquely coupled to the Gulf of Mexico proper. It contains a wide entrance from the west Florida shelf and a leaky boundary to the Straits of Florida through the Florida Keys (Wiseman and Sturges, 1999).

II.b Biological importance

The Gulf of Mexico exhibits great habitat complexity that supports a very high level of biologic diversity due to the presence of cosmopolitan and endemic species (Rabalais *et al*., 1999).

Marine and estuarine ecosystems present different forms of life and are considered as reserves of high micro and macrobiologic diversity. Some of their communities like mangroves, coral reefs and marine grasses in the coastal area and hydrothermal chimneys in the oceanic area possess high species richness.

This high biodiversity is by no means a product of chance. The Gulf of Mexico lies between two major biogeographic areas, the Neartic and the Neotropical. Both areas, with their particular environmental and hence, floristic and faunistic characteristics merge at the center of the Gulf producing rich habitats for the appearance of species and their interaction. Added to this, the topographic landscape of the Gulf is represented by almost all kinds of geomorphological features, producing a great number of habitats. In this respect, the GoM's eco-regions, terrestrial and marine, are among the most diverse in the world.

In accordance with Mexico's Biodiversity National System of Information (SNIB) of the National Commission for the Knowledge and Use of the Biodiversity (CONABIO), the inventory corresponding to the coastal and oceanic area has an approximate total of 20,796 species, where 340 of them are endemic (NOM-ECOL-059/2001).

II.b.1 Coral reefs

Along the Mexican coast, there are several coral reefs, being the Veracruz Reef System, the biggest and with the highest number of species (Vargas-Hernandez et al, 1993). It is located just in front of the Veracruz Port and is composed by 22 coral reefs, all spread in an area of 52 thousand hectares and declared as a National Park in 2000 (Diario Oficial de la Federación, 2000). As an example of the fin-fish diversity, only for this area, the number of fish species reported is of 248 (Vargas-Hernandez at al, 2002). Many of these species are fished by people living in the surrounding areas like the Port of Veracruz and the town of Antonio Lizardo. Another example, just for the coast of the State of Veracruz, Lozano-Vilano et al. (1993) report a total of 291 of fish species of which, 16 are endemic.

II.b.2 Turtles

Five threatened and/or endangered sea turtle species, including the critically endangered Kemp´s ridley (*Lepidochelys kempii*), loggerhead (*Caretta caretta*), green (*Chelonia mydas*), hawksbill (*Eretmochelys imbricata*) and leatherback (*Dermochelys coriacea*), use Gulf of Mexico habitats for foraging and/or nesting (Landry and Costa, 1999). *L. kempii, C. mydas and E. imbricate* populations are experiencing a gradual recovery, while *C. caretta* are stable and *D. coriacea* is unclearly (Landry and Costa, 1999; Márquez-M, 2004).

II.b.3 Birds

For the area of the Gulf of Mexico, Gallardo et al. (2004) published the number of bird species living at or using the Gulf coast as 231, of which 44 per cent are aquatic, 29 per cent terrestrial, and 27 per cent marine. These species represent 22 per cent of all species to be found in Mexico. Most of the species (65 per cent), though, are seasonal visitors of some areas along the gulf coast. In this way, 45 per cent of the northern visitors spend all the winter somewhere along the coast, 10 per cent will spend just a short time before leaving to an area further south, and the remaining 10 per cent are occasional visitors. The fact that so many species converge in this area is due to the variety and amount of suitable habitats for them. These habitats need to be in route of migratory species and have to have the necessary amount and quality of food, and shelter for them to use. These two characteristics, besides other meteorological events, converge along the shoreline of the Gulf in such a way that the corridor is known as one of the most important for migrating birds in the world.

II.b.4 Marine mammals

In the Gulf of Mexico there are 30 species of marine mammals, one species of the Order Carnivora, one species of the Order Sirenia, and 28 species of the Order Cetacea; of these, the manatee is of special interest. This animal likes to live along the coast in rivers, estuaries, coastal lagoons and places alike, it inhabits from Crystal River, Florida down to the Caribbean Sea. Two subspecies are present in the gulf, one living in the north of the gulf, Florida and up to Louisiana, and the second one, in the Caribbean; it used to live from Tamaulipas to the Yucatan Peninsula. Due to habitat degradation and the killing of individuals, it can only be found nowadays in the coastal lagoon of Alvarado, several small rivers and estuaries of Veracruz, the lagoon of Terminos, the Grijalva-Usumacinta river system, Celestun, and in Quintana Roo (Ortega-Ortiz et al., 2004). The area between the northern part of Tamaulipas and the south of Texas is believed to be the geographic limits of both subspecies. Although there are no genetic or behavioral studies for both subspecies, the hypothesis is that around this area there is certain amount of interaction (Ortega-Ortiz et al., 2004).

II.b.5 Vegetation

The vegetation in the coastal areas of the Gulf of Mexico is mostly in the form of macroscopic benthic algae. In areas where the surf is not so intense, the possibility exists of forming beds in rocks and jetties in the edges of the beaches or outlets of the rivers, and in the coast bottoms and lagoons.

There are also other plant groups: mangrove, popal, tular and carrizal, herbaceous communities, amphibious and sub aquatic and gallery forests. The mangroves grow in the banks of the coastal lagoons, outlets of rivers or bays where there is influence of marine water. There are four species of mangroves in Mexico located in both costs. In the Atlantic coast they are present from the south of Tamaulipas down to Yucatan. This community is very important because its roots serve as substratum to aquatic organisms besides of contributing to floor consolidation.

The “popal” inhabits marshy surfaces or of stagnated fresh water, and is distributed in Veracruz, Tabasco and Campeche. The “tular” and “carrizal” are also communities of aquatic plants from one to three meters high, rooted in the slow or stationary, not very deep bottom of channels and eddies of rivers. They are important since they constitute the housing for aquatic birds. The aquatic and sub aquatic vegetation do not cover big extensions; however, it is a group of great importance because 747 species of aquatic plants are recognized as not restricted in their geographical distribution. There are around a thousand fanerogam species, of which 15 per cent are endemic to Mexico

II.c Fish and Fisheries

Landings for the Mexican coast of the Gulf of Mexico fisheries account for 22 per cent of the total fisheries production in Mexico (313,686 tons out of the total 1,520,938 tons caught in 2001), although nearly 38 per cent of the Mexican fishermen live in its five coastal states (Tamaulipas, Veracruz, Tabasco, Campeche and Yucatan).

Most of the catch in the Mexican Gulf comes from artisanal fisheries. Only 10 per cent of the total comes from these fisheries. In the Gulf catch is distributed in many small-scale fisheries, only four items (“Mojarra” that also includes freshwater tilapia, shrimp, octopus and oyster) get catches above 10,000 tons and this account for 38 per cent of the total catch.

Most (up to 56 per cent) of the catch in the Gulf fisheries (Figure 1) is comprised by fin fish. Among the species included in this category we can find the following, referred by its common name in English (with Mexican most used common name and genus in parentheses): mojarra (mojarra, *Gerres, Eugerres*, *Eucinostomus*), gafftopsail catfish (bandera, *Bagre*), jack (jurel, *Caranx*), snook (robalo, *Centropomus*), weakfish (trucha, *Cynoscion*), snapper (guachinango, pargo, Lutjanus), seabass (corvina, *Cynoscion*), rudderfish, amberjack (esmedregal, *Seriola*), yellowtail snapper (rubia, *Ocyurus*), vermilion snapper (besugo , *Rhomboplites*), grunt (ronco , *Pomadasys, Anisotremus*), sea catfish (bagre , *Arius*), croaker (berrugata , *Menticirrhus*), pompano (pámpano, *Trachinotus*), grouper (cabrilla, *Paralabrax, Epinephelus*), flounder (lenguado, *Paralichtys, Syacium*), mullet (Lisa, *Mugil cephalus*), white mullet (lebrancha, *M. curema*), Grouper (Mero, Epinephelus morio), Spanish mackerel (Sierra, *Scomberomorus maculatus*) and king mackerel (peto or carito, *S. cavalla*).

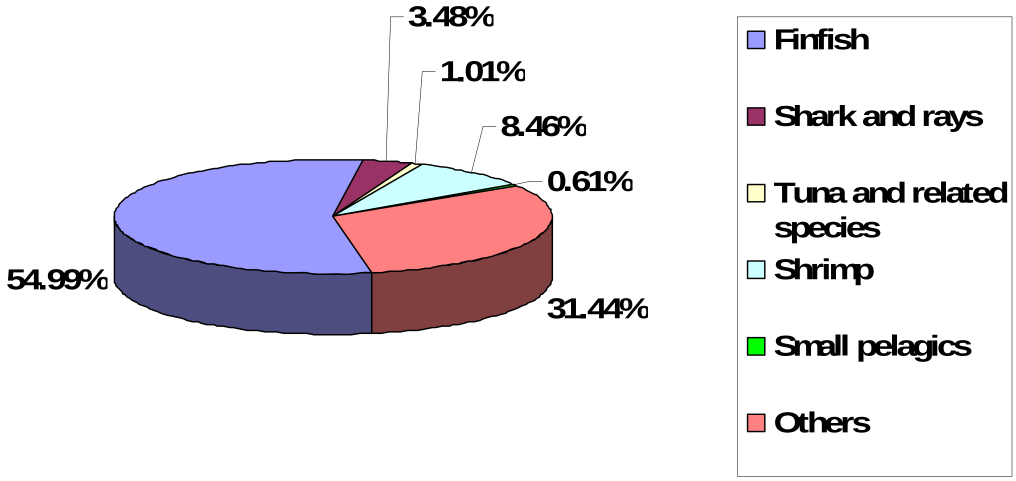


Figure 1. Catch composition in the Gulf of Mexico Mexican fisheries (CONAPESCA, 2001).

Under "Sharks" we can find the following species**:** Atlantic sharpnose shark (Cazón de ley, caña hueca, Rhizoprionodon *terraenovae*), blacktip shark (tiburón puntas negras, volador, *Carcharhinus limbatus*), bonnethead (cazón cabeza de pala, pech, S. *tiburo*), scalloped hammerhead (cornuda, *Sphyrna lewini*), bullshark (tiburón chato *C. leucas*), blacknose shark (cazón canguay, pico Negro, *C. acronotus*), smalltail shark (tiburón poroso, cuero duro, *C. porosus),* spinner shark (tiburón curro, puntas negras, picudo, *C. brevipinna*), hammerhead (cornuda grande, cornuda gigante, *Sphyrna mokarran*), night shark (tiburón nocturno, ojo verde, *Carcharhinus signatus*), sandbar shark (tiburón aleta de cartón, aletón., *C. plumbeus*), angel shark (tiburón ángel, angelote, *Squatina dumerili*), dusky shark (tiburón prieto, negro, tabasqueño, *Carcharhinus obscurus*).

"Rays" include mostly the following: spotted eagle ray (chucho, chucho obispo, chucho pintado, *Aetobatus narinari*), skate (raya, *Raja texana*), Southern stingray (raya látigo, *Dasyatis americana*), longnose stingray (raya látigo hocicona, *D. guttata*), cownose ray (raya gavilán, *Rhinoptera bonasus*).

Under "shrimp" we include the following species: brown shrimp (camarón café, Farfantepenaeus. *aztecus*), white shrimp (camarón blanco, *Litopenaeus setiferus*), pink shrimp (camarón rosado *F. duorarum*), seabob (camarón siete barbas, *Xiphopenaeus kroyeri*).

The category "others" include several important fisheries, and most small ones, among others: Mayan octopus (pulpo maya, rojo, *Octopus maya*) and common octopus (pulpo patón, pulpo común, *O. vulgaris*), spiny lobster (Langosta espinosa, mostly *Panulirus argus* but also found the spotted lobster, langosta pinta, *P gutatus* and the green lobster, langosta verde, *P. laevicauda*). It also includes several invertebrate fisheries of local importance like the queen conch (caracol rosado, *Strombus gigas*) and several gasteropods (*S. costatus, Pleuroploca gigantea*, Turbinella *angulatus* and *Busycon contrarium*).

The tuna fishery catch comprises mostly (50% of total catch, including non-thunid by-catch) yellowfin tuna (atún aleta amarilla, *Thunnus albacares*) but also, although less frequently, bluefin tuna (atún aleta azul, *Thunnus thynnus*), blackfin tuna (atún aleta negra, *Thunnus atlanticus*), skipjack (barrilete, *Katsuwonus pelamis*), bigeye (patudo or ojón, *Thunnus obesus*) are also caught.

Although more information is needed on the species caught, in the "small pelagics" category we can find herring-like species like menhadens (lacha, *Brevoortia spp.*) and scaled sardines and herrings (sardina, *Harengula spp.*).

While national catches had a noticeable fall after 1981 (due to the collapse of the anchovy fishery and marked reductions in sardine catches) and remained practically stagnated, oscillating around 1,300,000 annual tons, catches in the Gulf grew steadily until 1989. After that year, catches have been decreasing at an average of –4% yearly. In 2002, annual catches were 70% of those obtained in 1989.

In the case of the United States the commercial fishing industry represents an important component of the total economic value derived from utilization of Gulf of Mexico to U.S. Since 1984, the commercial fishing industry in the Gulf has accounted for approximately 25% of the nation's seafood landings and about 21% of the total U.S. dockside value for fishery landings. Louisiana is the leading state in the Gulf region in terms of landings volume. The commercial fishing industry in the Gulf harvested 1.7 billion pounds of fishery products in 1993, which were valued at $630 million dockside (value received by the vessel or boat) (Cato and Adams, 1999). Gulf Coast estuaries are among the most productive natural systems, producing more food per acre than the most productive midwestern farmland. The Gulf Coast region is second only to Alaska for domestic landings of commercial fish and shellfish, with 816,466 mt. in 2000, worth more than $900 million (NMFS, personal communication).

The major stocks and species groups in U.S. are shrimp (Brown, white, and pink shrimp), spiny lobster, stone crab, Gulf menhaden, Reef fish (include more than 100 species that prefer coral reefs, artificial structures, or other hard bottom areas, and tilefishes that prefer muddy bottom areas), recreational and commercial species in the family Sciaenidae (Atlantic croaker, spot, red drum, black drum, kingfishes (whiting), weakfish, spotted seatrout, and other seatrouts), Coastal pelagic fishes (king and Spanish mackerels, cero, dolphinfish, and cobia), sharks (large coastal sharks, which included tiger, lemon, smooth hammerhead, scalloped hammerhead, great hammerhead, blacktip, sandbar, dusky, spinner, silky, bull, bignose, Caribbean reef, Galapagos, night, narrowtooth, and nurse; small coastal sharks, which included Atlantic and Caribbean sharpnose, finetooth, blacknose, bonnethead, smalltail, and Atlantic angel; and pelagic sharks, which included longfin and shortfin mako, blue, porbeagle, thresher, bigeye thresher, oceanic whitetip, sevengill, sixgill, and bigeye sixgill), and pelagic fishes (highly migratory species that include swordfish, bluefin tuna, yellowfin tuna, bigeye tuna, albacore, skipjack tuna, blue and white marlin, sailfish, longbill spearfish, and others).

The menhaden fishery, with reduction plants in Louisiana and Mississippi, contributes an average of 76% of total commercial landings at U.S. ports in the Gulf of Mexico. The fishery for Penaeid shrimps contributes approximately 13% of total annual commercial landings, and accounts for the greatest source, 63%, of dockside revenues for commercial fishermen in the U.S. Gulf of Mexico. Shrimp landings have fluctuated without trend from 1977-2005, with an overall annual average of nearly 240 million pounds and an average dockside value of $421 million. Edible finfishes account for approximately 6% of total pounds landed commercially, and 12% of dockside revenues. Shellfishes other than shrimp account for approximately 6% of total commercial landings in the U.S. Gulf of Mexico and 17% of dockside revenues.

The harvesting sector is characterized by thousands of craft exhibiting a wide range of sizes. The gulf fleet contains large open-water shrimp trawlers, purse seiners, and long liners with several crew members. In addition, even large numbers of small near-shore hook and line boats and gill netters exist employing a crew of one or two persons (Cato and Adams, 1999).

II.d Productivity

Circulation patterns and freshwater inputs described above are important characteristics in the productivity patterns registered in the Gulf of Mexico. Productivity as an important functional characteristic of the LME, is frequently related to the carrying capacity of an ecosystem for supporting fish resources. However, it could be useful indicator of the growing problem of coastal eutrophication. In several LMEs, excessive nutrient loadings of coastal waters have been related to algal blooms implicated in mass mortalities of living resources, emergence of pathogens (e.g., cholera, vibrios, red tides, and paralytic shellfish toxins), and explosive growth of non-indigenous species (Epstein 1993).

The ecosystem variables useful as indicators of changing conditions in the productivity module in other LME are: phytoplankton-zooplankton biodiversity and biomass, water-column structure, transparency, chlorophyll-a, dissolved inorganic nutrients and primary production.

For the Gulf the values of primary productivity are in general low with an average value of 0.1 g C/m^2/day, which is typical for tropical regions (Margalef and Estrada, 1980). In relation to the Chl-a, the average value is of 0.2 mg Chl-a/m^3, (range 0.2-2 mg Chl-a/m^3) registering the highest value for the coast of Mexico in the areas of Veracruz-Tabasco with a mean value of 2.4 mg Chl-a/m^3 and Cabo Catoche upwelling with a range of 3-5 mg Chl-a/m3 (El-Sayed et al., 1972; Merino 1997; Troccoli et al., 2004; Aranda-Cirerol et al., 2006). According the above, the Gulf of Mexico is considered an oligotrophic sea; however, there are areas of low, medium and high production in marine and coastal waters. The areas of low production are related to anticyclonic gyres (central basin of the Gulf) and the high production areas with upwelling zones (Cabo Catoche) or freshwater inputs (Mississippi and Grijalva-Usumacinta Rivers), meaning that in the same seasonal period areas exist whose fertility differs notably. Some of these areas are related with fisheries zones as the Campeche Bank, which is considered as an area of particular importance by its great biological potential. It is one of the regions that more interest presents for fisheries in Mexico and offers big possibilities for the capture of species of high commercial value between crustaceans and fish.

One particular area of Gulf in the Mexican side is the Yucatan Peninsula, a karstic province that shows particular features (very similar to Southern Florida) as an almost free infiltration of rainwater to the aquifer, therefore it has an important net of underground water. The final destination of all this underground water is as input to the coastal waters through point sources (springs) or diffuse seeps. Therefore, the main freshwater inputs to the coastal ecosystems in the Yucatan Peninsula are through submerged groundwater discharges (SGD). The volume of water discharge in the coastal zone has been estimated between 8.6 and 12 x 10^6 m^3/km/y (Hanshow and Back 1980; CNA, 2001). The coastal area of the Yucatan Peninsula is an important fishery zone mainly of shrimp, lobster, snapper, grouper and octopus.

Other important feature of the Gulf of Mexico is the western anticyclone located in front of the coast of Tamaulipas and called "Mexican Anticyclone". This is semi-permanent and is directly influenced by the Loop Current. Another important area is the Cabo Catoche upwelling. This destroys the thermocline providing the surface layer with nutrients. Diatoms proliferate more actively, and at the same time benthic diatoms and abundant detritus can be found in the water column. At the later stage, cold waters rich in nutrients spread into the shelf. When upwelling finishes, the thermocline develops again. In this period, cold water remains only in the near-bottom layer in the shape of a dome. In the Campeche Bank area, the influence of upwelling on the phytoplankton development is quite noticeable only in the neritic zone and almost unnoticeable in the oceanic zone (Vinogradova, 1976). As has been observed, water circulation is responsible to a greater extent for the level of biological productivity. However, due to spatial shifts in the position of the zones of maximal concentrations of phyto-, zooplankton and higher levels of food webs, high production areas not always correspond to the centers of cyclonic gyres. As a result, maximal concentrations of carnivorous tuna fishes can be found in the center of anticyclonic gyres (Bessonov et al., 1971).

With respect to the relationship between abiotic factors and phytoplankton, Zernova (1982) studied the dependence of phytoplankton in the Gulf, observing in offshore areas a positive correlation between phosphate concentration and phytoplankton biomass in the open Gulf and low correlation in the downwelling regions. It was hypothesized that in the Campeche Bank the high production is related to the local turnover of nutrients above the shelf, both regenerated at sea bottom and by mineralization in the water column, which can result in high abundance and biomass of phytoplankton even beyond the upwelling zones. On the other hand, it has been suggested that the low concentration of silicates in the Gulf results in a smaller-sized phytoplankton in comparison to temperate regions. In the Gulf of Mexico, phytoplankton in the upwelling zones is at the initial stage of its succession and in oligotrophic areas in its final stage (Zernova, 1974). With respect to phytoplankton composition in the Gulf of Mexico, diatom species was more diverse in the coastal zone and dinoflagellates in offshore regions. The highest number of phytoplankton species was found in the Yucatan Channel and in the southwestern Gulf of Mexico (Troccoli et al., 2004).

The nutrient inputs are one of the major variables that control the phytoplankton biodiversity and production in the marine and coastal areas of the Gulf. Over the last several decades, nutrient loading levels in riverine ecosystems which discharge to coastal zone of the Gulf have contributed to a substantial increase in coastal production at levels that has produced eutrophication symptoms. However, in order to propose actions to reduce the eutrophication problems it is necessary to know the major sources of dissolved inorganic nutrients.

II.e Pollution and Ecosystem Health

The coastal environments are strongly affected by the development of a great number of activities that frequently are incompatible to each other. At present, human activities are direct or indirectly the main cause of the modifications of the marine biodiversity and whose effects are always almost irreversible, contrary to many of the natural interferences that have existed continually in the ocean (National Research Council 1995). Most of the current and potential threats of the marine biodiversity happen in the coastal area and they are directly related to the human population's demographic tendencies: it is considered that almost 70 per cent of the population lives on the coast, or at no more than 60 Km of distance from it. If this percentage continues increasing, the total population can end up being duplicated in less than 30 years (Norse 1994).

The quick development of certain economic activities such as the oil industry, energy generation, tourism, agricultural development and the marine transport have induced a disordered growth in the coastal and urban areas along the coast line with the derived consequent environmental conflicts of space competition, the use of resources and the generation of residuals and pollutants.

Among the main problems of concern to the coastal areas of Mexico are: lose of habitat in intertidal areas, dunes or cliffs due to deforestation, changes of land use for urban, port and tourist developments, and mining or filling for construction; the disappearance or decrease of wetlands (swamps, mangrove, and “petenes”) due to changes in the use of the land or by sedimentation as a result of alterations of the watershed.

The National Coastal Condition Report II, published in 2004, gives the American portion of the Gulf of Mexico a mean score of 2.4 (fair). This reports states that 41 per cent of the area is impaired for aquatic life or human use, 39 per cent is threatened and 20 per cent is unimpaired. In particular, the benthic index, with a score of 2 and the coastal habitat index with a score of 1 are the worst for this region. There is no equivalent report for Mexican estuaries and coastal lagoons, but recent reports summarized by Instituto Nacional de Ecologia (2004) indicate the presence of pollutants such as petroleum hydrocarbons and heavy metals.

II.e.1 Eutrophication

The direct discharge of residual waters has resulted in a potentially dangerous condition for human health and the marine environment. In the Mexican coasts of the Gulf, practically all the coastal populations discharge their domestic waste in the rivers, estuaries, coastal lagoons and the sea without any previous treatment (Botello et al., 1996). As the above-mentioned consequence the coastal lagoons of the Gulf of Mexico are highly stressed, the presence of metals have been detected, as well as persistent organic compounds and hydrocarbons in the silts of the main coastal lagoon systems of Tamaulipas, Veracruz, Tabasco and Campeche.

Available data show that, in the Gulf of Mexico, in general, there is a clear tendency to eutrophication. This is largely noticed in bays, estuaries and coastal lagoons, where direct discharges from human settlements arrive. Through an analysis of satellite images, Aguirre-Gomez, (2004) shows the great amount of sediments discharged and by consequence, of nutrients to the Gulf coast through the various rivers.

Excessive nutrients transported to the Gulf by the Mississippi River, physical changes to the river, such as channelization and loss of natural wetlands and vegetation along the banks, and the interaction of fresh water from the river with the saltwater of the Gulf cause a large area of hypoxia forms during the summer months (Giattina and Altsman 1999). Seasonally severe and persistent hypoxia or low dissolved oxygen concentrations occur on the inner to mid-Louisiana continental shelf to the west of the Mississippi River and Atchafalaya river deltas. The area extent of this zone during mid-summer surveys of 1993-1995 (ranged from 16,000 to 18,000 km^2, of near-bottom waters ≤ 2 mg/l) rivals the largest hypoxic area elsewhere in the world’s coastal waters like Baltic Sea and the northwestern shelf of the Black Sea. The northern Gulf of Mexico is strongly influenced by the Mississippi and Atchafalaya Rivers, whose combined discharges account for 80% of the total freshwater input. Spatial and temporal variability in the distribution of hypoxia exists and is related to the amplitude and phasing of the Mississippi river discharge. The freshwater fluxes dictate, along with climate, a strong seasonal pycnocline. Hypoxic waters are distributed from shallow depths near shore (4-5 m) to as deep as 60 m water depth. During upwelling-favorable wind conditions, hypoxic water masses will impinge on barrier island shore faces, often causing massive fish kills. The more typical depth distribution of hypoxic bottom water, however, is between 5 and 30 m (Rabalais et al., 1999b).

Benthic and demersal communities are strongly affected by decrease in oxygen concentration from 2 mg/l to anoxia. Motile fish and crustaceans are generally absent from bottom habitats when the oxygen falls below 1.5-2 mg/l; less motile invertebrates die at oxygen below 1.5 mg/l; infaunal invertebrates display stress behavior below 1.0 mg/l; and a fairly linear decrease in benthic macroinfauna diversity and abundance occurs between 0.5 mg/l and anoxia. Effects of hypoxia on fishery resources include direct mortality, altered migration, reduction in suitable habitat, increased susceptibility to predation, changes in food resources, and disruption of life cycles (Rabalais et al., 1999b). A low oxygen zone close to the Grijalva-Usumacinta delta, in the Southern Gulf of Mexico, has also been detected (Signoret *et al*., 2006), but it has not been as closely studied and its importance can not be evaluated.

II.e.2 Oil Pollution

The oil industry in Mexico is the most important industry since more than 50 per cent of the national income in taxes and exports come from the exploitation of oil and gas, and its subproducts. For example, Mexico exported to the United States between April and June of 2006 1,572 millions of barrels per day representing 83 per cent of all Mexican exports (PEMEX, 2006). Also, a major volume of oil and gas extraction occurs on the coastal area or within the Gulf of Mexico, mainly in the area of the Campeche Bank.

This high volume of oil and gas production represents a potential risk for the environment. Oil spills in the ocean or on the coastal areas is one of the most detrimental externalities that an ecosystem may support. Due to the oil characteristics, the recovery time of the ecosystem is much longer, compared with other natural events.

The best unfortunate example of the potential danger that the oil industry represents in the Gulf of Mexico is the oil spill in 1979 of the oil well IXTOC 1. After an underwater drilling accident, an estimated 140 million gallons of oil were dumped into the ocean and continental shelf environment. It took almost a year to fix the problem at the well and end the oil dumping. As a consequence of the great amount of oil in the ocean, and the long time it took to fix the problem, a certain amount of oil was carried by the Gulf currents to the coast of Texas (Ditton et al., 1980). In November of the same year, an oil tanker, the BURMAH AGATE sank in front of the Texas coasts. Analyzing the economic costs of both events in the 19 affected counties, Ditton and collaborators (1980) concluded that due to the IXTOC 1 effect, more than four million dollars were lost just in the tourist industry in the area, and expenses to the U.S. Government and the State of Texas were estimated at over 15.3 million dollars.

II.e.3 Pesticides and Heavy Metals

As a consequence to achieve higher agricultural productivity, it is a common practice by farmers to use fertilizers and pesticides. The former is one of the causes of the tendency of coastal waters to be close to a eutrophic state. The latter, although difficult to detect in a short term, is a potential problem not only to the ecosystem health but also to humans and in a collateral way to the economy of the region (Botello et al., 2002).

Pesticides have been used in Mexico for a long time, although in first world countries their use is being minimized and alternative pest control are being tested (e.g. natural enemies) (Albert and Benítez, 2005). This activity obeys more to a traditional lack of information, than to an effective pest control. Unfortunately, all pesticide components used in land end up in the rivers flow, fresh water basins, and ultimately in the Gulf.

Most of the coastal lagoons, estuaries, and bays along the Gulf of Mexico coast of the Gulf there are different levels of concentration either of pesticides, heavy metals or both. In either case, the concentration in water or sediments varies according to the season (Botello et al., 2002). At certain times of the year the concentrations of pesticides could be well above to that allowed by law. The same pattern happens for heavy metals. Unfortunately, their presence is documented, meaning that the ecosystem and human health are in danger, even though there are laws that regulate the use of these substances.

II.e.4 Habitat Loss

As stated above, along the coasts of the Gulf there is a high diversity of habitats where a great amount of species, many of commercial importance live or use them for shelter or nursing. Besides the commercially important species inhabiting the coastal areas, there are a great number of other species, responsible of sustaining, through the complicated food web, the function, structure and stability of the ecosystems.

The coverage of mangrove forests on the coasts of Mexico, have been affected considerably in the last years. According with data of FAO (2003), Mexico has lost in the last 30 years more than half of its mangrove coverage in both coasts. Although the available data are not precise, López-Portillo and Ezcurra (2002), provide an estimated rate of annual loss of the national coverage of mangrove between 2.9 and 5 per cent. Recently, the Instituto Nacional de Ecologia (INE, National Institute of Ecology) made a preliminary estimate of the average yearly rate of mangrove loss of 2.5 per cent. The projected rate for 2025 shows a loss of 50 per cent taking the year 2000 as a base line (INE, 2005).

The collapse of the shrimp fishery in the Gulf of Mexico is explained by the reduction of the fishing capacity, the contamination, the restrictive loss of trawling areas, the environmental conditions and the deterioration of nursery habitats. Although these factors can act in combination, exercising pressure on the shrimp populations, the fishing factor is determinant in the reduction of the shrimp existences, conditioning the future strategies for the management of the fisheries.

II.f Socio-economic aspects

Bordered by the U.S., Mexico and Cuba, the Gulf of Mexico is a valuable natural resource shared by the international community for a variety of resources and services including transportation, fisheries, natural resources and recreation (Giattina and Altsman, 1999).

The six coastal Mexican states of the Gulf and Caribbean comprise 16% of the national territory. The population within this region as of the 2000 census was almost 14 million and had experienced a 16% increase in just ten years. The population in Mexico, overall, grew by nearly 20% in the same time period (Yoskowitz 2006). The population of coastal counties in the Gulf Coast region in the U.S. was almost 18 million and increased more than 100% between 1960 and 2000. The state of Florida had three cities among the fastest growing in the United States: Port St. Lucie (third), Cape Coral (fifth) and Miramar (eighth) (U.S. Census Bureau).

II.f.1 Fisheries

Gulf fisheries are some of the most productive in the world. In 2004, commercial fishermen at U.S. ports along the Gulf of Mexico landed 1.48 billion pounds of fish and shellfish with a dockside value of approximately $669 million (NMFS, unpublished data), and in 2005 landed 1.20 billion pounds worth $621 million. The Gulf also supports a very productive recreational fishery. Excluding Texas, U.S. Gulf States accounted for over 40% (>104,000 lbs or >47,000 kg) of the U.S. recreational finfish harvest in 2000 (O'Bannon, 2001). In addition to being the cultural and historical foundation for many coastal communities, the Mississippi seafood industry is a major contributor to the state's economy. Landings average about 220 million pounds of seafood products entering Mississippi ports annually worth about $45 million to the fishermen. The total value of the industry exceeds $450 million annually. Over 5,000 people are employed in the harvesting, processing and distribution of seafood products. Additional 10,000 persons are employed indirectly through marine related sales, services and support of the seafood industry. Pascagoula/Moss Point and Gulfport are among the leading seafood ports in the United States (Marine Resources).

The shrimping industry constitutes 94% of all reported commercial fishing in Texas and provides 30,000 jobs. This dominance results from a number of causes, including the fact that the public favors sport fishing and tourism over commercial fishing (Handbook of Texas Online).

Mexican and U.S. fisheries in the Gulf face some of the same challenges. Over the decade of the 1990's the fishery harvest varied between 200,000 and 350,000 tons/year. Among the species with the highest commercial value are lobster, shrimp, octopus, and conch. In 2003 the Gulf States in Mexico produced

283,153 tons of fish with an estimated value of $381 million. Between 1999 and 2003 fishery production has decreased by 12% (Yoskowitz, 2006).

II.f.2 Tourism

Tourism often represents a push for the local economy, providing a source of jobs as well as services for cultural and natural attractions and resources. Sustainable coastal tourism, and especially ecotourism, has the potential of becoming economic incentives that will facilitate economic development and effective resource management in coastal areas of the Gulf of Mexico.

Tourism in the coastal area is an important source of foreign currency. Sánchez-Gil *et al*. (2004) reported the presence of 1,794 hotels with 71,254 rooms (22 per cent of the national total). And that in 1991 tourism in the state of Quintana Roo generated more than 560 million dollars. In 2003, Cancun reported 87 per cent of occupancy, Cozumel 63 per cent, Boca del Río, Veracruz 39 per cent, Villahermosa, Tabasco 56 per cent, Campeche, Campeche, 64 per cent, Playacar y Akumal 86 per cent and 88 per cent respectively (SECTUR, 2004).

In 2002 the Texas travel and tourism industry contributed $41.4 billion to the Texas economy and directly employed more than 451,000 persons. In Nueces County (County located on the Gulf of Mexico) alone, direct travel spending in 2002 reached $606.1 million (TTIA, 2004). The cities of Gulf Shores and Orange Beach along Alabama's Gulf Coast have a densely developed tourism industry. The total volume and value of construction in Orange Beach grew 10-fold from 1991 to 1995. Sales tax revenues to the state from Baldwin County grew by more than 300 percent since 1979, totaling about $20 million in 1995 (Kelley and Wade, 1999). Tourism is the most important factor driving Florida's economy. About forty million people visit Florida yearly. Amounting to over $40 billion dollars each year, tourism is the state's greatest source of income (FCIT USF, 2002).

Mississippi's tourism statewide income was $6.4 billion in 2002. The 92,700 direct jobs were 8.2 percent of the total statewide nonagricultural establishment-based employment in 2002 (Mississippi Development Authority Division of Tourism Development Research Unit, 2003).

II.f.3 Oil and Gas production

Another important economic activity in the Gulf is oil and gas production. It is estimated that 1.4-7.2x10^8 barrels of petroleum and 4.4-22.3x10^{10} cubic meters of natural gas are present beneath the seafloor in the northern Gulf (http://www.gulfbase.org/facts.php). According to the Minerals Management Service, offshore operations in the Gulf produce a quarter of the U.S. domestic natural gas and one-eighth of its oil. In addition, the offshore petroleum industry employs over 55,000 U.S. workers in the Gulf (http://www.gulfbase.org/facts.php). In Mexico, the Secretariat of Energy (http://www.gulfbase.org/facts.php) estimated that the daily crude oil and natural gas production from Gulf of Mexico offshore operations in the years 2000 to 2005 ranged from 2.293 to 2.839 million barrels and 41.4 to 44.8 million cubic meters, respectively (http://www.gulfbase.org/facts.php).

The infrastructure for oil and gas production is highly concentrated in the coastal areas of Louisiana and eastern Texas.38% of all petroleum and 48% of all natural gas reserves in the U.S. are estimated to be in the Gulf of Mexico (Giattina and Altsman 1999). Since the early 1970s, oil and gas production in the Gulf area, have followed different patterns with a oil production peaked in 1972 at 389.3 million barrels and about 800 million barrels of natural gas in 1978 (Cato and Adams 1999). Currently deepwater projects will drive the increase in deepwater oil production over the next few years. An increase is predicting from 1.5 million barrels of oil per day to over 2 million barrels of oil per day (Melancon et al, 2004).

The emergence of the offshore natural gas industry in Alabama has added significant revenues to both the State of Alabama and the coastal counties. Severance tax revenues to the state totaled about $30 million from 1990 to 1995 (Kelley and Wade, 1999).

The highest production in the Mexican portion of is located in the states of Tabasco and Campeche; this production is among the most important in the Western Hemisphere. Eighty percent of the oil extraction (an average of 1.5 million barrels of crude oil *per* day) and 90% of the natural gas production of Mexico is originated in the Gulf and its coastal plain (Sánchez-Gil *et al*., 2004). In 2003, Mexico was the world's fifth-largest oil producer, its ninth largest oil exporter, and oil and gas revenues provide about one-third of all Mexican Government revenues.

Although production in oil and gas has gradually increased over the past five years the challenge will be to continue this trend (Yoskowitz 2006):

1. Reserves are decreasing dramatically
2. Technology and expertise are needed
3. Outside operators are not allowed

An important development is the recent announcement of the discovery of large oil fields in the deep Gulf of Mexico, which are expected to begin extraction by 2010. This discovery can increase significantly the activities of the oil industry, particularly in the deep Gulf, with all its consequences.

II.f.4 Shipping

The second largest marine transport industry in the world is located in the Gulf of Mexico (Giattina and Altsman 1999).

Currently more than 75 per cent of Mexico's shipping and cruise traffic currently moves through the Gulf ports. This is an increase of nearly 13 per cent from just five years early. In 1999 total tonnage of shipping was 57 million tons and in 2004 total tonnage was 75.5 million tons. Veracruz is the key commercial port not only in the Gulf, but for the country as well. In 2004 the port handled 70 per cent of the total 687,000 automobiles that shipped in and out of the country. Veracruz is also a key port given the variety of material that it can handle (Yoskowitz, 2006).

Maritime shipping is significant along the Mississippi River corridor into the Gulf. Most of this activity along the entire Mississippi river (93%) occurs between Baton Rouge, Louisiana and the Gulf. 70% of all U.S. waterborne commerce ton-miles of shipping and 60% of all petroleum and petroleum products shipped via waterborne means occur in the Gulf. The volume of waterborne commerce has been increasing in the Gulf region. The total volume (imports and exports combined) has increased from 322 million short tons in 1986 to 397 million short tons in 1992 (Cato and Adams 1999).

Cargo received and shipped through Texas ports in 1990 totaled more than 335 million tons, of which 321 million tons was handled by thirteen major ports. Eighty percent of this tonnage in 1986 was made up of oil and petrochemical products. Because of its location on the Gulf of Mexico, Texas is economically linked to Latin America, especially to Mexico, with which it maintains an important trade relationship (Handbook of Texas Online).

The Gulf coast is the center of the state's oil refining and petrochemical industries. They are served by the Gulf Intracoastal Waterway, which extends 1,200 miles from Brownsville to Carrabelle, Florida, its course passing within the Texas barrier islands and thence mostly through channels dredged inside the coast. The waterway traverses the heart of the endangered whooping cranes' refuge with hazardous cargos of crude oil, benzene, carbon tetrachloride, hydrochloric acid, and other caustic chemicals; a mishap could be disastrous. The waterway must be dredged to remain open. Disposal of spoilage-some 400 million cubic yards of silt a year-gives rise to environmental threats, which must be balanced against the economic benefits. Environmentalists are generally opposed to expanding the waterway to accommodate more traffic and larger vessels, claiming that wetlands would be endangered by resultant incursion of salt water. Yet the waterway is credited with reducing the hypersalinity of the Laguna Madre (enclosed by Padre Island), which resulted in large fish mortalities in the 1930s and 1940s. From an economic standpoint, the waterway has proved highly cost-effective. It moves some eighty million tons of cargo along the coast each year. The waterway and the industries that depend on it provided more than 145,000 jobs in 1986.

II.g Governance

Large Marine Ecosystems produce nearly 90% of the world total fisheries yield, and most of them are overexploited, with many important fisheries dramatically collapsing along with biodiversity changes associated with such overexploitation (Jackson et al 2001, Garibaldi and Limongeli 2003, Pauly et al 2002). In addition, most of these species occur in highly polluted areas due to land based sources of pollution and altered coastal habitats (Miles 1999, GESAMP 2001, USCOP 2006). In this scenario there are some economic estimates of around $10.6 trillion USD per year of natural resources and services that will be necessary to prevent risks (Duda and Sherman 2002, Sherman et al. 2005).

The Gulf of Mexico coast is bordered by 27 large interconnected systems such as bays, deltas, estuaries and coastal lagoons, coastal wetlands, sea grass beds and coral reefs, that have been strongly impacted due to productive and economic activities that in many cases are incompatible among them (Caso et al. 2004).

Thus, the complexity of the Gulf of Mexico must be considered while attempting to manage all natural resources of this ecosystem, and this must be conducted strictly under a clear scheme of governance, with due consideration to political cycles and the current framework of decision making as well as the need for information regarding all natural resources occurring in this Large Marine Ecosystem shared by three countries.

This governance framework should consider factors like the context, purpose, legal jurisdiction, capacity and complexity, which will be able to fit the variety of existing sectoral policies and also consider the linkages needed to incorporate them into the ecosystem based management (Fanning et al. 2007) and would allow for an appropriate path to intervene in the identification of critical areas, whose main goal would be the establishment and improvement of cycles and linkages in a specific context with a clear purpose including aspects such as capacity and complexity.

Since governance is considered as the group of conditions of a political system that allows intervention between government and civil society, then governance for the Gulf of Mexico also refers to the capacity of the society to confront challenges and opportunities. For instance, governance as a concept is known to be a strategy to build capacity (Massolo, 2004).

Based on that concept, democratic governance, involves the legitimacy of political and administrative institutions at all levels, including complex mechanisms, processes and institutions used by citizens and groups in order to articulate their interests, to mediate their differences and to execute their rights as well as fiscal obligations; this type of governance is participatory and transparent in the process of decision making and has mechanisms to request co-responsibility from civil society, is efficient while using resources, has equity and promotes civil rights and the entire use of the Law.

Looking at the Gulf of Mexico as a region, is acknowledging that the common good –economic growth, enhanced public services, and improved environmental conditions and communities- move forward across jurisdictions, benefiting from economies of scale and reducing negative externalities (Gerber and Gibson, 2005 and Young, 1996). With this view, regional leaders should find ways to collaborate vertically across levels of government and horizontally across various sectors, for shared responsibility networking within a recognized interdependence of regional economies, environment, and societies (Basalo, 2003).

Some benefits obtained from governance and this regional coordination are: sharing and learning from each other, encouraging the development of good policies, and improving the quality of the environment of the Gulf of Mexico Large Marine Ecosystem.

The first major challenge that ocean governance faces around the world is institutional capacity, and in the case of the Gulf of Mexico Governance, and institutional framework should consider three main factors:

- Integrated coastal-marine management plans
- Sub-regional approaches
- National ocean and coastal policies

In addition, governance requires that institutions make informed decisions.

The concept of regional ocean governance is gaining attraction in ocean and coastal management as a new way of proactively governing cross-jurisdictional ocean uses, resources, and problems. According to Hershman and Russell (2006), this approach becomes important in the light of the LME project for the Gulf of Mexico, since it offers a way to bring together a wide range of issues and serves as a vehicle for thinking about and utilizing ecosystem-based management (ocean issues connected to one another by the ecosystem inhabitants and processes).

In the case of the Gulf of Mexico, the countries surrounding it have made several attempts to use a regional approach for tackling a diverse, but not necessarily comprehensive set of issues.

The numerous existing organizations in Mexico and U.S. related to ocean and coastal issues can be arranged into four categories as follows:

Government: federal, state, and municipal agencies.
Academic: state universities, associated research centers and federal research centers
Non-government: social organizations such as civil associations, anonymous societies, technical and public councils and commissions, among others
Private: entities that invest, use, extract, transform, or are involved in all sectoral economic activities in the coasts and oceans.

In addition, there are international organizations that need to be considered in order to build the ocean governance of the Gulf of Mexico:

- United Nations organizations established by the Law of the Sea Convention
- United Nations Convention on Environment Development and related organizations
- World Summit for Sustainable Development organizations

However, a greater coordination of integrated scientific studies of the coastal and marine environments and resources, considering social, economic, political, cultural, etc aspects, as well as biological and oceanographic research is necessary.

Regarding the ecosystem management for the Gulf of Mexico, existing legislation includes:

- The Cartagena Convention
- Security and Prosperity Partnership of North America
- Global Program of Action for the Protection of the Marine Environment from Land-based Activities
- North American Commission for Environmental Cooperation

In the mid-1990s Mexico embraced unique elements of governance, conservation, environmental threats, partnerships, and institutional capacity. From 1995 to 2000 and under the leadership of SEMARNAP, there was an increase in the revitalization of key conservation and environmental management tools such as natural protected areas and marine parks, environmental plans for coastal areas, surveillance and environmental law enforcement, and during the 2000-2006 period, the Mexican government has prepared the "National Environmental Policy for the Sustainable Development of Oceans and Coasts: Strategies for its Conservation and Sustainable Use" (PANDSOC).

In 2006 Mexico's federal government marked its determination to move towards the alignment of economic growth and sectoral development accompanied by a continuous improvement in the environmental performance, aided by streamline actions among sectors that use ocean and coastal natural resources (Alvarez, 2006). This environmental view for Ocean and Coast Policy calls on a governance scheme that assumes the legitimacy of the political, economic, and administrative institutions at all levels, through democratic public participative processes that endorse a sustainable development.

The current legal framework for the Gulf of Mexico includes domestic legislation (laws, regulations, norms and codes), international treaties and agreements and bilateral cooperation agreements. This legal element within governance needs a holistic approach. Considering the sea as a common heritage for humankind acknowledges the ocean's economic dimension, environmental dimension and peace and security dimensions.

According to Hershman and Russel (op cit.) the regional ocean governance for the Gulf of Mexico requires:

- Plans to restore and protect ecosystems
- Manage LME activities based on science
- Regionally identify issues, goals, priorities, issue specific responses
- Focus on coordination, regional information services;
- Use marine zoning, MPAs, address water quality, habitat and coastal development mechanisms/management measures determined by the issue;
- Broad representation at all levels of government, including non-governmental interests represented through advisory groups.

Major challenges for ocean governance in Mexico:

- To reconcile the immediate needs of Mexico within a long-term LME planning
- Establish an Integrated Coastal Zone Management Plan as the best option for ocean governance for the Gulf of Mexico.
- To reconcile diverse sector interests with the interests of various social actors at the coastal and marine zones
- To pass from participative planning to participative management
- Establish decision making for ocean governance
- At the regional level, opportunities for developing governance require tailoring policies addressing the major challenges for the Gulf of Mexico
- At the national level, opportunities for ocean governance rely on coastal ordinances, municipal and state development plans

SEMARNAT actions related to the marine and coastal area in Mexico:

- National Strategy for the Ecological Planning of the Territory in Oceans and Coasts (Feb - 2007)
- National environmental policy for sustainable development of oceans and coasts in Mexico
- Ecological sea use planning of the Gulf of California (official decree 2006)
- Ecological regional and sea use planning for the Gulf of Mexico and Caribbean sea (started 2006)
- Regional Plan of Action for the Peninsula of Yucatan (2006)
- Creation of the Inter-secretarial Commission for the Integrated Management of Oceans and Coasts (start in 2007)
- Regions with ecological land use as of today (28,500,839 ha), among them 52% include coastal areas (Muñoz et. al.2006).

Role of adaptive management and public participation to strength governance in the Gulf of Mexico

All of these aim to enhance the participatory process among governments at all levels, society, private entrepreneurs and NGOs. Ecosystem based management and integrated management approaches are both considered to be the key components ideal to achieve environmental sustainability and governance.

Some of these actions were developed in collaboration with the Consultative Councils for Sustainable Development (CCDS), created in 1995 in response to Agenda XXI that was adopted in 1992. They are made up of representative groups of different society sectors from each one of the 32 Mexican states, that meet periodically to analyze environmental and natural resources problems in order to advance solutions for proposals and recommendations to the Ministry of Environment and Natural Resources.

These groups are part of the most important organization of the country and participate intensely in the analysis, elaboration, implementation and evaluation of environmental policies. The regions involving the Gulf of Mexico are the NER (North-East Region) and SSER (South-South East Region), together with the National Council.

In Mexico, social demand has grown considerably and is today more active and complex in many ways.

Mexico's pending tasks

Gulf of Mexico exhibits a fast environmental degradation and faces possible collapse in several areas. The fragile productive chains are compromise in the long term leaving without opportunity to use its natural resources for future generations. Fishing resources, forests, coastal resources and other productive sectors such as hydrocarbons industry, tourism and agriculture have affected the ecosystem and its production at the same time.

Despite the fact that Mexico is part of several international agreements to preserve marine and coastal environment, most identified problems in last decades remain to be scarce or there is a lack of integrated policies to solve them and in general existing actions are isolated by sectors.

Implementation of the Johannesburg Plan for Sustainable Development (WSSD) which calls for actions to "sustain productivity and biodiversity of important vulnerable coastal areas, including those under national jurisdiction as well as out of it, represents an option to focus specific actions towards integrated management of marine and coastal natural resources as well of those in watersheds of the Gulf of Mexico, and immediate actions are recommended as follows:

- Follow up of PEMEX activities related to evaluate oil reserves in deep waters, control of activities in oil platforms and follow up to new wells drilling program in the Yucatan Peninsula
- Establish conservation programs for threaten or under risk species
- Develop management plans for industrial and artisanal fisheries
- Follow up of goals and actions stated in the National Strategy of Ecological Use Planning of the Territory in Oceans and Coasts presented by Mexico's President:
- Marine and regional ecological use planning process for the Gulf of Mexico and Caribbean Sea
- Creation of the Inter-ministerial Commission for the Integrated Management of Oceans and Coasts
- Update legal framework for coastal and marine areas
- Develop the National Ocean Policy
- Elaborate biodiversity conservation program
- Elaborate mangrove strategy for its conservation
- Review and update Official Standards related to ecosystem health and its sustainability

In U.S. the Gulf of Mexico has a history of regional ocean governance activity stemming from the Environmental Protection Agency (EPA) Gulf of Mexico Program, established in 1988, as a non-regulatory program. And because no single agency or level of government had either the necessary technical or financial resources or the legal mandate to address the spectrum of environmental and public health issues facing the Gulf, the Gulf Program was and is today a collaborative effort that includes a consortium of key stakeholders that share significant interests in coastal and marine resources. It is an ecosystem-based approach founded on the principles of bringing the appropriate science, together with the financial and technical resources, to help the Gulf States and coastal communities to effectively address their environmental problems within a broader regional and national context (Palmer, 2002).

The Gulf of Mexico Program's organizational partnership currently includes:

- The lead agency appointed by the Governors in each of the five Gulf States
    - Alabama Department of Conservation and Natural Resources
    - Florida Department of Environmental Protection
    - Louisiana Department of Environmental Quality
    - Mississippi Department of Environmental Quality
    - Texas Natural Resource Conservation Commission
- The Conference of Southern County Associations, representing local governments
- The Gulf of Mexico Coalition, representing business and industry
- The American Farm Bureau Federation's Gulf of Mexico Committee, representing production agriculture
- The Gulf Restoration Network, representing environmental and social justice interests
- The Gulf States Marine Fisheries Commission
- The Nature Conservancy

- The Gulf State Coastal Zone Managers
- The Gulf National Estuary Programs
- The Citizens Advisory Committee - citizens with backgrounds in business and industry, agriculture, fisheries, tourism and the environment - each appointed by their respective Gulf State Governor
- The U.S. Environmental Protection Agency
- The Department of Commerce
- The Department of Defense
- The Department of Agriculture
- The Department of Health and Human Services
- The Department of Interior.

Historically the Program played an important role in assisting the Gulf States address marine debris under the International Convention for the Prevention of Pollution from Ships (MARPOL) and in achieving a Special Area Designation for the Wider Caribbean. Today the Program is providing essential support to the Gulf States for improving the collection and treatment of domestic sewage, restoring important marine habitats, coordinating regional actions to address invasive species, and educating high risk consumers concerning issues of fish and shellfish contamination. Nevertheless, is necessary to examine the major factors that have proven to be significant barriers to original vision in order to define the parameters for any future national policy on coastal and ocean governance. The five principal factors are not mutually exclusive (Palmer, 2002):

1. A lack of support for the Gulf Program at the federal level - This lack of support takes two forms: (a) the Gulf Program has rarely been viewed or utilized by the federal agencies as a serious venue for utilizing the discretion that all agencies have for coordinating activities, leveraging resources, and developing policies and initiatives through a collaborative process; and (b) short of a flurry of legislative proposals in Congress during the early 1990's, there has never been any national mandate that formally established the Gulf Program's purpose and function. Therefore, there is little incentive at the national or regional level for agencies to step outside traditional "stove pipe" lines of authority to develop and pursue common objectives through complementary actions.
2. A lack of support at the State level - The Gulf of Mexico is a large marine ecosystem that is diverse, not only in its ecology, but also in its social and political traditions. The Gulf States have yet to recognize the Gulf as a shared resource with ecological and economic interdependencies to an extent that translates into coordinated political positions and actions. Therefore, in spite of significant efforts to emphasize State leadership in the Gulf Program, that leadership has been uneven across the five States.
3. Fear of additional regulation - EPA is the administrative lead for the Gulf Program. As a regulatory agency, concern has existed and continues today that there is a hidden regulatory agenda. Ironically, this concern was greatly heightened with the development of the Great Lakes water quality regulations and guidance. This package was a comprehensive set of regional regulations developed by the eight Great Lakes States and EPA in the mid-1990. As a result, this concern has curtailed and discouraged any effort to utilize the Gulf Program as a venue for addressing policy or regulatory inconsistencies at the federal or state level, or for developing new approaches, including incentive-based approaches that may involve future regulation.
4. The lack of a strong, vocal, and well-coordinated public interest that calls for better governance across the Gulf - Concerned citizens were initially vocal in their call for improved coordination and consistent policies when the Gulf Program was first formed. Today, while there continues to be citizen interest and involvement on Gulf issues, the concerns and calls for action only on occasion transcend specific issues, specific localized areas, or embrace the concept of integrated, coordinated management of the Gulf as a large marine ecosystem.
5. Finally, our ignorance of just how the Gulf functions as an ecological system - Our inability to articulate, based on scientific information, the inter-relationships and interdependencies of important living, as well as, nonliving natural resources that cross political boundaries and form the foundation for many of our coastal economies continues to be a major challenge. And as a result, we run the risk at the very worst of destroying that which we fail to understand and at the very best of missing opportunities for improved management and economic development of our coastal resources. The Gulf of Mexico is a magnificent sea of discovery - in many respects an ideal laboratory for elucidating physical, chemical, biological, and ecological interactions and phenomenon.

Gulf of Mexico Program has continuing with the current early phase efforts thought of the Gulf of Mexico Alliance (Preliminary Overview of US Regional Ocean Governance Initiatives). The Gulf of Mexico Alliance is a partnership, initiated in 2004, of the states of Alabama, Florida, Louisiana, Mississippi and Texas, intent on significantly increasing regional collaboration to enhance the ecological and economic health of the Gulf of Mexico. U.S. Ocean Action Plan (USOAP) recognizes the leadership that the five Gulf States have demonstrated in forming the Alliance and calls for the increased integration of resources, knowledge and expertise to address regional priorities (Gulf of Mexico Alliance Governors' Action Plan for Healthy and Resilient Coasts 2006-2009).

The Alliance has identified five issues that are regionally significant and can be effectively addressed through increased collaboration at the local, state and federal levels. These priorities represent an initial focus for action through the Alliance:
• Water quality for healthy beaches and shellfish beds.
• Wetland and coastal conservation and restoration.
• Environmental education.
• Identification and characterization of Gulf habitats.
• Reductions in nutrient inputs to coastal ecosystems.

In addition, the Gulf of Mexico Alliance can potentially serve as a forum for effective bi-national regional collaboration with the six Mexican Gulf States (Tamaulipas, Veracruz, Tabasco, Campeche, Yucatan and Quintana Roo). To this end, the Alliance currently coordinates closely with the Gulf of Mexico States Accord and this Action Plan proposes several activities to be implemented in partnership with the Mexican Gulf States.

Thirteen federal agencies have committed to actively support the Gulf of Mexico Alliance:
Council on Environmental Quality
National Aeronautics and Space Administration
National Science Foundation
U.S. Army Corps of Engineers
U.S. Department of Agriculture
    • Natural Resources Conservation Service
    • U.S. Forest Service
U.S. Department of Commerce
    • National Oceanic and Atmospheric Administration
U.S. Department of Defense
    • U.S. Navy
U.S. Department of Energy
U.S. Department of the Interior
    • Minerals Management Service
    • National Park Service
    • U.S. Fish and Wildlife Service
    • U.S. Geological Service
U.S. Department of Health and Human Services
    • U.S. Food and Drug Administration
U.S. Department of State
U.S. Department of Transportation
U.S. Environmental Protection Agency

This Federal Workgroup, coordinated by the U.S. Environmental Protection Agency (EPA) and the National Oceanic and Atmospheric Administration (NOAA), will:
• Support regional leadership of the five Gulf States.
• Supplement Gulf Coast recovery and rebuilding efforts in a coordinated manner.
• Provide local resource managers with state/federal data and decision-support tools.
• Build upon existing partnerships in the Gulf, including the non-regulatory EPA Gulf of Mexico Program.

The 88 Signatories to the Gulf of Mexico Ocean Observing System (GCOOS) resolution represent a diverse group of interested individuals from all sectors of government, academia, and private industry. Though still in a developmental stage, GCOOS hopes to integrate existing Gulf-wide coastal and ocean observing activities as an element of a national integrated ocean observing system for the U.S. coastal ocean (Preliminary Overview of US Regional Ocean Governance Initiatives).

GCOOS seeks to establish a sustained observing system for the Gulf of Mexico to provide observations and products needed by users in this region for the purposes of

- Detecting and predicting climate variability and consequences.
- Preserving and restoring healthy marine ecosystems.
- Ensuring human health.
- Managing resources.
- Facilitating safe and efficient marine transportation.
- Enhancing national security.
- Predicting and mitigating against coastal hazards.

GCOOS envisions sharing of data, models, and products via the internet for the common benefit of all participants, including industry, NGOs, academia, and federal, state, regional, and local government agencies. It is understood that this Gulf of Mexico observing system will be integrated with other regional coastal ocean observing systems, in particular to create an integrated and sustained U.S. component of the ocean observing system.

GCOOS recognizes that the system will require sustained financial support from a combination of government, private, and non-governmental organizations. That will be possible only if the system is built and remains responsive to the needs of these organizations and to the public. Thus, the system will be subject to continuing oversight by representatives of such organizations and of the public.
Collaboration with other nations bordering the Gulf of Mexico is to be actively sought in the design and implementation of this regional observing system (The Gulf of Mexico Coastal Ocean Observing System).

The fishery in U.S. is regulated by the Gulf of Mexico Fishery Management Council that is one of eight regional Fishery Management Councils established by the Fishery Conservation and Management Act of 1976. The Council prepares fishery management plans designed to manage fishery resources from where state waters end, out to the 200-mile limit of the Gulf of Mexico. These waters are also known as the Exclusive Economic Zone (EEZ) (Gulf of Mexico Fishery Management Council).

III. Transboundary problems

Priority transboundary problems for the Gulf of Mexico Large Marine Ecosystem were identified by the participants in a workshop of national experts, in two stages. In the first part, the participants identified a list of problems in each of the five Large Marine Ecosystems five modules: Fish and Fisheries, Productivity, Pollution and Ecosystem Health, Socioeconomics and Governance.

Once the list was completed, participants ranked each problem and the priority list was produced from the average scores.

III.a Complete list

A list of possible transboundary problems for the Gulf of Mexico was identified, and classified in each of the Large Marine Ecosystems five modules. These problems were then prioritised according to the method described below. The complete list of identified problems is:

Problem	Mean Score	Std Dev
Productivity		
Eutrophication and HABs*	2.63	0.50
Lack of adequate wastewater treatment*	2.44	0.73
Lack of knowledge of productivity driving forces	2.00	0.52
Variability of phytoplankton and zooplankton	2.00	0.73

Lack of knowledge of carrying capacity	1.88	0.81
Oceanographic variability (loop current, eddies)*	1.75	0.86
Pollution and Ecosystem Health		
Habitat modification (wetland loss, connectivity, loss of resilience)	2.69	0.60
Lack of information on pollution and ecosystem health	2.38	0.72
Loss of biodiversity	2.33	0.82
Invasive species	2.06	0.68
Impacts of expanded oil and gas development	1.56	0.89
Fish and Fisheries		
Overfishing of (shared, migratory, connected) stocks	2.63	0.50
Lack of knowledge of (shared, migratory, connected) stocks	2.31	0.60
Lack of understanding of keystone species in the food web	1.81	0.75
Effect of global climate change on fishery stocks*	1.63	0.89
Socioeconomics		
Inadequate assessment of value of environmental goods and services	2.63	0.62
Lack of data and analysis of current socioeconomic benefits	2.38	0.72
Governance		
Moving from single species to ecosystem-based management*	2.56	0.63
Present lack of mechanism for countries to improve ecosystem conditions	2.25	1.00
Cognizance of multiplicity of stakeholders to improve recovery	2.13	0.72
Lack of forum for considering additive and integrative ecosystem changes	2.00	0.73
Harmonization of institutional activities	1.94	1.06
Multiple-scale issues not well defined	1.93	0.88
Consideration not given to management of resources	1.56	1.03

Problem	Mean	Std Dev
Fish and Fisheries		
Overfishing of (shared, migratory, connected) stocks	2.63	0.50
Lack of knowledge of (shared, migratory, connected) stocks	2.31	0.60
Lack of understanding of keystone species in the food web	1.81	0.75
Effect of global climate change on fishery stocks*	1.63	0.89
Moving from single species to ecosystem-based management*	2.56	0.63
Productivity		
Eutrophication and Harmful Algal Blooms (HABs)*	2.63	0.50
Lack of knowledge of carrying capacity	1.88	0.81
Oceanographic variability (loop current, eddies)*	1.75	0.86
Lack of adequate wastewater treatment*	2.44	0.73
Lack of knowledge of productivity driving forces	2.00	0.52
Variability of phytoplankton and zooplankton	2.00	0.73
Pollution and Ecosystem Health		
Habitat modification (wetland loss, connectivity, loss of resilience)	2.69	0.60
Invasive species	2.06	0.68
Lack of information on pollution and ecosystem health	2.38	0.72
Loss of biodiversity	2.33	0.82
Impacts of expanded oil and gas development	1.56	0.89
Socioeconomics		
Inadequate assessment of value of environmental goods and services	2.63	0.62
Lack of data and analysis of current socioeconomic benefits	2.38	0.72
Governance		
Multiple-scale issues not well defined	1.93	0.88
Present lack of mechanism for countries to improve ecosystem conditions	2.25	1.00
Lack of forum for considering additive and integrative ecosystem changes	2.00	0.73
Harmonization of institutional activities	1.94	1.06
Consideration must be given to management of resources	1.56	1.03
Cognizance of multiplicity of stakeholders to improve recovery	2.13	0.72

The problems marked with an asterisk are those considered to be horizontal (crosscutting issues), or those important for two or more modules.

III.b Prioritised list

The national experts ranked each problem in the complete list, giving to each problem a score from 0 (no relevance to the Gulf of Mexico Large Marine Ecosystem) to 3 (very high relevance to the GoM-LME). It was decided to consider as the priority problems those with a mean score of 2.5 or higher.

The resulting table of priority transboundary problems, with their mean score and standard deviation from the mean, for the Gulf of Mexico is:

Problem	Mean Score*	Std Dev
Productivity		
Eutrophication and HABs*	2.63	0.50
Pollution and Ecosystem Health		
Habitat modification (wetland loss, connectivity, loss of resilience)	2.69	0.60
Fish and Fisheries		
Overfishing of (shared, migratory, connected) stocks	2.63	0.50
Socioeconomics		
Inadequate assessment of value of environmental goods and services	2.63	0.62
Governance		
Moving from single species to ecosystem-based management*	2.56	0.63

* On a 0 to 3 scale

Marked with an asterisk are the problems that can be included in more than one module. Given the magnitude of the standard deviations, and the differences in mean scores, it can be said that all the transboundary problems have roughly the same priority.

Many stocks in the Gulf of Mexico are over fished, or are at (or close to) their maximum yield. This is particularly important for stocks shared between two or more countries, or stocks that are migratory or connected via egg or larval transport. Thus, non-sustainable management of shared, migratory and/or connected stocks (the mackerels, tuna, etc.) was also identified as a priority issue for the Gulf of Mexico. One of the main problems, and challenges, identified is moving from a single species, maximum sustainable yield management of fisheries to an ecosystem-based approach. The actions taken to deal with these two problems must be closely interlinked, since they are closely related.

Eutrophication and harmful algal blooms was also considered a priority transboundary problem. The presence of a large seasonal “dead zone” at the mouth of the Mississippi river, and the increasing frequency of red and brown tides along the coast of the Gulf of Mexico is a consequence of increasing coastal population and activities, as well as increasing nutrient inputs from agricultural runoff.

Poorly planned coastal development for the construction of port facilities, tourism projects, housing for the increasing population, etc. has increased habitat destruction or alteration. Building on sand dunes, destruction of mangroves or sea grass beds, etc. produces both functional and structural changes in coastal ecosystems that can seriously impair their function as nursery grounds for many species, including commercially important ones, and also increase their vulnerability to extreme climatic events, such as storms or hurricanes.

The inadequate assessment of the value of the goods and services provided by the Gulf of Mexico is a handicap to management actions and public support, since this value is not fully appreciated. A related issue is the lack of widely accepted and harmonized methodologies for assessing the value of environmental services. A common framework for such assessments would be desirable.

IV. Causal chain analysis

For each priority problem identified, a causal chain analysis was done, as is presented in the next figure. A brief description follows the figure.

Habitat modification is the final result of three major transboundary problems: reduction of fishery stocks, increased risk for endangered species and loss of ecosystems and ecosystem services.

Each transboundary problem has immediate and underlying causes and all they have common root causes.

IV.a Reduction of fishery stocks

IV.a.1 Immediate causes

The immediate causes identified of these problems are: overexploitation, eutrophication and HABs and global climate change (global warming, sea level change, ocean acidification, etc.).

IV.a.2 Underlying causes

The underlying causes for overexploitation were: the increased fishing effort due to population migration to coast; increased technological capabilities which have resulted in higher catches per unit effort, particularly for the industrial fleets; the non-selectivity of fishing gear, resulting in more bycatch; uncertainty of assessments is perceived as being too high by stakeholders and managers; overcapitalization; deficient fisheries control policies.

The underlying causes for eutrophication and harmful algal blooms (HABs) were: poor agricultural practices (agricultural runoff, land management); poor planning (deforestation, urban planning); lack of wastewater treatment (urban and urban sewage, farms, industry, etc.); low level of fines/ enforcement of fines and weak enforcement of agricultural and urban regulation; aerosol contaminants and atmospheric deposition; inadequate building codes which allow, *inter alia*, building on top of the sand dunes, interruptions of laminar water flow, etc; lack of mitigation compensation mechanisms.

IV.b Increased risk for endangered species

IV.b.1 Immediate causes

The immediate causes are the construction and development in the costal zone and global climate change (global warming, sea level change, ocean acidification, etc.).

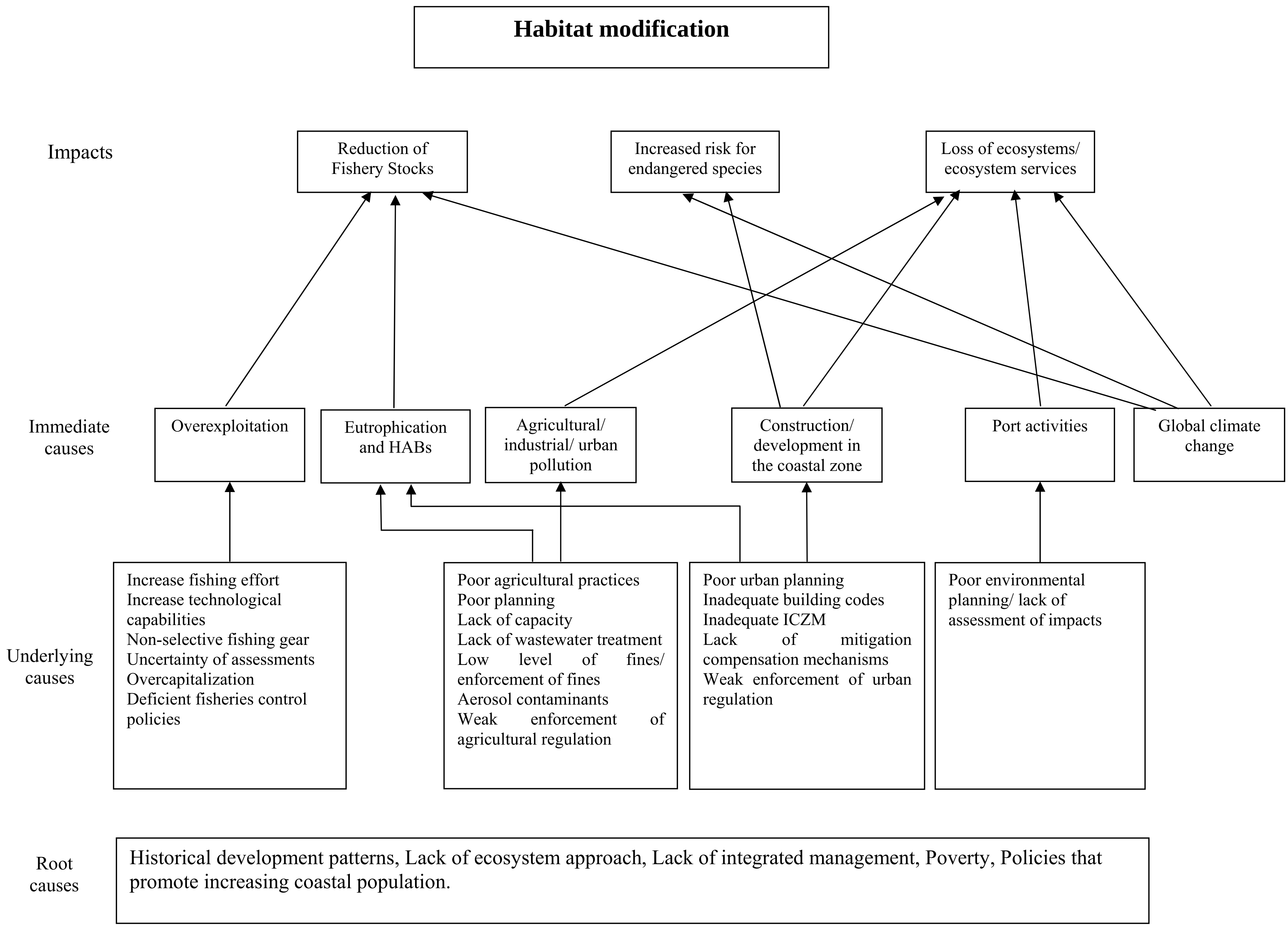
IV.b.2 Underlying causes

Underlying causes for construction and development in the costal zone are poor urban planning; inadequate building codes; lack of mitigation compensation mechanisms; weak enforcement of urban regulation.

IV.c Loss of ecosystems and ecosystem services

IV.c.1 Immediate causes

The immediate causes are agricultural, industrial and urban pollution; construction and development in the coastal zone; port activities and global climate change (global warming, sea level change, ocean acidification, etc.).


Habitat modification
Impacts
Reduction of Fishery Stocks
Increased risk for endangered species
Loss of ecosystems/ ecosystem services
Immediate causes
Overexploitation
Eutrophication and HABs
Agricultural/ industrial/ urban pollution
Construction/ development in the coastal zone
Port activities
Global climate change
Underlying causes
Increase fishing effort
Increase technological capabilities
Non-selective fishing gear
Uncertainty of assessments
Overcapitalization
Deficient fisheries control policies
Poor agricultural practices
Poor planning
Lack of capacity
Lack of wastewater treatment
Low level of fines/ enforcement of fines
Aerosol contaminants
Weak enforcement of agricultural regulation
Poor urban planning
Inadequate building codes
Inadequate ICZM
Lack of mitigation compensation mechanisms
Weak enforcement of urban regulation
Poor environmental planning/ lack of assessment of impacts
Root causes
Historical development patterns, Lack of ecosystem approach, Lack of integrated management, Poverty, Policies that promote increasing coastal population.

IV.c.2 Underlying causes

The underlying causes for agricultural, industrial and urban pollution were: poor agricultural practices (agricultural runoff, land management); poor planning (deforestation, urban planning); lack of wastewater treatment (urban and urban sewage, farms, industry, etc.); low level of fines/ enforcement of fines and weak enforcement of agricultural and urban regulation; aerosol contaminants and atmospheric deposition; inadequate building codes which allow, *inter alia*, building on top of the sand dunes, interruptions of laminar water flow, etc; lack of mitigation compensation mechanisms.

Underlying causes for construction and development in the costal zone are poor urban planning; inadequate building codes; lack of mitigation compensation mechanisms; weak enforcement of urban regulation.

The underlying causes for port activities were: poor environmental planning causes changes in coastal circulation from the constructions of port, industrial and urban infrastructure, development in sensitive coastal habitats such as sand dunes, mangrove forests and sea grass beds; lack of assessment of impacts.

IV.d Root causes

Common root causes are: historical development patterns; lack of ecosystem approach due to the economic system does not consider ecosystem health; lack of integrated management; poverty and lack of economic opportunities; policies that promote increasing coastal population due to migration and human and economic growth without planning.

V. Conclusions

- There is a long history of bilateral collaboration between the coastal countries of the Gulf of Mexico, but very little cooperation between the three countries. This collaboration needs to be strengthened, and current cooperation efforts broadened.

- The Gulf of Mexico Large Marine Ecosystem supports a high biodiversity for different biological groups, and contains important ecosystems such as coral reefs, coastal lagoons and estuaries that provide nursery and protection grounds for important species and are important for the productivity of the region.

- Coastal population is increasing, and is already very high on the United States coast of the Gulf.

- Increasing population and economic activities are increasing pressure on the Gulf and its resources. This increasing pressure is expressed as increasing pollution, “dead zones” and more frequent red and brown tides, and habitat alteration.

- Most fishing stocks are overfished, or are very close to their maximum yield and the fishing industry is very overcapitalized. Fishing stocks are decreasing.

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VII. Annexes

In Annex A are included the Thematic Reports prepared by the National Experts from the participating countries. They contain more detailed information than what is given in the Transboundary Diagnostic Analysis document for the Gulf of Mexico Large Marine Ecosystem, and are the basis for the background information on the GoM-LME. The Thematic Reports also document and give background information on the priority problems identified. They contain the factual, updated scientific information available for the region.

In Annex B a list of stakeholders from all participating countries is given.

Annex A

Thematic reports Mexico

Background for the Transboundary Diagnostic Analysis:

Fish and Fisheries

Associated with the Gulf of Mexico Large Marine Ecosystem

August 2006

Introduction

Landings from the Gulf of Mexico fisheries account to 22% of the total fisheries production in Mexico (313,686 tons out of the total 1,520,938 caught in 2001), although nearly 38% of the Mexican fishermen live in its five coastal states (Tamaulipas, Veracruz, Tabasco, Campeche and Yucatan). In those states, in 2001, lived 13,902,925 people (out of 97,483,412 Mexicans in that year), with an average population density of 52 inhabitants /km^2, against the national average of 89 (INEGI, 2001).

Traditionally, regarding catches, fishing technology and attention in research and government support, the Mexican Gulf of Mexico states have lagged behind the Pacific shore, particularly the states the Gulf of California.

Catch composition

In general, and in contrast with the Mexican Pacific shore, most of the catch in the Gulf of Mexico comes from artisanal fisheries. While up to 63% of catches in the Mexican Pacific come from a small number of industrial fisheries (Tuna, Shrimp, Small pelagics) and up to 40% from a single one (Small Pelagics), in the Gulf of Mexico only 10% of the total come from these fisheries. In the Gulf of Mexico catch is distributed in many small-scale fisheries, only four items ("Mojarra" that also includes freshwater tilapia, shrimp, octopus and oyster) get catches above 10,000 tones and these account for 38% of the total catch. In contrast, 6 Pacific fisheries catch above 50,000 tons (sardine, tuna, shrimp, squid, oyster and "mojarra", also including tilapia), comprising 71% of the total. Figure 1 shows the comparison between the catch composition in the Pacific and Gulf of Mexico shores in 2001 (CONAPESCA, 2001).

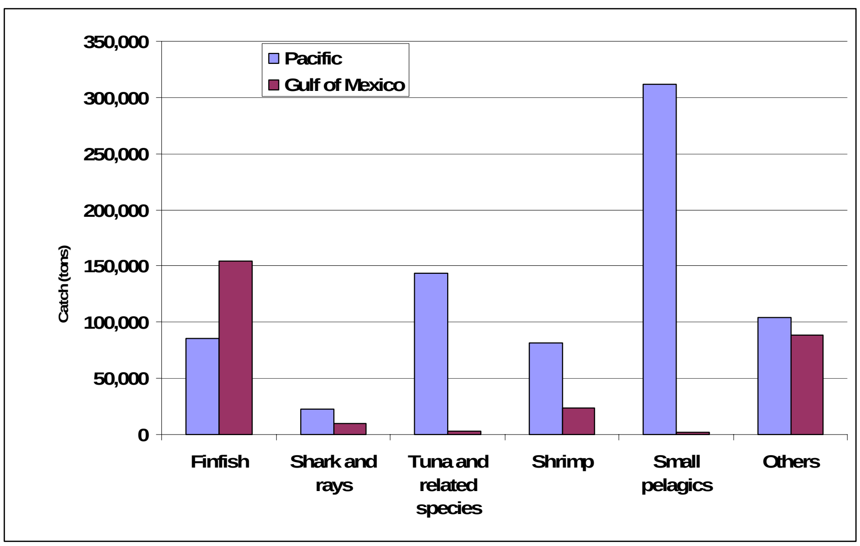


Figure 1. Comparison between catch compositions in the Mexican Pacific an Gulf of Mexico shores.

In figure 2 is easily seen that most (up to 56%) of the catch in the Gulf of Mexico fisheries is comprised by finfish. Among the species included in this category we can find the following, referred by its common name in English (with Mexican most used common name and genus in parentheses): mojarra (mojarra, *Gerres, Eugerres*, *Eucinostomus*), gafftopsail catfish (bandera, *Bagre*), jack (jurel, *Caranx*), snook (robalo, *Centropomus*), weakfish (trucha, *Cynoscion*), snapper (guachinango, pargo, Lutjanus), seabass (corvine, *Cynoscion*), rudderfish, amberjack (esmedregal, *Seriola*), yellowtail snapper (rubia, *Ocyurus*), vermilion snapper (besugo , *Rhomboplites*), grunt (ronco , *Pomadasys, Anisotremus*), sea catfish (bagre , *Arius*), croaker (berrugata , *Menticirrhus*), pompano (pámpano, *Trachinotus*), cabrilla (cabrilla, *Paralabrax, Epinephelus*), flounder (lenguado, *Paralichtys, Syacium*), mullet (Lisa, *Mugil cephalus*), white mullet (lebrancha, *M. curema*), Grouper (Mero, Epinephelus morio), Spanish mackerel (Sierra, *Scomberomorus maculatus*) and king mackerel (peto or carito, *S. cavalla*).

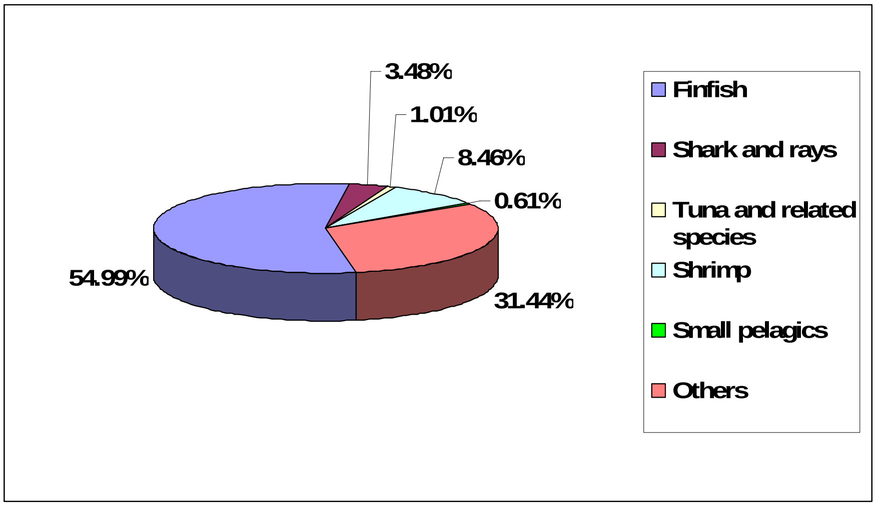


Figure 2. Catch composition in the Gulf of Mexico Mexican fisheries. (from data from CONAPESCA, 2001).

Under "Sharks" we can find the following species**:** Atlantic sharpnose shark (Cazón de ley, caña hueca, Rhizoprionodon *terraenovae*), blacktip shark (tiburón puntas negras, volador, *Carcharhinus limbatus*), bonnethead (cazón cabeza de pala, pech, S. *tiburo*), scalloped hammerhead (cornuda, *Sphyrna lewini*), bullshark (tiburón chato *C. leucas*), blacknose shark (cazón canguay, pico Negro, *C. acronotus*), smalltail shark (tiburón poroso, cuero duro, *C. porosus),* spinner shark (tiburón curro, puntas negras, picudo, *C. brevipinna*), hammerhead (cornuda grande, cornuda gigante, *Sphyrna mokarran*), night shark (tiburón nocturno, ojo verde, *Carcharhinus signatus*), sandbar shark (tiburón aleta de cartón, aletón., *C. plumbeus*), angel shark (tiburón ángel, angelote, *Squatina dumerili*), dusky shark (tiburón prieto, negro, tabasqueño, *Carcharhinus obscurus*).

"Rays" include mostly the following: spotted eagle ray (chucho, chucho obispo, chucho pintado, *Aetobatus narinari*), skate (raya, *Raja texana*), Southern stingray (raya látigo, *Dasyatis americana*), longnose stingray (raya látigo hocicona, *D. guttata*), cownose ray (raya gavilán, *Rhinoptera bonasus*).
Under "shrimp" we include the following species: brown shrimp (camarón café, Farfantepenaeus. *aztecus*), white shrimp (camarón blanco, *Litopenaeus setiferus*), pink shrimp (camarón rosado *F. duorarum*), seabob (camarón siete barbas, *Xiphopenaeus kroyeri*).

The category "others" include several important fisheries, and most small ones, among others: Mayan octopus (pulpo maya, rojo, *Octopus maya*) and common octopus (pulpo patón, pulpo común, *O. vulgaris*), spiny lobster (Langosta espinosa, mostly *Panulirus argus* but also found the spotted lobster, langosta pinta, *P gutatus* and the green lobster, langosta verde, *P. laevicauda*). It also includes several invertebrate fisheries of local importance like the queen conch (caracol rosado, *Strombus gigas*) and several gasteropods (*S. costatus,* Pleuroploca *gigantea*, Turbinella *angulatus* and *Busycon contrarium*).

The tuna fishery catch comprises mostly (50% of total catch, including non-thunid by-catch) yellowfin tuna (atún aleta amarilla, *Thunnus albacares*) but also, although less frequently, bluefin tuna (atún aleta azul, *Thunnus thynnus*), blackfin tuna (atún aleta negra, *Thunnus atlanticus*), skipjack (barrilete, *Katsuwonus pelamis*), bigeye (patudo or ojón, *Thunnus obesus*) are also caught.

Although more information is needed on the species caught, in the "small pelagics" category we can find herring-like species like menhadens (lacha, *Brevoortia spp.*) and scaled sardines and herrings (sardina, *Harengula spp.*).

Trends of catches

While national catches had a noticeable fall after 1981 (due to the collapse of the anchovy fishery and marked reductions in sardine catches) and remained practically stagnated, oscillating around 1,300,000 annual tons, catches in the Gulf of Mexico grew steadily until 1989. After that year, catches have been decreasing at an average of –4% yearly. In 2002, annual catches were 70% of those obtained in 1989 (figure 3).

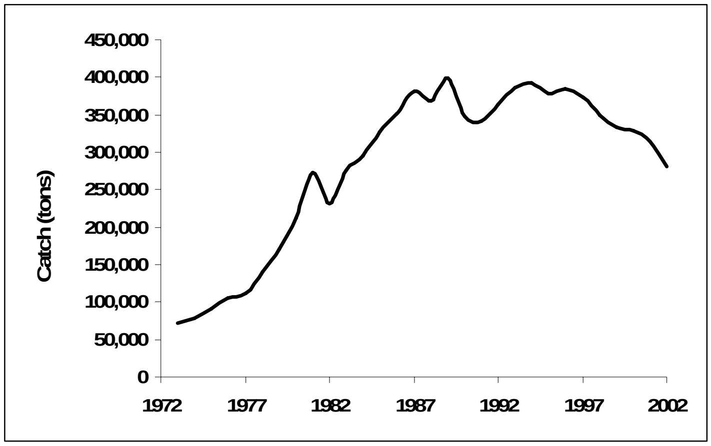


Figure 3. Trend of total catch in the Mexican fisheries in the Gulf of Mexico. (from data from CONAPESCA).

Figure 4 shows the trend of catches of the coastal Mexican states in the Gulf of Mexico, every state, except for Tabasco has a descending trend from the early to mid nineties onwards.

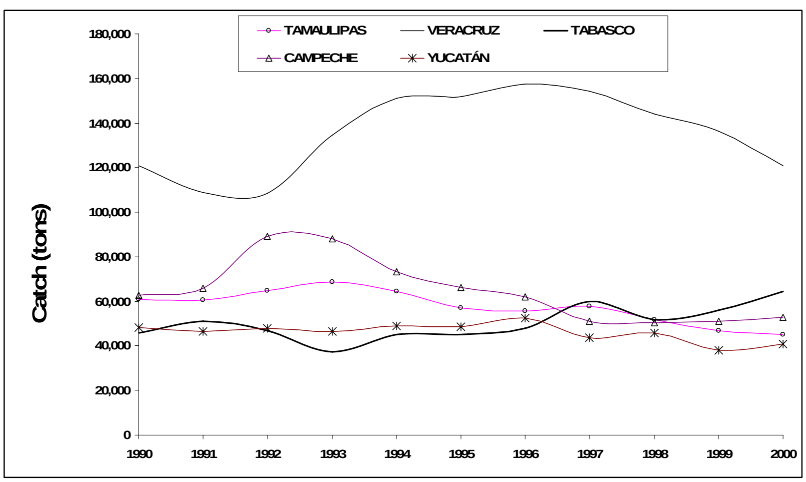


Figure 4. Trend of catches in the Mexican states in the Gulf of Mexico. (from data from CONAPESCA, 2001).

Overall, the most important fisheries have had small or negative average growths since the mid nineties. Only the small, relatively unimportant fisheries have had noticeable growth. This is shown with some fisheries in figure 5.

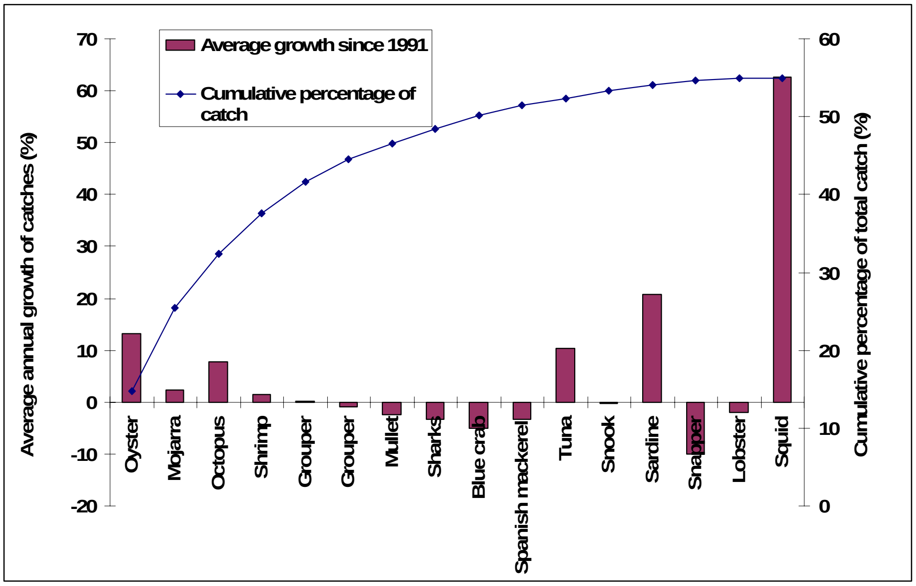


Figure 5. Average annual growth (in percentage) of some Mexican fisheries in the Gulf of Mexico (from data from CONAPESCA) since the mid nineties.

Figures 6 to 10 show the trends of catches of the fisheries included in the last graph. As can be seen, in most of the most important fisheries there is a descending trend of catches since the early to mid nineties.

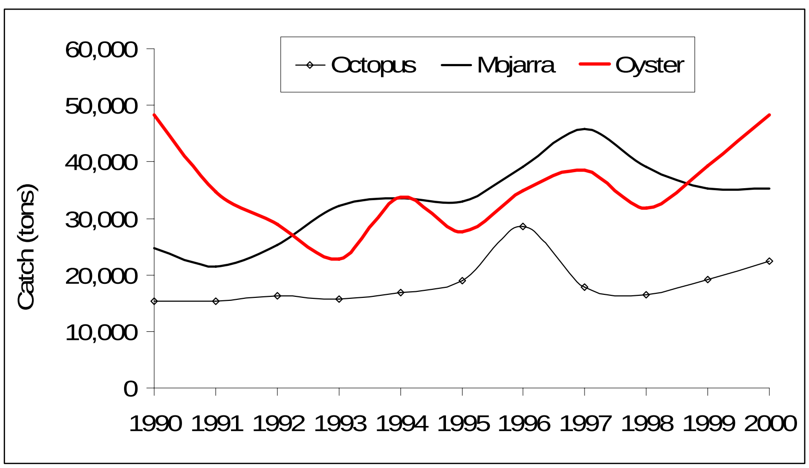


Figure 6. Trends of catches in the octopus, “mojarra”, and oyster fisheries.

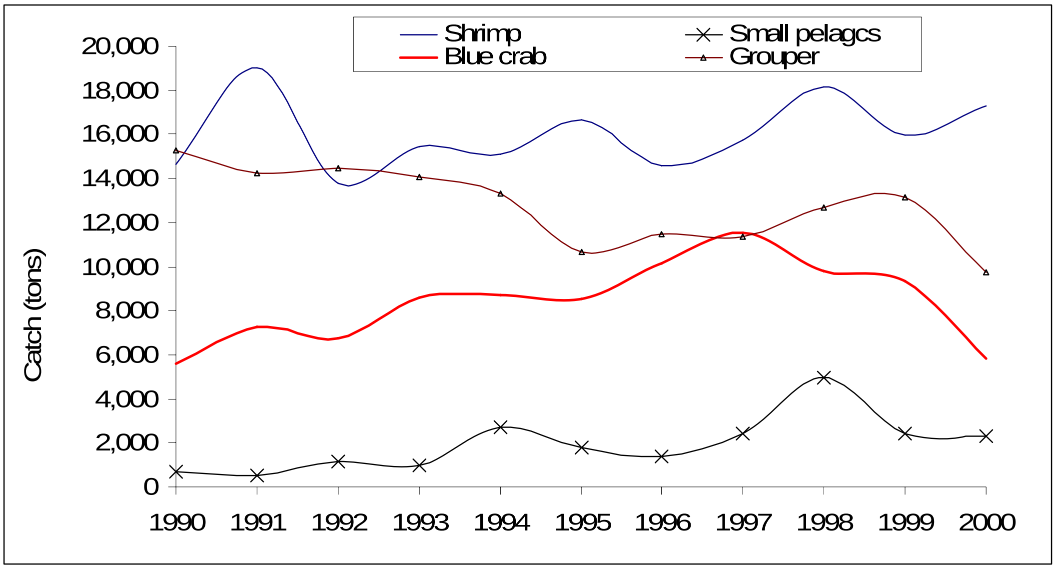


Figure 7. Trends of catches in the shrimp, blue crab, small pelagics and grouper fisheries.

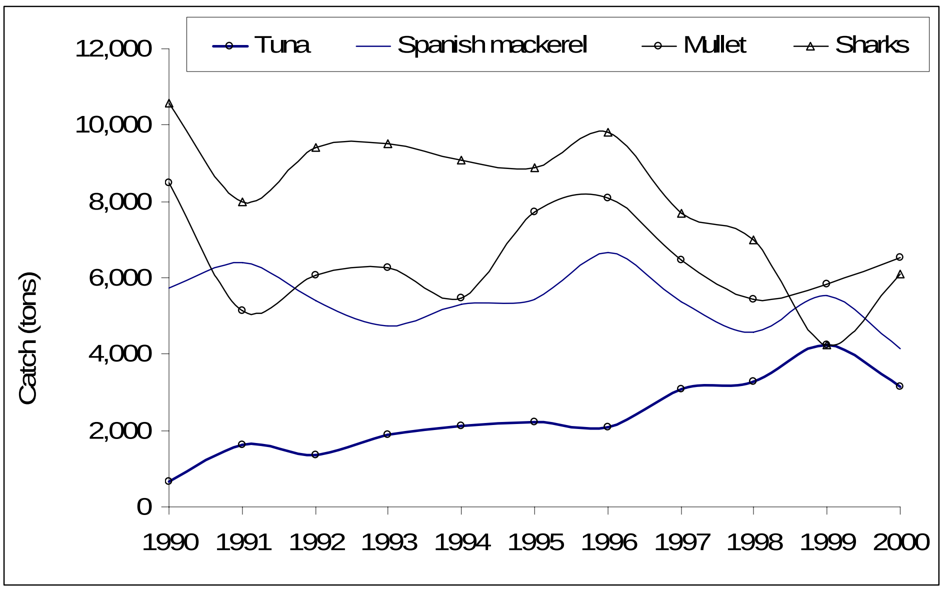


Figure 8. Trends of catches in the tuna, Spanish mackerel, mullet and sharks fisheries.

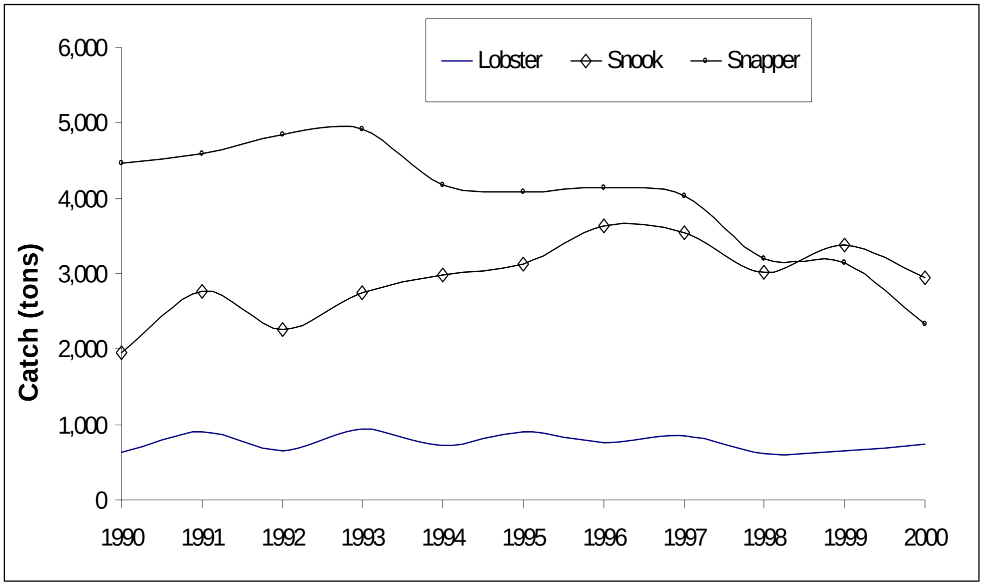


Figure 9. Trends of catches in the lobster, snook, and snapper fisheries.

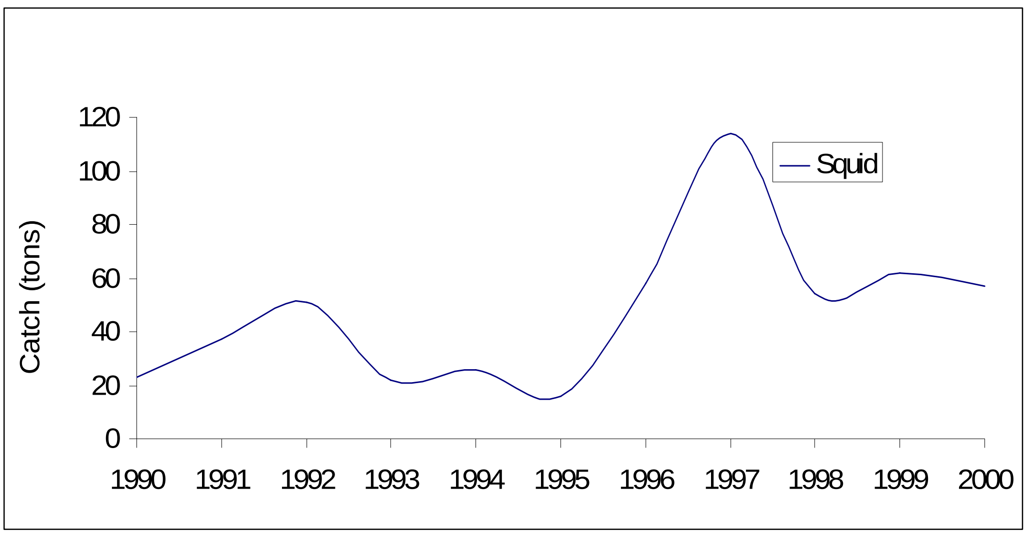


Figure 10. Trends of catches in the squid fishery.

Fleets used in Gulf of Mexico fisheries

Logically, the type of species exploited determines the kind of fleets operating in the Gulf of Mexico. Figure 11 shows a comparison of the number of vessels per type of fishery in the Mexican Pacific and Gulf of Mexico seashores. The shrimp and finfish fleets are the main industrial ones in the Gulf of Mexico. The industrial shrimp fishery employs wooden (21%), steel (76%) and fiberglass (3%) vessels with 300-600 HP engines. Since the mid seventies the usual fishing gear are two pairs of twin nets 36 to 60 ft wide and 1.5-2.25 in. mesh size (figure 12) (Fernández-Méndez et al., 2000).

The finfish fleet is a quite diverse one, including big, steel-hulled vessels, using trawl nets (operating mainly from Veracruz state) and relatively small, wooden vessels around 50-100 tons of displacement, 33 to 66 ft in length, and engine powers ranging from 120 to 365 HP. A sizable portion of this fleet, 628 vessels of the

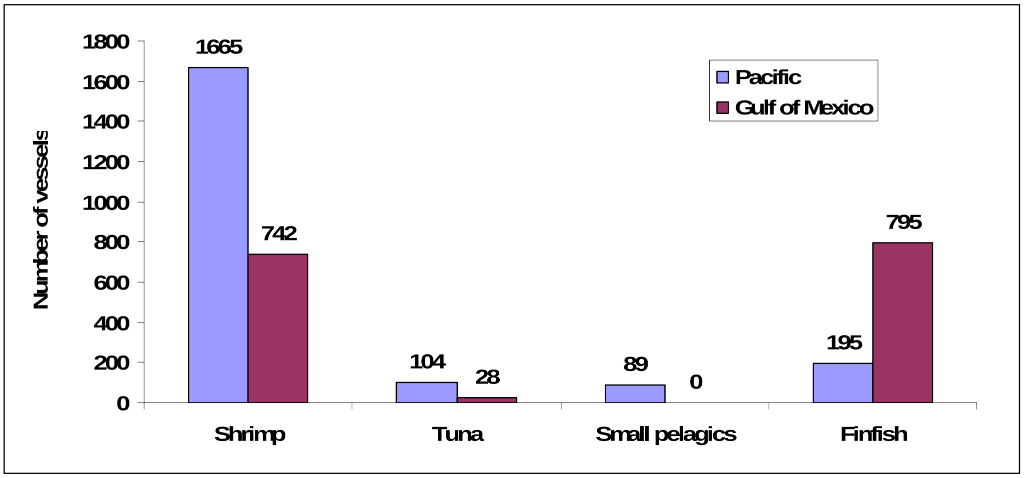


Figure 11. Comparison of the number of vessels in the industrial fisheries in the Mexican Pacific and Gulf of Mexico (data from Conapesca, 2001).

relatively small ones, operate in the wide Yucatan continental shelf, many employing long-lines (Monroy et al. 1996; Monroy et al., 2000). Some, if not most, of these vessels are classified as "industrial" based on size but, as they use the same fishing gears and have quite the same level of technification of the smaller vessels, should be considered in the same technological category with the artisanal vessels, although in many cases incorporate mechanical advantages like winches

The tuna fleet in many cases employs adapted finfish or shrimp vessels, operating mid-water long-lines to catch dispersed individual tuna that roams the edge of the continental shelf (González-Ania, 2000).

The most frequently found fishing vessel, however, is the fiberglass, fifteen to eighteen feet long, outboard-powered (25 to 200 HP), small vessel called panga, used in artisanal fisheries. In the Gulf of Mexico (as well as in the Pacific) up to 96% of the fishing vessels are of this type. Figure 13 shows the number of vessel for the fisheries discussed here in the Gulf of Mexico coastal states.

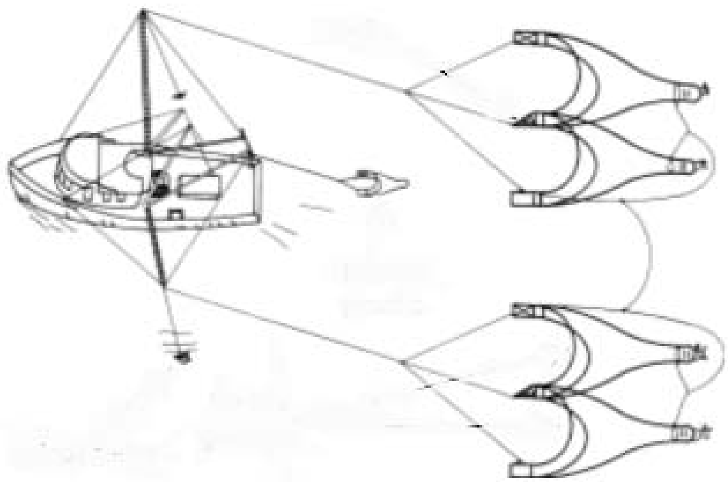


Figure 12. The most common type of shrimp vessel used in the Gulf of Mexico (modified from the National Fisheries Chart, 2000).

Number and distribution of fishermen

Statistical yearbooks report 268,727 persons employed in fisheries in Mexico in 2001 (CONAPESCA, 2001). INEGI (Instituto Nacional de Estadística, Geografía e Informática, National Statistics, Informatics

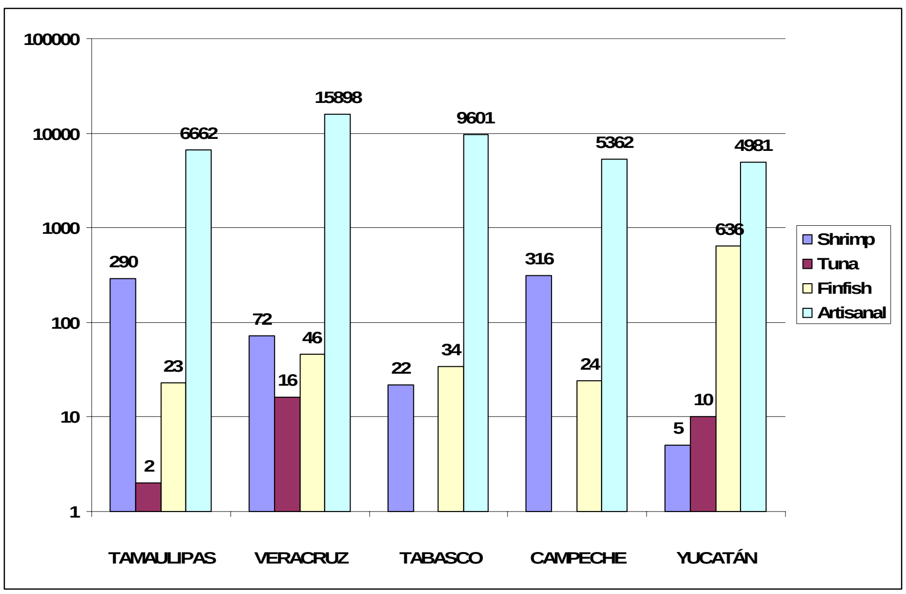
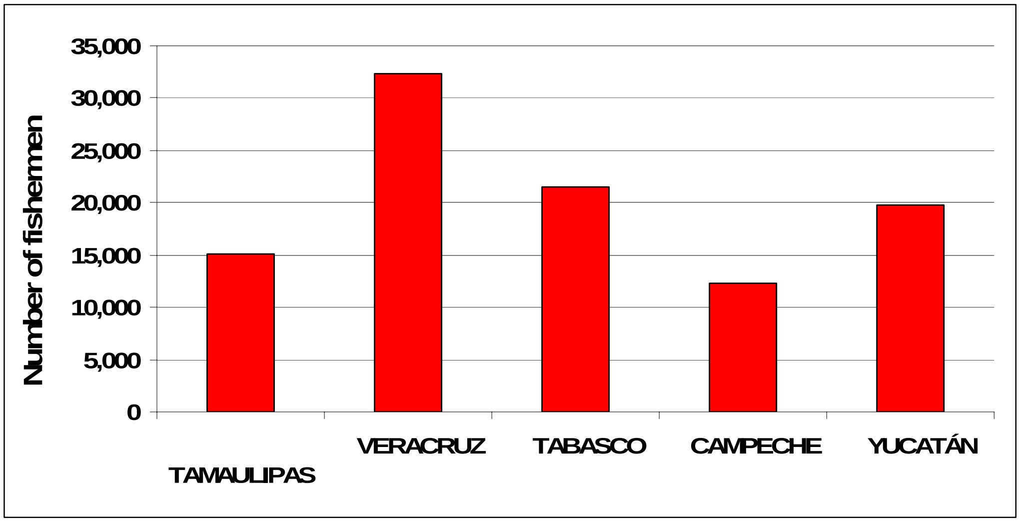


Figure 13. Number of vessels used per fishery in the Gulf of Mexico Mexican states (data from CONAPESCA, 2001).

and Geography Institute) (1999) reports 154, 379 persons employed directly in fisheries and aquaculture and 83,058 employed in jobs directly related to them. According to statistical yearbooks (CONAPESCA, 2001) there are 104,028 persons involved full time in fisheries in the Gulf of Mexico and Caribbean seashores 15,153 in Tamaulipas, 32,277 in Veracruz, 21,499 in Tabasco, 12,307 in Campeche, 19,711 in Yucatán and 3,081 in Quintana Roo. These numbers include artisanal and as industrial fishermen as well as 1,203 involved in aquaculture as well as other employees directly related to the sector. Most of the people registered by INEGI as employed in fisheries are registered as such by obtaining most of their income from fisheries or related activities.

Figure 14 shows the number of fishermen in Gulf of Mexico Mexican states and figure 15 the percentage of



fishermen in the populations of those states. The number of artisanal vessel is the best predictor of the number of fishermen (R^2= 0.88, slope 1.84), reflecting the artisanal nature of most Mexican fisheries (in the Pacific we find mostly the same relationship, R^2= 0.8, slope 3.04).

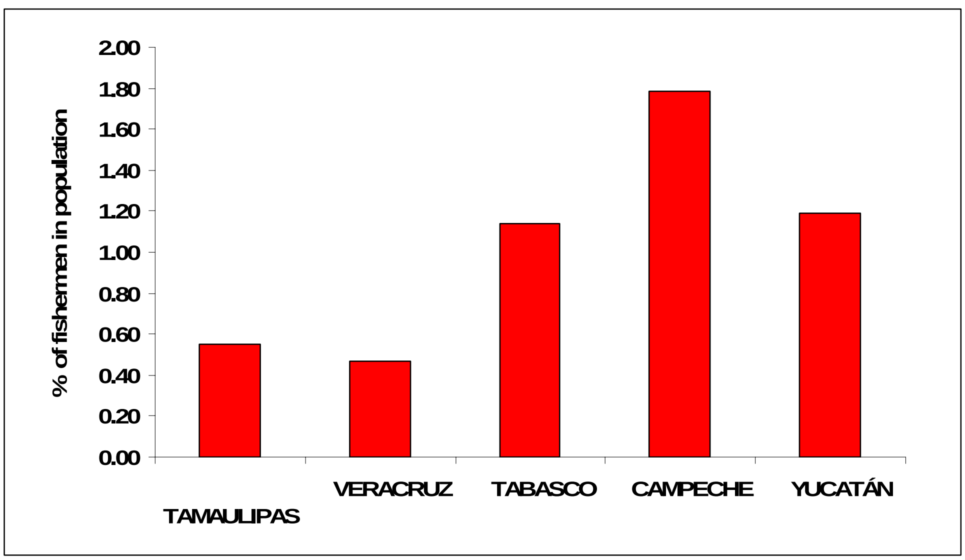


Figure 15. Percentage of fishermen in the population of coastal Mexican states (data from SEMARNAP, 1997,CONAPESCA, 2001).

Not surprisingly, in a country with little employment alternatives and traditionally lax fisheries regulations, fisheries are widely seen as an last-ditch employment option.

Chenaut (1985) and Solis et al. (1997) discuss that many fishermen in Yucatán were former peasants displaced from agriculture. This is reflected in the fact that, at least initially, they were organized in

Sociedades Pesqueras de Producción Rural (Fishing Societies of Rural Production). Many of these retained some of their agricultural activities. Chenault reports than in the neighboring Quintana Roo, the dependence of communities on fisheries were bigger, being the land in the North of that state unfit for agriculture.

The degree of dependence of certain coastal communities on fisheries resources can be illustrated by seasonal fishermen migrations. Although it can be considered that most fishermen are native of the areas they operate in, there is a considerable seasonal migration in certain areas, associated with local variations of resource abundance. Fernández et al (2000) and Gómez and Monroy (2000) comment on the seasonal influx of fishermen to Tamaulipas from other states (mostly Veracruz) to the shrimp and mullet fisheries in the periods of high abundance. Alcalá (1986) reports the presence of transient fishermen from Veracruz in Tabasco. Cesar (1998) reports migrant fishermen from Veracruz establishing fishing communities in Northern Quintana Roo.

Gulf of Mexico fishermen can be divided into two major groups, industrial and artisanal fishermen. According to Alcalá (2003), 80% of fishermen in Mexico are organized into fishing cooperatives. These can include some (a minority) offshore shrimp fishermen but most of them are artisanal fishermen. Other type of artisanal fisherman, the so-called "free fishermen" (pescadors libres) own their own vessels but are not organized into cooperatives. Another category includes the employed fishermen (apatronados"), who don't own their own vessel and work as employees in other people's vessels. Alcalá discuss that some "free fishermen" work only in a certain part of the year in their own vessel working the rest of the year as crew with somebody else.

There are 2,976 registered fishing cooperatives in Mexico, along with 2,954 organizations of other types like Fishing Production Societies, Fishing Producción Unions, Social Solidarity Societies and others. In total, there are 185,756 people associated within these organizations, 118,328 in cooperatives and 67,428 in the other kind of organizations (CONAPESCA, 2001). Many fishing cooperatives are in turn organized within the National Fishing Cooperatives Confederation.

The industrial fishermen (also known as "armadores" "assemblers for the erstwhile role of some of them as ship builders), most of them grouped within the National Fisheries and Aquacultural Industry Chamber (CANAIPESCA) are described by Alcalá (2003) as "wealthy and with the best political links" can, as discussed by this author and Hernández and Kempton, (2003), form a strong lobby that can face and modify fisheries policies.

Socioeconomic aspects

Economic and social benefits derived from fisheries are very unevenly distributed. Almost 50% of the catches come from industrial fleets. As has been said, a good portion of them (70% of the shrimp fleet, 80% of the tuna and all the sardine and anchovy fleets) operate in the Pacific, concentrated in the states surrounding the Gulf of California, so almost 40% of national catches and 58% of the total economic value come from this region. In addition to that, there is a noticeable economic value gap between the products of different fisheries. Despite being 7% in volume of catches (3% from capture fisheries, 4% from aquaculture) shrimp reached 53% of the gross value of Mexican fisheries in 2001 (CONAPESCA, 2001).

In terms of volume, the catch of the Mexican states in the Gulf of Mexico lag behind that of the states surrounding the Gulf of California (figure 16). In terms of volume this arrangement has not changed much in the last two decades.

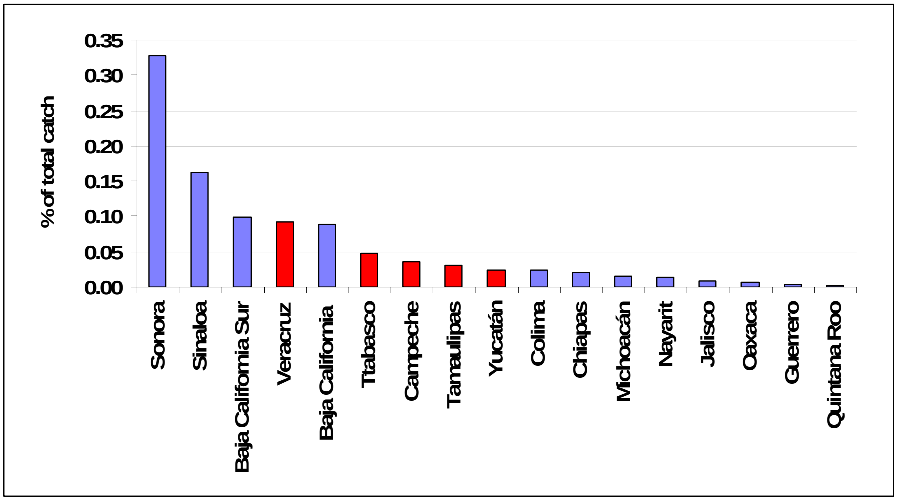


Figure 16. Percentage of the total catch obtained by coastal Mexican states (Gulf of Mexico states in red, data from CONAPESCA, 2001).

However, regarding economic value important changes have occurred. The gross value of total fisheries production has been around 1.06 billion USD in the last 5 years. Figure 17 shows the percentage of total value obtained by each coastal state in the last ten years. In that period Campeche, Veracruz and Tamaulipas fell from the second, third and fourth place they had after Sinaloa (where most of the industrial fleet is concentrated) to be displaced by Sonora. Most probably, these changes have to do with the growth of production of cultured shrimp In Sonora and Sinaloa. It also has to do with the collapse of the shrimp fishery in Campeche. In particular, this state’s share from above 10% to around 5% of the total value.

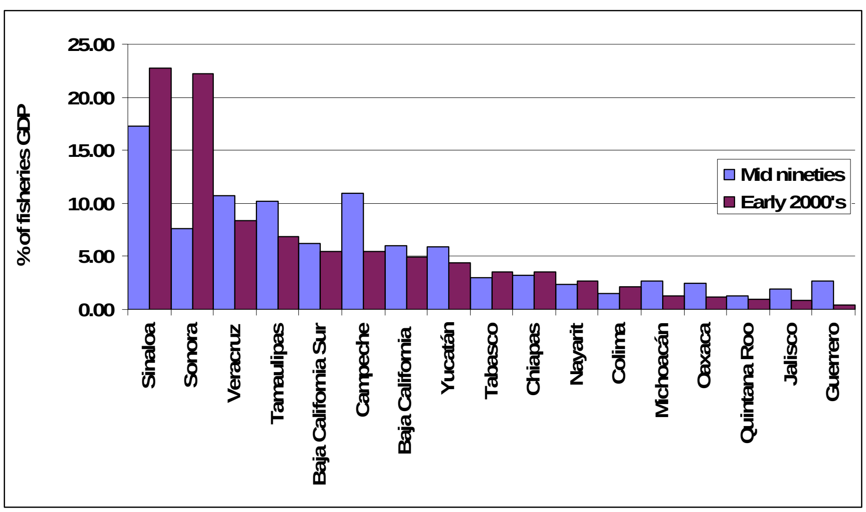


Figure 17. Percentage of the total value obtained by coastal Mexican states (data from SEMARNAP, 1997,CONAPESCA, 2001).

As was to be expected from different coastline length catch is not evenly distributed among Gulf of Mexico states. Veracruz gets around 40% of the Gulf of Mexico catch (figure 18). However, that stat and Campeche get about the same catch per fisherman (figure 19).

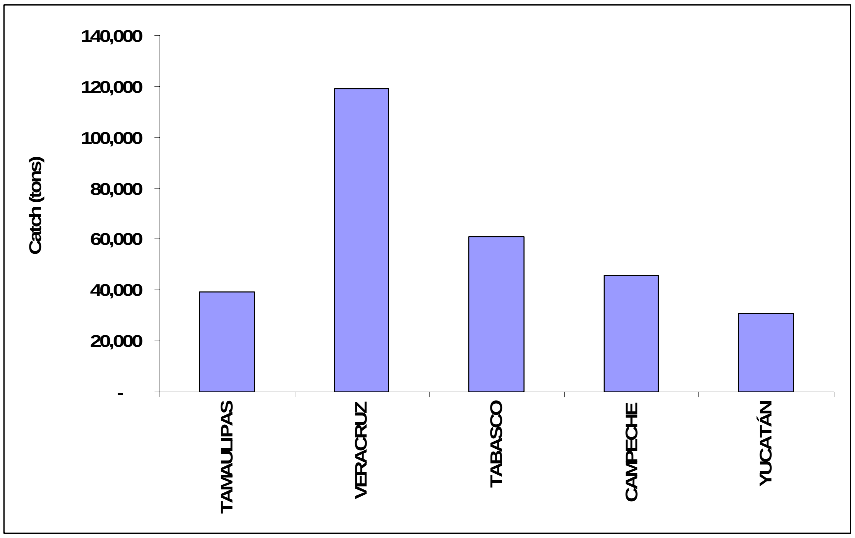


Figure 18. Catch obtained by coastal Mexican states in the Gulf of Mexico (data from CONAPESCA, 2001).

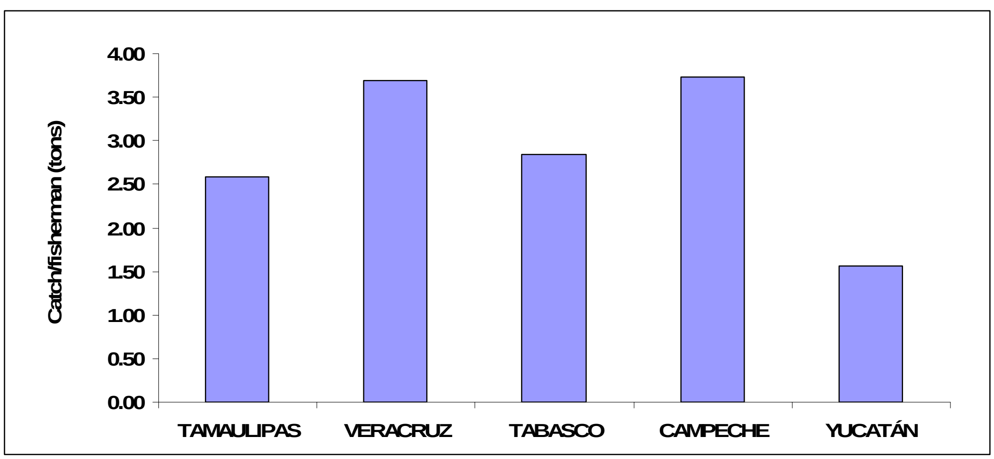


Figure 19. Catch per fisherman in the coastal Mexican states in the Gulf of Mexico (made with data from CONAPESCA, 2001).

As a result of the factors discussed above, big differences occur in the incomes derived from fisheries. Figure 20 shows the average monthly income derived from fisheries in different regions in Mexico, besides the maximum and minimum average income for municipalities within each region (in Mexican Pesos, MP; 11.30 MP= 1 USD in July 2006) (data processed from INEGI 2000). As can be seen, the average income of a fisherman in the Gulf of Mexico is around a fifth of the one obtained by a fisherman in the Gulf of California.

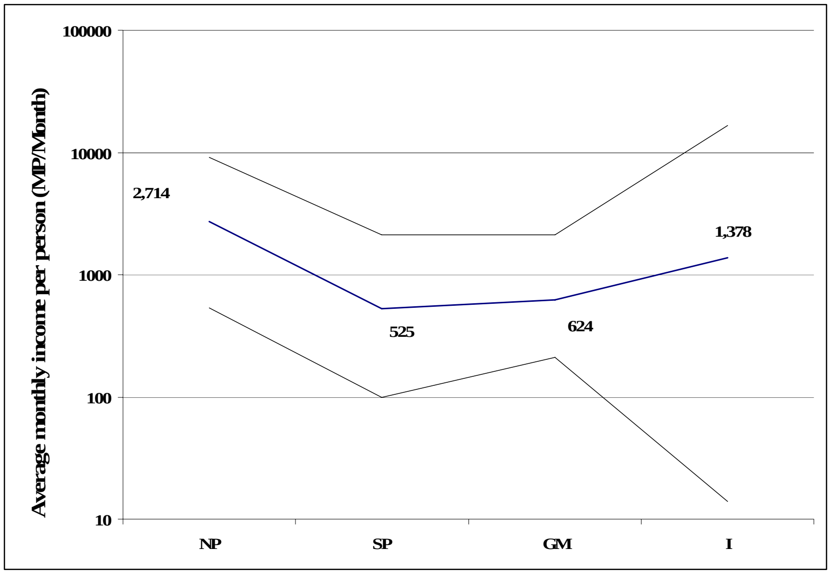


Figure 20. Average income derived from fisheries in municipalities of the different fishing regions. Thin lines show the highest and lowest average value in the municipalities in those regions. (NP: North Pacific, SP: South Pacific, GM: Gulf of Mexico and Caribbean, I: Continental waters) (from data from CONAPESCA).

Incomes are also unevenly distributed among strata of the fisheries sector. Nadal (1996) reported that 14% of fishing units received 43% of the total income while 67% of them, the smallest ones (those employing 1-15 fishers per unit), received only 2.8%. These figures are consistent with recent analysis performed by Villamar (and presented in Villamar et al. in press). According to these authors, artisanal fishermen included in the category "other fisheries" (that weren't included in the "shrimp", "tuna" "aquaculture" and "small pelagics" categories) that accounted for 61.9% of employment in fisheries received 5.92% of the total income in the fisheries sector. Incomes in this stratum lost 16% of the net present value they had in 1988. In contrast, Pacific tuna fishermen (0.99% of employment in fisheries) received 15.79% of the income, its net present value increasing by 275% since 1988. In addition, the number of people employed on fisheries without a formal salary has grown dramatically in the last two decades, in 1988 22% of people employed in this sector didn't receive a formal salary. In 2003 that percentage reached 70% (Villamar et al., in press).

Gulf of Mexico states are not particularly favored in social or economic terms. Among the 32 Mexican states, Veracruz ranks fourth in the "marginality index" of the Consejo Nacional de Población (National Population Council), just behind Oaxaca, Chiapas and Guerrero, the poorest states in the country (going from 1, the worst in social and economic terms to 32, the best in them). Campeche, Yucatan and Tabasco come next (in 8th, 9th and 11th places). Tamaulipas, the best placed ranks 21st. In the seven social well-being strata defined by INEGI (2001), going from 1 being the worst to 7 being the best, Tamaulipas is placed in the 6th,Yucatan in the 4th, Tabasco, Campeche and Veracruz in the 2nd. Only three states are ranked lower.

However, in many social welfare indices Gulf of Mexico states do not lag far behind the rest of the country. Average Life Expectancy in the Gulf of Mexico states was 74.46 years in 2001 (against an average of 74.88 years in the rest of the country). Population growth was an average of 2.34% /year against the 2.3%/year of the national average (INEGI, 2001).

Generally speaking, education level among artisanal fishermen is low. Méndez (2004) reports that less than 25% of boys in a fishing community in Yucatán reached secondary school.

Problems found in Gulf of Mexico fisheries

Fishermen's perception of problems in Mexican fisheries can be found in several documents (e.g. Fisheries Commission of the Chamber of Deputies, 2001; several papers in Guzmán-Anaya and Fuentes- Castellanos, 2006).

Some authors (Guarneros y Pérez, 2006; Cebreros-Murillo and Guarneros y Pérez, 2006; Ruíz-Moreno and Mérigo Orellana, 2006) argue that the decrease in catches and profitability in Mexican fisheries are the result solely of the Mexican government abandoning the promotion policies after 1982, when a crisis began hitting Mexico's economy, with effects lasting until the mid nineties. These authors seem to support the view that economic inputs and "support" (apparently meaning subsidies) are the sole determinants of catches and, and in turn these solely determine profitability.

In a stakeholders consultation, held in 2001 by the Fisheries Commission of the Chamber of Deputies (Comision de Pesca, 2001) resulted in lack of investment and promotion, a "lack of flexibility" of recommendations against raising fishing effort, and lack of "agility" in issuing permits being pointed out as relevant problems in Mexican fisheries.

Ruíz-Moreno and Mérigo Orellana (2006), in presenting the views of industrial fishermen point out several problems that, in their view, hampers the development of Mexican fisheries:

1. A restrictive legal framework. Regarding environmental protection, "it prevents fishing in Natural Protected Areas". The procedure of enactment of the National Official Standards (see the Legal framework section in this report) doesn't allow the fishermen "to vote or veto" a legal disposition contained in them.
2. Restricted access to financial resources and lack of government support (subsidies).
3. Lack of government promotion of fish trade and consumption.
4. Low degree of development of the fishing industry. A low volume of processed products and a low degree of processing of export products.
5. Illegal fishing that "is the main cause of deterioration of fisheries".
6. The uncontrolled growth of artisanal fisheries.
7. Lack of funds for research.
8. Deficient infrastructure in ports.

The common feature in these views is the opinion that a perceived deficit in government's support, a restrictive legislation and a lack of promotion of fish trade and consumption are the main causes of a poor performance in fisheries. Worth mentioning that the industrial fishermen pointed out that artisanal fisheries, and illegal fishing, were the culprits of the overexploitation of fisheries resources. Legal and industrial effort doesn't seem to be a problem.

Figure 21 shows the number of vessels in Mexican fisheries since 1970 (no disaggregated time series data exist for the Gulf of Mexico).

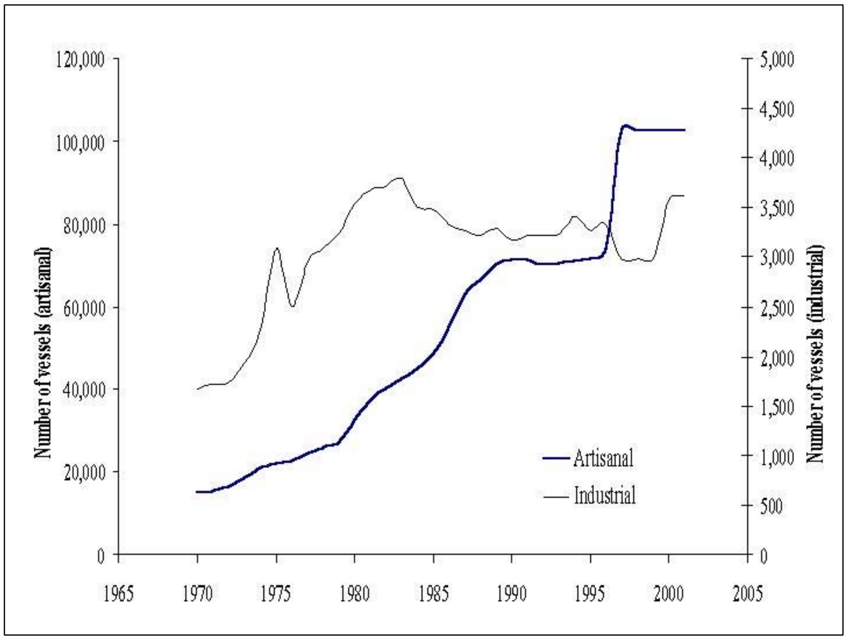


Figure 21. Change in numbers of industrial and artisanal vessels in Mexico since 1970.

Alcalá (2003), León and Gómez Palafox (2004) and Yáñez-Ramos (2006) discuss the promotion ("fomento") policies adopted by several Mexican administrations from the early fifties onwards, particularly in the seventies, that greatly increased fishing effort, including supporting vessel and processing plants construction, heavily subsidized credits and loans and an active policy of promoting trade and consumption of fishing products.

As a result of the growth in effort and decrease of catches, the catch per person employed in fisheries has been continuously falling since 1980 11.7 ton /person in that year to 5.2 in 2000.

The view that the stagnation in catches is the result of a lack of government support disregards the fact that effort and fishing power has increased greatly in Mexican fisheries, even after 1982. As can be seen in figure 21, the number of artisanal vessels (pangas) rose more than fivefold since 1970. In 1970 there were less than 15,000 registered artisanal vessel of this type, in 2000 there were around 102,000

Before 1982, 1,600 new artisanal vessels were incorporated each year. After that year, 3,200 new vessels entered the fisheries each year. Although the industrial fleet has decreased 5% from its maximum in 1983, its fishing power has increased due to the adoption of new fishing techniques and gears.

Promotion policies have been especially intense in some relatively recent cases. After the hurricane Gilbert badly hit the Yucatan peninsula in 1988, fisheries "promotion" in the shape of small vessels and outboards engines donations, resulted in an increase of fishing effort in that state (Solis et al, 1997, Monroy et al, 2000).

But ever increasing effort logically results in surpassing the productive capacity of the exploited resources. The following discussion is based on Conrad (1999), Iudicello et al. (1999) and Hanesson (1983, 2004) and modified from Fernández-Méndez (2006). This, in turn is related to the economic benefits that can be obtained from the fishery. Let's imagine an unexploited population that grows from a low level to its maximum population that can be supported by its environment (the carrying capacity). Notice that at each population level (on the x-axis) corresponds a different growth rate (reflected in the magnitude of change on the y-axis.

Figure 22 shows the growth of the population at each population level. As can be seen, growth is higher at mid population sizes and lower at higher and lower levels.

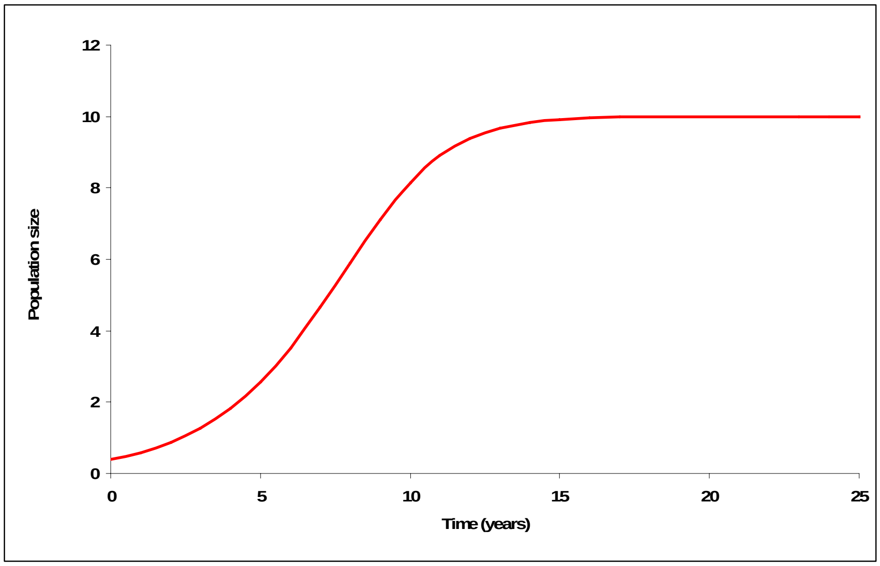


Figure 22. Growth of a hypothetical population

Let's assume that a fleet exploits the resource, that there is a constant proportionality between each unit of fishing effort (expressed in number of vessels) and that the feet catches exactly the biomass produced by the population's growth, that is, maintaining it at equilibrium. We would obtain a graph (figure 23) that relates effort and catch at equilibrium or sustainable yield. The point at the maximum is called the Maximum Sustainable Yield. If catches obtained by the fleet are above the curve, they are higher than the population growth and the population will decrease. If catches are below the curve, the opposite will happen.

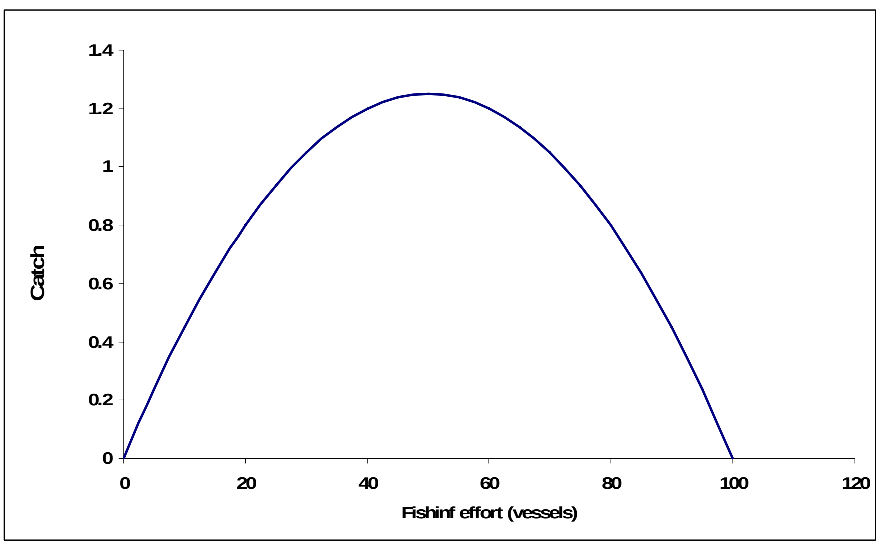


Figure 23. Sustainable catch at each effort level

Let's finally multiply the catches obtained by its price and include the cost of exploitation as a straight line. As can be seen in figure 24 even if catches are maintained at sustainable levels, a point is reached where exploitation costs equal the revenues obtained from the catch, no economic benefits are obtained from exploitation (rent dissipation occurs). Profitability is lost at this point and what is called overcapitalization occurs.

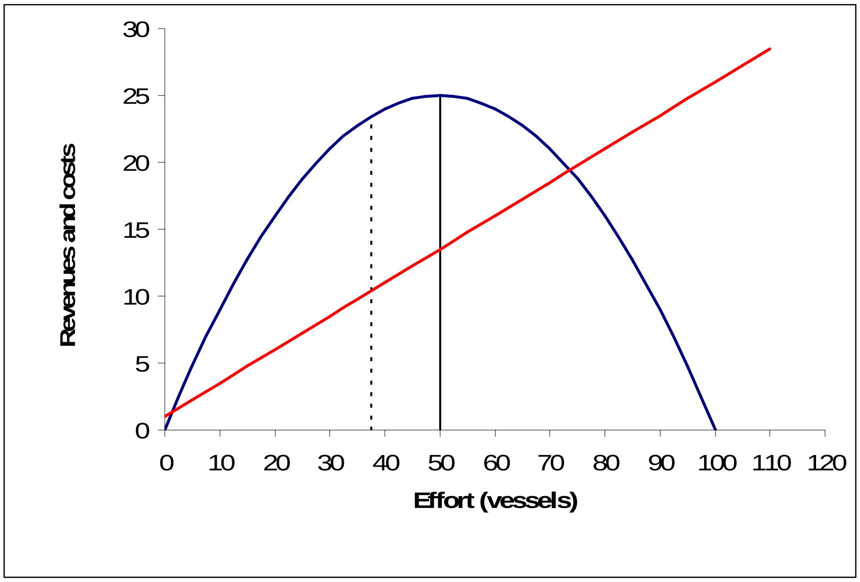


Figure 24 Sustainable revenues and costs at each effort level.

Conrad (1999) shows that when positive net benefits are obtained, efforts tend to grow and catches go above the sustainable level until they reach the point of no economic benefits (figure 25). So, if effort is not regulated its growth usually results in overexploitation (depletion the population of the resource) and overcapitalization (dissipating any economic benefit from the fishery).

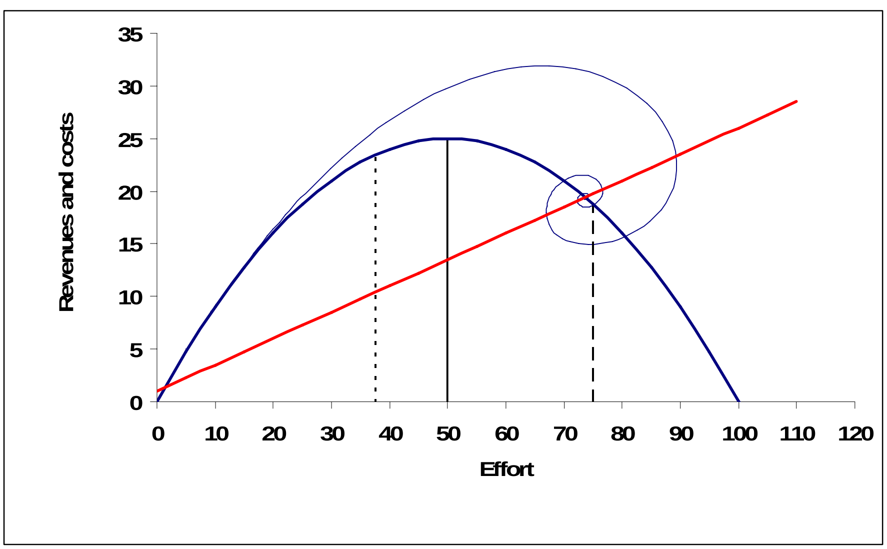


Figure 25. Trajectory of effort and catches in an idealized fishery

Overexploitation is a major concern in Mexican fisheries. In recent years many fisheries have shown noticeable decreases. According to data shown in Fisheries Statistical Yearbooks (CONAPESCA, 2001), since their peak year (shown in parentheses) catches have decreased for shark catches (1996) by an average of 1,180 tons per year and for the Gulf of Mexico shrimp (1991). Pink shrimp in the Campeche Sound (once the most important fishery in the Gulf of Mexico) fell from almost 20,000 tons/year in 1970 to around 500 in the late nineties.

According to a recent analysis made by the Instituto Nacional de la Pesca (National Fisheries Institute, INP) (Cisneros and Ulloa, 2000), nearly 80% of the national fisheries are exploited to their maximum or overexploited. In the Gulf of Mexico 89% of the fisheries included in that report were “exploited to the maximum”. This category included the shrimp (some stocks are shared to some extent with the US) and octopus the most important in economic terms. Some species included in this category, sharks, snook, red snapper, Spanish and king mackerels have shown descending trends in the last decades.

Overcapitalization and rent dissipation are also severe problems (Nadal, 1996; Thorpe et al., 2000). The shrimp fishery, the most important one in economic terms is heavily overcapitalized. Although the present average catch per vessel in the shrimp fishery in the Gulf of Mexico oscillates around twelve ton/vessel, the catch at economic equilibrium has been calculated at thirteen tons/vessel. The fishery is described as “highly sensitive to changes in prices and production costs and operates at low utility margins” (FIRA, 2001,2003).

Reductions in fleet size have been suggested recently, from 734 to 602 in the Gulf of Mexico (FIRA, 2001). Earlier analysis recommended a reduction in fleet of 50 to 66% for the Mexican Gulf of Mexico shrimp fleet (Goudet and Goudet, 1987, FAO/World Bank).

In this context, competition for the decreasing financial support is intense. Shrimp culture is drawing more and more support from institutions financially backing fisheries. In 2000, 36% of credits awarded by FIRA-FOPESCA, the National Bank branch devoted to backing the fishing sector, were directed to shrimp culture (two percent of total fisheries production but 21% of the total value). In comparison, 22% of credits were devoted to industrial fisheries and 16% to artisanal fisheries. Geographically, 83% of the credits were awarded to the five states in the North Pacific Region (CONAPESCA, 2001).

As Hanesson (2004), WWF (2001) and Iudicello et al. (1999) point out, the usual “remedies” to the fall of catches and revenues, subsidies and improvement of catch efficiency only results in maintaining or increasing effort and fishing power, further depleting the resource.

Although fishermen complain about receiving “little support or incentives” from Mexican government (Ruíz-Moreno and Mérigo Orellana, 2006), subsidies (in the form of reduction in fuel prices), play an increasing role in the “new” management scheme of the Fox administration. Subsidies to diesel fuel went from 468 million pesos in 2001 to 887 million in 2002, and “...from February 2003 to 2004 the level of subsidy reached 2.36 billion pesos” (El Universal, March 3rd 2005).The subsidy earmarked for 2002 is seven times higher than the one earmarked directly for fisheries research and higher than that earmarked for research and management put together for 2004. The 2003-2004 quoted figure is a fifth of the 12 billion pesos of gross value of all fisheries products in 2001.

At first, subsidies were directed at supporting the operations of the industrial fleet (as only it uses diesel), however they were later earmarked also to gasoline, used by the artisanal fleet (in 2003). Subsidies were seen as an important issue in the Chamber of Deputies consultation’s results to “increase competitiveness”. It is acknowledged that subsidies should not be directed to increasing fishing effort (Camara de Senadores, Senate, 2002), but it seems that little attention has been paid to their economic impact, and the effect on the exploited stocks, by maintaining present levels of fishing effort (as discussed in National Research Council, 1999 or World Wildlife Fund, 2001).

Not surprisingly, in a country with little employment and economic alternatives, social conflicts resulting from increasing pressure for access to fishing resources are on the rise. The conflicts between the industrial and artisanal sectors in the shrimp fishery and between artisanal octopus fishermen in the border of Yucatan and Campeche states are only a few examples.

As a result of all of the above, Hernandez and Kempton (2003) cited “low stock levels, too many fishermen, (…) reduced rent, no incentives to conserve the resource, race to fish” and overcapitalization as symptoms of a grave crisis. This also led Thorpe et al. (2000) to point out thatconflicts between fishers, particularly between the artisanal and industrial sectors was a serious problem in Mexican fisheries.

Governance issues

Institutional framework

Fisheries management in Mexico has undergone changes of emphasis and approach several times in the last decades. Accordingly, the institutions related to it have undergone several modifications. Some of these changes have been influenced by international processes and events but some are of local nature.

According to Thorpe & Bennett (2001), world fisheries management has been influenced by three distinct globalisation phases processes:
1. the globalisation of fish production and the growth of distant-water fleets (1945 to mid-1970s),
2. the globalisation of trade which was accompanied by extended fisheries jurisdictions and exclusive economic zones (EFJ and EEZ) and deregulation policies (1970s to 1990s), and
3. the globalisation of regulatory control due to growing concerns over the sustainability of fish resources (1990s to date).

In the local level, presidential terms in Mexico last for six years. Each successive administration usually redesigns institutions and policies, sometimes radically. This will be further discussed at the en of this section.

At the end of the first half of the 20th century, the (relatively small) Fisheries Department was part of the Forestry, Hunting and Fishing Division of the Ministry of Agriculture and Development.

In 1970 the first National Fisheries Program strengthened cooperative rights to inshore fisheries and encouraged the support to fishing fleets. The adoption of the Extended Fisheries Jurisdiction (EFJ) in 1976 in the Exclusive Economic Zone strengthened the possibilities of state support, allowing a faster expansion of national fisheries most in the way that happened in Canada (Breton, 2006) and the United States (Weber, 2002) and the government started focusing on the export market. In 1972 the Vice-Ministry of Fisheries was created in 1972 along with PROPEMEX, a state company devoted to processing and distributing fisheries products (that included Ocean Garden Products, based in the United States). Aiming to enhance scientific knowledge of fisheries led to the creation of the National Fisheries Institute (INP) in the early 1960s that had some precursors in research institutes of local influence in previous years (Kasuga-Osaka, 2006; Guzmán-Anaya, 2006).

During the period of rapid growth of catches before 1980, as it was reckoned that fisheries should be regulated by a higher ranking institution, the Vice-Ministry of Fisheries was upgraded to Ministry level (SEPESCA) in 1983. A state- fisheries bank (BANPESCA) was created for supporting cooperatives and private sectors.

By the mid eighties, the burden of financial debts and economic inefficiencies, along with catches stopping growing since 1981, put the Mexican fisheries sector in an extremely dire situation (Cruz-Torres, 2000). Also, as the strategy of unrestricted support that had prevailed during the last two decades had a high fiscal cost (León and Gómez-Palafox, 2004) these began to be restricted (Cruz-Ayala and Igartúa-Calderón, 2006).

Several issues in the government's strategy were under attack by the private sector. As with capture fisheries, only cooperatives were allowed by law to cultivate shrimp. However, a constant plea (accompanied by political pressure) from the private sector was to end the "reserved species" regime (Cruz-Torres, 2000). This plea was acknowledged by President Salinas' administration during its reforming process of the Mexican economy, which started in 1988. A priority of that administration was to restructure the sector and curb fiscal deficits. This included privatization to encourage investment in the fisheries sector. PROPEMEX and BANPESCA were both shut down, and the privatisation of government-owned canneries, processing factories and vessels began in 1988. The government-owned foreign-trade bank (BANCOMEXT) was empowered to support export-oriented fisheries. Subsidies through the PRONASOL programme were made available for the development of domestic fisheries, pinpointing poor fishing communities.

For some authors, (Guarneros y Pérez, 2006) these strategies of reducing state support are at the root of the problems of the Mexican fisheries.

In the mid nineties, after one decade and a half of stagnation in catches, Mexican fisheries management institutional structures and approaches were modified, in part as a result of the international forums held at that time (Mexico was an active promoter of the Code of Conduct for Responsible Fisheries) and Fisheries management was incorporated in 1994 in the newly formed Secretariat of Environment, Natural Resources and Fisheries. This change aimed at giving consideration to the importance of marine resources as part of a general natural resources framework. The new Fisheries Plan stated sustainability as a goal and the Precautionary Principle as a guideline. This is documented in extent by Hernandez and Kempton (2003). These authors comment on three changes, introduced in the management scheme to a greater degree during those years: a) a more scientific-based decision–making process, b) a new legal instrument, the National Fisheries Chart (contents and aims described in Álvarez-Torres, et al., 2002) and c) more active participation of stakeholders in decision making. These authors also discuss some difficulties encountered in the implementation of this scheme, particularly in the decision-making process of the shrimp fishery.

However this “fisheries-as-natural-resource-approach” was criticized by the private sector, blaming it for the economic stagnation of the sector (Ruíz-Moreno and Mérigo Orellana, 2006). As a result, in the present administration (2000-2006), the agency responsible for fisheries management, monitoring and enforcement is the National Commission of Aquaculture and Fisheries (Comisión Nacional de Acuacultura y Pesca, CONAPESCA), after the transfer to the Ministry of Agriculture, at present called Ministry of Agriculture, Cattle Raising, Rural Development, Fisheries and Food (Secretaria de Agricultura, Ganadería, Desarrollo, Rural, Pesca y Alimentación, SAGARPA). As a result of its transfer, the Undersecretariat was severely downsized, and its state delegations (formerly one in every one of the 32 states) were reduced in number and incorporated into SAGARPA delegations, losing their hierarchical link to the present CONAPESCA. In this scheme the local fisheries offices, subordinated to SAGARPA’s regional bodies act without a direct connection with the institution in charge of fisheries at the national level.

Legal and Policy framework

Alcalá (2003) discuss that in 1872 the “ Instructions on the procedures related to fisheries” (that this author considers the first Mexican fisheries law) was emitted and stated that “ Is free to every inhabitant of the Republic fishing in its territorial waters, as well as diving for pearls and the exploitation of all marine resources”. Mostly the same was stated in the law of 1882 that regulated the public use of territorial seas, estuaries, lagoons, channels and rivers. In 1938 President Lázaro Cardenas granted exclusive access to cooperatives for exploiting shrimp, abalone, lobster, oysters and totoaba, (the most highly valued species) (Alcalá, 2003; Cruz-Ayala and Igartúa-Calderón, 2006).

It was not until 1966 that the Law over the Exclusive Fishing Zone was emitted. In 1972 the Federal Law for the Promotion of Fisheries was enacted, followed by the 1986 Federal Fisheries Law, that aimed in practice, to strengthen co-operative access rights through concessions and permits for both fishing and aquaculture (Cruz-Ayala and Igartúa-Calderón 2006).

However, to facilitate the process of privatization, a new Fisheries Law was passed in 1992 (only six years after the enactment of the previous law). One of its main features was the withdrawal of the cooperatives’ exclusivity of access to valuable fisheries. The “reserved species” rights were replaced by a permits and concessions system, already in place for other fisheries. The privatization process, although benefiting the private sector in the exploitation of shrimp particularly in aquaculture, did little to improve the overall state of the sector, not stopping or reversing the process of catch stagnation, overexploitation an overcapitalization.

In mid 2006 the new General Law of Sustainable Fisheries and Aquaculture was enacted. The main novelty in this new law, despite that in appearance is a similar one to previous laws, is that (by being a General Law instead of a Federal one) instead of being a regulatory offshoot of the article 27th of the Mexican constitution that contain the general guidelines about natural resources management it follows the guidelines of the recently modified article 71st that gives the Mexican congress power to allocate responsibilities between the Federal, State and municipal governments, a development not expected (and even resisted) by the Federal government. In theory, this gives ground to decentralize responsibilities and powers (albeit limited) to local governments. It also contains certain definitions of overexploited fisheries and certain provisions for their management.

In the Mexican legal system a law gives general guidelines and can be modified only through the intervention of the Chamber of Deputies (Representatives) and the Senate. From the Fisheries Law stems the Fisheries Regulation (Reglamento de la Ley Federal de Pesca) made by the Executive on the basis of the general guidelines given in it. It deals with more particular aspects and can be modified without the intervention of the Legislature, which results in some degree of flexibility.

In the early nineties, a more particular type of instruments of legislation was introduced as the Mexican Official Standards (Normas Oficiales Mexicanas, NOMs). These standards deal with very particular aspects of fisheries that would be cumbersome to regulate in more general regulatory instruments (as these need to be changed from time to time), such as mesh sizes, types of fishing gear used, spatial restrictions and the like.

The process that shapes (or modifies) NOMs involves the participation of stakeholders, NGOs and other interest groups in committees. The conduction of these committees is regulated by the Federal Metrology and Normalization Law (Ley Federal de Metrología y Normalización). The idea is that, although the Fisheries regulatory agency (at present CONAPESCA) is the one that makes the final decision (and bears full responsibility for it) this process of decision-making and transparency is enhanced by stakeholder participation.

At present, this process if far from perfect. Only some committees have been formed so far. The functioning of those already established still has to be perfected. Most artisanal fishermen organizations have yet to have consultants who could assist them on technical issues. And recently, full representation of those invited to attend the meetings has yet to be achieved. Hernandez & Kempton (2003) discuss difficulties found in implementing this system in the shrimp fishery, in particular in relationship with the interaction of artisanal and industrial fishermen that will be discussed in the next section.

Until 2000, only 14 fisheries were regulated under NOMs although they comprise around 62 percent of total catches. Other fisheries have had to be regulated mostly with licenses with the INP being consulted, most of the time, on the possibility of awarding them.

Recently an advisory body, the National Fisheries Council (Consejo Nacional de Pesca) was formed, that included representatives from industrial and artisanal fishermen. It's yet too early to discuss the result of the implementation of such a body in designing and implementing fisheries policies.

A recently implemented instrument worth of attention is the National Fisheries Chart or NFC (Carta Nacional Pesquera, CNP), elaborated by the INP and published as an Official Decree in 2000 (SEMARNAP, 2000). This document has the function of defining levels of fishing effort applicable to species and groups of species in specific areas and giving guidelines, strategies and provisions for conservation, protection, restoration and management of aquatic resources that could affect their habitat and ecosystems. A useful (in terms of flexibility and transparency) characteristic of the CNP is that it can be updated regularly by public participation coming from research institutions and stakeholders. However this public participation process has been only partially successful and need to be strengthened (Fernández-Méndez, 2006).

The idea behind the NFC was to restrict the high possibilities of discretionality by management authorities and make more transparent the decision-making process and increase the degree of public participation in it. It also aimed at making public in an official document the exploitation limits of the main fisheries. However, it was not until the recent 2006 modification of the Fisheries Law that gave the NFC a binding character that must be considered in the process of decision making by management authorities, a development strongly resisted by the Federal government's fisheries officials during this administration.

Other Mexican legislation related to the management of fisheries includes the General Law of National Properties (enacted in 1982, modified in 1994), the Law of National Waters (1992), the General Law of Ecology and Environmental Protection (1988,1996) as well as Article 27 of the National Constitution (Álvarez-Torres et al. 2003).

Example of public participation in decision-making

Hernández & Kempton (2003) describe in detail the process of decision-making on closed season dates for the Mexican shrimp fishery in Tamaulipas-Veracruz from 1996 to 2000.

As juvenile shrimp are caught in coastal lagoons by artisanal fishermen and adult shrimp are caught by offshore industrial vessels, the shrimp caught by artisanal fishermen will not be available to the industrial fleet. The shrimp fishery is thus a sequential fishery with two competing sectors catching the same stock and depending heavily on the migration of a particular cohort. The percentage of the catch obtained by each sector depends greatly on the choosing of the dates of the closed season (Fernádez-Méndez, in press).

Meetings were held annually, between fishermen and State and Federal government representatives (including fisheries managers). In those meetings relevant research results were presented by the INP and consultants to the industrial and artisanal sectors. Discussions were held to choose the dates to begin and end the closed season. Proposals on closed season's dates were usually presented by the artisanal and industrial fishermen. The INP developed an age-structured model to assess the effect on proportional catches for both fisheries of the different dates proposed by both sectors, along with several alternative scenarios.

The final decision was made by the Deputy Secretary of Fisheries based on the examined scenarios. The adopted scenario traditionally resulted in percentages previously chosen by the authorities of around 65% and 35% of the total catch for the industrial and artisanal fisheries, respectively, for a number of years (Fernández-Méndez, in press)..

Hernández & Kempton (2003) discussed several problems faced in this decision making process. One of them was the artisanal fishermen were not happy with their reduction in catches as a result of the establishment of the closed season in relation to those obtained in the years previous to its establishment in 1993. During the first five years after the establishment of the closed season the average catch in the lagoon fishery was 21% lower than in the five years previous to 1993. In contrast, the offshore catch rose by an average of 54%. It can be said that artisanal fishermen had little reason to be satisfied with a management scheme that only resulted, in their perception, in a lower level of catches with the industrial fishermen reaping the benefits.

In the present situation, involving competition between two sectors in a sequential fishery, increases in total catch and value can be obtained only at the expense of the artisanal fishery. In fact, the closed season scheme presently applied affects mostly the artisanal fishery as it restricts fishing during the period (June-July) when artisanal fishermen obtained up to 35% of their annual catch.

Both groups of stakeholders, artisanal and industrial fishermen, have apparently not been satisfied with the portion of the total catch they have been obtaining and have modified their strategies accordingly. Modification of the age-frequency structure in offshore catches after 1999 indicate that the artisanal fishermen are not complying with the restrictions imposed upon them. The proportion of artisanal catches is again close to 50% of the total catch that can only be achieved by fishing during the closed season. This may be a result of the artisanal fishermen's perception that the management scheme benefits only the industrial sector of the fishery and may also be one of the causes of reductions in industrial catches in recent years.

In response, it also appears that the industrial fleet has adopted short-term, self-defeating strategies like fishing in shallow waters to compensate for these reductions. It may be that, as half of the fleet operates off Tamaulipas and Veracruz only for a relatively short period of time (three months) before returning to the Campeche Sound, these short-term strategies are deemed as sensible by at least a part of the industrial fishing fleet.

Fishing authorities have responded to catch reductions by imposing closed seasons that are more restrictive for the artisanal fishery. However, the failure of the authorities (in the view of industrial fishermen) in further restricting the artisanal fishery has led to accusations of "not managing by scientific criteria", meaning that any concession to the artisanal fishery should be considered a political stance (El Sol de Tampico, April 29th, 2000). Nevertheless, further restrictions without giving artisanal fishermen some economic alternatives should be considered as only a stopgap strategy that can cause negative social results and may not prove effective in the long run. Certainly, it has not been enough to ameliorate the situation of the offshore fleet since 2001 and has not avoided that the percentage of the total catch obtained by artisanal fishermen being close to 50%, as it was before the establishment of the closed season..

Although allocation has been a driving factor in the management of this fishery, it has never been explicitly stated. In our opinion, this has resulted in the possibility of discretional decisions by authorities being taken without the possibility of open negotiations by stakeholders (like the 65%-35% chosen previously by the authorities and not being revealed during or after the meetings of the committee). This, in turn, has resulted in the stakeholders reacting in a defensive but self-defeating fashion, as has been previously discussed.

As Henández and Kempton (2003) discuss, artisanal fishermen stopped hiring expensive consultants as they saw that, in their perception, technical discussion and participation in committees were not bearing the desired fruits. This has resulted in a loss of effectiveness of management in preventing growth or recruitment overfishing. The reactions of stakeholders (in particular the artisanal fishermen) to the management measures taken in this fishery, illustrates the importance of stakeholders' perceptions of their "fairness" and the value of public participation in achieving compliance with management strategies.

Governance related problems

1) The first governance problem, in our view is a serious **lack of long –term policies**. In part this stems from overexploitation and overcapitalization not being recognized as real problems.

As discussed in the previous sections, fisheries management in Mexico has undergone changes of emphasis and approach several times in the last decades. The most noticeable change is related to the extent to which the state acts as "promoter" of fisheries development (meaning not only direct intervention in trade and processing as in the period prior to 1988 but also the awarding of subsidies and other support). This, it seems, is perceived by many as the real cause of the present state of fisheries in Mexico.

Although it has been said that "traditionally, the administrative and organizational methods applied for the exploitation, use, and conservation of live marine resources have involved the establishment of permissible catch volumes based on the criterion of maximum sustainable yields" (OECD, 2005) very few fisheries (like the octopus fishery in Yucatán and Campeche, the quota set for the Cuban fleet in the Yucatán peninsula, and the abalone quotas in the Pacific) are managed by allowable catches. As a review of Official Standards, the NFC and other regulations would show, the so-called output controls (like allowable catches) practically don't exist in Mexican fisheries. The prevailing kind of regulations applied are related to input controls, namely restriction of effort, and these are not related to setting the effort level at the one that would result in obtaining the Maximum Sustainable Yield. Existing effort "regulations" are recommendations of "not raising fishing effort", without reference to any explicitly expressed sustainable yield.

So, no visible permanent instruments aimed at regulating effort to avoid overexploitation and overcapitalization exist. Particularly, profitability is, as discussed in a previous section, a direct result of levels of effort. However, no reference whatsoever to this fact in Mexican policy.

Apparently only artisanal effort is blamed for the problems in fisheries. In the fist page of the Fisheries Plan for 2000-2006 is stated that "The level of deterioration of some fisheries and the expectation of not raising catches is a result of a very strong pressure on the resources, as measured by an excess of fishermen and small vessels" (SAGARPA/CONAPESCA, 2001). The plan contemplates "promoting modernization, renovation, rehabilitation and substitution of major vessels" and conversion of small vessels to mid-scale ones.

Curiously, the most visible (and only) program of effort reduction in Mexican fisheries management is aimed at the most important industrial fleet. The so-called "voluntary retirement" of industrial shrimp vessels came originally from a proposal made by a NGO (Conservation International, 2003) and was pressed forward by the Ministry of the Environment.

The fundamental problems of Mexican fisheries, overexploitation, overcapitalization, user conflicts and inequities in distribution of income need to be explicitly recognized as such in Mexican fisheries law and planning, and management objectives defined specifically to address their effects. The implementation of such legal instruments as the National Fisheries Chart, that aims to set legal limits to fishing effort in a per fishery basis (Alvarez-Torres et al. 2003), should be strengthened and widened in scope. As well there is a need to develop the mechanisms for social participation in their making.

2) There is a high degree of **frailty in the institutions related to the fisheries sector**. Alcalá (2003) and Hernandez and Kempton (2003) discuss over the difficulties encountered in the implementation of long lasting policies and made comments on the problems resulting from the complete redesign of Mexican institutions, which generally occur every six years, with the coming of new administrations.

This was particularly obvious during the present administration. The change in the present institutional framework is seen by many (e.g. Hernandez as Kempton, 2003; Cebreros-Murillo and Guarneros-y Pérez 2006; Guarneros y Pérez, 2006; Muñoz-Villanueva, and Acosta-Jenkins, 2006; Ruíz-Moreno and Mérigo-Orellana, 2006) as a downgrading that seriously reduced the effectiveness of management and research.

In the view of many, decentralization plans were ill conceived since the beginning of the present administration. CONAPESCA was relocated out from Mexico City to Mazatlan (a port in North Western Mexico) in order to 'comply with decentralization schemes for the fisheries sector' (http://www.conapesca. sagarpa.gob.mx/wb/cona/cona_mision_y_vision.).

Nevertheless, this was more discursive than functional as centralized decision-making was taking place in Mazatlán, anyway. According to the National Fisheries Chamber (Ruíz-Moreno and Mérigo-Orellana, 2006) this relocation resulted in an increase of "red tape" and didn't result in a better attention to the Pacific coast.

The Gulf of Mexico fisheries were more affected than other regions by this relocation. According to Ruíz-Moreno and Mérigo-Orellana (2006) as it left "unprotected" the Gulf of Mexico Fishermen. Indeed, the Governor of Veracruz, the former third state in fishing GDP, claimed that " the fishing sector is badly looked after, there's no Federal participation to organize it" and " Mexico, having coasts in the Pacific and the Gulf of Mexico should have a coordinated (fishing) sector"(El Heraldo, June 19th, 2003).

CONAPESCA also lost autonomy in many areas like internal management, as it depended mostly on SAGARPA. It also lacked autonomy to apply some budgets to some support and promotion programs. Ruíz-Moreno and Mérigo-Orellana, (2006) comments on the fact that in 2005 President Fox assigned a special diesel price of 3.50 Mexican pesos for the industrial fleet (the difference with the usual price being covered by a subsidy) per liter. However, as the Ministry of the Treasure (Secretaría de Hacienda) didn't approve a budget for it, SAGARPA has to cover the expenses from its own budget, soon running out of funds. The artisanal fishermen (Muñoz-Villanueva, and Acosta-Jenkins, 2006) complained about the lack of autonomy of CONAPESCA on many support and promotion program. When appearing before the Fisheries Commission of the Chamber of Deputies in November 5th 2002, the head of CONAPESCA alleged "a lack of experience" and that the assignment of funds of a government program called Alianza Contigo didn't depend on his agency as reason for not assigning 50% of funds earmarked for projects in artisanal fishing communities (Comisión de Pesca, 2002; Muñoz-Villanueva, and Acosta-Jenkins, 2006).

At the same time, the number of researchers at the National Fisheries Institute (INP) was cut by half and (according to fishermen organization leaders) its "scientific structure being mutilated, atomized and vilified" (Muñoz-Villanueva, and Acosta-Jenkins, 2006).

When appearing before a Senate committee in 2002, the head of CONAPESCA acknowledged "an obsolete fishing fleet, absence of management plans, bad fishing gears, an increasing illegal fishing, deficient enforcing and an inadequate legal framework" (El Heraldo, June 18th, 2003).

Contrary to this, fishers were asking for a Secretariat to manage fisheries and the INP to be strengthened (Comision de Pesca, 2001; Muñoz-Villanueva, and Acosta-Jenkins, 2006; Ruíz-Moreno and Mérigo-Orellana, 2006). However, the trend of reductions of budgets of the institutions devoted to the fisheries is a long lasting ones. Figure 26 shows the budgets earmarked to the fisheries management and research institutions in Mexico (in 2003 Mexican pesos). Possibly, most of the increase seen in recent years is devoted to subsidizing diesel fuel. In general, Mexico invests 0.04% of the gross value of catches in research and management against an average of 4.5% of the OECD (OECD, 2005).

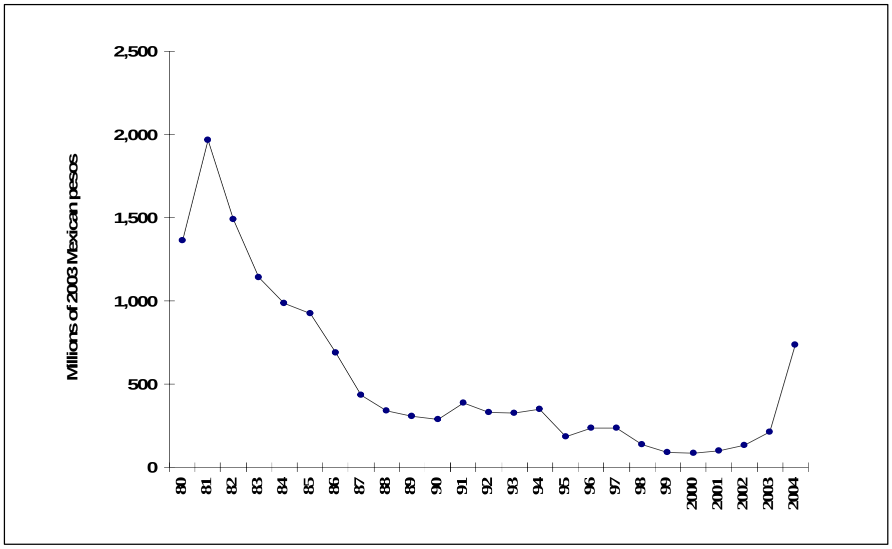


Figure 26. Budgets earmarked to the fisheries management and research institutions in Mexico (in 2003 Mexican pesos).

The reduction of institutions devoted to fisheries research and management, far from resulting in a "faster, cheaper, better" organization has resulted in an institutional deficit in terms of attention to problems and effectiveness in dealing with them. Clearly, establishing a strong appropriate institutional framework is a necessary step. Olstrom (2000), points out that an effective social organization and institutional effectiveness is the only way to deal with the depletion of natural resources problem. Thorpe et al (2000) clearly state that governments "must acquire greater management resources and expertise".

3) There's a need to **increase transparency in procedures in fisheries management and enhance the perception of fairness**.

Apparently, at present there is a fertile ground for conspiracy theories in Mexican fisheries management. For example, the proposed Mexican Official Standard for regulating the shark fishery was seen by many as a way of furthering the interests of a reduced group of industrial fishermen severely affecting artisanal and sport fishermen as well as negatively affecting endangered species by allowing industrial longline vessels to operate at short distances of the coast (Caporal, 2002). The artisanal sector expressed that the proposed standard was in opposition to prevailing scientific advice and that in the future "they should have a bigger presence at the negotiation table to avoid (the authorities) giving deaf ears to our suggestions" (Muñoz-Villanueva, and Acosta-Jenkins, 2006). Independent artisanal fishermen leaders expressed their views that the "imposition" of the standard was "of a sinister plan by SAGARPA and the industrial fishermen to eliminate artisanal fisheries"(Caporal, 2002).

The artisanal sector also expressed its fears that the "voluntary retirement" of shrimp vessel being "an strategy to make fisheries disappear" (Muñoz-Villanueva, and Acosta-Jenkins, 2006). As was commented on earlier, industrial fishermen describe the process of Mexican Official Standards as "unilateral and discretional" because authorities make final decision and "participants don't have right to vote or veto it". They also denounced that fisheries officials in charge of enforcement activities were involved in "illegal catch and trade activities" (Ruíz-Moreno and Mérigo-Orellana, 2006).

In 2003, the Mexican Senate demanded the destitution of the head of CONAPESCA on the grounds of illegally issuing fishing permits and delivering false information to that committee (El Heraldo, June 18th, 2003).

Thorpe et al. (2000) documented the effect of the introduction of the "New Economic Model" in fisheries management in several Latin American countries, including Mexico. These authors show the change in emphasis from privileging the social sector (cooperatives) to favoring private investment. Hernandez and Kempton (2003) argue that the new structure of the institutions of fisheries management in Mexico will "tip the balance in favor of industrial fishermen" and saw the new head of the National Fisheries Institute as having a "background sympathetic to industrial fishermen". They foresaw, as a potential result of the new management scheme, a "reduction of the influence of science and public participation on decision making process" and as step backwards from the processes initiated in the nineties.

In such a conflictive context, impartiality of authorities and technical credibility are to be considered as necessary assets. A rebuilding not only of the institutions themselves but also of the stakeholders' perceptions is a prerequisite to achieve management goals.

4) **Property or use rights and interactions between stakeholders**.

There is a broad consensus among social scientists on the pivotal role of institutional arrangements in shaping people's interactions with their natural environments and negotiation processes in natural resource management (Meyten and Doornbos, 2004).

The increasing degree of conflict in Mexico's fisheries stems in part from (for practical reasons) a free-access regime that persisted for decades. The environment of poorly defined property rights can only lead to a "tragedy-of-the-commons" and "prisoner dilemma" type of outcome (Harding, 1968, Ostrom, 2001).

The bottom line of the arguments presented by these (among many others) authors is that in a setting of poorly defined property or use rights and open access to the exploitation of natural resources, these tend to be overexploited.

They also state that cooperation among stakeholders to conserve and obtain maximum benefits from an exploited resource is an important prerequisite for success of management schemes. García-Sandoval and Robles-Ocejo (2006) discuss that a lack of cooperation between stakeholders in the mullet fishery in Tamaulipas and Veracruz in the early seventies was the cause of the failure of a proposed management scheme, resulting in a "race-for-fish" that reduced average size and total catches Pérez-Sánchez and Muir (2003) quote fishermen as saying that distrust over the honesty of cooperative leaders and authorities as an obstacle to an effective community organization.

Some authors (like Ostrom, 2000) discuss the role of incentives and the perception of fairness in the compliance of stakeholders with rules set by managers (as exemplified by Fernández-Méndez, in press for the Tamaulipas-Veracruz shrimp fishery). These incentives come in the shape of long-term assurance of being able to reap benefits, in a fair and equitable fashion from the exploitation. In economic terms, this situation is the equivalent of an exploited fishery with a low discount rate (that equals favoring long-term revenues more than short-term ones), that assures obtaining the Maximum Sustainable Economic Yield in the long term (Conrad, 1999).

But this assurance only can occur in a setting of well defined use or property rights like those in communal use in co-management schemes (like those proposed by Ostrom, 2000 and Hanesson, 2004 for artisanal fisheries) or well managed Individual Transferable Quota (ITQ) systems (Iudicello et al., 1999; Hanesson, 2004).

Ostrom (2000) summarizes the results of her own and several authors' analyses regarding the successful co management of common-pool resources in different parts of the world in eight principles:

- External and internal physical limits of the areas of resource exploitation, as well as the exploitation rights of each stakeholder, are well defined.
- Coherence exists between resource exploitation and conservation rules and local conditions (it implies that, although the exploitation rules are very variable in the cases reviewed by Ostrom, they are defined by the specific conditions of the resource).

- Rules of exploitation and conservation of are the result of the stakeholders' collective decisions.
- The supervisors that watch over the conditions of the resource and their exploitation report to, or they are part of, the stakeholders.
- The stakeholders that violate their own rules receive graduated sanctions, depending on the graveness and the context of the infraction on the part of other stakeholders, corresponding authorities or both.
- Stakeholders and authorities have quick and low access cost to local institutions to solve conflicts among stakeholders or between stakeholders and authorities.
- The rights of the users to build their own institutions or arrangements are not questioned by external government authorities.
- The activities of exploitation and conservation of the resource, supervision, application of rules, conflict resolution and management are organized in multiple concentric levels (that is to say, local organizations that are inside other organizations or bigger institutions).

In our opinion, a long way lays ahead to establish clear and uncontested limits to exploitation areas. Although reserving inshore areas exclusively for artisanal fisheries has been proposed it remains unclear how these would be established. In the recent modification process to Mexican Fisheries Law a 5 mile wide belt from the shore reserved for artisanal fisheries was proposed by independent artisanal fishermen organizations in 2004, apparently following a similar measure (although in different circumstances) considered in Chile's fisheries law. This was incorporated in an early version of the Fisheries Law modification proposal by representatives (diputados) sympathetic with the independent fishermen organization's view. This was opposed by industrial fishermen (the industrial shrimp fishery would have been badly affected) and the Cooperatives confederation being the final version of the law quite vague on this respect. The final text was similar to this: "The secretariat, in coordination with municipal and state governments, with the participation of stakeholders representatives and researchers, can decree the establishment of zones reserved for artisanal fisheries…"

In our opinion, although the 5 mile limit initially proposed could result in the introduction of unnecessary rigidities and potential for conflict the way in which the reserved zones would be established is still rather unclear, although it should be acknowledged that its an improvement over the present situation.

Territorial concessions are not widespread in Mexico. An exception would be the area concessions awarded to cooperatives exploiting benthonic resources like abalone or lobster in the Baja California peninsula. Some NGO's (like the Nature Conservancy México) have proposed this kind of regulation as a step towards comanagement. In a recent meeting on this theme (April 27th, 2005) some experiences on territorial management by artisanal fishermen were presented. Symptomatic enough, although invited, no fishing authorities attended this meeting (Chamber of Deputies, 2005).

The flexibility in organization and management that the principles 2 to 5 would imply seem not compatible with the rigidity and centralization (at a bigger degree during the present administration) of present fisheries management, being a major overhaul of regulations and institutions needed to achieve the conditions required by those principles.

The requirements of principle 6 could be accommodated within state or local fisheries committees but fishing authorities (since the last administration but particularly during this one) are reluctant to even form these committees, and more so to relinquish some authority to them (Ruíz-Moreno and Mérigo-Orellana, 2006).

Principle 7 has been a particularly difficult one. Although some basis for co-management can be found in traditional management practices, examples of this kind of management are sparse in Mexico. Chenaut (1985) report a traditional, self-imposed, territorial partitioning system for lobster fishermen in eastern Yucatán and Northern Quintana Roo, where territorial units were assigned to communities, independently of their affiliation in fishing cooperatives. This author comments on the fact that fishing authorities didn't recognize these territorial divisions. Some communities in the Pacific, working with demersal resources have had successful experiences in community–based management that obtained a certification from the Marine Stewardship Council that however were hampered by Mexican fisheries authorities (Bourillon and Ramade, 2004).

However, co-management can result from ad-hoc institutional arrangements. Breton (2006) comments on proposals on collective use contracts for fisheries resources that could decentralize management functions to stakeholders in the Mediterranean.

Worth mentioning is that, despite that the term decentralization has been used in terms of giving local communities a role in management (Meynem and Doornbos, 2004) in Mexico this term has been applied to physical relocation of facilities (like the moving of CONAPESCA headquarters to Mazatlán) or, more to the point, to cede powers of awarding fishing permits to local and state governments.

In mid 2006 the new General Law of Sustainable Fisheries and Aquaculture was enacted. The main novelty in this new law, despite that in appearance is a similar one to previous laws, is that (by being a General Law instead of a Federal one) instead of being a regulatory offshoot of the article 27th of the Mexican constitution that contain the general guidelines about natural resources management it follows the guidelines of the recently modified article 71st that gives the Mexican congress power to allocate responsibilities between the Federal, State and municipal governments in fisheries management, a development not expected (and even resisted) by the Federal government. In theory, this gives ground to decentralize responsibilities and powers (albeit limited) to state and local governments.

However, in a formerly highly centralized political system in a not-so-orderly transition, accountability in local and state governments is still an unresolved issue. The performance of state governments in previous decentralizations of health and education functions has not been paramount. There is a fear that decentralizing function like awarding fishing permits to state governments will only result in benefiting the political clients of these governments without improving management. Enríquez and Batalla (2000) considered a better option the descentralization of management function to communities although they consider a decentralization to local and state governments an improvement over the present situation.

Regarding principle 8, the effect of a Corporativismo (the still continued control of citizen organizational activities by grouping them within state-controlled organizations) system has to be closely examined. At present, a big, national organization like the Cooperatives Confederation, with a seat in all the significant advisory bodies, being opposed in different degrees by local organizations seems not a promising environment.

Only until recently the possibility of establishing ITQ systems in Mexico has been examined, and not by fishing authorities but by researchers of the National Ecology Institute (Ibañez de la Calle, et al. 2004) or in the academia (Enríquez and Batalla, 2000). Quotas have seldom been used in Mexico’s fisheries management. The grouper fishery has a quota awarded to Cuban vessels fishing in Yucatán. The Octopus fishery has a TAC-type quota that has been used as a substitute for effort regulations and which has been of little effectiveness and was early recommended against by researchers (Solis et al. 1998). The closest to an Individual Quota system is the one applied to abalone cooperatives in Baja California but these are not transferable and the management is based on territorial allocation (turfs) (Muciño et al., 2000).

Ibañez de la Calle, et al (2004) discuss that five conditions have to be fulfilled in Mexico to adopt an ITQ regime:

1) To strengthen respect for property rights, so that the assignment of quotas generates a feeling of ownership and exclusivity on the stakeholders.
2) To increase the available resources for enforcement of present and future regulations.
3) To promote the interest of stakeholders in this type of instruments so that they understand the benefits from the environmental and economic perspective.
4) To reinforce the regulatory framework and to better regulate fishing effort.
5) To consider the biological characteristics of the species (such as longevity and migration patterns) to be regulated by quotas.

It can be said that some requisites (pointed out by several authors) to be met for co management and an ITQ regime are better defined property rights and a better “enforcement” of regulations.

As has been discussed, in Mexico's fisheries property rights are ill defined with (for practical reasons) a free-access regime prevailing for a long time. Permits and concessions are the main instrument to regulate entry. As Enríquez and Batalla (2000) discuss, concessions and permits constitute highly attenuated forms of access rights to fishing. Neither permits nor concessions are divisible and cannot be traded or leased. They are not exclusive and can be transferred only with the permission of the federal authority. Poor enforcement makes these already weak property rights instruments even more attenuated.

Instead of exploring these new approaches, however, government officials have insisted on resorting to traditional schemes, like concessions to give "certainty" to stakeholders. In the original proposal of the new fisheries law, the period of concessions was to be extended. González-Pedrero (2006) considers that this could only result in "undesirable rigidities" in the management process.

Enforcement seems to be considered by Enríquez and Batalla (2000) and Ibañez de la Calle, et al. (2004) as a matter of having a bigger budget earmarked to it. However, in addition to this and perhaps more importantly, economic alternatives for fishermen and the perception of fairness and usefulness of regulations are condition to be met.

Vázquez-León (2006) argues that not taking demographic (seemingly meaning social and economic) characteristics in fisheries communities (particularly the economically disadvantaged) or the possibility of economic alternatives make difficult the design of restriction policies of access to fisheries resources.

Not taking them into account result in the stakeholders not recognizing those restrictions as legitimate entering illegal fishing. From this point of view, illegal fishing is not only a matter of enforcement but also of careful assessment of stakeholders' conditions and of offering economic alternatives.

That's one reason why Breton (2006) advocate a much fuller involvement of social sciences in fisheries management as happened in Canada after the catastrophic collapse of the cod fishery.

Enríquez and Batalla (2000) consider that the widespread implementation of rights based management in Mexico will require mayor constitutional amendments and discussed that the right wing government taking office in 2000, a "constitutional overhaul contemplating stronger property rights provisions over coastal and ocean resources could be a conceivable Scenario". However, the then new administration limited itself to awarding more subsidies to the private sector without improving the definition of property rights or the institutional framework and function.

5) **Compatibility with environmental protection objectives and relationships with other economic activities.**

Seemingly, stakeholders perceive making fisheries management compatible with environmental protection policies as an obstacle to production and resented the inclusion of fisheries in the old SEMARNAP (Muñoz-Villanueva and Acosta-Jenkins, 2006; Ruíz-Moreno and Mérigo-Orellana, 2006). A widespread perception of fisheries as a "production activity" unrelated to the need of environmental protection, along with the dire economic situation of many fishermen and the ever growing dependence of the fisheries sector on subsidies drive upper level officials to design policies that in many occasions are not compatible with other branches of government. Meynem and Doornbos (2004) that such cases as different agencies siding with different sectors (instead of serving as a unified mediator) tend to worsen existing conflicts. At least this was the case in the case of the much discussed shark 029 Mexican Official Standard.

This and the fact that an increasing number of incompatibilities with environmental objectives have occurred (although the most noticeable of them in the Gulf of California) and the many possible direct and indirect effects of fisheries on ecosystems (see, for example Walters et al. 2005) as well as the effects of other productive activities on it clearly point at including fisheries in a wider management framework.

This clearly points towards the need of adopting the Ecosystem-based Approach in managing Mexican fisheries. This approach recognizes that stocks sit within a food web, that non-human predators of stocks and fisheries compete with each other, and that the abiotic environment is to be considered in assessment and management of fisheries (MRAG, 2000). The earliest, and still best, example of ecosystem-based management is the Convention for the Conservation of Antarctic Marine Living Resources (CCAMLR), which attempts to address the indirect effect of fisheries for Southern Ocean krill on the marine mammals and birds that are krill predators (MRAG, 2000).

Shepherd (2004) discusses the 12 principles of the Ecosystem Approach, together with MRAG (2000) specific suggestions for fisheries management it can be said the following.

In the adoption of this approach, conservation of ecosystem structure and functioning, to maintain ecosystem services (not only to the fisheries sector but to society as a whole) as a priority target should be implied.

It comprises the recognition that change in ecosystems, due to multiple causes, are to be expected and that human intervention must be flexible (Adaptive Management) rather than fixed. It has to be assumed that that human intervention will have an effect on many parts of the ecosystem and not only in the exploited stocks. So, monitoring of the ecosystem as a whole is essential.

It has to be recognized that uncertainty will always be present in assessment and monitoring. Managers must be cognizant of the levels of ignorance in which they are working, apply methods of risk analysis and adopt the Precautionary Approach in decision making (MRAG, 2000; (MRAG, 2000; Shepherd, 2004).

Managers and stakeholders must be aware of the missed economic opportunities (not only arising in the fisheries sectors but in other coastal activities as well) from lower levels of fishing mortality and less destructive fishing practices (MRAG, 2000). Managers should aim at: (i) reducing market distortions that adversely affect biological diversity; (ii) aligning incentives to promote biodiversity conservation and sustainable use; and (iii) internalizing costs and benefits in the given ecosystem. To do this, assessment of the relevant economic variables is a necessary requirement.

As the objectives of management natural resources are a matter of societal choice, management should be decentralized to the lowest appropriate level and should involve all relevant sectors of society and scientific disciplines.

According to MRAG (2000), based on the CCAMLR experience, a successful Ecosystem-based management requires:
1. Specification of clear operational objectives, including performance criteria for evaluating management. The objectives should include species-oriented objectives (v.gr. altering the probability of stock collapse), habitat-oriented objectives (v.gr. how much habitat is required to remain unaltered?) and process-oriented objectives (v.gr. how much change in ecosystem productivity can be tolerated before management actions have to be applied)
2. Prospective evaluation of the present management procedures (such as fishing controls, monitoring, and decision rules) that would fail to meet the above stated objectives.

In the opinion of the author of this report, a narrowly focused fisheries management system that has not taken into account economic, social, stakeholder interactions, and wider environmental concerns, as the one traditionally implemented in Mexico, cannot result in correctly addressing the issues presented here. The adoption of new approaches and practices, as well as a carefully designed institutional framework are needed in order to meet these challenges.

Transboundary issues

Since the adoption of the Mexican EEZ in the mid seventies, the American industrial shrimp fleet ceased to operate in Mexican Waters (Weber, 2002). Several species migrate within the EEZ of Mexico, United States and Cuba.

Cid del Prado et al (2000) report extensive migrations of several species of shark in winter months that span Mexican, United States' and Cuban EEZs associated with changes in temperature and reproduction. Collaborative studies have been performed between the Mexican National Fisheries Institute and the Southeast Fisheries Science Center within the Mexus-Gulf program. This included a joint research survey in

1997 to estimate abundance indices of several coastal shark species. Collaborations have been made also with the Mote Marine Laboratory in tag-recapture studies in the mid nineties (Cid del Prado et al., 2000).

Vasconcelos et al. (1986), Vasconcelos (1988) and Scultz-Ruíz et al (2000) also report migrations of Spanish (*Scomberomorus maculatus*) and King Mackerel, (*S. cavalla*). Apparently, the King Mackerel migrate to the Northern Gulf in spring and returns to Southern Florida and Mexico in the fall. These species has been object of collaboration between Mexico and the US within the Mexus-Gulf program including, migrations planktonic larvae surveys and tag-recapture studies (e.g. Vasconcelos et al. , 1986; Olvera et al.1991; Sánchez, et al., 1991; Schultz-Ruíz et al. 1991).

Tuna is caught by longline fleets in Mexican and US waters in the Gulf of Mexico. As tuna is a pelagic, highly migratory species that roams widely in the Gulf of Mexico and Atlantic Ocean is has been object of collaborative studies (also within the Mexus-Gulf program) aimed at standardizing catch rate using Generalized Linear Models (González-Ania, 2000). Mexico is a member of the International Commission for the Conservation of Atlantic Tuna (ICCAT).

The grouper fishery in Yucatán, although completely within the Mexican EEZ, a Cuban fleet operates in the area since the early thirties. In 1976 an agreement was signed between Mexico and Cuba that allowed the Cuban fleet to operate in Mexican waters within a quota scheme. This agreement is part of a wider binational collaborative scheme. The Cuban fleet operates in waters deeper than 20 fathoms, farther offshore than the Mexican fleets although some overlapping has existed between the operative zones of the Cuban and Mexican industrial fleets. In the mid nineties the Cuban fleet obtained an average of 15 of the total catch but their quota has been progressively reduced.

The most important fishery on the Mexican side of the Gulf of Mexico is the shrimp fishery in Tamaulips, just south of the border with the United States. Although no evidence exists of the fishery of one country affecting the other's, there have been several cooperative studies (within the Mexus-Gulf program) that show a transboundary movement of brown shrimp in the border area between the two countries (Klima et al. 1987).

The fisheries considered in this section accounts for 16.89% of the total catch but 48.87% of the total value (most of it being the value of the shrimp catches). The next table shows the catch and value of the fisheries discussed here, and figure 27 shows the percentage of the value and catch of the Gulf accounted for by these fisheries.

	Catch (tons)	**Value (thousands pesos)**
Spanish and King Mackerel	**10,519**	**124,342**
Thunids	**1,326**	**10,387**
Sharks and rays	**9,801**	**93,032**
Shrimp	**18,484**	**1,431,940**
Grouper	**10,352**	**201,686**

As can be seen, although the shrimp fishery accounts for a relatively small volume is, by far, the one with the biggest economic importance.

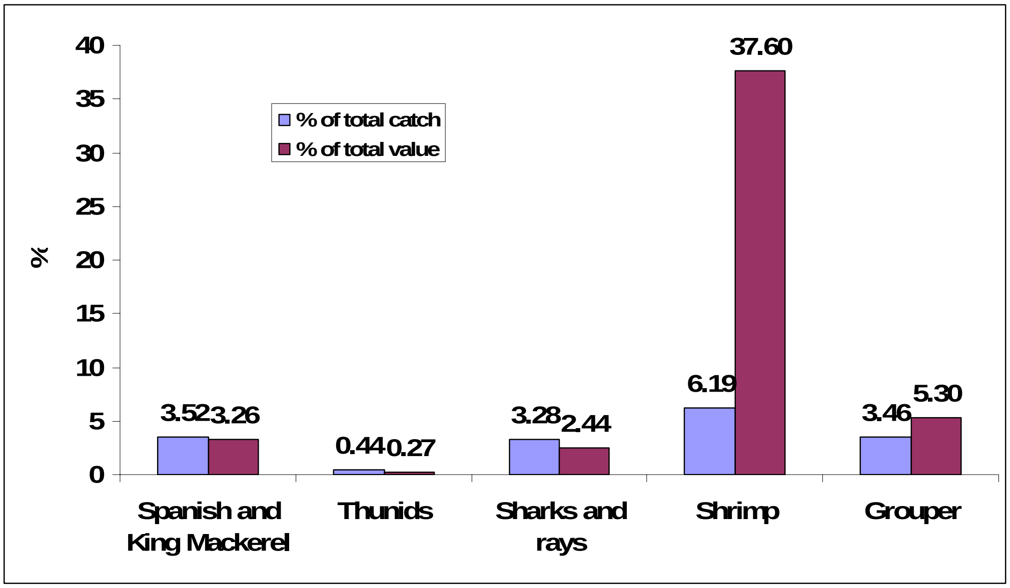


Figure 27. Percentages of total Gulf of Mexico's catch and value accounted for the fisheries discussed in this section.

The protection of sea turtles (*Chelonia mydas*, *Lepidochelys kempi, Eretmochelys imbricata)* that migrate widely in the waters of the Gulf of Mexico has been a focus of attention in Mexico since the early sixties, and collaboratively between Mexico and the United States since 1978 within the Mexus-Gulf program) (Márquez-Millán et al, 2000; Garduño-Andrade, et al., 2000; Garduño-Andrade, et al., 2000b), including cooperative studies (including tagging and migration studies) as well as protection activities. In 1993, the Mexican Official Standard NOM-002-PESC-1993 stated that every vessel in the Mexican shrimp fleet should use Turtle Excluder Devices (TEDs). This was a result of the possibility of an embargo from the United States to shrimp coming from countries not using this kind of devices.

As has been discussed, some of the species discussed in this report have shown descending trends (Spanish and king mackerels, sharks, grouper and possibly shrimp) although most of the transboundary issues directly related to fisheries seem to have little (if any) influence on catches in the other countries sharing the Gulf of Mexico, except for the quota system in the grouper fishery and the highly migratory tuna. Even these are included in bi-lateral or multi-lateral agreements. The Mexus-Gulf program and the bi-national agreements between Cuba and Mexico appear to include most of the relevant issues.

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Background for the Transboundary Diagnostic Analysis:

Pollution and ecosystem health

Associated with the Gulf of Mexico Large Marine Ecosystem

September 2006

General Facts about the Gulf of Mexico
From: Gore, 1992; Darnell and Defenbaugh, 1990, unless otherwise noted.

Location and size

The Gulf of Mexico is a Mediterranean-type sea located at the southeastern corner of North America. The Gulf is bordered by the United States to the north (Florida, Alabama, Mississippi, Louisiana, Texas), five Mexican states to the west (Tamaulipas, Veracruz, Tabasco, Campeche, Yucatan), and the island of Cuba to the southeast.

The Gulf measures approximately 1,600 kilometers from east to west, 900 kilometers from north to south, and has a surface area of 1.5 million square kilometers. The marine shoreline from Cape Sable, Florida to the tip of the Yucatan peninsula extends ~5,700 kilometers, with another 380 kilometers of shore on the northwest tip of Cuba. If bays and other inland waters are included, the total shoreline increases to over 27,000 kilometers in the U.S. alone.

Depth

The Gulf of Mexico basin resembles a large pit with a broad shallow rim. Approximately 38% of the Gulf is comprised by shallow and intertidal areas (< 20 m deep). The area of the continental shelf (< 180 m) and continental slope (180 - 3,000 m) represent 22% and 20% respectively, and abyssal areas deeper than 3,000 m comprise the final 20% (Gore, 1992). The Sigsbee Deep, located in the southwestern quadrant, is the deepest region of the Gulf of Mexico. Its exact maximum depth is controversial, and reports by different authors state maximum depths ranging from 3,750 m to 4,384 m. Mean (average) water depth of the Gulf is ~1,615 m (Turner, 1999) and the basin contains a volume of 2,434,000 cubic kilometers of water ($6.43 * 10^{17}$ or 643 quadrillion gallons).

Circulation and currents

Water enters the Gulf through the Yucatan Strait, circulates as the Loop Current, and exits through the Florida Strait eventually forming the Gulf Stream. Portions of the Loop Current often break away forming eddies or 'gyres' which affect regional current patterns. Smaller wind driven and tidal currents are created in nearshore environments.

Drainage into the Gulf of Mexico is extensive and includes 20 major river systems (>150 rivers) covering over 3.8 million square kilometers of the continental United States (Moody, 1967). Annual freshwater inflow to the Gulf is approximately 10.6×10^{11} m^3 per year (280 trillion gallons). 85% of this flow comes from the United States, with 64% originating from the Mississippi River alone. Additional freshwater inputs originate in Mexico, the Yucatan Peninsula, and Cuba.

Resources

The Gulf of Mexico ecosystem provides a wide array of valuable resources to the nations on its shores. Brief summaries of petroleum and fisheries resources can be found below.

Physical / Mineral
It is estimated that $1.4\text{-}7.2 \times 10^8$ barrels of petroleum and $4.4\text{-}22.3 \times 10^{10}$ cubic meters of natural gas are present beneath the seafloor in the northern Gulf (Darnell and Defenbaugh, 1990). According to the Minerals Management Service, offshore operations in the Gulf produce a quarter of the U.S. domestic natural gas and one-eighth of its oil. In addition, the offshore petroleum industry employs over 55,000 U.S. workers in the Gulf (MMS, 2002). In Mexico, the Secretariat of Energy (Secretaria de Energia - SENER) estimated that the daily crude oil and natural gas production from Gulf of Mexico offshore operations in the years 2000 to 2005

ranged from 2.293 to 2.839 million barrels and 41.4 to 44.8 million cubic meters, respectively (SENER 2006).

Fisheries

Gulf fisheries are some of the most productive in the world. In 2000, the commercial fish and shellfish harvest from the five U.S. Gulf states was estimated to be 1.7 billion pounds (approximately 772 million kg), which represents almost 1/5 (19.4%) of the total domestic landings in the United States. In the same year, commercial catches in the Gulf represented approximately 25% of the total U.S. domestic commercial fishing revenue and were valued at over $900 million. The Gulf also supports a productive recreational fishery. Excluding Texas, U.S. Gulf States accounted for over 40% (>104,000 lbs or >47,000 kg) of the U.S. recreational finfish harvest in 2000 (O'Bannon, 2001).

The above information was taken from the web page called "GulfBase" (http://www.gulfbase.org), it is a project of the Harte Research Institute for Gulf of Mexico Studies at Texas A&M University-Corpus Christi. GulfBase is a database of resources about the Gulf of Mexico. The goal of this website is to regroup, synthesize, and make freely available Gulf of Mexico research information. Our vision is that GulfBase will help researchers, policy makers, and the general public work together to insure long-term sustainable use and conservation of the Gulf of Mexico. M. Nipper, J.A. Sánchez Chávez, and J.W. Tunnell, Jr., Editors. 2006. GulfBase: Resource Database for Gulf of Mexico Research. World Wide Web electronic publication. http://www.gulfbase.org, 11 August 2006

Coastal ecosystems

The coastal lagoons, estuaries and associate habitats in the Gulf of Mexico are good as protection, reproduction and nursing areas of species commercially important. In the United States of America, these fisheries provide 72% of the shrimp fishery, 66% of production of oysters, and 18% of commercial captures of fish approximately. In Mexico, it corresponds to 45% of the shrimp fishery, 90% of production of oysters and 40% of commercial capture of fish. At present, the whole Gulf of Mexico fishery, contributes with catches of more than $1x10^6$ tons / year, without considering discards of the incidental fishing or by catch from the shrimp fishery.

Mangroves grow in the banks of the coastal lagoons, outlets of rivers or bays where there is an influence of marine water. There are four species of mangroves in Mexico located in both costs. In the Atlantic coast they are present from the south of Tamaulipas down to Yucatan. Mangroves are very important since their roots serve as substratum to aquatic organisms besides contributing to floor consolidation and an increase in productivity.

Wetlands provide environmental services of great importance like flood control, coastal area protection, the conservation of the underground coastal springs, the dilution of pollutants and protection of the water quality, the fertilization of the floor, the creation of habitats for birds and wildlife in general. They also provide possibilities of aquatic recreational and sport activities; they increase the value of the property for their aesthetic value. At the same time, for their high productivity, they also play an important role in the carbon capture and as nurseries for commercially important species. Under the approach of the Ramsar Convention, in the Mexican coast of the Gulf 21 of these wetlands are located with a total area of 2, 390, 888 ha.

Biodiversity

Mexico is ranked among the first five countries of the world for its megadiversity. An essential component of the megadiversity of the country is the coastal and oceanic environments. For the extension and the great variety of habitat of the marine and estuarine ecosystems, these present different forms of life and are considered as reserves of high micro and macrobiologic diversity. Some of their communities like mangroves, coral reefs and marine grasses in the coastal area and hydrothermal chimneys in the oceanic area possess high species richness.

This high biodiversity is by no means a product of chance. The country lies between two major biogeographic areas, the Neartic and the Neotropical. Both areas, with their particular environmental and hence, floristic and faunistic characteristics merge at the center of the country producing rich habitats for the appearance of species and their interaction. Added to this, the topographic landscape of the country is represented by almost all kinds of terrain, producing a great amount of habitats. In this respect, the country's eco-regions, terrestrial and marine, are among the most diverse in the world.

Referring to the Gulf of Mexico, three are the zoogeographic provinces that lie within its boundaries. The Carolinian, which goes from Cape Hatteras to Cape Canaveral where it breaks and continues from Cape Romero, Florida to Cape Rojo, Veracruz. The other province is the Caribbean, which runs from Cape Rojo, Veracruz, all the way south the coast of the Gulf of Mexico up to the Orinoco River, Venezuela. A second part of this province is located from Cape Canaveral to Cape Romero, Florida. A third province is related to the Gulf of Mexico, the West Indian, of which Cuba is part (Briggs, 1995).

Along the Mexican coast, there are several coral reefs, being the Veracruz Reef System, the biggest and with the highest number of species (Vargas-Hernandez et al, 1993). It is located just in front of the Veracruz Port and is composed by 22 coral reefs, all spread in an area of 52 thousand hectares and declared as a National Park in 2000 (Diario Oficial, 2000). As an example of the fin-fish diversity, only for this area, the number of fish species reported is of 248 (Vargas-Hernandez at al, 2002). Many of these species are fished by people living in the surrounding areas like the Port of Veracruz and the town of Anton Lizardo. Another example, just for the coast of the State of Veracruz, Lozano-Vilano et al (1993) report a total of 291 of fish species of which, 16 are endemic.

For the area of the Gulf of Mexico, Gallardo et al. (2004) published the number of bird species living at or using the Gulf coast as 231, of which 44% are aquatic, 29% terrestrial, and 27% marine. These species represent 22% of all species to be found in Mexico. Most of the species (65%), though, are seasonal visitors of some areas along the gulf coast. In this way, 45% of the northern visitors spend all the winter somewhere along the coast, 10% will spend just a short time before leaving to an area further south, and the remaining 10% are occasional visitors. The fact that so many species converge in this area is due to the variety and amount of suitable habitats for them. These habitats need to be in route of migratory species and have to have the necessary amount and quality of food, and shelter for them to use. These two characteristics, besides other meteorological events, converge along the shoreline of the Gulf of Mexico in such a way that the corridor is known as one of the most important for migrating birds in the world.

In the Gulf of Mexico there are 30 species of marine mammals, one species of the Order Carnivora, one species of the Order Sirenia, and 28 species of the Cetacea Order; of these, the manatee is of special interest. This animal likes to live along the coast in rivers, estuaries, coastal lagoons and places alike, it inhabits from Crystal River, Florida down to the Caribbean Sea. Two subspecies are present in the gulf, one living in the north of the gulf, Florida and up to Louisiana, and the second one, in the Caribbean, which used to live from Tamaulipas to the Yucatan Peninsula. Due to habitat degradation and the killing of individuals, it can only be found nowadays in the coastal lagoon of Alvarado, several small rivers and estuaries of Veracruz, the lagoon of Terminos, the Grijalva-Usumacinta river system, Celestun, and in Quintana Roo (Ortega-Ortiz et al., 2004). The area between the northern part of Tamaulipas and the south of Texas is believed to be the geographic limits of both subspecies. Although there are no genetic or behavioral studies for both subspecies, the hypothesis is that around this area there is certain amount of interaction (Ortega-Ortiz et al., 2004).

Degradation of ecosystems in the Gulf of Mexico

The coastal environments are strongly affected by the development of a great number of activities that frequently are incompatible to each other. At present time human activities are direct or indirectly the main cause of the modifications of the marine biodiversity and whose effects are always almost irreversible, contrary to many of the natural interferences that have existed continually in the ocean (National Research Council 1995 in Caso et al., 2005). Most of the current and potential threats of the marine biodiversity happen in the coastal area and they are directly related to the human population's demographic tendencies: it is considered that almost 70% of the population live on the coast, or at no more than 60 km of distance from it. If this percentage continues increasing, the total population can end up being duplicated in less than 30 years (Norse 1994 in Caso et al., 2005).

The quick development of certain economic activities such as the oil industry, energy generation, tourism, agricultural development and the marine transport have induced a disordered growth in the coastal and urban areas along the coast line with the derived consequent environmental conflicts of space competition, the use of resources and the generation of residuals and pollutants.

Among the main problems that concern to the coastal areas of Mexico are: lose of habitat in intertidal areas, dunes or cliffs due to deforestation, to the change of land use for urban, port and tourist developments, to mining or filling for construction; the disappearance or decrease of wetlands (swamps, mangrove, and petenes) due to changes in the use of the land or by sedimentation, produced from of the alteration of the watershed.

Eutrophication

Eutrophication is a natural process which consists of an increase in organic matter production as a result of the addition of nutrients, mainly nitrogen and phosphorous. This natural process has been accelarated due to the human discharges of organic matter to the water of rivers and basins. The phenomenom of eutrophication is better noted as an increase of algae biomass, a decrease of seagrass coberture, and nocive algae blooms (Bianchi et al, 1999).

The direct discharge of residual waters has resulted in a potentially dangerous condition for the human health and the marine environment. In the Mexican coasts of the Gulf of Mexico, practically all the coastal populations discharge their domestic waste in the rivers, estuaries, coastal lagoons and the sea without any previous treatment (Botello et al., 1996). As the above-mentioned consequence the coastal lagoons of the Gulf of Mexico are highly stressed, the presence of metals have been detected, as well as persistant organic compounds and hydrocarbons in the silts of the main coastal lagoon systems of Tamaulipas, Veracruz, Tabasco and Campeche.

According to studies along the Yucatan Peninsula (Herrera-Silveira et al., 2004) bays and laggons presented an eutrophic or mesotrophic state with a tendency towards eutrophication. On the other hand, places which are normally oligotrophic, like the coastal area of Campeche are now eutrophic. This condition reflects the lack of water treatment from urban settlements along the coast as well as the high rate of increase of urban development.

Available data shows that, in the Gulf of Mexico, in general, there is a clear tendency to an eutrophication. This is largely noticed in bays, estuaries and coastal lagoons, where direct discharges from human settlements arrive. Through an anlysis of satelite images, Aguirre-Gomez, (2004) shows the great amount of sediments discharged and by consequence, of nutrients to the Gulf coast through the various rivers.

Related to this, it is possible that in the Campeche Bank or around that area, an hypoxic zone is formed between the months of June and September, when the greatest amount of river disharges have ocurred (Yañez-Arancibia et al., 2004).

In conclusion, the direct discharge of residual waters has resulted in a potentially dangerous condition for the human health and the marine environment. In the Mexican costs of the Gulf of Mexico all the coastal populations discharge their domestic waste practically in the rivers, estuaries, coastal lagoons and the sea without any previous treatment (Botello et al. 1996).

Oil Pollution

The oill industry in Mexico is the most important industry since more than 50% of the National income in taxes and exports come from the exploitation of oil and gas, and its derivatives. For example, México exported to the United States between April and June of 2006 1,572 millions of barrels per day representing 83% of all exports (PEMEX, 2006). On the other hand, a major volume of oil and gas extraction occures on the coastal area or within the Gulf of Mexico, mainly in the area of the Campeche Bank.

This high volume of oil and gas production represents a potential risk for the environment. Oil spills in the ocean or on the coastal areas are one of the most nocive externatlities that an ecosystem may support. Due to the oil characteristics, the recovery time of the ecosystem's is much longer, compared with other natural events.

The best unfortunate example of the potential danger that the oil industry represents in the Gulf of Mexico, is the oil spill in 1979 of the oil well IXTOC 1. After an underwater drilling accident, an estimated 140 million gallons of oil were dumped into the ocean and continental shelf environment. It took almost a year to fix the problem at the well and end the oil dumping. As a consequence of the great amount of oil in the ocean, and the long time it took to fix the problem, a certain amount of oil was carried by the Gulf currents to the coast of Texas (Ditton et al., 1980). In november of the same year, an oil tanker, the BURMAH AGATE sank in front of the Texas' coasts as well. Analyzing the economic costs of both events in the 19 affected counties, Ditton and collaborators (1980) concluded that due to the IXTOC 1 effect, more than four million dollars were lost just in the tourist industry in the area, and expenses to the U.S. Government and the State of Texas were estimated at over 15.3 million dollars.

Although in the last years there have been no major oil spills in the ocean, particularly in the Gulf of Mexico, the official records show, for example, that for the year of 2001 no more than 381 barrels ended in the ocean (PEMEX, 2001) (with no reference in what ocean). On the other hand, oil spills in the coastal area are more frequent or at a major quantity. In 2001, PEMEX reports that a duct rupture caused the spill of almost 14,500 barrels close to the Coatzacoalcos river with an important loss of habitat at the river's coast and damage to the flora and fauna.

The IXTOC 1 accident seems to be history by now, but the potentiality of another one of the same size is there. The number of wells has increased since that year, and the amount of precautory policies by the PEMEX company have also increased. Nevertheless the possibilities are there and a major oil spill in the Gulf of Mexico, in either side of the border, can be a disaster for both countries.

Pesticides and Heavy Metals

As a consequence to achieve higher agricultural productivity, it is a common practice by Mexican farmers to use fertilizers and pesticides. The former is one of the causes of the tendency of coastal waters to be close to an eutrophic state. The second one although difficult to detect in a short term, is a potential problem not only to the ecosystem health but to humans and in a collateral way to the economy of the region (Botello et al., 2002).

Pesticides have been used in Mexico for a long time, allthough in first world countries their use is being minimized and alternative pest control are being tested (e.g. natural enemies) (Albert and Benítez, 2005). This activity obeys more to a traditional lack of information, than to an effective pest control. Unfortunately, all pesticede components used in land end up in the rivers flow, fresh water basins, and ultimately in the Gulf of Mexico.

The harmful effects of pesticides are well documented (Albert and Benítez, 2005; Botello et al., 2002) they go from skin rash in humans to genetic malformations in humans and other animals. A classic eample of this is the rapid decay in the American Eagle population which resulted, after years of investigation, due to its exposure to DDT

One of the main characteritics of pesticides is that they are not bio-degradable. That is, once an animal or plant is in contact with the substance it enters into its system and there is no metabolic path to eliminate it. This is what is known as bioaccumulation. Because of this, the concentration of pesticides accumutates, also along the food chain, with higher concentrations at high trophic levels as compared to those at low trophic levels. This process is known as biomagnification. Considering that the species relations within an ecosystem resemble more a web or net than a chain, the paths that pesticides can take increases as the number of species do. According with this, the probabilities of bioaccumulation of nocive substances at every trophic level increases with the trophic level itself. For example, a substance uptaken by an algae passes to its predator, lets say a copepod, since the copepod consumes a great quantity of algae, the amount of the harmful substance increases as well. This substance will not be metabolized by the copepod and will be passed to the next trophic level, the organism that preys on copepods. This mechanism goes on up to the higher trophic levels. Human consumption of fish is one of the easiest ways in which the harmful substances are introduced to its system. This is mainly because the fihseries are targetting fishes at the highest trophic levels.

On the other hand, disease on animals and plants do affect the ecosystem by producing high mortalities and, by consequence a decrease in biomass. This pattern may produce a total depletion of one or more species with negative effects on the ecosystem's structure and functioning, in other words, in the ecosystem's health. The resilience of the ecosystem may be altered as well producing that, after natural or exogenous stresses, the system could not be able to return to its natural state.

Most of the coastal lagoons, estuaries, and bays along the Mexican coast of the Gulf of Mexico there are different levels of concentration either of pesticides, heavy metals or both. In either case, the concentration in water or sediments varies according to the season (Botello et al., 2002). At certain time of the year the amount of DDT or similar pesticides could be well above to that allowed by law. The same pattern happens for heavy metals. Unfortunately, their prescence is documented meaning that the ecosystem and human health are in danger, eventhough there are laws that regulate the use of these substances.

Habitat Loss

As stated above, along the coasts of the Gulf there is a high diversity of habitats where a great amount of speceis, many of commercial importance live or use them for shelter or nursing. Besides the commercially important species inhabiting the coastal areas, there are a great number of other species, responsible of sustaining, through the complicated food web, the function, structure and stability of the ecosystems.

The coverage of mangrove forests on the coasts of Mexico, have been affected considerably in the last years. According with data of FAO (2003), Mexico has lost in the last 30 years more than half of its mangrove coverage in both coasts. Although the available data is not precise, López-Portillo and Ezcurra (2002), provide an estimated rate of annual loss of the national coverage of mangrove between 2.9 and 5%. Recently, the CONABIO made a preliminary estimate of the average yearly rate of mangrove loss of 2.5%. The projected rate for 2025 shows a loss of 50% taking the year 2000 as a base line (CONABIO, 2006).

The collapse of the shrimp fishery in the Gulf of Mexico is explained by the reduction of the fishing capacity, the contamination, the restrictive loss of trawling areas, the environmental conditions and the deterioration of nursery habitats. Although these factors can act in combination, exercising pressure on the shrimp populations, the fishing factor is determinant in the reduction of the shrimp existences, conditioning the future strategies for the management of the fisheries.

Main anthropogenic causes of ecosystem degradation

Federal Bureau for the Environment Protection (PROFEPA) has detected as the main cause of negative effects to the coastal-marine environment the following: a) habitat modification and/or destruction, for big real estate tourism development, that include hotels, condominiums, and golf fields, b) destruction of the coastline, dunes and adjacent ecosystems in order to build jetties, aquatic sport areas, four-wheel vehicules, c) deforestation and illegal lumber traffic in coastal environments, d) capture and illegal traffic of marine protected species, as mammals and sea turtles, e) illegal traffic of terrestrial protected species of fauna and flora, f) introduction of non native flora and fauna, g) collisions of ships and anchorage on coralline reefs, h) polluted discharges to the sea and the underground water, i) polluting emissions to the atmosphere, from boilers and industrial chimneys, j) inadequate management of residual fuels, by contention systems of spills, separation of residuals, and substances to wash chlorine and k) high energy consumption and its water.

The environmental problem associated to the farming sector is related to: a) the inadequate handling of the agro chemist use (pesticides and fertilizers), originating contamination due to the incorporation of surpluses to the floor and aquatic ecosystems as estuaries, rivers, coastal lagoons, etc., generating eutrophication processes and causing a high death toll on non-objective species; b) inadequate agricultural practices and in areas without aptitude, originating erosion processes, salty conditions, definitive loss of vegetation coverage, imbalances in the geo-hydrological balances of the coastal basin, changes in the micro-climatic conditions, c) and long term desertification and active deforestation to expand the agricultural borders or for extensive cattle raising, causing coverage and biodiversity loss of native vegetation coastal communities.

Health

Costanza and Mageau (1999, see also Rapport et al., 1998) wrote: "An ecological system is healthy and free from distress syndrome if it is stable and suitable – that is, if it is active and maintains its organization and autonomy over time and is resilient to stress." Their definition of ecosystem health implies what the authors mention as important aspects: vigor, organization and resilience. Vigor refers to the functional aspect of the ecosystem (e.g. metabolism, primary productivity). Organization makes reference to structure and biodiversity, and it can be measured by diversity indices, diversity of interactions, and the number of pathways of material exchange between species. Resilience is the ability for the system to maintain its structure and pattern of behavior when a stressful situation is affecting the system. In other words it is the capability of the system to maintain its vigor and organization in the presence of stress.

An ecosystem should be able to recover after a stressful condition and be stable and sustainable in order to be considered as healthy. These characteristics would be achieved through a good structure, its vigor and a high resilience. Assessing these properties for several ecosystems (Rapport, 1989; Mageau et al., 1995; Wicher and Rapport, 1998) has resulted that in stressed ecosystems a biotic impoverishment, reduction in the productivity, reduced resilience and a reduction in diversity.

Following this definition, diversity is a key element for the health of an ecosystem. Diversity is responsible of the ecosystem's structure hence for its functionality. In the above definition, organization is well defined by the diversity of the ecosystem within its boundaries.

In this context, diversity not only is a reference to the number of species, better known as species richness, but the proportion of individuals or their biomass of each species respect to all present in the community This definition of diversity implies that even an area rich in species could be low in diversity due to a disproportional abundance or biomass of few species On the opposite side, a not so rich community may present a high diversity if all species have an even or almost even distribution of their individuals or biomasses.

However, an ecosystem is not only the number of species or the individual's proportions between them. It is, as for other complex systems, more than the sum of all its parts. That is, taking one characteristic at a time and measuring it will not be enough to have a good idea of the system's behavior, structure, or function. On the other hand, trying to consider all the ecosystem's variables would be a titanic endeavor and most probably with no sense at the end. In view of the difficulty of the problem, several approaches have been tried in order to adequately measure the ecosystem's structure and functionality, parameters related as well to stability and resilience.

By using the predator-prey relationship that exist between species (among other kind of interactions, e.g. parasitism, mutualism) the structural characteristics of the ecosystem may be measured. In this way, the Ascendancy index, as proposed by Ulanowicz (1986), Ulanowicz and Norden, (1990), Ulanowicz and Abarca-Arenas, (1997) has been taken as an example to be followed and used as a good indicator of the ecosystem's health (Costanza and Mageau, 1999). The basic approach for this analysis is through the study of the weighed trophic structure of the ecosystem. In this, the biomass, feeding habits, respiration, exports and fishing (if any) of the ecosystem's species are considered. These data are used arranged as a food web depicts two of the elements mentioned above as important for the study of health: vigor and organization. Vigor is represented as the amount of primary productivity, and organization as the diversity of species and matter flow, the amount of connectivity between them. With these data and through the use of information theory is that the Ascendancy is calculated, summarizing the state of development and growth of the ecosystem.

Along the Gulf's coast several studies using trophic interactions have been done. These are good examples of what is needed all around the Gulf of Mexico serving as an indication of the amount of data that is still necessary to be compiled in order to have a better understanding of them.

Because negative inputs to the ecosystem as over fishing, pesticides, oil spills or fertilizers are considered as a stress, baseline studies are necessary for many of the ecosystems in order to be compared to those where a suspicion of stressful condition exist. Comparisons between the different conditions that an ecosystem has been through are important data in order to measure its capacity of resilience and hence return to its former condition, or close to it. This is the third of the characteristics to be analyzed for an ecosystem in order to measure its health. If, and in most of the cases this is probably the situation no prior data are available, simulations under different stressing scenarios of the ecosystem are a useful tool.

General summary and conclusion

The coastal areas in Mexico present a variable vulnerability to the impact of natural phenomena, mainly hurricanes and floods, as well as slips and telluric movements. The above-mentioned due to the climatic characteristics of their geographical localization in the subtropical area, to the geomorphologic and tectonic characteristic, and locally to factors associated to the vegetation state, and to the coast physiographic characteristics. Other fundamental factors of its vulnerability to natural risks are population concentrations and the productive development, since in accordance with Palacio (2004), it is this area of our country, where 95% of the oil production is concentrated, 80% of the natural gas, 80% of the exports leave the national ports, more than 60% of the foreign tourism arrives and 50% of the electric power is produced.

Other phenomena that affect the local environment, are the floods caused by the rivers overflow in the rainy season or for extreme precipitations caused by the hurricanes. Among the causes that intensify their effects is the deforestation of the hydrological coastal basins, the erosion and loss of soil originating a modification of the geo-hydrological regional patterns.

With the continuing climatic change trend in the Gulf of Mexico, wetlands, coastal plains, barrier islands, estuarine mouths, sand dune, among other critical habitats, will show deterioration, erosion and floods.

The main problems associated to the great basins in the Gulf face are: a) loss of critical habitats, b) contamination of water and silts, c) increase in turbidity and nutrients, d) reduction in fresh water discharge and its quality to the coastal plain and the sea, e) alteration of the estuarine dynamics and the connection mouths between the wetlands and the sea, f) coast erosion, g) biodiversity loss, and h) deterioration of the public health.

It should be a priority to take measures to conserve the operation of the beaches and the coastal dunes, and the functional structure of their biodiversity; to create new protected natural areas; to regulate their use, conservation and handling; to redefine the marine - terrestrial federal area and gained land from the sea, based on geomorphológic and ecological approaches, in function of the different coastal regions of the Gulf of Mexico and their delimitation; to identify vulnerable areas and of high risk and to impel the specific studies of environmental impact for dunes and beaches based on the conservation of the function and protection of the coastal dynamics.

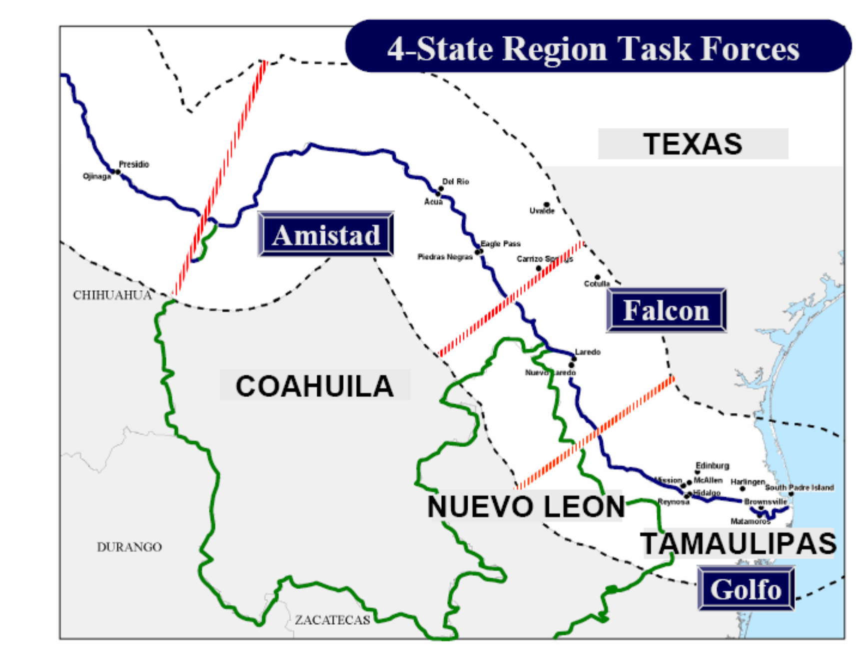
Tranboundary problems

We consider that there are two major areas where we have transboundary problems: 1) The Rio Bravo/Grande basin and coastal area and 2) The Ramsar sites along the coastal zone in the Gulf (21 sites, 2,390,888 Ha.).

The Rio Bravo/Grande basin and coastal area

In this area, we have the following problems:
Water contamination
Air pollution
Land contamination
Exposure to chemicals
Modification of the ecosystems (river, wetlands and estuary)

EPA and SEMARNAT, have a binational program addressing these issues, the Border 2012 Program, it is the latest multi-year, planning effort to be implemented under the La Paz Agreement and succeeds Border XXI, a five-year program that ended in 2000. Nevertheless the causes still exist and thus more effort to solve them is required.



The Ramsar Sites

Mexico signed the Ramsar Convention on Wetlands since 1971 and now has 21 sites registered, which add up to a total of 2,390,888 Ha. The Convention on Wetlands text, as amended in 1982 and 1987, states the following in its third and fourth article:

Article 3
The Contracting Parties shall formulate and implement their planning so as to promote the conservation of the wetlands included in the List, and as far as possible the wise use of wetlands in their territory.
Each Contracting Party shall arrange to be informed at the earliest possible time if the ecological character of any wetland in its territory and included in the List has changed, is changing or is likely to change as the result of technological developments, pollution or other human interference. Information on such changes shall be passed without delay to the organization or government responsible for the continuing bureau duties specified in Article 8.

Article 4
Each Contracting Party shall promote the conservation of wetlands and waterfowl by establishing nature reserves on wetlands, whether they are included in the List or not, and provide adequately for their wardening.
Where a Contracting Party in its urgent national interest, deletes or restricts the boundaries of a wetland included in the List, it should as far as possible compensate for any loss of wetland resources, and in particular it should create additional nature reserves for waterfowl and for the protection, either in the same area or elsewhere, of an adequate portion of the original habitat.
The Contracting Parties shall encourage research and the exchange of data and publications regarding wetlands and their flora and fauna.
The Contracting Parties shall endeavour through management to increase waterfowl populations on appropriate wetlands.
The Contracting Parties shall promote the training of personnel competent in the fields of wetland research, management and wardening.

Besides the agreement to the Ramsar convention Mexico has several regulations/ laws that protect wetland areas and species that live in them, Agraz-Hernandez et al., 2006 present a detailed list (10) with remarks concerning their main purpose (ANNEX II).
Regardless of the regulations these ecosystems are subject to continue stress, where one or more human activities are constantly impacting the ecosystem:
Increase in population settlement
Port development
Bad agriculture practices (excess pesticides and chemical fertilizers)
Upland deforestation
Untreated sewage (Urban and industrial)
Mangrove deforestation
Over fishing
Increase in tourism
Oil industry
Poor law enforcement

These bad practices lead to a modification of the habitat and thus in a loss of biodiversity, ecosystem structure, eutrophication, which have an impact on other economic activities that represent an income to many persons: tourism and fisheries.

Underlying causes

Increase in urban settlements
Increase in industrial development (untreated waste)
Air pollution
Deforestation upland and mangroves
Runoffs
Soil
Fertilizers
Pesticides

Ecosystems health depends in three main factors as mentioned above. These are interconnected and a change in one could produce a change in the others that, if big enough, the well being of the ecosystem will be jeopardised. Biodiversity is one of the main promoters of ecosystem health; it is responsible of its structure and functioning, together acting on its stability and resilience. On the other hand stress on ecosystems is always present, either in a natural way like hurricanes or seasonal changes, or induced by man. The ecosystem has the capacity to maintain its health within certain boundaries based on natural stressful causes, but, if we add to these causes others, there is a high risk that the stress will go beyond and the ecosystem will not be able to return to its former state.

Human induced pollution to the environment is one of the most stressful externalities to an ecosystem. High concentrations of pollutants represent values beyond its recovery capacity. The same happens with habitat fragmentation. The same way as species in an ecosystem are connected through predator-prey, or commensalism interactions, habitats are connected. These connections serve species in several ways, and eliminating them is a major cause of biodiversity loss, and, consequently, an important degradation of the ecosystem.

Proposed solutions

Adequate development planning
Proper waste treatment
Law enforcement and taxation
Increase penalties
Change to better agriculture practices
In general increase environmental consciousness through education (from kinder garden up to higher education)
Socio-economic studies of natural resources

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ANNEX I

Área de Protección de Flora y Fauna Laguna de Términos. *02/02/04*; Campeche; 705,016 ha; 18°37'N 091°41'W. Wildlife Reserve. The largest coastal lagoon on the Mexican shore of the Gulf of Mexico. Mangrove forests of approximately 127,000 ha are a major feature and produce as much as 716,000 tons of dead leaves every year. The coastal waters are enriched with nutrients by upwelling and turbulence, while the lagoon receives freshwater from rivers and swamps. Other vegetation types are evergreen tropical forest, thorny forest, palmetto (*Sabal Mexicana*) forest, reedbeds of cattail (*Typha latifolia*) and Jointed Flatsedge (*Cyperus articulatum*), and patches of Bent Alligator Flag *Thalia geniculata*. Flagship animals of the site include the Jabiru *Jabiru mycteria*, the Horseshoe Crab *Limulus polyphemus* and endemic amphibians *Rana brownorum*, *Bolitoglossa yucatana*; and reptiles *Anolis ustus*, *A. cozumelae, A. quercorum*, amongst others. Ciudad del Carmen, with a population of almost 100,000, is an important industrial port located on the barrier island of the lagoon. A variety of fishing, agricultural and livestock raising activities are done in the site, all of which are causing problems of sedimentation, pollution, deforestation and reduction of stocks. Further conflicts have arisen with the oil pipes that traverse the area. Ramsar site no. 1356.

Área de Protección de Flora y Fauna Yum Balam. *02/02/04*; Quintana Roo; 154,052 ha; 21º28'N 087º19'W. Wildlife Sanctuary. A coastal lagoon and patches of low and medium forests on the northern coast of the Yucatan Peninsula, home to a rich fauna, including the jaguar, Baird's Tapir *Tapirus bairdii*, Crocodiles (*Crocodylus acutus* and *C. moreletii*), sea turtles, American Manatees *Trichechus manatus*, Spiny Lobsters *Panulirus argus*, and the near-threatened Ocellated Turkey *Agriocharis ocellata*. Besides the well preserved forests, noteworthy vegetation communities are those of Everglades palms (*Acoelorreaphe wrightii*), mangroves and petenes. Fishing is the main income source for locals yet the main problem for the area as well, as fishing intensity has increased and stocks diminished. Tourism, forestry, cattle ranching and agriculture are of low intensity today, yet their impact could grow in the next years. Ramsar site no. 1360.

Dzilam (reserva estatal). 07/12/00; Yucatán; 61,707 ha; 21°35'N 088°35'W. Reserva Estatal. A coastal and marine reserve located in the north of the Yucatán Peninsula, adjacent to the Ría Lagartos Ramsar site. The site includes a unique hydrological system, "anillo de cenotes", a formation caused by the impact of a huge meteor. This site comprises various habitats: marine areas of the continental platform, seagrass beds, intertidal lagoons, sandy dune shores, flooded jungle, dry low jungle and medium height jungle. The site provides important habitat for more than 20,000 waterbirds, such as the Mexican pink flamingo and many other migratory species. It is also an important habitat for a wide diversity of species and life history stages of fish, molluscs and crustaceans, some of them with a high commercial value, and it provides habitat for several endemic, threatened and endangered species of cactus, reptiles and amphibians. The site has extremely important cultural values, as it was an area of residence of prehispanic cultures. 14,000 hectares of the site belong to private landowners. About 68% of the population residing in the area derives their livelihoods from fishing, hunting and agriculture, 8.5% from trade, 7.5% from industry, 4% from tourism, and the rest work for the government. Ramsar site no. 1045.

Humedal de Importancia Especialmente para la Conservación de Aves Acuáticas Ría Lagartos. *04/07/86;* Yucatán; 60,348 ha; 21º30'N 088º00'W. Added to the **Montreux Record**, 4 July 1990, removed from the Record, 7 August 1996. Biosphere Reserve. An extensive complex of small estuaries and hypersaline coastal lagoons separated from the Gulf of Mexico by a dune cordon. Certain parts receive fresh water from subterranean aquifers. Eight specific vegetation zones are present, providing habitat for several notable or endangered species of plants. The vegetative diversity gives rise to an abundant fauna, representing a high percentage of species known in the Yucatan, including numerous threatened or endangered species. Several villages and archaeological areas are located within the site. Human activities include, fishing, tourism, agriculture, livestock rearing, and salt extraction. Special research and educational efforts are devoted to the protection and conservation of marine turtles. Subject of Ramsar Advisory Missions in 1989 and 1991. Area significantly extended in September 2002. Ramsar site no. 332.

Humedales de la Laguna La Popotera. *05/06/05*; Veracruz; 1,975 ha; 18°40'N 095°31'W. An extensive site containing at least 24 wetland types and a large number of marshes, ponds, rivers and sand dunes combined with a thick mangrove forest. The estuarine nature of the waters makes the site an ideal resting and breeding ground for numerous species. A total of 78 endangered or threatened species inhabit the area, among them the manatee (*Trichechus manatus*), river otter (*Lontra longicaudis*), and an endemic lizard species that resembles a snake (*Ophisaurus ceroni*). An estimated 300 species of waterfowl inhabit the area. Sugar cane agriculture, cattle ranching and poaching constitute the main potential threats to this site. Ramsar site No.1462.

La Mancha y El Llano. *02/02/04*; Veracruz; 1,414 ha; 19°36'N 096°23'W. Two coastal lagoons in the Gulf of Mexico surrounded by mangroves and two humid dune slacks. The latter are shallow freshwater lakes supplied by groundwater and surrounded with deciduous seasonally flooded forest of *Crysobalanus icaco* and *Enterolobium cyclocarpum* and communities of *Cyperus articulatus* and *Phyla nodiflora*. These are threatened and unique ecosystems in the whole coast of Veracruz where coastal dunes can reach 80 m in height but are being filled in for urban growth. Mangroves host populations of Belize Crocodiles *Crocodylus moreletii*, Wood Stork *Mycteria americana* and Reddish Egret *Egretta rufescens*. Oysters, clams and shrimp are fished regularly. The lagoons are being silted due to mangrove and upper basin deforestation, and impacts of infrastructure such as oil pipelines, road and railway building present threats. The Instituto de Ecología A.C. is located on the site, maintaining ongoing research activities and elaborating a community management plan. Ramsar site no. 1336.

Laguna de Tamiahua. *27/11/05;* Veracruz; 88,000 ha; 20°58'N 097°19'W. The third largest coastal lagoon in Mexico, with the largest well-structured mangrove forest to the north of the Papaloapan river, acting as an industrial and urban wastewater filtration and treatment system. The site is also of importance for marine turtles and fish (around 120 registered species). Among the species under protection are the turtle *Chelonia mydas* (endangered), the fish *Poecilia latipunctata* (critically endangered) and the sea horse *Hippocampus erectus* (vulnerable), as well as several waterbird species. Deforestation of the mangrove forest, overfishing and water pollution constitute the greatest threats to the integrity of the Lagoon. Ramsar site No. 1596.

Laguna Madre. *02/02/04*; Tamaulipas; 307,894 ha; 24°44'N 97°35'W. The largest water body in the country, on the Gulf of Mexico near the Texas border, it is a coastal lagoon system bordered by a sand barrier 223km long. Salinity varies greatly depending on rainfall. The site is of critical importance to resident and migratory waterbirds, especially shorebirds such as *Pluvialis squatarola*, *Calidris alba*, *Calidris minutilla* and the endangered Piping Plover *Charadrius melodus*. 26 waterfowl species are found on the lake, where concentrations of over 100,000 individuals of Redheads *Aythya americana* and Northern Pintail *Anas acuta* stand out. Desert scrub of mesquite *Prosopis glandulosa*, Blackbrush *Acacia rigidula*, *Castela tortuosa*, amongst others, is the most representative terrestrial vegetation. Seagrass beds of *Halodule wrightii* and others cover large areas. Fishing is by far the most important human activity on the site, yet the over-exploitation of resources has diminished stocks. The Intracoastal Waterway project from Tampico to Brownsville would seriously alter the site's character. The area is regarded as the first priority wetland for migratory birds in Mexico by Ducks Unlimited, which contributed towards the site designation. Ramsar site no. 1362.

Manglares y humedales de la Laguna de Sontecomapan. *02/02/04*; Veracruz; 8,921 ha; 18º32'N, 095º02'W. Part of a Biosphere Reserve. A coastal lagoon featuring an important mangrove forest on the western coast of the Gulf of Mexico, as well as a low seasonally flooded forest, reedbeds and coastal dunes. The site is an important stopover site for migratory birds using the coastal route from North to Central and South America, and it is part of the Tuxtlas Biosphere Reserve. Nationally threatened species inhabit the site, such as the howling monkey *Alouatta palliata*, otter *Lutra longicaudis*, royal duck *Cairina moschata*, and

Unicolored Rail *Amaurolimnas concolor*. The mangroves are vital spawning and nursery grounds for marine fish, while the freshwater wetlands harbor endemic species such as *Atherinella ammophila*, *Priapella olmecae* and *Cychlasoma fenestratum*. Fishing in the lagoon is an important economic activity, as well as cattle ranching and small-scale agriculture. Though deforestation has diminished since the site was declared a protected area, it remains the main problem of the reserve. The paving of a road poses problems if tourism increases in an unregulated manner. A management plan is being drafted for the Biosphere Reserve. Ramsar site no. 1342.

Manglares y humedales de Tuxpan. *02/02/06*; Veracruz; 6,870 ha; 21°00'N 097°21'W. The Tuxpan river separates the mangroves and wetlands of Tuxpan into the northern mangroves of the Tampamachoco lagoon and the southern mangroves associated with the Tumilco and Jácome estuaries. The importance of this site lies in its vast and well-preserved mangrove area, one of the largest in the Gulf of Mexico, with approximately 3,500 ha of mangroves reaching 8-15m in height. Some 179 fish species make this wetland one of the richest in fish diversity in the Atlantic coast of Mexico. Threatened species include the cantil snake (*Agkistrodon bilineatus*), the pale-billed woodpecker (*Campephilus guatemalensis*), the spiny-tailed or black iguana (*Ctenosaura acanthura*) and the monarch butterfly (*Danaus plexippus*). Ramsar site No. 1602.

Parque Nacional Isla Contoy. *27/11/03;* Quintana Roo; 5,126 ha; 21º29'N 086º47'W. National Park. One of the northernmost islands in the Mesoamerican Barrier Reef, 50km north of Cancún and 13km off the mainland Yucatán peninsula, the principal nesting site for seabirds in the Mexican Caribbean. Coastal dunes, mangroves, lagoons, low forest and coconut palm trees dominate the terrestrial landscape of the island, while marine environments include sea-grass beds and coral reefs. Marine fish stocks are significant due to the abundance of plankton provided by the upwelling of cold submarine currents. Mammals are notably absent from the island. The endangered Green, Loggerhead, Hawksbill and Leatherback turtles nest on Isla Contoy, as well as the Horseshoe Crab *Limulus polyphemus* and large colonies of Magnificent Frigatebird *Fregata magnificens*, Double-crested Cormorant *Phalacrocorax auritus* and Brown Pelican *Pelecanus occidentalis*. A management plan regulates lobster fishing, sports fishing and tourist activities, and there is a fully equipped visitor and information centre. Rapid tourist development on the mainland coast poses threats to the island, as well as hurricanes such as Isidore in 2002. Ramsar site no. 1323.

Parque Nacional Sistema Arrecifal Veracruzano. *02/02/04*; Veracruz; 52,238 ha; 19°08'N 096°00'W. National Park. Just offshore the city of Veracruz, this National Park in the Gulf of Mexico comprises 23 coral reefs in two distinct areas, rising from depths of around 40m. The reef is very rich in fauna and a favorite diving destination, boasting 84 different coral species, 339 mollusks, 47 sponges and 140 crustaceans. There are large seagrass beds, and pioneer coastal dune vegetation, coconut palms and mangroves are present in the emerged keys, as well as the Florida Cherry palm *Pseudophoenix sargentii*. Three main rivers have outlets in the vicinity, La Antigua, Jamapa-Atoyac, and Papaloapan, jointly discharging significant amounts of freshwater and sediments in the area, which pose a problem of turbidity. Additionally, water pollution comes from sewage and industrial waters from Veracruz and large vessels navigating close to the reefs. Overfishing is also affecting populations of lobsters, octopi and other species. In spite of these pressures, the recovery rate of the reef is greater than that of others in the Gulf of Mexico. The Veracruz Aquarium carries out monitoring of turtle nesting in the keys and a management plan is being drafted for the site. Ramsar site no. 1346.

Playa Tortuguera Chenkán. *02/02/04*; Campeche; 100 ha; 19°09'N 091°01'W. An important nesting site for the endangered Hawksbill Turtle *Eretmochelys imbricata* and the Green Turtle *Chelonia mydas*. Coastal dune communities feature the Seagrape *Coccoloba uvifer*, Largeleaf Geigertree *Cordia sebestana*, *Ipomea pescaprea* and *Jaquinia flamma*. A stretch of mangrove forest is found behind the beach, as well as deciduous forest. *Lylisoma bahamensis*, *Piscidia piscipula*, *Bursera simarub*a and *Croton flavens* are the more common species of trees. Oil and natural gas exploration in the Campeche Sound have caused some water pollution, and there are concerns for the risks for turtles. Northerly winds, tropical depressions and hurricanes have made the beach retreat in width, while coconut palms are suffering from lethal yellowing. A research camp has been built to monitor turtle populations and do awareness activities with local communities. There are plans to designate this beach as a Wildlife Sanctuary. Ramsar site no. 1348

Reserva de la Biosfera Los Petenes. *02/02/04*; Campeche; 282,857 ha; 20°11'N 090°32'W. Reserva de la Biosfera. Located in the western Yucatan peninsula just north of the city of Campeche, whose old town is a

World Heritage Site. Los Petenes owes its name to this unique ecosystem, consisting of islands of low seasonally flooded and/or mangrove forests associated with underwater springs from sinkholes or cenotes. The marine parts of the site are noteworthy for their seagrass beds, while inland the landscape is dominated by a saline wetland dotted with petenes. Worth highlighting are the communities of Button Mangrove *Conocarpus erectus* and Campeche Wood *Haematoxylum campechianum*. There are several globally near-threatened species, such as the Horseshoe Crab *Limulus polyphemus* and the Jabiru *Jabiru mycteria*. The site also hosts relatively large colonies of the White Ibis *Eudocimus albus* and Greater Flamingoes *Phoenicopterus ruber*. Cod, sardines, shrimp and octopus fishing are the main human activities in the site. Overfishing of stocks and illegal tree felling are the main problems, as well as the lack of the implementation of the management plan. In 2003, a joint council of several institutions was established to carry out a conservation initiative in western Yucatan. Ramsar site no. 1354.

Reserva de la Biosfera Ría Celestún. *02/02/04*; Yucatán; 81,482 ha; 20º45'N 090º22'W. Reserva de la Biosfera. A diverse complex of wetlands including mangroves, seagrass beds, small estuaries, coastal dunes, hypersaline coastal lagoons, karstic caves and other coastal wetland types. Fresh water from subterranean aquifers has an outlet in the site. Eight specific vegetation zones are present, providing habitat for several notable or endangered species of plants. The vegetative diversity gives rise to an abundant fauna, representing a high percentage of species known in the Yucatan, including numerous threatened or endangered species. The site is of particular importance as a nesting and feeding site for turtles and migratory birds. Human activities include fishing, tourism, and salt extraction. Special research and educational efforts are devoted to the protection and conservation of biodiversity in the area. Ramsar site no. 1333.

Reserva Estatal El Palmar. *27/11/03;* Yucatán; 50,177 ha; 21º03'N 090º12'W. State Reserve. The site lies on the northwestern coast of the Yucatán peninsula and features mangroves, seagrass beds and tidal flats, as well as coastal dune vegetation, petenes (emerging islands of forests protected from saline intrusions), sinkholes or cenotes, swamp forests and low deciduous forest. El Palmar harbours a significant population of Greater Flamingos *Phoenicopterus ruber*, and 15 duck species have been recorded. The site also provides nesting ground for the endangered Hawksbill turtle *Eretmochelys imbricata*, for which a nest survey and liberation programme is underway. Fishing, agriculture, hunting and palm leaf collection are the main economic activities, which also represent the main potential threats to the site. Federal, state and municipal authorities as well as NGOs, communities and academic institutions participate in a board that manages the reserve. Training, restoration and awareness activities have been carried out successfully. Ramsar site no. 1328.

Sistema Lagunar Alvarado. *02/02/04*; Veracruz; 267,010 ha; 18°39'N 095°51'W. A lagoon and estuarine complex comprising several coastal brackish lagoons, more than 100 interior lagoons and parts of the Papaloapan, Acula, Blanco and Limón rivers. The site features representative and diverse ecosystems of the coastal plain of the Gulf of Mexico, such as coastal dunes, reedbeds of *Cyperus spp*., cattail *Typha spp.*, palm forests of *Sabal mexicana*, *Scheelea liebmaniim Acrocomia mexicana*, oak forests of *Quercus oleoides*; apompales (*Pachira aquatica*); and large mangrove forests. It is regarded as the most important site for the American Manatee *Trichechus manatus* in Veracruz. Silting, agricultural expansion, mangrove cutting and extensive cattle raising are threatening the site, as are increases in fish catch and the use of banned fishing nets. The area is highly regarded as of conservation priority and listed as an Important Bird Area. The Biological Research Institute of the Universidad Veracruzana has carried out several research activities in the area. Ramsar site no. 1355.

ANNEX II

Mexican Regulations / Laws that regulate the use and protection of coastal wetlands: (C. Agraz-Hernández et al, 2006)

NOM-001-ECOL-1996 stated the maximum limits of contaminants contained in municipal discharges, Diario Oficial de la Federacion, January 6/ 1997.

NOM-002-PESC-1993 regulates the capture of shrimp species in waters of federal jurisdiction of Mexico, Diario Oficial de la Federacion, December 31/1993. This norm was modified on July30, 1997.

NOM-009-PESC-1993, states the procedures to be followed in order to establish ban and ban zones for the capture or collection of aquatic flora and fauna in Mexican territory waters, Diario Oficial de la Federacion, March 4/ 1994.

NOM-012-RECNAT, states criteria and specifications for firewood for domestic use, Diario Oficial de la Federacion, June 26/ 1996.

NOM-013-PESC-1994 regulates the capture of mollusc gastropods species from the waters of Campeche, Quintana Roo and Yucatan, Diario Oficial de la Federacion, April21, 1995.

NOM-022-SEMARNAT-2003, which establishes the preservation, conservation, sustainable use - and restoration of the mangrove ecosystems requirements to be fulfilled, Diario Oficial de la Federacion, October 6,2000.

NOM-ECOL-059/2001 (SEMARNA T 2001). The former norm classifies white *(Laguncularia racemosa),* black *(Avicennia germinans),* red *(Rhizophora mangle)* and buttonwood *(Conocarpus erectus)* mangroves as subject to special protection.

The General Law of Ecological Balance and Environment Protection, states that any activity or construction that may pose a risk for the ecological balance or may have potential detriment effects on the environment, must have an official consent from SEMARNAT that is issued after that an environmental impact assessment has been carried out.

Law for the National Waters (article 86, 11 fraction and article 155) defines the responsibility of the National Water Commission for the formulation of integral programs for the protection of hydraulic resources, hydrological basins and water bodies including wetlands. The Commission is also responsible for the inventory of water resources and the promotion of water reserves that are important for the existence and preservation of wetlands. It is also the instance that issues permits for the desiccation of wetlands to enable areas for other purposes (e. g. production systems, urban developments).

General Law for National Goods (June 20,2004) the article 119 defines the limit of the Marine-Terrestrial Zones; Mangroves are affected by the II and III fractions of the same law, which dictates:

1. For the Continental shelf and islands that compose the national territory, the marine terrestrial federal zone is determined as:
2. The total surface area of keys and coral reefs situated within national marine waters.
3. In the case of lakes, lagoons, estuaries or natural deposits of marine water with a direct or indirect communication with the sea, the 20 meters fringe of the Federal marine-terrestrial Zone will be establish from the point reached by the largest vessel or the high tide limit, in the terms that determine the Law."

Background for the Transboundary Diagnostic Analysis:

Productivity

Associated with the Gulf of Mexico Large Marine Ecosystem

August 2006

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Introduction

In order to reach the sustainable use of Large Marine Ecosystems (LME), we must first understand the inter-relationship between different physical and biological components controlling the functioning and dynamics that regulate the systems. This ecosystem approach is especially sensitive in marine-coastal environments because the costal zone is the final destination of all drainage basins regardless of whether these are superficial or underground, which means that there is an intense connectivity between inland and coastal-marine ecosystems through the hydrology. Additionally, in these regions the marine waters conditions are strongly related with the atmosphere-ocean relationships, thus, the connectivity concept must be introduced in all LME approach analyses, and is specially important in the LME Gulf of Mexico due to this sea is share among USA, Mexico and Cuba.

Due to the multitude of factors involved for accomplishing the sustainable use and conservation of LME as the Gulf of Mexico (GOM), a multidisciplinary and holistic approach is necessary, including different spatial (regional and local; from river-underground basins, ocean basin, to estuarine and coastal areas) and temporal scales (short and long-term; pulse events, seasonality, inter-annual). These must be integrated to the human population dynamic in order to provide the necessary holistic management and enhance the capacity of the GOM as LME, for example, to resist human impacts, maintain their resilience when faced with natural events such as hurricanes, changes in upwelling time period, and improve their resistance as ecosystems under sea-level rise, harmful algal blooms, eutrophication and aquatic invasive species.

The structure and functioning of the marine-coastal ecosystems of the GOM are controlled through interaction among regional (i.e., Yucatan current) and local forcing functions (i.e., Cabo Catoche upwelling, groundwater discharges), as well as pulsing events ranging from high-frequency low-intensity (i.e., tides), to low-frequency high-intensity (i.e., hurricanes) (Hererra-Silveira et al., 2006).

This short report present a general vision of the variables and process related with the production in the GOM, including several characteristics which produce concern in the population, authorities and researches, as a start point to establish a strategy for their understanding and sustainable management.

General description

The Gulf of Mexico is a 2 million km^2 semi-closed oceanic basin with a volume of water of 20 million km^3. The basin is surrounded by three main areas of continental platform: The Florida, to the West; Texas-Louisiana, to the Northwest and Campeche and Yucatan, to the South. The tides in the Gulf of Mexico are mainly diurnal except for Campeche Bank (mixed-diurnal), and with an average tides range for the South of the Gulf of Mexico of 0.48m.

The Yucatan current is the main source of water and other inputs to the Gulf of Mexico, entering through the "Canal de Yucatan". This current has a south-north direction with a speed average of 1.5 m/s (Fig. 3). Its waters are warm and of high transparency, favouring the development of the fringe reef in the Mexican Caribbean, which is part of the second largest reef barrier in the World - "The Mesoamerican Reef System". This forcing function is present continuously; its contribution to the functioning of the marine-coastal ecosystems of the GOM is related to the transport and dispersion of chemical (salinity, nutrients, dissolved organic matter) and biological (transport of larvae) variables, and also of pollutants (hydrocarbons, heavy metals, pesticides) that can come from river basins from Central-South America (Capurro et al., 2004; Monreal-Gomez et al., 2004).

In the northeast of the Yucatan Peninsula is observed an upwelling area. During spring and summer time, when the Yucatan current is more intense, the upwelled water intrudes into the Yucatan Shelf to create a two-layered water column. Strong stratification between Caribbean surface water and the Yucatan upwelling water layer on the shelf is likely to prevent mixing among them, except during the winter periods of northern winds. Field observations suggest that the upwelling is probably caused by bottom friction or other topographical mechanisms (Merino, 1997). Due to the high aquatic productivity in the upwelling area, it is common to observe in spring and summer abundant marine fauna such as dolphins and sea turtles. This area is probably the most important zone of shark whale aggregations in the Caribbean region; it is possible to observe up to 500 organisms during summer time.

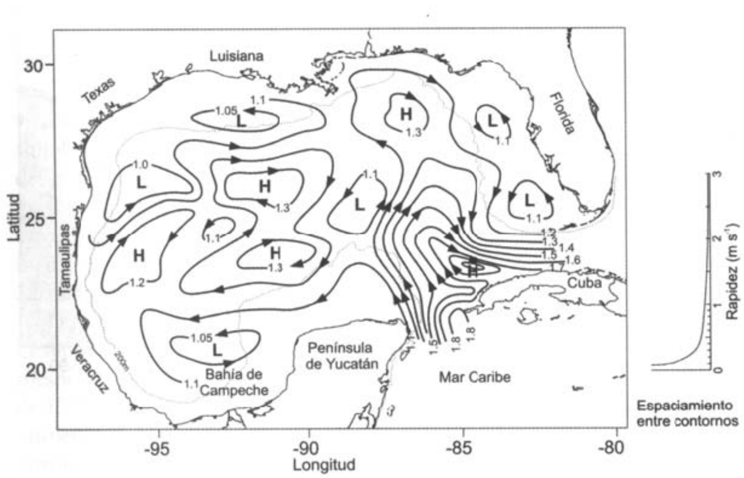


Figure 1. Main currents pattern in the Gulf of Mexico.

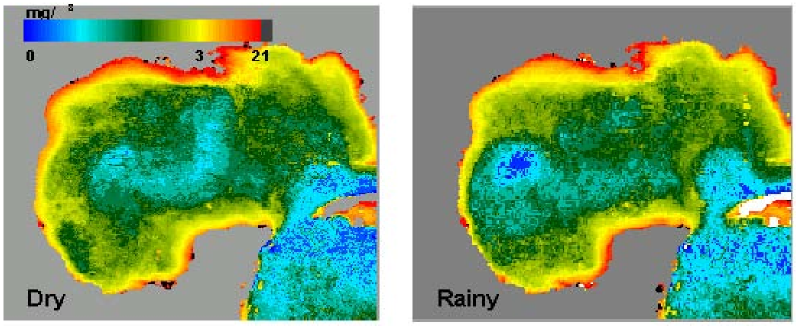
One of the most important features of the open waters in the GOM, is when the water enters the Gulf through the Yucatan Strait, and circulates as the Loop Current (Corriente de Lazo), which exits through the Florida Strait eventually forming the Gulf Stream. Portions of the Loop Current often break away forming eddies or 'gyres' which affect regional current. Other important feature is the extensive freshwater inputs that receive through rivers (Mississippi, Grijalva-Usumacinta) and groundwater (Yucatan and Florida peninsulas).

Productivity

The currents patterns and freshwater inputs described above are important characteristics in the productivity patterns registered in the GOM. Productivity as an important functional characteristic of the LME, is frequently related to the carrying capacity of an ecosystem for supporting fish resources. However, it could be useful indicator of the growing problem of coastal eutrophication. In several LMEs, excessive nutrient loadings of coastal waters have been related to algal blooms implicated in mass mortalities of living resources, emergence of pathogens (e.g., cholera, vibrios, red tides, and paralytic shellfish toxins), and explosive growth of nonindigenous species (Epstein 1993).

The ecosystem variables useful as indicators of changing conditions in the productivity module in other LME are phytoplankton-zooplankton biodiversity and biomass, water-column structure, transparency, chlorophyll-a, dissolved inorganic nutrients and primary production. Plankton inhabiting LMEs have been measured over decadal time scales by deploying continuous plankton recorder systems monthly across ecosystems from commercial vessels of opportunity.

Advanced plankton recorders can be fitted with sensors for temperature, salinity, chlorophyll-a, nitrate/nitrite, petroleum, hydrocarbons, light, bioluminescence, and primary productivity, providing the means for *in situ* monitoring and for calibrating satellite-derived oceanographic data. Properly calibrated satellite data can provide information on such ecosystem aspects as physical and biological state, like the wok of Paat (2005), which shows the spatial and seasonal patterns of Chl-a using MODIS images analysis (Fig.2).



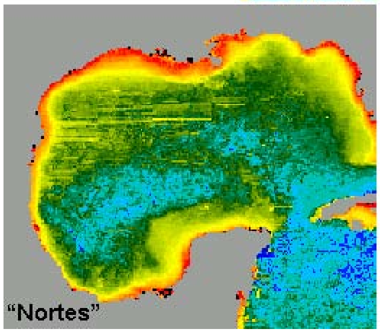


Figure 2. Spatial distribution of Chl-a concentrations from MODIS (terra level 3) analysis images.

For the GOM the values of primary productivity are in general low with an average value of 0.1 $gC/m^2/day$, which is typical for tropical regions (Margalef and Estrada, 1980). In relation to the Chl-a, the average value is of 0.2 mg $Chl\text{-}a/m^3$, (range 0.2-2 mg Chl-a/m3) registering the highest value for the coast of Mexico in the areas of Veracruz-Tabasco with a mean value of 2.4 mg $Chl\text{-}a/m^3$ and Cabo Catoche upwelling with a range of 3-5 mg $Chl\text{-}a/m^3$ (El-Sayed et al., 1972; Merino 1997; Troccoli et al., 2004; Aranda-Cirerol et al., 2006).

According the above, the GOM is considered an oligotrophic sea, however, can be observed areas of low, medium and high production in marine and coastal waters. The areas of low production are related to anticyclonic gyres (central basin of the GOM) and the high production areas with upwelling zones (Cabo Catoche) or freshwater inputs (Mississippi and Grijalva-Usumacinta rivers) (Figure 3), meaning that in the same seasonal period areas exist whose fertility differs notably.

Some of these areas are related with fisheries zones as the Campeche Bank, which is considered as an area of particular importance by its great biological potential. It is one of the regions that more interest presents for fisheries in Mexico and offers big possibilities for the capture of species of high commercial value between crustaceans and fish.

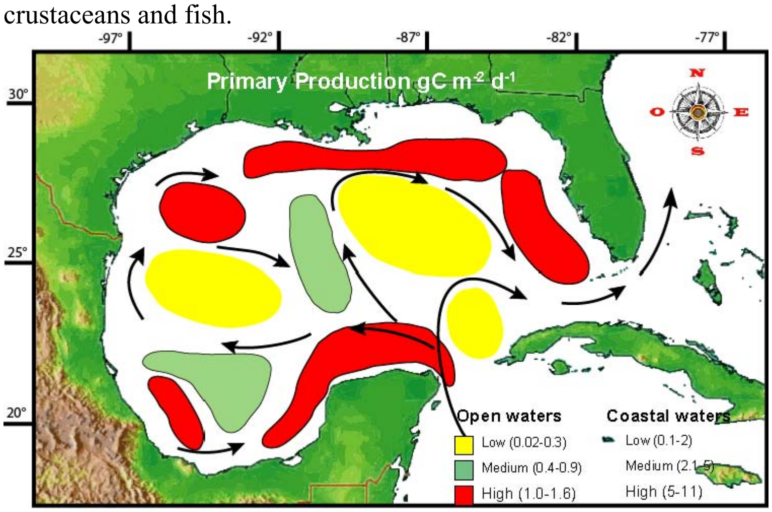


Figure 3. Areas with high, medium and low production in the GOM and their relationship with the main currents pattern and freshwater discharges (after Bogdanov et al., 1968, with changes).

One particular area of GoM in the Mexican side is the Yucatan Peninsula, a karstic province that shows particular features as an almost free infiltration of rainwater to the aquifer, reason why it has an important net of underground water. The final destination of all this underground water is to incorporate to the coastal water through point sources (springs) or diffuse (seeps). Therefore, the main freshwater inputs to the coastal ecosystems in the Yucatan Peninsula are through submerged groundwater discharges (SGD). The volume of water discharge in the coastal zone has been estimated between 8.6 and 12 x 10^6 m^3/km/y (Hanshow and Back 1980; CNA, 2001). The coastal area of the Yucatan Peninsula is an important fishery zone mainly of shrimp, lobster, snapper, grouper and octopus.

Other important feature of the GOM is the western anticyclone located in front of the coast of Tamaulipas and called "Mexican Anticyclone"; this is semipermanent and is directly influenced by the Loop Current.

Another important area is the Cabo Catoche upwelling; this destroys the thermocline providing the surface layer with nutrients. Diatoms proliferate more actively, and at the same time benthic diatoms and abundant detritus can be found in the water column. At the later stage, cold waters rich in nutrients spread into the shelf. When upwelling finishes, the thermocline develops again. In this period, cold water remains only in the near-bottom layer in the shape of a dome. In the Campeche Bank area, the influence of upwelling on the phytoplankton development is quite noticeable only in the neritic zone and almost unnoticeable in the oceanic zone (Vinogradova, 1976).

As has been observed, water circulation is responsible to a greater extent for the level of biological productivity. However, due to spatial shifts in the position of the zones of maximal concentrations of phyto-, zooplankton and higher levels of food webs not always high production areas correspond to the centers of cyclonic gyres. As a result, maximal concentrations of carnivorous tuna fishes can be found in the center of anticyclonic gyres (Bessonov et al., 1971).

Respect to relationship between abiotic factors and phytoplankton Zernova (1982) studied the dependence of phytoplankton in the Gulf of Mexico, observing in offshore areas a positive correlation between phosphate concentration and phytoplankton biomass in the open Gulf and low correlation in the downwelling regions. It was hypothesized that in the Campeche Bank the high production is related to the local turnover of nutrients above the shelf, both regenerated at sea bottom and by mineralization in the water column, which can result in high abundance and biomass of phytoplankton even beyond the upwelling zones. On the other hand, has been suggested that the low concentration of silicates in the Gulf of Mexico results in a smaller-sized phytoplankton in comparison to temperate regions. In the Gulf of Mexico, phytoplankton in the upwelling zones is at the initial stage of its succession and in oligotrophic areas in its final stage (Zernova, 1974).

Respect to phytoplankton composition in the GOM, diatom species was more diverse in the coastal zone and dinoflagellates in offshore regions. The highest number of phytoplankton species was found in the Yucatan Channel and in the southwestern Gulf of Mexico (Troccoli et al., 2004).

Nutrients export to GoM

As can be observed, the nutrient inputs are one of the major variables that control the phytoplankton biodiversity and production in the marine and coastal areas of the GOM. Over the last several decades, nutrient loading levels in riverine ecosystems which discharge to coastal zone of the GOM have contributed to a substantial increase in coastal production at levels that has produced eutrophication symptoms.

However, in order to propose actions to reduce the eutrophication problems is necessary to know the major sources of dissolved inorganic nutrients. The GEF/LME Nutrient Export Modelling Workshop (Paris 23-26 January 2006) used the DINsubmodel of the global NEWS model (Seitzinger et al., 2005) to simulate riverine DIN export to the GOM. NEWS allows calculating a simplified input-output budget on a medium to large river catchment scale, which considers fertilizer, manure application, biological nitrogen fixation, atmospheric DIN deposition, and raw sewage as nitrogen sources, whereas N export with harvested crop, sewage treatment, as well as river, wetland and reservoir N removal are included as nitrogen sinks.

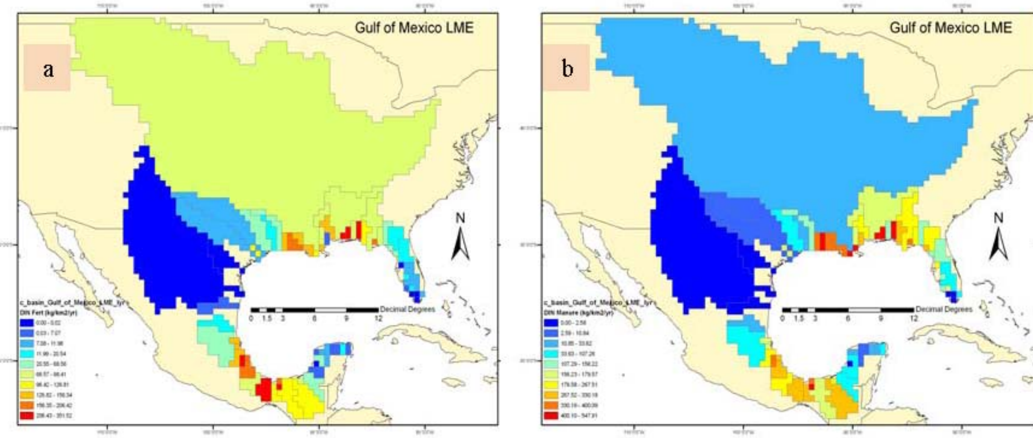


Figure 4. Export of DIN estimated by DIN NEWS from fertilization (a) and natural fixation (b).

A preliminary analysis showed that agriculture is an important DIN source in Tabasco and Veracruz (Fig. 4a), while with respect to the natural fixation of DIN, the values in Yucatan are underestimated (Fig. 4b) due to the less knowledge on the vegetation biomass.

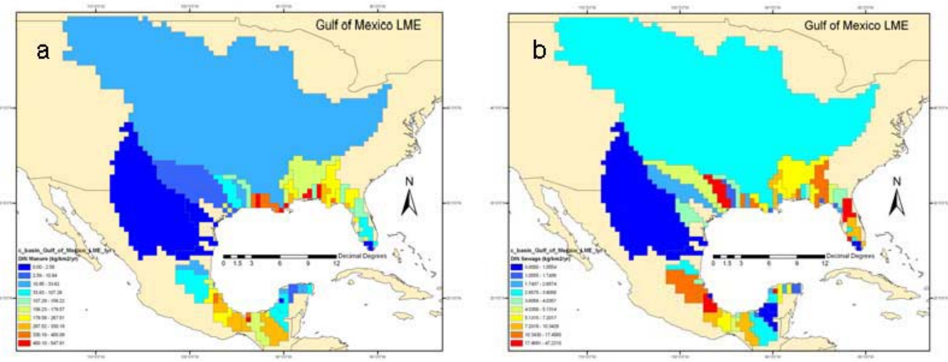


Figure 5. Export of DIN estimated by DIN NEWS from manure (a) and sewage (b).

In relation to the inputs of DIN from manure in basins to discharge in the GOM, the rivers in Veracruz and Tabasco showed an important contribution, however, in Yucatan peninsula the export of DIN is underestimated (Fig. 5a), due to the model did not take in account the DIN export through groundwater discharges. On the other hand, the DIN exportation due to sewage source is important in Veracruz and Yucatan, this could favor a strong pollution problem if actual coastal development projects in Yucatan Peninsula did not consider the sewage treatment.

Problems in the LME-GOM

The GOM is subject of several problems related with natural and anthropogenic events, some of them are, global change, eutrophication, harmful algal blooms and aquatic invasive species among others.

Global Change

One of the most critical problems facing coastal areas is a high rate of relative sea-level rise (RSLR) due to a combination of eustatic sea-level rise and subsidence.

There are serious environmental problems in many coastal areas, including enhanced subsidence due to drainage, lowered freshwater input, which has led to reduced accretion and salinity intrusion, water quality deterioration, and decreased biological production. These problems are the result of habitat destruction and the construction of dams, impoundments, dikes, and canals, among other factors. These activities reduce the influence of pulsing events such as storms and river floods that lead to accretion, higher net biological production, and enhanced deltaic functioning.

Coastal managers must now also consider global warming and a predicted acceleration of the rate of eustatic sea-level rise, which will exacerbate the above problems. The scientific consensus is now that the rise over the next 40 yr will likely be about 30 cm (Warwick and Oerlemans, 1990).

If wetlands do not accrete vertically at a rate equal to the rate of RSLR, they will become stressed due to water logging and ultimately will disappear

Nevertheless, because the oceans may be affected predominantly by changes in temperature and circulation, predicting the outcome of climate change on the oceans may be somewhat less complicated than for coastal and estuarine systems, where the roles of precipitation and anthropogenic stress are so important.

As noted above for inshore waters, increased temperature or freshwater input to the upper layers of the ocean results in increased density stratification, which affects ocean productivity in two opposing ways. Increased stratification suppresses upwelling of nutrients into the upper, lighted region of the ocean, which leads to decreased production of phytoplankton

Open ocean productivity is also affected by natural interannual climate variability, and climate-driven changes in the frequency, magnitude, or timing of any of these phenomena may lead to marked changes in water column mixing and stratification, and ultimately a reorganization of the ecosystem (Pérez et al., 2005). For example, El Niño-related stratification of the Pacific Ocean around Hawaii over the past decade resulted in a change from a system controlled by nitrogen concentrations to one controlled by phosphorous concentrations; this signals a significant reorganization of the food webs in the region, with one suite of microorganisms replacing another suite as the dominant primary producers (Karl, 1999).

The exact mechanism by which these changes occurred is unknown and doubtless differs for many of the species. What appears indisputable, however, is that the driving force behind these widespread ecosystem modifications was climate variability. Anthropogenic climate change can be expected to produce major modifications as well.

Eutrophication

The primary factor driving coastal eutrophication in the Gulf region is the excessive nutrient loading which can be linked directly back to increase and expanded agricultural, urban and industrial activities within the river basins.

However, as nutrient levels become scarce or excessive, the system becomes unbalanced and the effects of stratification and hypoxia start to impact coastal community structure and energy flow. Here, the connectivity between the terrestrial (agriculture, industry and population centers) and marine-coastal ecosystems is clearly seen.

From an ecological perspective the Gulf of Mexico is very unique. Hypoxia has become one of the most significant stressors that is presently influencing and controlling the structure of populations and the flow of energy in the gulf. Seasonal changes in the concentration of dissolved oxygen affect the habitats of many benthic organisms. A major concern for benthic, epibenthic and demersal populations is forced migration from habitats that have become unsuitable (Pavela et al., 1983). Hypoxia alters trophic level interactions, affecting flow of energy through the community.

In the north of the GOM is well documented a “dead zone” where seasonally the bottom dissolve oxygen is lower than 2 mg/l, and is located in front of the Mississippi delta. However, in the Mexican side this phenomena is unknown due to there is not a monitoring program in the marine plume of the main rivers as Grijalva-Usumacinta, Coatzacualcos, Papaloapan among others, where has been reported high export of nutrients, pollutants, dissolved organic matter and suspended particular matter. The fate of all this materials is unknown, but according with the currents pattern these could reach USA coastal waters, then, a joint monitoring program in marine and coastal areas should favored the understanding of the processes related with the transport of pollutants around the GOM, the buoys installation in front of the main ports and plume rivers will help in these purpose.

Harmful Algal Blooms (HABs)

The HABs in the Gulf of Mexico are one of the majors concerns due to the impacts to the economy of many coastal zones. There is a strong difference between USA and Mexico information on HABs in the GOM coasts (Fig. 6). This is mainly due to there is no a coordinate program among Mexican institutions. In Mexico has been registered more than 20 species of HABs, and the available reports are from Veracruz and Yucatan coasts.

Among the registered species, one of them could be a transboundary concern, *Karenia brevis*, which should be a subject to develop a joint research and monitoring program, due to the marine waters of Veracruz and Yucatan Peninsula should play an important role as seed source of *K. brevis* to the coastal area of USA. Other species as *Scrippsiella trochoidea*, *Dinophysis caudata, Heterocapsa circularisquama, Gambierdiscus toxicus, Prorocentrum mexicanum, Pyrodinium bahamense var. compressum, Prorocentrum lima, Prorocentrum minimum*, has been observed during the monitoring HABs program of Yucatan (Alvarez-Góngora et al., 2005).

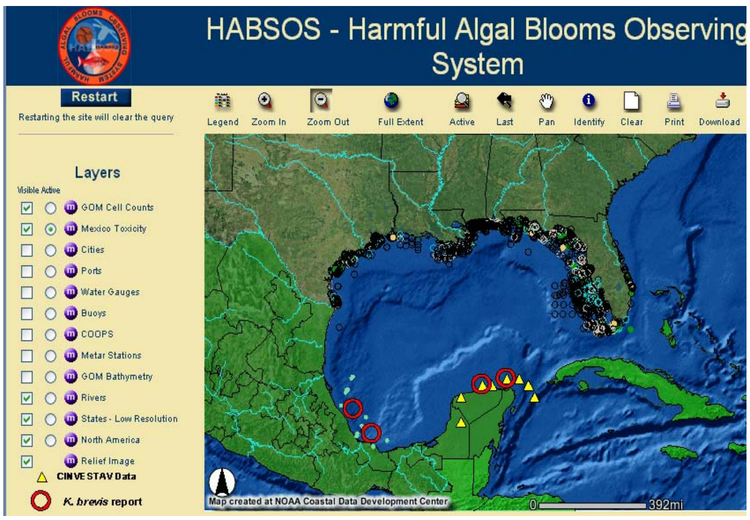


Figure 6. Locations of the monitoring program of HABs in the GOM

Aquatic invasive species

Aquatic invasive species (AIS) pose a growing threat to ecological, economic and social values around the world. Several thousand marine species are thought to be moved globally in ships ballast water every day (Smith et al., 1996), with many transported via hull fouling on vessels of all sizes and types. Once established, AIS are a particularly insidious form of ecosystem pollution because they can be extremely difficult if not impossible to eradicate, they can cause severe consequences to cooling water systems, aquaculture operations, navigation, fisheries, public health, native biodiversity or other aquatic amenity or environmental value, and their impacts tend to increase through time. Managers hoping to prevent, minimize or remove this threat are placing increased emphasis on risk assessment and risk management (Lodge and Shrader-Frechette, 2003), as has the International Global Ballast Water Management Programme, known as “Globallast” (Raaymakers and Hilliard, 2003).

In the GOM the AIS problem is latent due to the oil-ships transportations. A survey on the impacts of ships ballast water discharging in the Cayo Arcas reefs, showed that 90% of the ships comes from USA coasts (Fig. 7a). The water quality of the ballast water is poor according with the Chl-a concentrations (Fig. 7b), and the phytoplankton species richness (Fig. 7c) and composition. Ballast water management through re-change in the open sea could be a strategy to reduce the impact on the biodiversity and production in areas with significant ship-transportation.

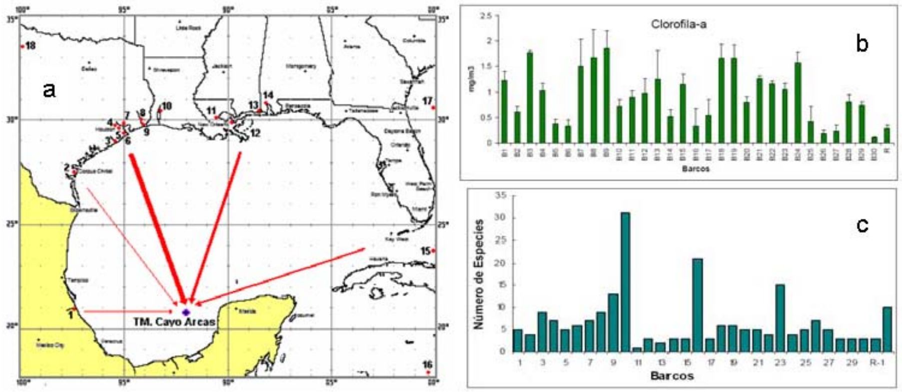


Figure 7. Locations from Ballast water is coming and discharge to Cayo Arcas (a). Chlorophyll-a and phytoplankton species number in the ballast water to discharge in Cayo Arcas (b).

General considerations

During the past 30 years, human intervention has resulted in unprecedented changes in the Gulf ecosystem (Kumpf et al., 1999). Why not consider the large amount of data obtained in the earlier period to understand the present state of the ecosystem and probably to figure out the trends in the area around which about 50 million people live?

The available information permit a base knowledge on the physical and biological processes related with the biological production, eutrophication, nutrient export and HAB´s in the USA side of the GOM, however, there is gap information on all these variables and processes related with the production in the Mexican side of the GOM.

As the biological production in the GOM appears a complex process with both spatial and temporal variability, is necessary understand how the abiotic and biological variables are related on a basin wide scale, mainly due to the strong influence that the Yucatan current show in the general behavior of the GOM.

With the objective to advance in the sustainable management of this LME, should be a priority the understanding of the spatial and temporal variability of the processes and characteristics related with biological production in marine and coastal waters of the GOM, been necessary an integrated ecosystem approach.

According to the above, the next step is develop a coordinate work among disciplines (physical, chemical, biological) and nations in order to advance in the knowledge of the processes which controls the functioning of the GOM and provides management tools to reach the sustainable development of this LME.

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Background for the Transboundary Diagnostic Analysis:

Governance

Associated with the Gulf of Mexico Large Marine Ecosystem

August 2006

Introduction

Large Marine Ecosystems produce nearly 90% of the world total fisheries yield, and most of them are overexploited, with many important fisheries dramatically collapsing along with biodiversity changes associated with such overexploitation (Jackson et al 2001, Garibaldi and Limongeli 2003, Pauly et al 2002). In addition, most of these species occur in highly polluted areas due to land based sources of pollution and altered coastal habitats (Miles 1999, GESAMP 2001, USCOP 2006). In this scenario there are economic estimates of around $10.6 trillion USD per year of natural resources and services that will be necessary to prevent risks (Duda and Sherman 2002,Sherman et al. 2005).

The Gulf of Mexico coast is bordered by 27 large interconnected systems such as bays, deltas, estuaries and coastal lagoons, coastal wetlands, sea grass beds and coral reefs, that have been strongly impacted due to productive and economic activities that in many cases are incompatible among them (Caso et al. 2004).

Thus, the complexity of the Gulf of Mexico must be considered while attempting to manage all natural resources of this ecosystem, and this must be conducted strictly under a clear scheme of governance, with due consideration to political cycles and the current framework of decision making as well as the need for information regarding all natural resources occurring in this Large Marine Ecosystem shared by three countries. This governance framework should consider factors like the context, purpose, legal jurisdiction, capacity and complexity, which will be able to fit the variety of existing sectoral policies and also consider the linkages needed to incorporate them into the ecosystem based management framework (Fanning et al. 2007).

This governance framework for the Gulf of Mexico would allow for an appropriate path to intervene in the identification of critical areas, whose main goal would be the establishment and improvement of cycles and linkages in a specific context with a clear purpose including aspects such as capacity and complexity.

Since governance is considered as the group of conditions of a political system that allows intervention between government and civil society, then governance for the Gulf of Mexico also refers to the capacity of the society to confront challenges and opportunities. For instance, governance as a concept is known to be a strategy to build capacity (Massolo, 2004).

Based on that concept, democratic governance, involves the legitimacy of political and administrative institutions at all levels, including complex mechanisms, processes and institutions used by citizens and groups in order to articulate their interests, to mediate their differences and to execute their rights as well as fiscal obligations; this type of governance is participatory and transparent in the process of decision making and has mechanisms to request co-responsibility from civil society, is efficient while using resources, has equity and promotes civil rights and the entire use of the Law.

Governance involves a structural dimension (institutional arrangements) and a dynamic dimension (actors that can affect the structural dimension). To ensure this governance it is necessary to convince society of the need for an equal application of the Law regardless of social standing.

Looking at the Gulf of Mexico as a region, is acknowledging that the common good –economic growth, enhanced public services, and improved environmental conditions and communities- moves forward across jurisdictions, benefiting from economies of scale and reducing negative externalities (Gerber and Gibson, 2005 and Young, 1996). With this view, regional leaders should find ways to collaborate vertically across levels of government and horizontally across various sectors, for shared responsibility networking within a recognized interdependence of regional economies, environment, and societies (Basalo, 2003).

Some benefits obtained from governance and this regional coordination are: sharing and learning from each other, encouraging the development of good policies, and improving the quality of the environment of the Gulf of Mexico Large Marine Ecosystem.

The first major challenge that ocean governance faces around the world is institutional capacity, and in the case of the Gulf of Mexico's governance the institutional framework should consider three main factors:

Integrated coastal-marine management plans
Sub-regional approaches
National ocean and coastal policies

In addition, governance requires that institutions make informed decisions. In Mexico communication between the scientific communities and the decision-makers is still building up. Important elements lacking at local and state levels, are leadership and continuity, trained staff, inter agency coordination, formal mechanisms for conflict settlement, fully participative processes, and the ability to enforce regulations. Important requirements are new and alternative mechanisms for sustainable financing of coastal management plans and new initiatives.

The concept of regional ocean governance is gaining attraction in ocean and coastal management as a new way of proactively governing cross-jurisdictional ocean uses, resources, and problems. According to Hershman and Russell (2006), this approach becomes important in the light of the LME project for the Gulf of Mexico, since it offers a way to bring together a wide range of issues and serves as a vehicle for thinking about and utilizing ecosystem-based management.

The most important focus of regional ocean governance is the emphasis on ecosystem-based management, which considers ocean issues connected to one another by the ecosystem inhabitants and processes. Hershman and Russel (op cit.) stated that although some examples around the world of regional management of oceans and coasts have in many cases improved the *status quo*, not all of them reflect the notion of regional ocean governance as envisioned by the environmental ocean policies of each one of the countries surrounding those seas.

In the case of the Gulf of Mexico, the countries surrounding it have made several attempts to use a regional approach for tackling a diverse, but not necessarily comprehensive, set of issues.

The numerous existing organizations in Mexico related to ocean and coastal issues can be arranged into four categories, as follows:

Government: federal, state, and municipal agencies.
Academic: state universities and associated research centers, and federal research centers.
Non-government: social organizations such as civil associations, anonymous societies, technical and public councils and commissions, among others
Private: entities that invest, use, extract, transform, or are involved in all sectoral economic activities in the coasts and oceans.

In addition, there are international organizations that need to be considered in order to build the ocean governance of the Gulf of Mexico:

(a) United Nations organizations established by the Law of the Sea Convention
(b) United Nations Convention on Environment Development and related organizations
(c) World Summit for Sustainable Development organizations

However, a greater coordination of integrated scientific studies of the coastal and marine environments and resources, considering social, economic, political, cultural, etc aspects, as well as biological and oceanographic research is necessary.

Regarding the ecosystem management for the Gulf of Mexico, existing legislation includes:

(a) Cartagena Convention, adopted in 1983, and its protocols (1990 and 1999)
(b) Security and Prosperity Partnership of North America, to increase security, prosperity, and improve the quality of life for the citizens of each sovereign nation
(c) Global Programme of Action for the Protection of the Marine Environment from Land-based Activities (GPA), adopted in 1995
(d) North American Commission for Environmental Cooperation , to address regional environmental concerns, help prevent potential trade and environmental conflicts, and to promote the effective enforcement of environmental law

In the mid-1990s Mexico embraced unique elements of governance, conservation environmental threats, partnerships, and institutional capacity. From 1995 to 2000 and under the leadership of SEMARNAP, there was an increase in the revitalization of key conservation and environmental management tools such as natural protected areas and marine parks, environmental plans for coastal areas, surveillance and environmental law enforcement, and during the 2000-2006 period, the Mexican government has prepared the National Environmental Policy for the Sustainable Development of Oceans and Coasts: Strategies for its Conservation and Sustainable Use" (PANDSOC).

In 2006 Mexico's federal government marked its determination to move towards the alignment of economic growth and sectoral development accompanied by a continuous improvement in the environmental performance, aided by streamline actions among sectors that use ocean and coastal natural resources (Alvarez, 2006). This environmental view for Ocean and Coast Policy calls on a governance scheme that assumes the legitimacy of the political, economic, and administrative institutions at all levels, through democratic public participative processes that endorse a sustainable development. The aim of this Policy is to seek an equilibrium between the use and conservation of the coastal and ocean zones of Mexico.

The current legal framework for the Gulf of Mexico includes domestic legislation (laws, regulations, norms and codes), international treaties and agreements, and bilateral cooperation agreements. This legal element within governance needs a holistic approach. Considering the sea as a common heritage for humankind acknowledges the ocean's economic dimension, environmental dimension and peace and security dimensions.

According to Hershman and Russel (op cit.) the regional ocean governance for the Gulf of Mexico requires:

- Plans to restore and protect ecosystems
- Manage LME activities based on science
- Regionally identify issues, goals, priorities, issue specific responses;
- Focus on coordination, regional information services;
- Use marine zoning, MPAs, address water quality, habitat and coastal development mechanisms/management measures determined by the issues;
- Apply federal consistency, allow citizen suits, default plans by any authority (applying a subsidiarity approach);
- Broad representation at all levels of government, including non-governmental interests represented through advisory groups.

Major challenges for ocean governance in Mexico:

- To reconcile the immediate needs of Mexico within a long-term LME planning
- Establish an Integrated Coastal Zone Management Plan as the best option for ocean governance for the Gulf of Mexico.
- To reconcile diverse sector interests with the interests of various social actors at the coastal and marine zones
- To pass from participative planning to participative management
- Establish decision making for ocean governance
- At the regional level, opportunities for developing governance require tailoring policies addressing the major challenges for the Gulf of Mexico
- At the national level, opportunities for ocean governance rely on coastal ordinances, municipal and state development plans

SEMARNAT actions related to the marine and coastal area in Mexico:

- National Strategy for the Ecological Planning of the Territory in Oceans and Coasts (Feb - 2007)
- National environmental policy for sustainable development of oceans and coasts in Mexico
- Ecological sea use planning of the Gulf of California (official decree 2006)
- Ecological regional sea use planning for the Gulf of Mexico and Caribbean sea (started 2006)
- Regional Plan of Action for the Peninsula of Yucatan (2006)

- Creation of the Inter-secretarial Commission for the Integrated Management of Oceans and Coasts (starting in 2007)
- Regions with ecological land use as of today (28,500,839 ha), among them 52% include coastal areas (Muñoz et al.2006).

Among the existing and available environmental tools to integrate all type of economic activities Mexican law provides an appropriate framework related to Sea and Land Use Planning, which is applicable in both terrestrial coastal and marine areas.

Existing environmental policy instruments

- Environmental Planning
- Land and Sea Use Planning
- Natural Protected Areas
- Economic Instruments
- Environmental Regulations on Infrastructure for human uses
- Environmental Impact Assessment
- Mexican Official Standards on environmental issues
- Environmental Audits
- Research and Education

Such tools represent a way to integrate policy for oceans and coasts where each federal agency usually works alone, considering only its duties and faculties given by the Organic Law. Thus the Sea Use Planning framework becomes the ideal mechanism to build upon concurrent sector plans and comes under the view of the National Constitution and all related environmental laws

General aspects related to Ecosystem Based Management aimed to enhance Governance in the Gulf of Mexico

Mexico has adopted the concept of ecosystem-based management in managing watersheds, river-basins, estuaries and coastal seas through the application of integrated and adaptive management approaches to work with several important issues, such as pollution of coastal and marine habitats, loss of biodiversity and habitats, depletion of exploited natural marine resources, coastal land erosion and land reclamation and many other issues related to social, economic, political, cultural and ecological features in the country (Alvarez, 2006).

To facilitate effective cooperation for the conservation and enhancement of Mexico's oceans and coastal ecosystems, the federal government is determined to participate actively along with civil society to achieve sustainable development and increase government accountability regarding the enforcement of environmental laws. Within such a context Mexico is moving along with several key policy principles:

- Sustainability,
- Ecosystem Based Management,
- Adaptive Management,
- Precautionary Approach,
- Multiple Use,
- Integrated Approach,
- Transparency, Accountability and
- Governance

Role of adaptive management and public participation to strengthen governance in the Gulf of Mexico

All of these aim to enhance the participatory process among governments at all levels, society, private entrepreneurs and NGOs. Ecosystem based management and integrated management approaches are both considered to be the key components ideal to achieve environmental sustainability and governance.

Some of these actions were developed in collaboration with the Consultative Councils for Sustainable Development (CCDS), created in 1995 in response to Agenda XXI that was adopted in 1992 and have had a positive influence in the decisions about public policies in order to guarantee the conservation and sustainable utilization of natural resources. They are made up of representative groups of different society sectors from each one of the 32 Mexican states, that meet periodically to analyze environmental and natural resources problems in order to advance solutions for proposals and recommendations to the Ministry of Environment and Natural Resources.

These representatives groups are part of the most important organization of the country and participate intensely in the analysis, elaboration, implementation and evaluation of environmental policies. The regions involving the Gulf of Mexico are the NER (North-East Region) and SSER (South-South East Region), together with the National Council.

In Mexico, social demand has grown considerably and is today more active and complex in many ways. Consequently, the modernization of environmental public management implies a more democratic, plural and co-responsible relation between government and society.

Mexican views for major constraints and the way forward to ensure Governance in the Gulf of Mexico

- Implement the National Strategy for Ecological Use Planning of the Territory in Oceans and Coasts presented by Mexican President Felipe Calderón on February 21st, 2007
- Move towards sectoral integration by creating the Inter-ministerial Commission for Oceans and Coasts instructed by Mexican President Felipe Calderón
    - Define common priorities among federal agencies and sectors regarding? oceans and coastal sustainability
    - Strengthen the environmental crosscutting "Agenda" among involved sectors and stakeholders at large
    - Adjust the current legal framework
    - Establish the National Ocean Policy based on the Environmental Policy for the Sustainable Development of Oceans and Coasts

The National Strategy for Ecological Use Planning of the Territory in Oceans and Coasts of Mexico as the main tool to promote Governance in the Gulf of Mexico

This National Strategy sets out the Mexican government goals and grand vision based on a robust planning model and solid bases to strengthen its policies towards an efficient management of natural resources in coastal and marine areas.

This instrument provides the overall strategic framework for the conservation and sustainable use of oceans and coasts and includes the guidelines to articulate public and sectoral policies, representing a model based on ecosystem management and ecosystem approach, which is holistic, adaptive, multi-sectoral and enhances a wider public participation

The Gulf of Mexico exhibits a fast environmental degradation and faces possible collapse in several areas. The fragile productive chains are compromised in the long term leaving without opportunity to use its natural resources for future generations. Fishing resources, forests, coastal resources and other productive sectors such as the hydrocarbons industry, tourism and agriculture have affected the ecosystem and its productivity at the same time.

Despite the fact that Mexico is part of several international agreements to preserve the marine and coastal environments, most identified problems in the last decades remain to be solved or there is a lack of integrated policies to solve them, and in general existing actions are isolated and sectoral.

Implementation of the Johannesburg Plan for Sustainable Development (WSSD), which calls for actions to "sustain productivity and biodiversity of important vulnerable coastal areas, including those under national jurisdiction as well as out of it", represents an option to focus specific actions towards integrated management of marine and coastal natural resources as well of those in watersheds of the Gulf of Mexico, and immediate actions are recommended as follows:

- Follow up of PEMEX activities related to evaluate oil reserves in deep waters, control of activities in oil platforms and follow up to new wells drilling program in the Yucatan Peninsula
- Establish conservation programs for threatened or endangered species
- Develop management plans for industrial and artisanal fisheries
- Follow up of goals and actions stated in the National Strategy of Ecological Use Planning of the Territory in Oceans and Coasts presented by Mexico's President:
  - ⇒ Marine and regional ecological use planning process for the Gulf of Mexico and Caribbean Sea
  - ⇒ Creation of the Interministerial Commission for the Integrated Management of Oceans and Coasts
  - ⇒ Update legal framework for coastal and marine areas
  - ⇒ Develop the National Ocean Policy
  - ⇒ Elaborate a biodiversity conservation program
  - ⇒ Elaborate a mangrove strategy for its conservation
- Review and update Official Standards related to ecosystem health and its sustainability

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Background for the Transboundary Diagnostic Analysis:

Fish and Fisheries

Associated with the Gulf of Mexico Large Marine Ecosystem

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Executive Summary

U.S. Gulf of Mexico marine fisheries are monitored, assessed, and managed by a complexity of organizations. NOAA Fisheries—principally through the staff and facilities of the Southeast Fisheries Science Center—observes and analyzes information on stocks primarily within federal waters extending beyond state jurisdictions to a 200-mile limit. Within these waters, the Gulf of Mexico Fishery Management Council has primary authority for regulating commercial and recreational fishing. Inside the federal jurisdiction, individual states and the Gulf States Marine Fisheries Commission have the primary responsibility for observing and regulating fishing. Highly migratory stocks occurring beyond the federal jurisdiction are observed and regulated by the International Commission for the Conservation of Atlantic Tunas (ICCAT), of which NOAA Fisheries participates.

A cursory review of fishable stocks in U.S. waters reveals that many are over fished or being over fished. Many U.S. stocks have insufficient information to support definitive mathematical stock assessments to determine if they are under used, fully used, or over fished. And many stocks are transboundary and therefore fished internationally, particularly by Mexico, Cuba, and the United States.

The primary man-induced stress placed upon stocks within U.S. waters is mortality inflicted by various sectors of the commercial and recreational fisheries. Fishing mortality generally exceeds natural mortality or mortality associated with pollution, loss of habitat, climate change, etc.

At present, each nation in the Gulf of Mexico collects, archives, and analyzes information relative to its particular jurisdiction. But the transboundary nature of many important stocks points up the need to pool information over the entire range of each stock and across international boundaries. Analysis and modeling of information for the large marine ecosystem should produce enhanced scientific advice for rational fisheries management.

The usual procedure for analyzing a stock is to draw together information on the biology of the species—growth rates, sex ratios, spawning habits, migration, etc.—with fishery statistics that quantify in time and space the harvest of the species by size or age and the fishing effort expended. Using this information, fishery analysts can apply mathematical modeling to simulate the effects of varying factors on the fishable stock. The analytical process attempts to determine the 1) status of the stock with regards to human endeavors, 2) the likely response of the stock to proposed regulations that affect fishing, and 3) the effects of atypical mortality events, such as hurricanes, oil spills, or major disruptions in recruitment.

Status of Important Fishery Resources

Living marine resources in the Gulf of Mexico are subjected to a variety of environmental and man-induced stresses. One of the primary man-induced stresses is continual commercial and recreational exploitation. In the United States, as well as in other countries, fishery stocks are continually monitored to assess exploitation rates, and management organizations then use that information to regulate commercial and recreational fishing entities. Overexploitation not only affects population stability, it affects the economic and social contributions of such stocks to society and the trophic contributions of the population in the ecosystem.

Discussed below is the status of some of the major stocks and species groups within the U.S. federal jurisdiction of the Gulf of Mexico (also see Appendix A). Included in the following discussions are some additional concerns relating to those stocks. It should be noticed that a number of stocks are overutilized and the status of many are unknown.

Shrimp

<u>Status:</u>

Brown, white, and pink shrimp account for over 95% of the total Gulf of Mexico shrimp catch. In 2000 alone, these three important species produced 110,742 t valued at over $346,304,000 in ex-vessel revenue. They are found in all U.S. Gulf waters inside 120 m depths. Most of the offshore brown shrimp catch is taken at 40–80 m depths; white shrimp are caught in 20 m or less; and pink shrimp in 40–60 m. Brown shrimp are most abundant off the Texas-Louisiana coast, and the greatest concentration of pink shrimp is off southwestern Florida.

Gulf brown and white shrimp catches increased significantly from the late 1950's to around 1990, with the with most of the 1990s showing catch levels below these maximum values. However, catch levels in 2000 were extremely good for both species, with near record levels reported. Catches over the past three years were below these record catch levels, but still well above average for both species. Pink shrimp catches were stable until about 1985; then they declined and were at an all time low in 1990. During the mid-1990s catches increased above average levels. However, catches have again shown a moderate declining trend in recent years (Hart and Nance, 2004). The numbers of young shrimp for each species entering the fisheries have generally reflected the level of catch. All commercial shrimps are harvested at maximum levels. The fishery is believed to have more boats and gear than needed (i.e. reducing fishing effort would not significantly reduce the shrimp catch) (Nance 2004a). Reducing the bycatch of the shrimp industry, however, would help protect finfish resources.

Recruitment over fishing has not been evident in the Gulf of Mexico any shrimp stocks (Klima et al., 1990; Nance, 1993, 2004b). The number of young brown shrimp produced per parent increased significantly until about 1991 and has remained near or slightly below that level during most years. White and pink shrimp have not shown any general trend, although pink shrimp stocks rebounded from the low values experienced in the early 1990's, but have started to decline again in recent years. The brown shrimp increase appears related to marsh alterations. Coastal sinking and a sea-level rise in the northwestern Gulf inundate intertidal marshes longer, allowing the shrimp to feed for longer periods within the marsh area. In the Gulf, both factors have also expanded estuarine areas, created more marsh edges, and provided more protection from predators. As a result, the nursery function of those marshes has been greatly magnified, and brown shrimp production has expanded. However, continued subsidence will lead to marsh deterioration and an ultimate loss of supporting wetlands, and current high fishery yields may not be indefinitely sustainable.

	Recent Average Yield[1]	Current Potential Yield	Long-term Potential Yield[2]	Fishery Utilization	***Stock Level Relative to Long-term Potential Yield***
Brown shrimp, Gulf of Mexico	60,232	Unknown	57,744	Full	Near
White shrimp, Gulf of Mexico	39,096	Unknown	36,195	Full	Near
Pink shrimp, Gulf of Mexico	7,079	Unknown	8,486	Full	Near
Royal Red shrimp	382	Unknown	Unknown	Unknown	Unknown
Seabob shrimp	3,073	Unknown	Unknown	Unknown	Unknown
Rock shrimp	2,544	Unknown	Unknown	Unknown	Unknown

[1]2001-2003 average in metric tons; [2]Long-term potential of brown, white, and pink shrimp based upon last observed 10-year average annual yield (1994-2003).

Concerns:

Overcapitalization:
Until recently, shrimp fisheries were overcapitalized, with more fishing effort being expended than necessary to harvest the resource. This trend in fishing effort may have been modified with the lower than average ex-vessel prices for shrimp over the past few years.

Over-harvesting of Small Shrimp:
Over-harvesting of small shrimp in inshore waters can result in a reduced potential yield and overall value of the catch. Management regulations and monitoring systems that regulate harvesting shrimp in inshore waters for given periods of the year can lead to shrimp growth and improved overall yield for fishermen.

Bycatch and Multispecies Interactions:
Shrimp fisheries use small-mesh trawl nets and can catch non-target species such as red snapper, croakers, seatrouts, and sea turtles. Juvenile finfish are often harvested, contributing to overall mortality that for some non-target species may slow or prevent the stock recovery. Bycatch Reduction Device (BRD) technology is being developed to reduce the overall take of non-target species in shrimp fishing operations.

Sea Turtle Mortality:
All five species of sea turtles in the Gulf of Mexico are all listed as endangered or threatened under the Endangered Species Act. Consequently, shrimp vessels have been required to Use Turtle Excluder Device (TED) technology in their nets since 1988 to avoid capturing and drowning sea turtles.

Shrimp Habitat:
Continued loss and degradation of estuarine and marsh habitat necessary for young shrimp survival and development can potentially harm the quantity and quality of shrimp harvested in the Gulf of Mexico. Additional studies are needed to further assess the impacts of human-induced changes on the availability, environmental conditions, predator abundance, and pollution in inshore and nearshore areas necessary for shrimp production.

Spiny Lobster

Status:

Annual Florida spiny lobster landings were fairly stable during the 1980's, running about 2,700 metric tons (t), but yielding recent high landings in 1996 of 3,568 t with ex-vessel revenue of about $30,000,000. The fishery is considered overcapitalized with approximately 900,000 lobster traps fished during 1992. In 1993, a trap reduction program was established, not to exceed 10% per year, which would maintain or maximize sustainable spiny lobster harvest from the fishery. Excessive effort in the fishery has been estimated to occur when the number of traps fished exceeds 300,000 per year. Spiny lobster fishermen use live undersized lobsters as attractants in their traps, but due to a high mortality rate for these "live bait" animals, about 30–50% of the potential yield is lost. The recreational fishery in Florida had over 120,000 participants purchasing recreational lobster stamps during the 1991 season. Recreational spiny lobster catches were estimated to comprise 41% of total landings during the first month and 22% of the total 1991–92 season landings.

	Recent Average Yield[1]	Current Potential Yield	Long-term Potential Yield	Fishery Utilization	***Stock Level Relative to Long-term Potential Yield***
Spiny lobster, SE United States (Atlantic and Gulf)	2,872	2,400	3,565	Over	Below

[1]2001-2003 average in metric tons. Yields based upon commercial catches; recreational catch is unknown but may be significant.

Concerns:

Spiny Lobster Recruitment
Spiny lobster larvae may drift at sea for 9 months, and thus identification of their source or parent stock is almost impossible. It is possible that planktonic early-life forms of spiny lobster are brought into the Gulf of Mexico through the Loop Current transport mechanism. There is a practical management need, therefore, to know more about the origin and subsequent movement of individuals into the fishery. Spiny lobster stocks in Florida, as an example, could be partially of Caribbean origin. If that is the case, spiny lobster in Florida could be comprised from a number of different spawning stocks. The actual sources of all Florida lobster stocks (both U.S. and foreign) need to be identified and international management established to prevent overharvesting.

Stone Crab

Status:

Annual catches of stone crab (claw weight) averaged 1,456 t on the Gulf of Mexico and Atlantic coasts during the 1990's, with a record 1,604 t landed during 1998 . Recent annual ex-vessel revenue averaged $24,800,000. The number of stone crab traps fished seasonally increased from 295,000 in 1979–80 to 567,000 in 1985–86 to a record 985,000 during 1994–95. While total landings have increased modestly in recent years, it is clear that these landings are the result of increased fishing effort (number of traps fished), especially during the early months of the stone crab season.

	Recent Average Yield[1]	Current Potential Yield	Long-term Potential Yield	Fishery Utilization	***Stock Level Relative to Long-term Potential Yield***
Stone crab	1,453	1,121	976	Full	Near

[1]2001-2003 average. Yields are in metric tons of claws (note: declawed crabs regenerate new claws).

Concerns:

Stone Crab Habitat
Florida spiny lobsters depend on reef habitat and shallow-water algal flats for feeding and reproduction. These habitat requirements may conflict with expanding coastal developments. The productivity of stone crabs in Florida Bay is related to water quality and flow through the Everglades. Specific water requirements need to be identified and maintained through comprehensive Everglades water management. A unified program to integrate and study the effects of environmental alterations, fishing technology, regulations, and economic factors on shrimp, lobster, and crab production and restoration, is needed, particularly in the reef habitats of South Florida. Steps need to be taken to mitigate or restore lost estuarine habitats.

Gulf Menhaden

Status:

Gulf menhaden are found from Mexico's Yucatán Peninsula to Tampa Bay, Fla. They form large surface schools that appear in nearshore Gulf waters from April to November. Although no extensive coastwide migrations are known, some evidence suggests that older fish move toward the Mississippi River delta. Gulf menhaden may live to age 5, but most of those landed are ages 1 and 2. In 2003, active gulf menhaden reduction plants were located in Moss Point, Miss., and in Empire, Intracoastal City, and Cameron, La.

Historically, landings rose after World War II to a peak of 982,800 t in 1984. Landings were generally high during the mid 1980s (greater than 800,000 t for 1982–87), but they declined steeply from 894,200 t to 421,400 t between 1987 and 1992. During this period (1987–92), the number of processing plants declined from 8 to 6 and vessels fell from 75 to 51. Landings in 1994 of 761,600 t were the greatest during the 1990s. During 2001-2003, only four processing plants operated on the Gulf with about 40 vessels. Landings during 2001-2003 averaged about 537,600 t annually. The commercial ex-vessel revenue of gulf menhaden for 2000-2002 averaged $77,100,000 per year.

Because gulf menhaden has a short life cycle and a high natural mortality, growth over fishing has not been a management concern (Vaughan et al., 2000). Management is coordinated through the Gulf States Marine Fisheries Commission, and consists of an approximate 28-week fishing season (mid April through 1 November) and closure of inside waters across the northern Gulf of Mexico. The Gulf Menhaden Fishery Management Plan has recently been revised and adopted (Gulf Menhaden Advisory Committee, 2002). An updated stock assessment for gulf menhaden (data through 2002) has recently been completed. Suggested benchmarks for management of the fishery are similar to those for Atlantic menhaden (F and population fecundity).

	Recent Average Yield[1]	Current Potential Yield	Long-term Potential Yield	Fishery Utilization	***Stock Level Relative to Long-term Potential Yield***[2]
Gulf Menhaden	564,000	564,000	772,000	Near	Above

[1]Recent three-year average is used as estimates of recent average yield and current potential yield; [2]Stock level criteria based on terminal population fecundity relative to target fecundity.

Concerns:

Landings:
Gulf menhaden landings have declined greatly since the mid 1980's; however, estimates of static spawning potential ratio remain high (about 60%).

Transboundary Stocks and Fishery Management Jurisdictions:
Gulf menhaden migrate long distances along the gulf coast, and they cross state and international boundaries. Inside U.S. waters, interstate coordination for menhaden management is conducted through the Gulf States Marine Fisheries Commission. However, the international transboundary aspects of gulf menhaden need additional study and evaluation.

Multispecies Interactions
The stock status of gulf menhaden and its associated importance as prey for other species has been an issue of concern.

Reef Fish

Status:

Reef fish include more than 100 species that prefer coral reefs, artificial structures, or other hard bottom areas, and tilefishes that prefer muddy bottom areas. While landings and value for individual species are not large, reef fishes overall produce significant landings and values. Recent average commercial and recreational catches for the U.S. Atlantic and Gulf have been about 22,615 t with dockside ex-vessel commercial revenue of $59,386,000. Sport fishers make more than 20,000,000 angler-trips annually.

Reef fishes are vulnerable to over fishing owing to their long lives, slow growth, ease of capture, large body size, delayed reproduction, and other factors. Most are probably either fully used or overused. Red snapper, traditionally the most important Gulf reef fish, is overused in part as a result of its incidental catch by the shrimp fishery. Eight of the ten major species in the Atlantic headboat fishery show significant size declines since 1972. In the Caribbean, such traditional fishery mainstays as Nassau grouper have practically disappeared, and total landings of species of more recent importance like the red hind have declined since the late 1970's. Landings of amberjack, lane snapper, vermilion snapper, and similar species have increased as catches of traditional species have declined.

	Recent Average Yield[1]	Current Potential Yield[2]	Long-term Potential Yield[2]	Fishery Utilization	***Stock Level Relative to Long-term Potential Yield***
Red snapper	3,074	2,722	15,000	Over	Below
Vermillion snapper	1,046				
Red grouper	3,309	Unknown	Unknown	Full	Unknown
Nassau and goliath groupers 3	0	0	Unknown	Over	Unknown
Shallow groupers (7 species)	2,610	Unknown	Unknown	Over	Unknown
Other groupers (5 species)	692	Unknown	Unknown	Unknown	Unknown
Other snappers (12 species)	1,387	Unknown	Unknown	Unknown	Unknown
Porgies (6 species)	97	Unknown	Unknown	Unknown	Unknown
Amberjacks (3 species)	961	Unknown	Unknown	Unknown	Unknown
Grunts (3 species)	767	Unknown	Unknown	Unknown	Unknown
Sea basses (3 species)	202	Unknown	Unknown	Unknown	Unknown
Others (14 species)	3,086	Unknown	Unknown	Unknown	Unknown

[1]2000-2003 average in metric tons; [2] CPY is overestimated, and LTPY is probably greatly underestimated; although potential production estimates are not available for most species groups, many are probably overutilized.

Concerns:

Bycatch and Multispecies Interactions
Reef fish form a complex, diverse multi-species system. The long-term harvesting effects on reefs are not well understood, requiring cautious management controls of targeted fisheries as well as bycatch. Removals of apex predators from the reef complex may result in shifts of species composition. Major bycatch issues currently occur with the capture and discarding of red snapper by vessels fishing for shrimp with small-mesh

nets. This bycatch problem means that, in order to meet the rebuilding goals for the stock, targeted harvests must be even more restricted. Bycatch of other species may pose similar difficulties as will the capture of undersized fish, even if they are released. The mortality rate of released fish is not well known.

Scientific Information and Adequacy of Stock Assessments
Several stocks of reef fish are currently depleted and need to be rebuilt (e.g. goliath grouper and Nassau grouper). A variety of management measures need to be explored, including the use of artificial reefs and the effectiveness of marine parks and reserves to protect spawning areas.
There are a number of important scientific issues that need to be addressed to improve the advice for management. The long-term potential yields for most of the reef fish species is unknown. Data on catch and the identification of species are inadequate for many stocks. They should be collected on a routine basis. Additional life history and biological data are needed to better understand this complex of species.

Allocation
Reef fish resources are used by a wide range of groups. Commercial and recreational fishermen may come into conflict with one another as well as with other users such as ecotourists. Balancing the interests of these groups is an important management issue.

Drum and Croaker

Status:

Important recreational and commercial species in the family Sciaenidae include the Atlantic croaker, spot, red drum, black drum, kingfishes (whiting), weakfish, spotted seatrout, and other seatrouts. These have constituted an important fishery resource since the late 1800's, although significant increases in commercial landings did not occur until the 1950's when the pet food industry began harvesting them in the northern Gulf of Mexico. The recreational harvest of sciaenids in the Gulf of Mexico and Atlantic Ocean has generally been similar to the commercial landings in weight. However, since most recreational fishing occurs within state jurisdiction, it is managed primarily through state authorities. Some states have established regulations heavily favoring recreational uses of Sciaenidae resources: in particular the prohibition of commercial fishing for red drum and spotted seatrout. The recent average annual yield of sciaenids in the Southeast region is estimated at almost 45,000 metric tons (t).

Large numbers of sciaenids are also caught and killed as an incidental catch in the shrimp fishery. The small mesh used in shrimp trawls can catch non-target species such as sea turtles, red snappers, croakers, seatrouts, and other species. Sciaenids constitute the bulk of the finfish bycatch biomass, and since many are harvested as juveniles, their mortality may slow recovery of over fished stocks or otherwise prevent full use of the adult resource.

Commercial landings of drum and croaker in the northern Gulf of Mexico rose sharply in 1956 to over 32,000 t, more than 20,000 t above that of 1953. This increase for the most part resulted from a demand for sciaenids as raw material in the production of canned pet foods, of which about 76% were Atlantic croaker and sand and silver seatrout.

Commercial landings of red drum increased rapidly in the mid 1980's when public popularity and demand suddenly grew for a new seafood preparation called blackened redfish. To supply this demand, a red drum purse-seine fishery evolved in the Gulf of Mexico, primarily targeting the offshore adult spawning stock. Prior to this, most red drum were harvested in nearshore state waters as juveniles. But as the offshore purse-seine fishery developed, it became clear that the schooling adults were extremely vulnerable to overexploitation, thus jeopardizing recruitment in subsequent years. Fishery analyses showed that the sustainability of the long-term potential yield depended in a large part upon limiting the harvest of adult red drum in the offshore waters as well as limiting the take of smaller individuals in inshore waters both by recreational and commercial fishermen (Goodyear, 1996; Porch, 2000)

These conservation measures were established by a fishery management plan developed and implemented for the Gulf of Mexico. The first plan is the Fishery Management Plan for the Red Drum Fishery of the Gulf of Mexico (administered by the Gulf of Mexico Fishery Management Council). The plan bans red drum fishing within Federal jurisdiction until the adult population has increased in size. And since state management actions have preserved inshore harvests and allocated much of the catch to recreational uses, they in effect bar the development of another adult red drum fishery in Federal waters.

The absence of an offshore fishery, size limits, limiting the daily take of red drum by recreational fishermen, and an increased incidence of fish released by conservation-oriented anglers are all expected to help rebuild the red drum spawning stock and reduce overall mortality. Current statistics indicate that such conservation measures are having this desired effect in some areas.

	Recent Average Yield[1]	Current Potential Yield[2]	Long-term Potential Yield[2]	Fishery Utilization	***Stock Level Relative to Long-term Potential Yield***
Black drum	4538	Unknown	Unknown	Unknown	Unknown
Atlantic croaker	16985	Unknown	50,000	Over	Below
Spot	4126	Unknown	Unknown	Unknown	Unknown
Red drum, Gulf of Mexico	5839	Unknown	7,900	Over	Below
Seatrouts	11094	Unknown	Unknown	Variable	Variable4
Kingfishes (whiting)	1243	Unknown	Unknown	Unknown	Unknown

[1]12000-02 average in metric tons; [2] LTPY is probably underestimated and CPY overestimated; although potential production estimates are not available for some species groups, it is expected that they may be overexploited.

Concerns:

Bycatch

Bycatch of these resources in the shrimp fishery has a significant impact on their status. Large numbers of Atlantic croaker, spot, and seatrout are caught and discarded dead from shrimp trawls. Estimates of as many as 500,000,000 spot, 1 billion seatrout, and 7.5 billion croaker are discarded. These species constitute the bulk of the finfish bycatch that averaged about 175,000 t during the 1980s. The National Marine Fisheries Service and the fishing industry have been working together to develop gear designs that will reduce the bycatch. Several promising solutions are under development.

Coastal Pelagics

Status:

Coastal pelagic fishes inhabiting waters off the southeastern United States include king and Spanish mackerels, cero, dolphinfish, and cobia. These species range in coastal and continental shelf waters from the northeastern United States through the Gulf of Mexico and the Caribbean Sea and as far south as Brazil. Coastal pelagics are fast swimmers that school and feed voraciously, grow rapidly, mature early, and spawn over many months.

U.S. and Mexican commercial fishermen have fished Spanish mackerel since the 1850s and king mackerel since the 1880s. The Spanish mackerel fishery began off New York and New Jersey but shifted southward through the decades to the southern U.S. Atlantic and Gulf of Mexico. In 2003, over 70% of the commercial catch was landed in Florida. Although early commercial fisheries harvested Spanish mackerel by hook and line, most of the commercial catch is taken by gillnets, including beach seines and runaround gillnets. In the latest years, the proportion of catch taken by hook and line has increase as the ban of gillnets went into effect for Federal waters in Florida in 1996. A major recreational fishery also exists for Spanish mackerel throughout the range and since 1995-97 the percent of landings by recreational anglers has increase to about 80% for the Gulf stock.

King mackerel are fished commercially from Chesapeake Bay southward. Four major production areas exist: North Carolina, Florida east coast (Cape Canaveral to Palm Beach), the Florida Keys, and off Grande Isle, Louisiana. The Louisiana fishery began in the early 1980s; the area was believed to harbor larger (and older) king mackerel females that served as a major spawning population for the Gulf of Mexico stock. Unrestricted fishing mortality was believed to be high on these fish from the late 1970s through the early

1980s, and these stocks currently comprise about 30% of the commercial quota for the Gulf regulatory group. Landings, which reached a peak of 9,768 metric tons (t) in 1982-83 fishing year, were reduced to a minimum of 4,700 t by the 1987-88 fishing year. Since then landings have increased to an average of 6,100 t in the last 5 fishing years. King mackerel landings are under a Federal quota management from the mid 1980s to the present.

Commercial king mackerel vessels have used gillnets, troll lines, handlines, purse seines, otter trawls, and pound nets. King mackerel sport fisheries exist off many southeastern states throughout the year. Commercial yields were unregulated until the mid 1980s. Recreational landings are thought to have been reduced by an expanding commercial runaround gillnet fishery in the 1970s and a driftnet fishery operating off southeast Florida in the late 1980s. Purse seines were used also to exploit the Gulf of Mexico king mackerel during the 1980s but are now prohibited as part of the stock recovery plan.

Status:

Recreational fishermen caught from 7,000-19,000 t per year of coastal pelagic species, and commercial fishermen caught 6,000–12,000 t per year during 1981–2002. Annually king and Spanish mackerel account for about 34% of all coastal pelagic species harvested. In addition to king and Spanish mackerel, Atlantic dolphinfish and cobia contributed significantly to the total recreational yield of coastal pelagics. Some cobia are incidentally caught by commercial mackerel fishermen; however, cobia and dolphinfish are for the most part a recreationally caught species. Cero mackerel are relatively unimportant and are usually taken as bycatch in other fisheries. Cero are not known to form large schools and are more difficult to target individually; in general, they do not contribute significantly to coastal pelagic catches.

As a group, presently coastal pelagics yield only about 80% of their long-term potential base on current estimates of maximum sustainable yield (MSY) and the total landings as of 2002. Several species in the group are currently being fished near or over the long-term maximum production levels. The Gulf king mackerel stock was considered over fished until recently because of previous overexploitation and has been managed under rigid rebuilding schedules since 1985. In 2003 long-term production potential (i.e., MSY) was estimated as 5,175 t for the Gulf king stock, and 2,680 t for the Atlantic king stock.

The mackerels have been managed recently using either F30 %SPR 1 (GMFMC) or F40%SPR (SAFMC) as a proxy for FMSY. The management benchmark selected for determining over fishing for all four migratory groups of mackerels (i.e., the maximum fishing mortality threshold (MFMT)) is thus F30% or F40% . If the current median estimated harvesting rate is below the MFMT then over fishing is not occurring.

Gulf Spanish mackerel were removed from an over fished status in 1995 following a long period of federal regulation to rebuild the stock that began in 1987. The recent 2003 stock assessment for the Gulf Spanish mackerel indicated that current fishing mortality on this stock is less than MFMT (F30% SPR) but as with the Atlantic Spanish mackerel stock additional information is needed on the exact level of bycatch to evaluate the stock status with more certainty.

The Gulf king mackerel stock is believed to have a large long-term potential yield, but the stock was severely depleted until recent years. Recent average annual production is now at an estimated 73% of the maximum long-term level. It is believed that major stock reductions that occurred during the 1980s and early 1990s were due to excessive harvests from the late 1970s through the early 1980s. Absence of fishing effort controls and sparse data on size and age composition hampered determining stock status and conservation efforts until 1986. Results from the most recent stock assessment in 2004 suggest that currently the stock is not over fished and that over fishing is not occurring. These results are thought to be due mainly to reductions in landings in the recent years resulting in lower fishing mortality and higher estimates of stock biomass but should be viewed with some caution. As year classes with current high recruitment move out of the fishery future stock biomass could decline.

The status of cobia stocks remains uncertain. Atlantic cobia yields have ranged from 13 to 685 t from 1980-2000. Gulf cobia yields are traditionally much larger, ranging from 300 to 1,110 t annually since 1980. Fishing mortality is assumed to be low for the Atlantic group, and Gulf cobia are believed to be more heavily exploited. Management of the cobia population currently assumes two separate stocks for assessment. Although cobia are caught mainly by recreational anglers, data are needed to assess their long-term potential are limited. The 1993 and 1994 spawner per recruit (SPR) calculations for Gulf cobia suggested SPR was between 20% and 45%. The 1993 and 1994 assessments for the Atlantic group suggested fishing mortality was very low and that SPR was greater than 30%. The most recent 2001 cobia stock assessment for the Gulf group indicates that the population has increased since the 1980s and the Gulf stock is not over fished. However, large uncertainty exists regarding the level of exploitation and therefore the stock is considered over fishing. The optimum yield for Gulf cobia has been set at 659 t.

Current management options for both cobia stocks include minimum size regulations and individual bag limits. Updated information is needed to further investigate the stock structures of cobia in the Gulf and Atlantic. Also, more precise estimates of cobia bycatch, natural mortality rate, and increased biostatistical sampling throughout the range of cobia are needed to improve assessment estimates of stock status and long-term potential yields. Sampling efforts should be focused on the recreational fisheries. Increased fishery sampling (length and age) is needed to reduce the current uncertainty in stock status. Two additional areas of research need for cobia include updating the reproductive information available for cobia and estimates of cobia bycatch.

Dolphinfish is primarily a recreational fisheries in the southeastern U.S. Recreational anglers landed on average 6,300 t (or 93%) of dolphinfish, while commercial fisherman landed on average 460 t (7%) dolphinfish in the 1998-2002 period. Total landings of dolphinfish have ranged from about 3000 to 10,300 t since 1981. Current stock status is difficult to quantify because comprehensive information for the total U.S. stock is restricted. The available information supports the hypothesis of one stock in the Gulf of Mexico and the South Atlantic. Stock assessment results of 2000 suggested some increase in stock size. Uncertainties in stock structure, the need to corroborate abundance trends, and the lack of mortality rates from recent time period make it difficult to estimate the current true status of the U.S. dolphinfish stocks. Research efforts should be focused on these areas. Because of the trans-migratory movements of this species international cooperation between scientists is needed to further refine information on stock status.

	Recent Average Yield[1]	Current Potential Yield	Long-term Potential Yield	Fishery Utilization	***Stock Level Relative to Long-term Potential Yield***
Dolphinfish, Gulf and Atlantic[2]	8,362	8,362	12,241	Unknown	Unknown
King mackerel, Gulf of Mexico	3,945	3,447	5,398	Full	Below
Spanish mackerel, Gulf of Mexico	1,794	4,173	3,855	Full	Near
Cobia, Gulf of Mexico	697	697	Unknown	Unknown	Unknown
Cero	22	Unknown	Unknown	Unknown	Unknown

[1]Recent average yield is for 1997-2000 average; [2]Recent Average Yield is for 1995-1997 average.

<u>Concerns:</u>

Stock boundary and mixing rates of king mackerel

The stocks of king Atlantic and Gulf mackerel do overlap during the winter months in the east south Florida and Florida Keys region. Recent studies suggest that there is considerable mixing between them however it is not yet determine the proportion of effective emigration-immigration between stocks, or the contribution of each stock to the landings in the region during the mixing period. Further sampling and research is needed to better quantify the stock source for catches in the mixing region to proper allocate fishing mortality rates and estimate stock status and productivity levels.

Trans-boundary Stocks and Jurisdiction

Effective management of migratory species will continue to require the coordination of Federal, State, and international regulatory actions. Accurate determination of the status of western Gulf of Mexico mackerel resources will require an increase in the information base on Mexican mackerel catches, their associated biological data, and cooperation of international scientists involved.

Allocation

The division of total allowable catches between recreational and commercial users remains an important issue for all of the coastal pelagic group species. Future allocation decisions require improvements in the precision and accuracy of user-specific harvest levels and in the understanding of the spatial and temporal segregation of the resource.

Sharks

Status:

The 1993 shark fishery management plan divided Atlantic shark fisheries into three management groups: 1) large coastal sharks, which included tiger, lemon, smooth hammerhead, scalloped hammerhead, great hammerhead, blacktip, sandbar, dusky, spinner, silky, bull, bignose, Caribbean reef, Galapagos, night, narrowtooth, and nurse; 2) small coastal sharks, which included Atlantic and Caribbean sharpnose, finetooth, blacknose, bonnethead, smalltail, and Atlantic angel; and 3) pelagic sharks, which included longfin and shortfin mako, blue, porbeagle, thresher, bigeye thresher, oceanic whitetip, sevengill, sixgill, and bigeye sixgill.

Large Coastal Sharks

The U.S. Atlantic shark fishery is primarily a southeastern fishery extending from Virginia to Texas, although sharks are also landed in the states north of Virginia. Commercial landings collected under the NMFS cooperative statistics program include the period 1981-2002. Landings are typically reported in dressed weight and an average weight is used to convert to numbers. Data for average weights are more reliable for the period 1994-2002 because they were based on an observer program of the directed shark bottom longline fishery. Similarly, commercial landings estimates are more reliable starting in 1995 because of improved species-specific reporting. Unreported commercial landings from 1986 to 1991 are also included, as used in the 1998 and 2002 shark evaluation workshops. Recreational catches in numbers also span the period 1981-2002 and include estimates from the NMFS Marine Recreational Fishery Statistics Survey, Headboat survey, and the Texas Parks and Wildlife recreational creel survey. Discards include estimates from the pelagic longline fishery for 1981-2002, the shark bottom longline fishery for 1993-2002, and the menhaden fishery in the Gulf of Mexico for 1994-2002.

Sandbar and blacktip sharks are the two most important species in the large coastal shark fishery. Although the catch and catch rate series available for these two species are shorter than those available for the large coastal shark aggregate, an assessment of these two species was conducted at the 1998 and 2002 shark evaluation workshops. Currently, the catch series available for each of these two species spans from 1986 to 2002, including commercial landings, recreational catches, catches from artisanal fisheries in Mexico, and unreported commercial landings (only from 1986 to 1991). Discards include estimates from the menhaden fishery for 1994-2002.

The 1996 Shark Evaluation Workshop report (SEFSC, 1996) concluded that catch rates of many of the species and species groups declined by about 50–75% from the early 1970's to the mid 1980's, but that the rapid rate of decline in the catch rates that characterized the stocks in the early 1980's had slowed significantly in the 1990's. Partly based on results from the 1996 workshop (SEFSC, 1996), a 50% reduction in catches of large coastal species (i.e. relative to 1995) was targeted. This reduction was to be achieved by a 50% reduction in the commercial quota for the large coastal management group and a reduction of the recreational bag limit to two fish per boat per day (from the previously established recreational bag limit of four fish). During the 1998 workshop (SEFSC, 1998), preliminary data for 1997 were presented and reviewed, and the indications were that commercial catches, in numbers of animals, were reduced from 1995 by more than 50%, but recreational catches were reduced by only 12%. The most recent catch rate data analyzed at that time continued to show inconsistent trends, many of which were not statistically significant. These findings were not totally unexpected given that the expected rates of change in shark abundance are small and the measures of stock abundance used are uncertain, meaning that longer time series are needed to detect significant changes in stock size since implementation of the most recent management measures.

Biomass dynamic model analyses that used catch, catch rate, and demographic data were integrated within a Bayesian statistical estimation approach during the 1998 shark evaluation workshop. The main findings of these analyses were that 1) for the large coastal complex, current (for 1998) stock size was estimated to be between 30 and 36% of the stock size producing LTPY; 2) for sandbar shark, the 1998 stock size was between 58 and 70% of LTPY levels; and 3) for blacktip shark, the 1998 stock size was between 44 and 50% of LTPY levels. A sensitivity analysis undertaken following peer review (Cortés, 2002a) showed that results for blacktip shark were particularly sensitive to some of the estimation techniques used. The most recent stock assessment (Cortés et al., 2002) conducted for the large coastal shark complex showed that the status of the resource had improved since 1998, but continued to show that over fishing was likely to be occurring and the resource was likely to be over fished. It also indicated that on average a reduction in catch of at least 50% of the 2000 catch level was likely required for the biomass to reach LTPY in 10 years.

Multiple models and estimation techniques were used to assess the status of sandbar and blacktip sharks. Results indicated on average that the status of sandbar sharks had also improved since 1998, that current (for 2002) biomass could be near or somewhat above LTPY, but over fishing could still be occurring. Most results for blacktip shark indicated that the stock was rebuilt and that current (for 2002) removal levels were sustainable.

Small Coastal Sharks

Four species (Atlantic sharpnose, bonnethead, blacknose, and finetooth) account for the majority of the small coastal shark fishery. For this group and individual species, commercial landings include only the period 1993-2002, whereas recreational catches include 1981-2002. Landings only represent a small fraction of all catches because small coastal sharks are also caught as bycatch and discarded in a variety of fisheries. Bycatch estimates in the shrimp trawl fishery operating in the Gulf of Mexico and U.S. South Atlantic were available for the small coastal shark aggregate, Atlantic sharpnose sharks, and bonnetheads for 1972-2000 and 1992-1997, respectively, and account for the majority of the catches of small coastal sharks. A stock assessment for the small coastal shark group, and Atlantic sharpnose, bonnethead, blacknose, and finetooth sharks was conducted in 2002 using Bayesian estimation techniques (Cortés, 2002b). Results indicated that removal levels were sustainable for the small coastal shark complex and the individual species, with only results for finetooth sharks indicating that over fishing might be occurring.

Pelagic Sharks

For the pelagic group, the catch series spans from 1981 to 2002. Commercial landings include the period 1982-2002, recreational catches include 1981-2002, and dead discards estimates from the pelagic longline fishery are available for 1987-2002. Due to the highly migratory nature of pelagic sharks, these species are harvested or caught as bycatch in the North Atlantic by fishers from several nations. An assessment of blue sharks and shortfin makos is scheduled to be conducted in 2004 under the auspices of the International Commission for the Conservation of Atlantic Tunas (ICCAT).

	Recent Average Yield[1]	Current Potential Yield	Long-term Potential Yield	Fishery Utilization	***Stock Level Relative to Long-term Potential Yield***
Large coastal sharks	na	1,017	na	Over	Below
Sandbar shark	na	na	na	Over	Near
Blacktip shark	na	na	na	Full	Above
Small coastal sharks	2,444	454	1,724-6,350	Full	Above
Atlantic sharpnose	1,433	na	1,270-7,076	Full	Above
Bonnethead	325	na	454-1,633	Full	Above
Blacknose	144	na	138-726	Full	Above
Finetooth	226	na	46-236	Over	Above
Pelagic sharks	625	853	Unknown	Unknown	Unknown
Prohibited species[2]	na	Unknown	Unknown	Unknown	Unknown

[1]Total allowable catches for sharks include quotas and discards. Dead discards and state landings after federal closures are subtracted from quotas when adjusting the commercial quota for sharks to account adequately for all sources of fishing mortality. Expressed as tons in dressed weight; [2]A group of 19 species that cannot be kept commercially or recreationally. It presently includes sand tiger, bigeye sand tiger, whale, basking, white, dusky, bignose, Galapagos, night, Caribbean reef, narrowtooth, Caribbean sharpnose, smalltail, Atlantic angel, longfin mako, bigeye thresher, sevengill, sixgill, and bigeye sixgill sharks.

<ins>Concerns:</ins>

Scientific Information and Adequacy of Assessments

The lack of extensive time series for species-specific landings and effort data continues to be a problem that hampers shark stock assessments (NMFS, 1999b). Without reliable species-specific data and stock assessments, management measures will necessarily continue to be based on species aggregates. Several of these important data deficiencies have been recognized in the past (SEFSC, 1998; Cortés et al., 2002). First, to continue to improve shark stock assessments, it is critical to continue to improve species- and size-specific catch (landed and discarded animals caught both in U.S. and non-U.S. fisheries) and effort data, and 2) improve fishery-independent measures of shark abundance and productivity. Second, it has been recognized that every effort should be made to assess the status of shark species separately because individual species are responding differently to exploitation based on their innate capacity to rebound and fishing history. Thus, management of large coastal shark aggregates can result in excessive regulation on some species and excessive risk of over fishing on others.

Management Concerns

Although species-specific shark assessments are preferable from a scientific standpoint, reliable species identification continues to pose problems for practical management and may only be remedied through observer programs and extensive public outreach and educational programs. The magnitude of estimated recreational catches has surpassed that of commercial landings in several years since 1996 and it appears that the minimum size limit imposed on the recreational sector has been largely ineffective and the reduced bag limit per trip is often not met. Significant reductions in mortality from the recreational sector could be achieved if these regulations were followed. The issue of incidental catches and discarding of dead sharks in commercial fisheries is also contentious from a management perspective. The final amendment 1 to the 1999 FMP incorporates a number of measures to mitigate bycatch in commercial shark fisheries that include gear restrictions and adoption of Vessel Monitoring Systems (VMS) in some cases (NMFS, 2003). A time-area closure aimed at protecting sandbar and dusky shark nursery and pupping areas off North Carolina during winter is also being implemented.

Pending work includes individual assessments of species classified as prohibited, especially dusky, night, and sand tiger sharks which were recently included in the Candidate Species List under the Endangered Species Act (ESA) and assessment of pelagic sharks, which will be undertaken under the auspices of ICCAT.

Oceanic Pelagics

<u>Status:</u>

Oceanic pelagic fish are highly migratory species that include swordfish, bluefin tuna, yellowfin tuna, bigeye tuna, albacore, skipjack tuna, blue and white marlin, sailfish, longbill spearfish, and others. In the Atlantic Ocean, swordfish and bluefin tuna have long provided important fisheries, while in recent years yellowfin tuna and bigeye tuna have increased in significance to U.S. fishermen. Many recreational anglers target yellowfin and bluefin tuna, blue marlin, white marlin, and sailfish in U.S. waters and occasionally longbill spearfish. All commercial retention of the latter four billfish species is now banned in U.S. waters; however, they are still incidentally caught in tuna and swordfish longline fisheries.

Because these large pelagic fish migrate widely and are harvested over broad ocean areas by U.S. and foreign fishermen, both national and international management measures are necessary. In all cases, stock assessments are conducted using aggregate data and provide the basis for regulations. U.S. fleets operate in the western Atlantic Ocean, Caribbean Sea, and Gulf of Mexico. These fleets are regulated under the Magnuson-Stevens Fishery Conservation and Management Act and the Atlantic Tunas Convention Act, which provides authority to implement international agreements reached by the International Commission for the Conservation of Atlantic Tunas (ICCAT). A Fishery Management Plan (FMP) for Atlantic tunas, sharks, and swordfish, and Amendment One to the Atlantic Billfish FMP (which addresses blue marlin, white marlin, sailfish, and spearfish) were enacted in 1999. Management of Atlantic tunas and swordfish has been based largely on recommendations by ICCAT and implemented via regulatory articles under the Atlantic Tunas Convention. ICCAT has set and allocated western bluefin tuna quotas by country since 1982 and eastern bluefin quotas since 1994. ICCAT first established catch limitations for north Atlantic swordfish in 1991 and south Atlantic swordfish in 1994; country-specific quotas have since been adopted for both stocks. ICCAT has recommended reductions in billfish catches for all nations since 1997.

From the early 1960's through 1977, U.S. fishermen caught an average of about 5,000 metric tons (t) per year (2,000–12,000 t per year) of the highly migratory pelagic species. During the late 1970's and early 1980's, U.S. fishermen caught 8,000 t or more per year, and since 1985 they have caught 14,000–20,000 t per year. The U.S. share of current potential yield for the highly migratory pelagic resource is about 16,600 t per year, and long-term potential yield to the U.S. fleet is estimated at about 17,800 t per year (Table 5-1) (ICCAT, 2004).

Since 1960, the top species by volume in the U.S. harvest has changed from bluefin tuna to swordfish to yellowfin tuna as each species declined due to fishing pressure and U.S. fishing effort shifted. During 1961–73, bluefin tuna represented 45–85% of the U.S. western Atlantic catch of large pelagics. But since 1980, the percentage has dropped to less than 15%, reflecting the decline in the bluefin tuna population, catch restrictions, and the increasing harvests of alternative species. During 1961–73, swordfish represented 5–20% of the U.S. catch, rose to 55% in 1982, but has since dropped to about 15-30%. During 1961–80, the percentage of yellowfin tuna in the U.S. north Atlantic catch was usually less than 10%, but that has since risen to 40–60%.

The U.S. dockside ex-vessel revenue from these fishes soared from about $30,000,000 (early 1980's) to nearly $100,000,000 in 1988 and then declined to roughly $60,000,000 in recent years.

Angler harvests of large pelagic fishes are estimated from dockside and telephone surveys. The average annual landed catch by recreational anglers for 1999-2002 is estimated conservatively at 7,200 t. Fishing tournament surveys indicate a substantial increase in billfish fishing since 1972. Although the practice of tagging and releasing of large pelagics has grown in recent years, more data are needed to quantify the recreational fishery trends for these fishes in U.S. Atlantic and Gulf of Mexico waters.

The value of the recreational fisheries for highly migratory species has not been estimated for all species; however, preliminary estimates indicate that they are highly valued.

NMFS has classified the following Atlantic highly migratory species (HMS) as over fished: west Atlantic bluefin tuna, north Atlantic swordfish, bigeye tuna, north Atlantic albacore, blue marlin, white marlin, and sailfish. Recently, ICCAT has assessed the stock of bigeye and found it to be near BMSY and thus no longer over fished. Other oceanic pelagics in the HMS FMP are considered fully fished. The HMS FMP and Billfish Amendment include rebuilding plans for the over fished species as well as measures designed to maintain healthy stocks at the optimum yield. Catch of blue and white marlin by domestic and foreign fleets has resulted in overharvesting these stocks. Fishing mortality rates on swordfish have been excessive since the late 1970's, prompting the development of international agreements to substantially reduce catches beginning in 1991. U.S. harvests since July 1991 are consistent with ICCAT's recommendations designed to reduce the risk of further declines. While yellowfin and bigeye tunas are fully and over used respectively, no catch quotas are in place for either of these species. Western Atlantic bluefin tuna have been overharvested to the point of being severely depleted, and as a result the harvest of this species has been restricted since 1982. The most recent assessment indicates that current quotas may result in a gradual rebuilding of the spawning stock in the future.

	Recent Average Yield[1]	Current Potential Yield[1]	Long-term Potential Yield[1]	Fishery Utilization	***Stock Level Relative to Long-term Potential Yield***
Yellowfin tuna (Atl.)	143600	~148,000	~148,000	Full	Near
Bigeye tuna (Atl.)	91300	89,000-103,000	93,000-114,000	Full	Near
Albacore (N. Atl.)	27,200	Unknown	32,400-33,100	Over	Below
Skipjack tuna (W. Atl.)	27,400	Unknown	Unknown	Possibly full	Near
Bluefin tuna (W. Atl.)	2,850	>3,000 (probably)	3,200-9,600	Over	Below
Other tunas (Atl.)	27,700	Unknown	Unknown	Unknown	Unknown
Swordfish (N. Atl.)	10,300	~14,000	11,580-15,330	Over	Near
Blue marlin (Atl.)	3,100	840-1,600	2,000-3,000	Over	Below
White marlin (Atl.)	800	<1,000	850-1,070	Over	Below
Sailfish (W. Atl.)		Unknown	Unknown	Over	Below

[1]Total RAY, CPY, and LTPY under present fishing patterns by U.S. and foreign nationals; 2000-2002 average in metric tons from ICCAT Task I data as of 8 Oct 2004.

Concerns:

Transboundary Stocks
Regulation of species that migrate across international boundaries is difficult. Domestic regulation without international agreements inherently is limited, but international agreements can be difficult to achieve. The latter is particularly true if the primary fishing nations cannot agree on fishing and conservation objectives, or do not abide by agreements once they are adopted. An additional problem is that not all fishing nations are members of ICCAT. The recent United Nations agreement on straddling fish stocks and highly migratory fish stocks may help to resolve these problems.

Bycatch and Multispecies Interactions
Marlin and sailfish bycatch in tuna and swordfish fisheries are a major concern, especially as commercial fisheries encounter concentrations of billfish important to recreational anglers. Expansion of the U.S. longline fishery for Gulf of Mexico yellowfin tuna and Spanish longline fishing in the tropical eastern Atlantic have heightened concern for distressed stocks of Atlantic tunas, swordfish, and the billfish sought by recreational anglers.

Bycatches of marine mammals and turtles are emerging issues particularly for the pelagic longline fishery. Research is underway to better characterize these interactions.

Domestic Management
Although the number of permits for large pelagics increased substantially during the 1990s, actual levels of effort in the longline fishery have declined in recent years. NMFS has proposed a limited access system for the swordfish, shark, and tuna longline fisheries as part of the draft HMS FMP in order to reduce latent effort and prevent future expansion of these fleets.

Since 1999 multiple areas in the Gulf of Mexico and the Atlantic Ocean have been closed to U.S. longline fishing for one to twelve months each year for the purpose of reducing bycatch of small swordfish, marlins, turtles and bluefin tuna. In one of those areas scientifically designed experimental fishing has been conducted to study factors influencing bycatches.

SEFSC Collaborators and Key Issues

The Southeast Fisheries Science Center collaborates with more than two hundred organizations in the southeast region of the United States (Appendix B). Collaboration includes diverse organizational relationships necessary for conducting fishery research from planning, implementing, and maintaining data collection mechanisms to the performance of research and delivery of scientific advice. Stakeholders and collaborators in the Southeast Fisheries Science Center routinely recognize four areas of key research:

Fishery stock assessments for fishery management

There are many competing commercial and recreational fisheries and environmental interests that drive fishery stock assessments to the top of the stakeholder priority list in the southeastern United States. Monitoring the relative abundance of fishable stocks; investigating the dynamic effects of stock recruitment, fishing, and natural mortality on fish stocks; and the economic consequences of fisheries management are accepted scientific priorities of the Gulf of Mexico Fishery Management Council and the Gulf State Fishery Commission, as well as state agencies, commercial and recreational fishing sectors, and non-governmental organizations.

Protection of marine mammals, sea turtles, and other threatened or endangered species.

Throughout the Gulf of Mexico, marine mammals and sea turtles are generally considered threatened or endangered by human-induced activities, such as trawling, longlining, and other harvesting techniques. Similarly, other species, such as goliath grouper and Nassau grouper and staghorn coral, are considered threatened in the United States and therefore need additional scientific and management attention to ensure survival and recovery. Conservationists, environmentalists, and the general public are consistent through the years in their demands for continued biological studies, improved technologies, and scientifically based management strategies to ensure that threatened or endangered populations are rebuilt and protected.

Coral reef conservation and management

Drastic destruction and degradation of coral reefs off Florida and Texas in past decades have raised concerns throughout the region and nation for adequate conservation and management. The monitoring of coral reef resources, investigations of coral reef habitat and consequences of man-induced factors, and the development of management strategy based on sound scientific information is fundamental to this effort. Commercial and recreational fishery interests and organizations, environmental interests and organizations, subsistence fishers, ecotourism, and the public in general hold coral reef resource protection, conservation, and management as a high priority.

Liquefied Natural Gas (LNG) processing facilities

A key new issue in the coastal zone of the southeast relates the amount of seawater used for industrial or commercial purposes, particularly with regards to the development of Liquefied Natural Gas (LNG) processing facilities. LNG development in the Gulf of Mexico along with potential new power plants and desalination plants have highlighted a potential impact on living marine resources in the inherent use of seawater for cooling or heating for industrial purposes and the potential for killing fish eggs and larvae as seawater is processed in great quantities. There is also a relatively unexamined usage is cooling water for ships (estimated to be 100 times as extensive as projected LNG usage). A controversy exists already regarding LNG processing, and the controversy is expected to escalate as environmentalists, commercial and recreational fishers, and the public in general become acquainted with future prospects and impacts.

Information and Data in Support Fishery Stock Assessment

U.S. federal and state laws applicable to fisheries management can be simplified in two concepts: the best available scientific data must be analyzed for each fishable stock; and based on that knowledge, applicable regulations that govern fishing must seek to maintain or recover the stock to a maximum sustainable level (i.e., not over fished or being over fished). The corollary to this is that fishable stocks are integral to the ecology of healthy oceans and contribute to natural predator and forage relationships. Over harvesting, therefore, exacerbates stresses exerted upon the stocks through pollution, loss of habitat, climatic warming, storm mishaps, etc.

Data and Information

Information to support a stock assessment generally begins with a description of the biology of the species. Delineation of stocks, age at maturity, growth rates, migration patterns, spawning and nursery habitats, reproductive characteristics, etc. are fundamental to an understanding of the species. University and governmental studies are often published that describe these aspects of the stocks.

Harvests by commercial and recreational fisheries are usually recorded and maintained by respective nations. In some cases the statistics are a census, in other cases they are incomplete and extrapolation is needed to represent the entire harvest. A particular fishery can also have individual entities, such as fisheries defined by gear types, periods or locations of harvests, etc. Consequently, statistics are generally desirable from each aspect of a fishery for more precise analysis and modeling.

Effort expended by a fishery in making the harvest is also generally recorded and maintained by respective nations. Such information is vital to stock assessment. If a species is abundant in time and space, less effort is needed to harvest a catch. Conversely, if a species is not abundant, more effort is needed. Consequently, one of the best indicators of abundance is expressed as catch-per-unit of effort expended by the fishery.

The size or age composition of the catch is likewise useful in modeling the population. Species that are heavily harvested (i.e., over fished) are typified by smaller sizes and ages of fish in the catch. Such harvests require the mortality of more individuals (i.e., smaller individuals) to produce the same catch weight. Species that are not heavily harvested are typified by a more normal range of individuals in the harvest: small, medium, and larger fish.

Manipulation of Data, Analysis and Modeling

Information from the commercial and recreational sectors of a fishery—as well as from research surveys conducted independently of the fisheries—requires a certain amount of organization and manipulation prior to analysis and modeling. Typical steps in this process include gaining access to the sources of data and information, the development of applicable summaries, the expansion of sample data, the conversion of information to unified units of measure, and the standardization of effort across gear types. In all such steps, certain transparency and privacy regulations might apply and thereby restrict access and handling procedures.

Once the information is organized and manipulated, scientists skilled in fishery analyses and modeling can establish assumptions and apply mathematical models to the data. The purpose of population modeling is to determine if the stock is under fished, over fished, or being fished more than it will ultimately sustain. Once they have an acceptable mathematical model of the stock, assessment scientists usually evaluate various management strategies for regulating the future harvest of the stock. Such strategies might, for instance, increase or decrease fishing mortality by altering the allowable times or regions open for fishing, the minimum size of fish in the harvest, the types of fishing gear used, etc. In turn, these analyses provide insight that managers can use to establish regulations that are scientifically based and thus transcend political and economic agendas.

Transboundary Issues

The fact that many stocks cross international borders in the Gulf of Mexico necessarily produces problems for fishery managers using fishery information from any particular nation. Without international cooperation in statistics, one nation must necessarily depend on incomplete data and information to establish a stock assessment. Proposed, therefore, is collaboration and sharing of information on a particular stock for the mutual interests of member nations.

Appendix A
Stock Status for Species in Gulf of Mexico Fishery Management Council Federal Fishery Management Plans.

(Includes joint plans with the South Atlantic Fishery Management Council)

(Source: www.nmfs.noaa.gov/sfa/statusoffisheries/statusostocks03/Support_TablesA.pdf)

Fishery Management Plan	Stock	Jurisdiction	Over fishing? (Is Fishing Mortality above Threshold?)		Over fished? (Is Biomass below Threshold?)		Approaching Over fished Condition?	Management Action Required	Rebuilding Program Progress
			Pre SFA	Post SFA	Pre SFA	Post SFA			
Dolphin Wahoo and Coastal Migratory Pelagics of the Gulf of Mexico and South Atlantic	dolphin	SAFMC / GMFMC		No		No	No	N/A	N/A
Coastal Migratory Pelagics of the Gulf of Mexico	king mackerel - Gulf group	SAFMC / GMFMC		No		No- rebuilding	No	continue rebuilding[1]	year 18 of plan*
and South Atlantic	king mackerel - Atlantic group	SAFMC / GMFMC		No		No	No	N/A	N/A
Coastal Migratory Pelagics of the Gulf of Mexico	Spanish mackerel -Gulf group	SAFMC / GMFMC		No		No	No	N/A	N/A
and South Atlantic	Spanish mackerel -Atlantic group	SAFMC / GMFMC		No		No	No	N/A	N/A
Coastal Migratory Pelagics of the Gulf of Mexico and South Atlantic	little tunny	SAFMC/ GMFMC		No	No		No	N/A	N/A

Fishery Management Plan	Stock	Jurisdiction	Over fishing? (Is Fishing Mortality above Threshold?)		Over fished? (Is Biomass below Threshold?)		Approaching Over fished Condition?	Management Action Required	Rebuilding Program Progress
			Pre SFA	**Post SFA**	**Pre SFA**	**Post SFA**			
Coastal Migratory Pelagics of the Gulf of Mexico and South Atlantic	cobia	SAFMC/ GMFMC		No		No	No	N/A	N/A
South Atlantic Snapper-Grouper and Reef Fish Resources of the Gulf of Mexico	yellowtail snapper	SAFMC/ GMFMC		No[4]		No[4]	No	N/A	rebuilt
Gulf of Mexico / South Atlantic Spiny Lobster	spiny lobster	SAFMC / GMFMC		No	No		No	N/A	N/A
Coastal Migratory Pelagics of the Gulf of Mexico and South Atlantic	bluefish - Gulf of Mexico only	GMFMC		Unknown	Unknown		Unknown	N/A	N/A
`Gulf of Mexico Stone Crab	stone crab	GMFMC		No	No		No	N/A	N/A
Gulf of Mexico Shrimp	brown shrimp	GMFMC	No			No	No	N/A	N/A
Gulf of Mexico Shrimp	pink shrimp	GMFMC	No			No	No	N/A	N/A
Gulf of Mexico Shrimp	white shrimp	GMFMC	No			No	No	N/A	N/A
Gulf of Mexico Shrimp	royal red shrimp	GMFMC	No		Undefined		Unknown	N/A	N/A
Gulf of Mexico Shrimp	rock shrimp	GMFMC	Undefined		Undefined		Unknown	N/A	N/A
Gulf of Mexico Shrimp	seabob shrimp	GMFMC	Undefined		Undefined		Unknown	N/A	N/A
Reef Fish Resources of the Gulf of Mexico	red snapper	GMFMC	Yes		Yes		N/A	reduce mortality continue rebuilding	13/31-year plan
Reef Fish Resources of the Gulf of Mexico	red grouper	GMFMC		Yes		No- rebuilding	No	reduce mortality continue rebuilding[1]	2/10-year plan

Fishery Management Plan	Stock	Jurisdiction	Over fishing? (Is Fishing Mortality above Threshold?)		Over fished? (Is Biomass below Threshold?)		Approaching Over fished Condition?	Management Action Required	Rebuilding Program Progress
			Pre SFA	**Post SFA**	**Pre SFA**	**Post SFA**			
Reef Fish Resources of the Gulf of Mexico	greater amberjack	GMFMC		Yes		Yes	N/A	reduce mortality continue rebuilding	2/10-year plan
Reef Fish Resources of the Gulf of Mexico	vermilion snapper	GMFMC		Yes		Yes[5]	N/A	reduce mortality rebuilding program	under review[6]
Reef Fish Resources of the Gulf of Mexico	gag	GMFMC		No	No		No	N/A	N/A
Reef Fish Resources of the Gulf of Mexico	gray triggerfish	GMFMC		Unknown	Unknown		Unknown	N/A	N/A
Reef Fish Resources of the Gulf of Mexico	mutton snapper	GMFMC		Unknown	Unknown		Unknown	N/A	N/A
Reef Fish Resources of the Gulf of Mexico	gray (mangrove) snapper	GMFMC		Unknown	Unknown		Unknown	N/A	N/A
Reef Fish Resources of the Gulf of Mexico	lane snapper	GMFMC		Unknown	Unknown		Unknown	N/A	N/A
Reef Fish Resources of the Gulf of Mexico	yellowedge grouper	GMFMC		Unknown	Unknown		Unknown	N/A	N/A
Reef Fish Resources of the Gulf of Mexico	snowy grouper	GMFMC		Unknown	Unknown		Unknown	N/A	N/A
Reef Fish Resources of the Gulf of Mexico	black grouper	GMFMC		Unknown	Unknown		Unknown	N/A	N/A
Reef Fish Resources of the Gulf of Mexico	scamp	GMFMC		Unknown	Unknown		Unknown	N/A	N/A
Gulf of Mexico Red Drum	red drum	GMFMC		No	Yes		N/A	continue rebuilding	year 13 of plan*
Gulf of Mexico / South Atlantic Spiny Lobster	slipper lobster	SAFMC / GMFMC	Undefined		Undefined		Unknown	N/A	N/A

Fishery Management Plan	Stock	Jurisdiction	Over fishing? (Is Fishing Mortality above Threshold?)		Over fished? (Is Biomass below Threshold?)		Approaching Over fished Condition?	Management Action Required	Rebuilding Program Progress
			Pre SFA	**Post SFA**	**Pre SFA**	**Post SFA**			
Coastal Migratory Pelagics of the Gulf of Mexico and South Atlantic	cero mackerel	SAFMC / GMFMC		Unknown	Unknown		Unknown	N/A	N/A
Coral and Coral Reefs of the Gulf of Mexico	fire corals	GMFMC	No[2]		Undefined		Unknown	N/A	N/A
Coral and Coral Reefs of the Gulf of Mexico	hydrocorals	GMFMC	No[2]		Undefined		Unknown	N/A	N/A
Coral and Coral Reefs of the Gulf of Mexico	octocorals	GMFMC	No[2]		Undefined		Unknown	N/A	N/A
Coral and Coral Reefs of the Gulf of Mexico	stony corals	GMFMC	No[2]		Undefined		Unknown	N/A	N/A
Coral and Coral Reefs of the Gulf of Mexico	black corals	GMFMC	No[2]		Undefined		Unknown	N/A	N/A
Reef Fish Resources of the Gulf of Mexico	nassau grouper	GMFMC		No[2]	Yes		N/A	continue rebuilding	year 6 of plan*
Reef Fish Resources of the Gulf of Mexico	goliath grouper	GMFMC		No[2]	Yes		N/A	continue rebuilding	year 13 of plan*
Reef Fish Resources of the Gulf of Mexico	lesser amberjack	GMFMC		Unknown	Unknown		Unknown	N/A	N/A
Reef Fish Resources of the Gulf of Mexico	almaco jack	GMFMC		Unknown	Unknown		Unknown	N/A	N/A
Reef Fish Resources of the Gulf of Mexico	banded rudderfish	GMFMC		Unknown	Unknown		Unknown	N/A	N/A
Reef Fish Resources of the Gulf of Mexico	queen snapper	GMFMC		Unknown	Unknown		Unknown	N/A	N/A
Reef Fish Resources of the Gulf of Mexico	schoolmaster	GMFMC		Unknown	Unknown		Unknown	N/A	N/A
Reef Fish Resources of the Gulf of Mexico	blackfin snapper	GMFMC		Unknown	Unknown		Unknown	N/A	N/A
Reef Fish Resources of the Gulf of Mexico	cubera snapper	GMFMC		Unknown	Unknown		Unknown	N/A	N/A

Fishery Management Plan	Stock	Jurisdiction	Over fishing? (Is Fishing Mortality above Threshold?)		Over fished? (Is Biomass below Threshold?)		Approaching Over fished Condition?	Management Action Required	Rebuilding Program Progress
			Pre SFA	Post SFA	Pre SFA	Post SFA			
Reef Fish Resources of the Gulf of Mexico	dog snapper	GMFMC		Unknown	Unknown		Unknown	N/A	N/A
Reef Fish Resources of the Gulf of Mexico	mahogany snapper	GMFMC		Unknown	Unknown		Unknown	N/A	N/A
Reef Fish Resources of the Gulf of Mexico	silk snapper	GMFMC		Unknown	Unknown		Unknown	N/A	N/A
Reef Fish Resources of the Gulf of Mexico	wenchman	GMFMC		Unknown	Unknown		Unknown	N/A	N/A
Reef Fish Resources of the Gulf of Mexico	goldface tilefish	GMFMC		Unknown	Unknown		Unknown	N/A	N/A
Reef Fish Resources of the Gulf of Mexico	blackline tilefish	GMFMC		Unknown	Unknown		Unknown	N/A	N/A
Reef Fish Resources of the Gulf of Mexico	anchor tilefish	GMFMC		Unknown	Unknown		Unknown	N/A	N/A
Reef Fish Resources of the Gulf of Mexico	blueline tilefish	GMFMC		Unknown	Unknown		Unknown	N/A	N/A
Reef Fish Resources of the Gulf of Mexico	tilefish	GMFMC		Unknown	Unknown		Unknown	N/A	N/A
Reef Fish Resources of the Gulf of Mexico	rock hind	GMFMC		Unknown	Unknown		Unknown	N/A	N/A
Reef Fish Resources of the Gulf of Mexico	speckled hind	GMFMC		Unknown	Unknown		Unknown	N/A	N/A
Reef Fish Resources of the Gulf of Mexico	red hind	GMFMC		Unknown	Unknown		Unknown	N/A	N/A
Reef Fish Resources of the Gulf of Mexico	misty grouper	GMFMC		Unknown	Unknown		Unknown	N/A	N/A
Reef Fish Resources of the Gulf of Mexico	warsaw grouper	GMFMC		Unknown	Unknown		Unknown	N/A	N/A
Reef Fish Resources of the Gulf of Mexico	yellowmouth grouper	GMFMC		Unknown	Unknown		Unknown	N/A	N/A

Fishery Management Plan	Stock	Jurisdiction	Over fishing? (Is Fishing Mortality above Threshold?)		Over fished? (Is Biomass below Threshold?)		Approaching Over fished Condition?	Management Action Required	Rebuilding Program Progress
			Pre SFA	Post SFA	Pre SFA	Post SFA			
Atlantic Billfishes	blue marlin - Atlantic	HMS		Yes		Yes	N/A	reduce mortality rebuilding program	Phase I implemented[24]
Atlantic Billfishes	white marlin - Atlantic	HMS		Yes		Yes	N/A	reduce mortality rebuilding program	Phase I implemented[24]
Atlantic Billfishes	sailfish - west Atlantic	HMS		Yes		Yes	N/A	reduce mortality rebuilding program	not internationally implemented[25]
Atlantic Billfishes	longbill spearfish - west Atlantic	HMS		Unknown		Unknown	Unknown	N/A	N/A
Atlantic Tunas, Swordfish and Sharks	skipjack tuna - west Atlantic	HMS		Unknown		Unknown	Unknown	N/A	N/A
Atlantic Tunas, Swordfish and Sharks	porbeagle shark	HMS		Unknown		Unknown	Unknown	N/A	N/A
Atlantic Tunas, Swordfish and Sharks	blue shark	HMS		Unknown		Unknown	Unknown	N/A	N/A
Atlantic Tunas, Swordfish and Sharks	**BIGEYE TUNA - ATLANTIC**	HMS		Yes		Yes	N/A	reduce mortality rebuilding program	not internationally implemented[9]
Atlantic Tunas, Swordfish and Sharks	**ALBACORE - NORTH ATLANTIC**	HMS		Yes[10]		Yes	N/A	reduce mortality rebuilding program	not submitted [11]
Atlantic Tunas, Swordfish and Sharks	**BLUEFIN TUNA - WEST ATLANTIC**	HMS		Yes		Yes	N/A	reduce mortality continue rebuilding	7/20-year plan[12]
Atlantic Tunas, Swordfish and Sharks	**YELLOWFIN TUNA - ATLANTIC**	HMS		No		No	Yes	N/A	N/A

Fishery Management Plan	Stock	Jurisdiction	Over fishing? (Is Fishing Mortality above Threshold?)		Over fished? (Is Biomass below Threshold?)		Approaching Over fished Condition?	Management Action Required	Rebuilding Program Progress
			Pre SFA	Post SFA	Pre SFA	Post SFA			
Atlantic Tunas, Swordfish and Sharks	**SWORDFISH - NORTH ATLANTIC**	HMS		No		No - rebuilding	N/A	continue rebuilding	6/10-year plan[13]
Atlantic Tunas, Swordfish and Sharks	**SANDBAR SHARK**[14]	HMS		Yes		No - rebuilding	No	reduce mortality continue rebuilding[1]	2/26-year plan
Atlantic Tunas, Swordfish and Sharks	**BLACKTIP SHARK**[14]	HMS		No		No	No	N/A	rebuilt under plan
Atlantic Tunas, Swordfish and Sharks	**LARGE COASTAL SHARK COMPLEX**[15]	HMS		Yes		Yes	N/A	reduce mortality continue rebuilding	2/26-year plan
Atlantic Tunas, Swordfish and Sharks	**FINETOOTH SHARK**[16]	HMS		Yes		No	No	reduce mortality	N/A
Atlantic Tunas, Swordfish and Sharks	**ATLANTIC SHARPNOSE SHARK**[16]	HMS		No		No	No	N/A	N/A
Atlantic Tunas, Swordfish and Sharks	**BLACKNOSE SHARK**[16]	HMS		No		No	No	N/A	N/A
Atlantic Tunas, Swordfish and Sharks	**BONNETHEAD SHARK**[16]	HMS		No		No	No	N/A	N/A
Atlantic Tunas, Swordfish and Sharks	**SMALL COASTAL SHARK COMPLEX**[17]	HMS		No		No	No	N/A	N/A
Atlantic Tunas, Swordfish and Sharks	**SHORTFIN MAKO SHARK**[18]	HMS		Unknown		Unknown	Unknown	N/A	N/A
Atlantic Tunas, Swordfish and Sharks	**PELAGIC SHARK COMPLEX**[19]	HMS		Unknown		Unknown	Unknown	N/A	N/A

*Pre-SFA Rebuilding Plan with no timeline defined.

[1]This stock is currently above the minimum stock size threshold; however, it was previously below this level and rebuilding must continue until the stock is at a level consistent with MSY.

[2]Fishery in the EEZ is closed; therefore, fishing mortality is very low.

[3]On July 11, 2003, NMFS partially approved the FMP for this stock. Although one of the disapproved provisions included the MFMT, a component of the over fishing definition, an examination of the rate of harvest (currently zero), relative to the approved MSY level (100,000 t), indicates that over fishing is not occurring. In addition, no directed fishery for this stock currently exists. This species has the capacity to increase its biomass through vegetative growth by as much as 10 percent per day, thus doubling its biomass every two weeks. Therefore, it is unlikely that this stock is over fished.

[4]The most current assessment for this stock (Muller et al. 2003) has concluded that over fishing is not occurring, nor is it over fished. Although this assessment did not use criteria contained in the FMP, it is regarded as the best available information.

[5]The most recent assessment (July 2001 Status of the Vermilion Snapper Fishery in the Gulf of Mexico Report (Assessment 5.0), October 2001 Report of the Reef Fish Stock Assessment Panel, and the Summary of the Standing and Special Reef Fish Scientific and Statistical Committee (January 2002 Council meeting)) concluded that this stock is over fished. To this effect, the Gulf of Mexico Fishery Management Council was notified on October 30, 2003 that this stock is over fished and undergoing over fishing. Although this assessment did not use criteria contained in the FMP, it is regarded as the best available information.

[6]Amendment 23, which includes a rebuilding plan for Gulf Vermilion Snapper, has been submitted and is awaiting final approval.

[7]For the over fished North Atlantic blue and white marlins, Amendment One to the Atlantic Billfish FMP established a foundation to develop an international rebuilding plan. An international rebuilding plan with a two-phase approach was adopted in 2000 by ICCAT; Phase I has been implemented, while the United States continues to work toward its full implementation. It should be noted that the ICCAT rebuilding program does not satisfy all the requirements of the Magnuson-Stevens Act. NMFS is continuing to work domestically to monitor its fisheries and promote conservation. The SCRS conducted an assessment of white marlin in spring 2002.

[8]For over fished sailfish, Amendment One to the Atlantic Billfish FMP established the foundation to develop an international 10-year rebuilding program. While steps have been taken internationally to pursue recovery of the over fished west Atlantic sailfish stock, an international rebuilding program has not yet been adopted. NMFS is continuing to work through ICCAT to establish an international rebuilding program and is working domestically to monitor its fisheries and promote conservation.

[9]For the over fished Atlantic bigeye tuna, the HMS FMP established the foundation to develop an international 10-year rebuilding program. While steps have been taken internationally to pursue recovery of this stock, an international rebuilding program has not yet been adopted. NMFS is continuing to work through ICCAT to establish an international rebuilding program and is working domestically to monitor its fisheries and promote conservation.

[10]Although the last conclusive assessment conducted in 2000 determined that over fishing was occurring for this stock, total landings have been 33,754, 25,186, 22,617, and 25,516 t for the years 2000-2003, respectively. The TAC for this stock is 34,500 t, which is the replacement yield; if landings are below 31,000 t, the biomass is expected to rebuild for this stock.

[11]For the over fished North Atlantic albacore, NMFS is working through ICCAT to establish an international rebuilding program. Domestically, NMFS is monitoring its fisheries and promoting conservation.

[12]International rebuilding program implemented in 1999. The SCRS conducted an assessment in summer 2002 but that assessment had not been officially adopted by ICCAT.

[13]International rebuilding program implemented in 2000.

[14]This stock is part of the Large Coastal Shark Complex, but is assessed separately.

[15]In addition to Sandbar Shark and Blacktip Shark, the Large Coastal Shark Complex also consists of additional stocks that cannot be retained in commercial or recreational fisheries, which include: Spinner Shark, Silky Shark, Bull Shark, Tiger Shark, Lemon Shark, Nurse Shark, Scalloped Hammerhead Shark, Great Hammerhead Shark, Smooth Hammerhead Shark, Dusky Shark, Bignose Shark, Galapagos Shark, Night Shark, Caribbean Reef Shark, Narrowtooth Shark, Sand Tiger Shark, Bigeye Sand Tiger Shark, Whale Shark, Basking Shark, White Shark. Status determinations were made for the complex by using the assessments of Sandbar Shark and Blacktip Shark.

[16]This stock is part of the Small Coastal Shark Complex, but is assessed separately.

[17]In addition to Atlantic Sharpnose Shark, Blacknose Shark, Bonnethead Shark, and Finetooth Shark, the Small Coastal Shark Complex also consists of: Atlantic Angel Shark, Caribbean Sharpnose Shark, and Smalltail Shark; these 3 species cannot be retained in recreational or commercial fisheries.

[18]This stock is part of the Pelagic Shark Complex, but is assessed separately.

[19]In addition to Shortfin Mako Shark, Blue Shark, and Porbeagle Shark, the Pelagic Shark Complex also consists of: Oceanic Whitetip Shark and Thresher Shark. This complex also consists of stocks that cannot be retained in recreational or commercial fisheries, which include: Bigeye Thresher Shark, Bigeye Sixgill Shark, Longfin Mako Shark, Sevengill Shark, and Sixgill Shark.

Appendix B

Southeast Fisheries Science Center Collaborators

FEDERAL
Atlantic Oceanographic and Meteorological Laboratory (NOAA)
Biscayne National Park (DOI, USPS)
Camp LeJeune Marine Corps Base
Cape Lookout National Seashore
Caribbean Fishery Management Council
Center for Coastal Services (NOS)
Chesapeake Bay Office (NOAA)
Coastal Services Center (NOAA)
CoastWatch and Ocean Color (NOAA/NESDIS)
Damage Assessment Center (NOAA)
Everglades National Park (DOI, USPS)
Florida Keys National Marine Sanctuary (NOAA /NOS)
General Council for Natural Resources (NOAA)
Grays Reef National Marine Sanctuary (NOAA/NOS)
Gulf Islands National Seashore/N.P.S.
Gulf of Mexico Fishery Management Council
Laboratory Charleston (NOS)
Marine Mammal Commission
Middle Atlantic Fishery Management Council
Minerals Management Service
Monitor National Marine Sanctuary
National Research Council
National Science Foundation
Naval Research Laboratory
NOS-NCCOS-Monitoring Program
NOS-NESDIS -CoastWatch Program
Oak Ridge National Laboratory
Office of Naval Research
Padre Island National Seashore (U.S.G.S.)
Rachel Carson Estuarine Sanctuary
Restoration Center (NOAA)
Sanctuaries and Reserves Division (NOAA)
Sea Grant – Florida, Georgia, California, and Louisiana
Smithsonian Institute
South Atlantic Fishery Management Council
US Coast Guard
US Department of Agriculture Res. Station, New Orleans
US Department of State
US Environmental Protection Agency
US Fish and Wildlife Service
US Geological Survey
US Navy

STATE
Alabama Department of Natural Resources
Atlantic States Marine Fisheries Commission
Connecticut Department of Environmental Protection
Delaware Department of Fish and Game
Florida Department of Environmental Protection
Florida Fish and Wildlife Resources Commission
Georgia Department of Natural Resources
Gulf States Marine Fisheries Commission
Hammocks Beach State Park
Louisiana Department of Wildlife and Fisheries
Maryland Department of Natural Resources

Massachusetts Department of Natural Resources
Mississippi Bureau of Marine Resources
New Jersey Fish, Game and Wildlife
New York Department of Environmental Protection
North Carolina Aquariums
North Carolina Department of Administration
North Carolina Department of Environmental and Natural Resources
North Carolina Department of Transportation
North Carolina Division of Marine Fisheries
North Carolina Maritime Museum
North Carolina Sea Grant
North Carolina Shellfish Sanitation
North Carolina Wildlife Resources Commission
Puerto Rico Department of Natural Resources
Rhode Island Department of Environmental Management
South Carolina Department of Natural Resources
South Carolina Marine Resources Department
South Florida Water Management District
Texas Parks and Wildlife Department
Virgin Island Department of Planning and Natural Resources
Virginia Marine Resources Commission
Virginia Marine Science Museum
Virginia Sea Grant Consortium

INDUSTRY
COMPASS - Communication partnership for Science and the Sea
Gulf and South Atlantic Fishery Development Foundation
IGFA - International Gamefish Association
Monroe County Commercial Fisherman's Association

ACADEMIC
Auburn University
Bethune-Cookman College
Cape Fear Community College
Chesapeake Biological Laboratory (University of Maryland)
College of Charleston
Costal Carolina University
Dillard University
Duke University Marine Laboratory
Duke University, Nicholas School of the Environment
East Carolina University
East Tennessee State University
Eckerd College
Florida A&M University
Florida Atlantic University
Florida Institution of Technology
Florida International University
Florida Memorial College
Florida State University
Harbor Branch Oceanographic Institute
Iowa State University
Jackson State University
James Cook University, Australia
Kutztown University
Louisiana State University
Massachusetts Institute of Technology
McNeese State University
Montana State University
Mote Marine Laboratory
Murdoch University, Western Australia, Australia
North Carolina State University

Nova Southeastern University
Old Dominion University
Oregon State University
Rutgers University
San Diego State University
Savannah State University
Scripps Institute of Oceanography
Sonoma State University
State University of New York, Stony Brook
Texas A & M University - Dr. Bernd Wursig; Gulf of Mexico dolphin assessment
University of Puerto Rico-- Dr. Ernest Williams; marine mammal assessment & strandings
Texas Tech University
Universidad Metropolitana, Puerto Rico
Universidade da Madeira, Seccao de Biologia Marinha da
University College Cork (Ireland
University of Bergen, Norway
University of British Columbia, Canada
University of California at Berkeley
University of California at Santa Cruz
University of Charleston
University of Durham
University of Florida
University of Kansas
University of Maryland
University of Maryland, Horn Point Laboratory
University of Massachusetts, Dartmouth
University of Miami--Jerry Ault; assessment of habitat and fish populations in the Florida Keys and Tortugas for the Florida Keys National Marine Sanctuary, National Park Service, FFWCC, and NMFs and NMFS.
University of New Hampshire
University of North Carolina at Chapel Hill
University of North Carolina, Wilmington
University of Oxford
University of Padua, Italy
University of Puerto Rico
University of Queensland, Queensland, Australia
University of South Alabama, Dauphin Island Sea Lab
University of South Florida
University of Southern Mississippi
University of Texas at Port Aransas
University of Texas, Pan American
University of Virginia
University of Western Carolina
Virginia Institute of Marine Sciences
Virginia Polytechnic Institute and State University
Woods Hole Oceanographic Institution

INTERNATIONAL
Brazilian National Institute for Research on the Amazon
Cayman Turtle Farm, Grand Cayman Island
Center For Research in Oceanography in Senegal
Danish Institute of Marine Fisheries
Fisheries Laboratory in Ghana
ICCAT
ICES
Instituto Nacional de la Pesca
Inter American Tropical Tuna Commission
Intergovernmental Oceanographic Commission
International Council for the Conservation of Atlantic Tunas
International Whaling Commission
IOCARIBE
IOCARIBE, IOC, UNESCO

Ministerio de Agricultura, Pesca y Alimentacion, Spain
Morocco Fisheries Research Institute
Mozambique Fisheries Research Institute
National Centre for Marine Research, Greece
Nigerian Institute For Oceanography & Marine Research
Norway Institute of Marine Research
Queens University, Ontario, Canada
Sea Mammal Research Unit, United Kingdom
South African Dept. of Marine & Coastal Management
South Australia Fisheries Department
UNDP-GER
UNIDO

PRIVATE
Audubon Society
Baldhead Island Conservation
Baltimore Aquarium
Beaufort Fisheries, Inc.
Center for Marine Conservation
Chelonia, Inc
Daybrook Fisheries Inc.
Dolphin Ecology Project, Florida Keys
Environmental Defense Fund
Florida Power and Light, St. Lucie Power Plant
Jekyll Island Authority
Johnson Controls
Karen Beasley Sea Turtle Rescue & Rehabilitation Center
Mote Marine Laboratory
Nags Head Dolphin Watch
National Aquarium in Baltimore
National Fisheries Institute
North Carolina Coastal Federation, Inc
North Carolina Power Company
Ocean Imaging Co.
Omega Protein Inc.
Quilleute Tribe
Savannah Science Museum
Science Applications International Corporation
The Dolphin Project
TracPak
Virginia Power Company
Whale Acoustics, Wyoming
World Services, Inc.

OTHER NON-OVERNMENT ORGANIZATION
Center for Marine Conservation
Environmental Defense
Natural Resources Defense Council
Nature Conservancy
Pacific Ocean Conservation Network
Reef Environmental Education Foundation

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Background for the
Transboundary Diagnostic Analysis

Ecosystem Health. Part 1 - Fishery Habitats: Trends and Research Needs

Associated with the
Gulf of Mexico Large Marine Ecosystem

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Prepared by the:
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Executive Summary

Marine species in the Gulf of Mexico have habitat requirements that must be maintained to promote healthy stocks for human consumption and to maintain their roles in the ecosystem. Critical habitats for marine species are primarily concentrated in the estuaries but include the substrate, open waters, and currents of the offshore areas as well. In particular, inshore habitats and freshwater flowing into the estuaries have been stressed historically, principally through agricultural, municipal, and industrial practices. Maintaining and improving the future quality and health of fishery resources requires wise management, protection, and enhancement of associated habitats. Expanded research is needed to investigate and document fishery habitat dependencies and as well as habitat quality and quantity.

Gulf of Mexico Fishery Habitats, Trends and Research Needs

Introduction

The Gulf of Mexico is a large semi-enclosed basin. It has a surface area of about 1.5 million square kilometers and an average depth of about 1,615 m. It is bounded on the north by the United States and on the south by Mexico and Cuba. The rim of the basin is a broad continental shelf, above which are found most of the marine resources harvested by commercial and recreational fisheries. Estuarine fishery habitats occur on the shallow fringe of the shelf, where it joins with terrestrial habitats. Estuaries are complex, dynamic, nutrient-rich environments consisting of intricately linked fauna and flora in tidal creeks, bays, sounds, and inlets. Seawater from the Gulf, pulsing with the rise and fall of tides, enters the estuaries and continually mixes with varying amounts of freshwater drained by streams and rivers from as far north as the headwaters of the Mississippi, Ohio, and Missouri Rivers. A chain of barrier islands separates most of the U.S. estuaries from the open Gulf. They are composed of unconsolidated sand, shell, and gravel that have been deposited and redeposited through erosion and accumulation by prevailing oceanic currents, winds, and storms. Barrier islands provide significant frontal beach. They also provide partial protection to inland waterways from wind, wave, and storm energies.

Hundreds of species of marine species targeted by commercial and recreational fisheries inhabit the estuarine, continental shelf and slope, and deepwater habitats of the Gulf of Mexico. Thousands upon thousands more are important ecologically, forming a highly complex food web with trophic dependences and interactions that define a healthy, sustainable semi-tropical to tropical ecosystem. A common life cycle of estuarine dependent fish in the northern Gulf is characterized by a species that spawns in the offshore waters. Its planktonic eggs and larvae then float into the nutrient-rich estuarine nursery grounds to feed, grow, and develop into juveniles and young adults. Finally, the young-of-the-year migrate offshore to join older adults to spawn and renew the life cycle. Pelagic species generally spawn eggs and larvae that remain planktonic and grow and develop in surface waters above the shelf and slope or over deep waters of the basin.

A current of warm high-saline water runs continuously through the center of the Gulf basin. Known as the Loop Current, the stream enters at the narrow yet deep Yucatan Channel and exits through the Straits of Florida to become the Gulf Stream in the Atlantic Ocean. The meandering path of the Loop Current can vary significantly. In some years it turns eastward soon after entering the basin; in other years, it penetrates to the northern continental shelf bordering Louisiana, Mississippi, and Alabama. Hydraulic disturbances along the northern boundary of the current promote upwelling and primary productivity above the shelf and slope. The current with its hydrologic disturbances also provides a mechanism for the transportation of planktonic stages of marine flora and fauna. In addition, when the current moves towards the Mississippi River and passes 27° N latitude, it occasionally bifurcates to produce large eddies of high saline water measuring 300 km or more in diameter. These break from the main current, drift westward, and disintegrate over a period of months along the continental shelf of western Louisiana and Texas. Like the main current, these stimulate upwelling and provide transport for marine fauna and flora.

Estuaries are indispensably valuable and directly linked with important fishery species. Nevertheless, they are continually threatened by numerous man-induced activities. The quantity and quality of freshwater have long been subject to significant alteration. Activities such as diversion, damming, and channelization threaten the supply of freshwater to the estuaries. Point and non-point sources of pollution, and the use and reuse of water for agricultural, municipal, and industrial purposes likewise threaten water quality.

Besides water quantity and quality, estuaries, like other coastal areas, have become a limited resource with an ever-increasing social and economic demand. The beauty of coastal property linked with its recreational and commercial opportunities has long promoted human development. Dredging and filling of wetlands and the construction of primary and ancillary structures such as farms, homes, buildings, corporate facilities, roads, bridges, marinas, restaurants, docks, peers, jetties, and seawalls, have caused significant habitat loss.

Stress commonly associated with coastal habitats is often associated with chronic phosphorus and nitrogen loading; abnormal algal blooms; hypoxia; fish kills, elevated levels of bacteria in streams, bayous, beaches, and shellfish; toxic contaminants in water, sediments, fish, and shellfish; wetland loss; land subsidence; saltwater intrusion; invasive species; and climatic warming. In addition, much of the U.S. energy needs are satisfied by thousands of offshore wells, platforms, pipelines and associated structures for petroleum production. These along with the transportation of crude and refined products through pipelines and ocean-going tankers present a constant danger of accidental pollution or petroleum spill. The outlook for petroleum production is long lived in the Gulf of Mexico, and the future will likely include new liquefied natural gas processing plants.

Habitat-Species Associations

Generalized habitats used by major species and species groups within the northern Gulf of Mexico are discussed below:

Corals

Corals in the Gulf of Mexico are sessile invertebrates that require high oceanic salinity, relatively clear water, and hard substrate. The availability of hard substrate is the primary determinant of coral distribution. Corals construct and develop reefs over millennia that are ecosystems providing habitat to a large variety of invertebrates and reef fish. Coral reefs are tropical to subtropical, light-dependent communities. They are generally restricted to waters of less than 200 m in depth and predominantly in waters less than 50 m.

Mollusks

Eastern oyster (*Crassostrea virginica*) inhabits coastal estuaries and occurs in a wide range of salinities. It is found in the estuaries of Alabama, Mississippi, Louisiana, and Texas east of Corpus Christi. Preferred habitats are intertidal areas, shallow bays, mud flats, offshore sand bars, and shell substrates.

Calico scallop (*Argopecten gibbus*) occurs at depths of 18 to 73 m. Beds of calico scallop are distributed on the continental shelf parallel to the coastline. They are found on unconsolidated sediments, including hard sand and shell substrates, in salinity ranging from 31-37 ppt.

Crabs

Stone crabs (*Menippe mercinaria* and *M. adina*) are found in burrows under rock ledges, coral heads, dead shell, or seagrass flats (primarily *Thalassia testudinum*). They occasionally inhabit oyster bars and rock jetties. Juvenile stone crabs, however, do not dig burrows. Instead, they use available hiding places that offer close proximity to food. Juveniles are abundant on habitats of shell bottom, sponges, and *Sargassum* mats as well as in channels and deep grass flats.

Blue crab (*Callinectes sapidus*) is widely distributed in estuarine habitats along the coast. It tolerates a wide range of salinity from freshwater to hyper saline. Blue crab distribution varies with age, sex, and season. Juveniles are most abundant in seagrass beds or emergent marsh vegetation. Adults occur on muddy and sandy bottoms to about 90 m in depth; however, their greatest abundance occurs in waters of less than 35 m.

Spiny Lobster

Spiny lobster (*Panulirus argus*) inhabits soft bottom sediments, coral, and other hard bottom areas. It can be found among sponges, algal communities, and mangrove habitat as well. Oceanic waters and currents play an important role in the growth, survival, and dispersion of spiny lobster during its planktonic early-life forms.

Shrimp

Brown shrimp *Farfantepenaeus aztecus*, white shrimp *Litopenaeus setiferus*, and pink shrimp *Farfantepenaeus duorarum* constitute the primary species of shrimp harvested by commercial fisheries in the northern Gulf of Mexico. Adults generally live and spawn in waters on the continental shelf. Planktonic larvae are carried by currents to estuarine nursery habitats where postlarvae grow over a period of several months to become subadults. At this point, subadults migrate to join older adults offshore. Within the estuaries, high densities of all three species are associated with emergent marsh or submerged aquatic vegetation. Offshore, adult white shrimp occur to depths of about 40 m, pink shrimp to 65 m, and brown shrimp to 110 m.

Rock shrimp (*Sicyonia brevirostris*) occurs on sand bottom habitats in water depths of 25-65 m.

Royal red shrimp (*Pleoticus robustus*) occurs at depths of 250-475 m.

Inshore and Nearshore Fish

Gulf menhaden (*Brevoortia patronus)* is an estuarine-dependent fish that lives near shore. Throughout most of it range, it uses oceanic, near-shore and estuarine habitats that include unconsolidated bottom consisting primarily of sand and mud. It is found in coastal waters but is occasionally found in offshore waters of less than 200 m in depth.

Mullet (*Mugil* spp.) are widespread, occupying virtually all near-shore shallow marine and estuarine habitats, including lagoons, bays, rivers, waters adjacent to open beaches, mud flats, salt marshes, and grass beds. Spawning occurs near the surface of offshore waters, and juveniles enter the bays and estuaries to mature.

Gizzard shad *(Dorosoma cepedianum)* occurs in tidal fresh and brackish waters. The species spends most of the year downstream in moderately saline water and migrates upstream to tidal fresh water to spawn.

Threadfin shad *(Dorosoma petenense)* is essentially a freshwater fish, although the young move downstream to inhabit brackish waters.

Gulf flounder (*Paralichthys albigutta)* inhabits estuarine and marine habitats. It prefers higher salinity waters above 20 ppt, typically over hard sand bottoms. Adults can be found on the shelf at depths up to 50 m, although they prefer nearshore waters and bays. Juveniles are often associated with sea grass beds.

Southern flounder (*Paralichthys lethostigma*) inhabits estuarine and marine habitats. The species is euryhaline, inhabiting estuarine and coastal habitats to a depth of 40 m, generally in areas containing fine unconsolidated substrates of clay and mud. Juveniles are often associated with sea grass beds.

Round herring (*Etrumeus sadina*) is a pelagic marine species that occurs in depths of 50-150 m. The species usually schools and feeds on euphausiids and copepods.

Atlantic thread herring (*Opisthonema oglinum*) occurs in depths less than 37 m. Schools prefer shallow coastal waters and are found frequently in the upper 3 m of the water column. Adults follow inshore-offshore and north-south movements in response to changes in water temperature.

Spanish sardine (*Sardinella aurita*) occurs in the eastern Gulf of Mexico to depths of 30-40 m. Most are found in waters 5-20 m in depth. The species schools near the bottom during the day and becomes more dispersed in the water column at night.

Red drum (*Sciaenops ocellatus)* occurs in shallow estuarine waters and above the continental shelf to depths of about 40 m. Spawning occurs near the mouths of bays and inlets where pelagic larvae are transported into the estuarine nursery areas. Juveniles are associated with seagrass beds and marsh edge habitats in some areas, but they appear to use quiet, mesohaline (5-18 ppt) backwaters in others. Adults use the estuaries as habitat but as they age they spend more time offshore. Schools of large red drum are common.

Shallow-Water Reef Fish

Numerous species of shallow-water reef fish are distributed widely in the Gulf of Mexico. Adults typically use high and low relief hard bottom habitats, patch reefs, or sandy areas near reefs. After spawning, planktonic egg and larval stages can be found in the water column near reef locations. Larvae and early juveniles move into shallower areas and may enter the bays and sounds. Early juveniles may occupy habitats such as seagrass beds, marsh areas, shallow hard bottoms, or they may occupy waters around piers, jetties, or artificial structures. Late juveniles move into deeper waters and occupy habitats similar to adults. Some juveniles are closely associated with coral heads or crevices. Late juveniles and adults are typically demersal and are usually associated with nearshore habitats such as coral reefs, hard-bottom substrates, wrecks, or artificial structures on the shallower areas of the continental shelf.

Deep-Water Reef Fish

Deep-water reef fish include snappers, groupers, and tilefish. Snapper and grouper inhabit coral reefs, live and hard bottom habitats, submerged aquatic vegetation, artificial reefs, and medium to high profile outcroppings around the shelf break from shore to at least 183 m where the annual water temperature is sufficiently warm to maintain adult populations. Most eggs and larval stages are planktonic. Triggerfish, on the other hand, spawn benthic eggs in sandy depressions adjacent to hard bottom ledges. Tilefish are bottom dwellers that prefer clay and mud substrates and living in burrows at depths from 80 to 450 m. Most individuals, however, occur between 250 and 350 m.

Semi-Pelagic Reef Fish

Semi-pelagic reef fish include several species of jacks. The greater amberjack (*Seriola dumerili*) is pelagic and epibenthic as an adult. It occurs around reefs, oil and gas rigs, buoys, and irregular bottoms with high relief. As a juvenile, it is pelagic but attracted to floating debris and *Sargassum*. The adults occur to depths of 400 m.

Coastal Migratory Pelagics

Coastal migratory pelagics include mackerels, cero, dolphinfish, and cobia. Essential fish habitat includes sandy shoals of capes and offshore bars, coastal inlets, estuaries, high profile rocky bottom areas, barrier islands, and ocean-side waters from the surf to the shelf break. The occurrence of these species is affected by temperature and salinity. The species are seldom found in water temperatures less than 20^{o} C. Salinity preference varies, but the species generally prefer high salinity waters. Eggs and larvae are planktonic and concentrated in surface waters.

Oceanic Pelagic Fish

Oceanic pelagic fish include tunas, swordfish, and billfish. Most species primarily inhabit waters above the outer continental shelf and open ocean. Essential fish habitat includes oceanic fronts, river plumes, current boundaries, shelf edges, sea mounts, temperature discontinuities, and floating mats of *Sargassum*. Tuna and swordfish are capable of using deeper, lower temperature habitats than the istiophorid billfishes (marlin and sailfish). The life stages of all the species are found in salinities of 33-37 ppt. Eggs and larvae are generally concentrated in surface waters. The distribution and habitat used by the juvenile stages of each species are generally unknown due to their extreme rarity in scientific collections.

Small Coastal Sharks

Small coastal sharks include the Atlantic sharpnose shark (*Rhizoprionodon terraenovae)*, blacknose shark (*Carcharhinus acronotus)*, bonnethead (*Sphyrna tiburo)*, and finetooth shark (*Carcharhinus isodon)*. Small coastal species are generally distributed in coastal bays and estuaries. There is some evidence of spatial segregation. Adult female Atlantic sharpnose shark, for example, are usually found offshore while adult males and juveniles typically occupy coastal areas. Most species prefer warmer water temperatures of 20-34º C, but some species, such as bonnethead, are captured in water temperatures down to 15 °C.

Large Coastal Sharks

Large coastal sharks include the sandbar shark (*Carcharhinus plumbeus),* silky shark (*C. falciformis*), tiger shark (*Galeocerdo cuvieri),* blacktip shark (*C. limbatus)*, spinner shark (*C. brevipinna*), bull shark (*C. leucas*), lemon shark (*Negaprion brevirostris),* nurse shark (*Ginglymostoma cirratum*), scalloped hammerhead shark (*S. lewini*), great hammerhead shark (*S. mokarran),* and smooth hammerhead shark (*S. zygaena)*. Large coastal sharks are found in a wide variety of habitats. Bull sharks, for example, have been known to occur in freshwater while silky and smooth hammerhead sharks are more of an offshore, epipelagic species. Adults in many species are found offshore while juveniles occupy the inshore nurseries.

Pelagic Sharks

Pelagic sharks include the shortfin mako (*Isurus oxyrinchus)*, blue shark (*Prionace glauca)*, oceanic whitetip (*Carcharhinus longimanus)*, and thresher shark (*Alopias vulpinus)*. These tend to occupy habitats greater than 180 m. Pelagic sharks are generally found in water temperatures from 10-25°C, although mako sharks have been reported in temperatures as high as 27 °C. Studies using acoustic telemetry have indicated that some vertical migration of pelagic sharks occurs in the offshore habitat. Blue and mako sharks can occupy the upper water column at night and remain at depths of 100-500 m during the day.

Marine Turtles

Five species of sea turtles are known to inhabit the Gulf of Mexico: loggerheads (*Caretta caretta*), green (*Chelonia mydas*), Kemp's ridley (*Lepidochelys kempii*), hawksbill (*Eretomechlys imbricata*), and leatherback (*Dermochelys coriacea*); a sixth species, olive ridley (*L. olivacea*) may also occur in the Gulf. Loggerheads, greens, and Kemp's ridleys are the species most likely to nest on the beaches fringing the Gulf of Mexico. Beaches of the western Gulf, mainly in the Mexican state of Tamaulipas, are the only location in the world where Kemp's ridleys nest. Post-hatchlings of all species lead a pelagic oceanic life. Except for leatherbacks, juveniles thereafter reside mainly in the benthic neritic environment. Green turtles feed on worm reefs, sea grasses, and attached algae; they play a significant role in structuring the sea grass habitats. Hawksbills feed mainly on corals. Loggerheads and Kemp's ridleys primarily feed on crustaceans and mollusks. Leatherbacks feed on jellyfish. Poikilothermic sea turtles are documented to undertake long migrations.

Marine Mammals

The Gulf of Mexico LME is home to a diverse community of marine mammals. These include two endangered large whales: the Sperm Whale (*Physeter macrocephalus*) and a small population of Bryde's whale (*Balaenoptera edeni*). There are multiple stocks of bottlenose dolphins (*Tursiops truncatus*) occupying estuarine, coastal, and oceanic waters of the Gulf along with a broad suite of tropical and sub-tropical odontocete species. These include several species of beaked whales (*Mesoplodon sp.*), several delphinid species from the genus *Stenella*, and there are several pods of killer whales (*Orcinus orca*) that are routinely seen during assessment surveys.

The focus of SEFSC marine mammal research in the Gulf has been upon the oceanic community, with a particular emphasis on sperm whales. This research has primarily taken the form of large vessel assessment surveys designed to assess the abundance, spatial distribution, and habitat preferences of oceanic cetaceans. In addition, focused work has been conducted on sperm whales including behavioral and tagging studies designed to assess acoustic behaviors and potential impacts due to oil exploration activities. More recently, extensive research outside of NMFS has been funded by the Minerals Management Service to evaluate sperm whale habitat use and behaviors in the Northern Gulf of Mexico.

The major focus of SEFSC research goals in the Gulf of Mexico include continued assessment of the status of the sperm whale population, investigations into spatial distribution and habitats, and evaluation of the potential impacts of anthropogenic noise due to military and energy exploration activities. In addition, we have recently begun to conduct studies to improve our understanding of population size, population structure, and environmental stressors on bottlenose dolphins in nearshore coastal and estuarine environments. Finally, several harmful algal bloom (HAB) events have occurred in the western Gulf of Mexico in the last five years resulting in significant mortality events of bottlenose dolphins and other taxa. Capture-release studies have been conducted in the last two years to evaluate the health of localized bottlenose dolphin populations and their exposure to toxins from HABs.

Habitat Trends

Fishery related habitats in the northern Gulf of Mexico face a number of stresses and potential stresses from man-induced activities. Some applicable trends are discussed below:

Freshwater Quality and Quantity

Tidal creeks, bays, sounds, and inlets that form the estuaries of the Gulf are irreplaceable as nursery grounds for larvae and juvenile forms of mollusks, crabs, shrimp, and fish. The quantity and the quality of freshwater feeding the estuaries of the northern Gulf of Mexico, however, have declined in the past century. The decline is generally inversely proportional to population expansion, increased agricultural practices, and industrialization. For an estuary to function properly and within its natural capacity, an appropriate quantity and quality of freshwater from upland habitats are necessary. The pulsating and seldom constant flow of freshwater feeds and helps maintain the relative health of aquatic fauna and flora and other indigenous wildlife. But use and reuse of water for drinking, flushing, irrigation, manufacturing, and disposal by municipalities, agricultural operations, and industry have long degraded freshwater flows and similarly the quality of estuarine habitat.

Wetland Loss

The southeast has experienced a significant loss of wetlands through the decades. Marsh, seagrass, and mangrove habitats have been lost from man-induced activities such as residential construction and industrialization to more naturally occurring phenomena, such as a rise in sea level and the subsidence of land. Wetland degradation has also occurred due to diversions of freshwater for agricultural, domestic, and industrial uses, and through channeling, dredging, damming, ditching and the draining of rivers and their floodplains. Reductions in wetlands from 1780 to 1980 have been estimated at 60% in the U.S. Gulf region. Louisiana marshes in particular have experienced habitat loss rates that once approached 129 sq. km (50 sq. miles) per year. Between the mid-1950s and the mid-1970s, over one-third of Texas' 4,000 sq. km (1,544 sq. miles) of coastal marsh may have been lost. In Tampa Bay, Florida, more than 80 percent of the seagrass beds have been lost.

Diversion of Freshwater Flow

Wide-scale diversions of freshwater have created environmental degradation, particularly in large wetland habitats like the Everglades swampland in southern Florida. Traditionally, much of the region drained as a slow moving, shallow course, many kilometers wide but only a few centimeters deep. This broad, shallow plane of surface water passing through palustrine vegetation towards Florida Bay changed significantly in the early twentieth century when the prevailing sheet flow was channeled and drained for mosquito control and residential construction. Environmental degradation followed, and by the 1990s the effects of major habitat loss was apparent. In consequence, a multi-billion dollar, multi-decade restoration program was initiated to reverse the man-induced degradation.

Coastal Development

Human habitation, agriculture, and industrialization in or near wetland environments have consumed or significantly altered habitats used by aquatic organisms. Coastal properties, including wetlands, have long been sought for their beauty and commercial and recreational opportunities. But farms, homes, streets, buildings, cities, industries, bridges, tunnels, causeways, canals, jetties, shipping channels, and similar structures have altered the natural hydrologic flows as well as contributing to wetland loss. Coastal development has also greatly contributed to the content, toxicity and quantity of pollutants in aquatic systems as well as the deposition of sediments and nutrients, thus the quality and quantity of available wetlands. The effect of these has resulted in a coastal zone that significantly differs from the coastal zone of centuries past: less pristine, smaller, more polluted, and reduced in function for aquatic organisms.

Flood Control

A significant factor in the decline of anadromous fish worldwide has been the construction of dams on rivers and tributaries used by such fish for spawning grounds. Although most anadromous species spend the majority of their adult lives in salt water, they migrate into rivers and lakes to reproduce. Dams and weirs can inhibit their upward migration and restrict traditional spawning habitats. In 1991 the National Marine Fisheries Service and the U.S. Fish and Wildlife Service listed Gulf sturgeon (*Acipenser oxyrinchus desotoi*) as a threatened sub-species under the Endangered Species Act. Adult Gulf sturgeon primarily feed within the Gulf of Mexico and adjacent estuaries on bottom invertebrates such as brachiopods, insect larvae, mollusks, worms and crustaceans. Adults then return up the rivers to reproduce and spawn in deep freshwater over bottoms of clean rock and rubble. Unfortunately, dams have been constructed on the Pearl River in Mississippi, on the Alabama River in Alabama, and on the Apalachicola River in Florida within the range of Gulf sturgeon. These physically limit the use of upland freshwater habitats for reproduction, thus hindering population recovery.

Eutrophication

Dissolved nitrogen and phosphorus are the primary causes of eutrophication in freshwater and estuarine habitats in the northern Gulf of Mexico. The problem has plagued water quality in many aquatic areas of the nation for decades. Excessive nutrients over a long period of time entering freshwater runoff will typically lead to algal blooms: an abnormal and excessive growth of one or only a few species. Associated with algal blooms are: murkiness in the water column, death and the sinking of algae, decomposition and bacterial growth, significantly lowered dissolved oxygen, fish kills, and replacement of some species with others that are more tolerant to low concentrations of dissolved oxygen and high concentrations of phosphorus. The occurrence of eutrophication is often high along the eastern coast of the United States, having been observed in about 38% of the estuaries.

Hypoxia

When dissolved oxygen falls below about 2 ppm in a water system, the condition is called hypoxic. It is insufficient to support most fish and other aquatic animals. Hypoxia, however, is not necessarily restricted to freshwater and estuarine habitats. Large hypoxic, or low oxygen, zones annually occur above the continental shelf of the northern Gulf of Mexico in the region adjacent to the Mississippi and Atchafalaya River outflows. The likely cause of this phenomenon is an increased concentration of phytoplankton in nutrient-laden, turbid regions of water that have flowed into the Gulf from the Mississippi River. Analyses of sediments cored from the area of the shelf where hypoxia generally occurs indicate that algal production was significantly lower in the first half of the 20th century than in the latter half. This suggests that man-induced changes in phosphorus and nitrogen—likely through agricultural runoff and municipal disposal in the Mississippi River basin—may have significantly increased primary productivity thus the occurrence of hypoxic zones in the Gulf.

Habitat Research Needs

Scientifically sound guidance should be provided to resource managers and officials charged with managing, protecting, conserving, and restoring fishery habitat. Information is needed on habitat associations and on habitat quality and quantity. In general, managers need to know where habitat-species associations exist, the condition of various habitats and their associated species, and the best practices to employ to conserve or restore the habitat and thus its dependent species. Some general areas of research needs for are discussed below:

Monitoring of habitat condition

Estuaries are complex, dynamic habitats. The quantity and quality of freshwater entering the estuaries in the upland reaches as well as the quantity and quality of marine waters entering from the Gulf of Mexico are intrinsically associated with the distribution and composition of sediments, water quality, and fauna and flora. Expanded research into these associations is needed, along with a broad-scale monitoring of habitats to determine systemic changes and the relevance of best-use management practices. Similarly, the quality of nearshore, continental shelf, and deep water habitats in the Gulf need monitoring to ensure their relative health. The massive offshore petroleum industry that produces and the transportation industry that moves crude and refined products and similar hazardous materials constitute perennial risks that could harm water quality, particularly during an accidental spill.

Ecosystem structure and function and linkages to large marine habitats

Expanded research is needed into the physical, chemical, and biological aspects of estuaries and marine habitats as they relate to the function of indigenous plants and animals. Linkages among physical, chemical, and biological parameters are complex, yet vital to understanding the fundamental processes that sustain life and healthy ecosystems.

Managed species dependence on habitat types, quantity and quality

Certain marine invertebrates and fish are singled out by society because of their commercial, recreational, or ecotourism value. The dependence of these species on various habitats in the Gulf of Mexico, particularly during their vulnerable early life stages, needs enhanced study to delineate critical associations, characteristics, and functions.

Habitat delineation and mapping

An enhanced, integrated system of categorizing and mapping broad habitat categories and subcategories in the Gulf of Mexico would provide managers with a useful tool for evaluating and monitoring broad scale biological, hydrological, meteorological, and geological resources. Expanded research, development, and ground truth are needed for the Gulf of Mexico large marine ecosystem. Detailed mapping of habits and their use could also provide a resource for public education and help in disaster assessment and recovery.

Human impacts on fishery production

The impact of humans on fishery production is the primary stressor on fishery stocks in the northern Gulf of Mexico. Many important fishable species are over fished and are not at a sustainable population level. Expanded research, especially targeting transboundary species, is needed throughout the Gulf of Mexico large marine ecosystem. Over harvesting can also impact the productivity of Gulf off Mexico habitats by causing large-scale disruptions in trophic relationships among levels of flora and fauna. Harvesting of commercially and recreationally important species needs constant monitoring and analysis to prevent the likelihood of population depletion.

Restoring fishery-related habitats

Many impaired habitats important to fisheries, particularly those occurring within the estuaries, can be restored or improved with technology. Expanded research is needed to assess existing technologies and develop new cost-effective technologies for habitat building and restoration.

Coral reef research

Corals and coral reefs are resources of particular concern. They are used as habitat by numerous species of flora and fauna, and they support ecotourism and commercial and recreational fishing. They are also extremely vulnerable to over harvesting by humans; physical damage by ships and hurricanes; and changes in water-quality and temperature. There is an ongoing need, therefore, to expand the base of knowledge relating to coral research, understanding, and protection, particularly for deep water corals.

Identify essential habitat for pelagic fish

The range, life cycle and associated habitats of pelagic fish are not well described. Yet these species are largely fished throughout the Gulf of Mexico. Moreover, many of the species are transboundary and harvested by more than one nation. Expanded research is needed to describe and monitor critical habitat requirements for each species.

Economic and sociological benefits of conserving and restoring critical habitats

Economic and sociological implications of conserving, restoring, and managing estuarine and marine habitats are not well known. Expanded research into these associations is needed to augment traditional biological, fishery, and ecological lines of research.

Seagrass community monitoring

Seagrass is of particular importance in the nearshore communities of the Gulf of Mexico. Some researchers have described seagrass communities as the marine equivalent of tropical rainforests. Seagrass is valuable for its habitat value, and it is valuable as a general indicator of water quality. Estimates of seagrass production can reach 10 tons of leaves per acre per year. It provides food, habitat, and nursery areas for important vertebrate and invertebrate organisms. An acre of seagrass, for example, can provide habitat for as many as 40 thousand fish and 50 million small invertebrates. It is sensitive to changes in water quality, and therefore it reflects the general health of the particular coastal ecosystems. Unfortunately, major storms, excessive herbivore grazing, diseases, pollution, water clarity, excessive nutrients in runoff, sedimentation and propeller scarring are serious threats to seagrass communities. Constant mapping and monitoring of the health of seagrass communities in the Gulf of Mexico would provide important bench marks as well as means for determining overall shifts in ecosystem health.

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Background for the Transboundary Diagnostic Analysis

Ecosystem Health. Part 2 – Pollution and Ecosystem Condition –Existing and Proposed Approaches

Associated with the Gulf of Mexico Large Marine Ecosystem

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Office of Research and Development

Pollution and Ecosystem Condition –Existing and Proposed Approaches
Gulf of Mexico Large Marine Ecosystem

Introduction

Since 1991, U.S. Federal Agencies (U.S. EPA, NOAA, USGS) have conducted surveys (annual, occasional, probabilistic, targeted, biological, fisheries, chemical, water quality, etc.) to assess the ecological condition of the Gulf of Mexico Large Marine Ecosystem, particularly, estuaries, nearcoastal watersheds, near coastal shelf waters. These assessments have included a characterization of the environmental stressors affecting the water, sediment, habitat and biotic condition of the GOM LME. These surveys have included all five U.S. states – Florida, Alabama, Mississippi, Louisiana and Texas – and U.S. coastal waters adjacent to these states. Environmental, ecological, and biological data are available for regions showing the changes in environmental stressors from 1991 through 2006 as well as changes in overall ecological condition. The largest and most consistent of these surveys have been the National Coastal Assessment, jointly reported by EPA, NOAA and DOI, including:

- EPA's Environmental Monitoring and Assessment Program (EMAP)– Probabilistic assessment of the ecological condition of estuaries in the US (including the GOM LME)
- NOAA's Fisheries Surveys – Targeted and probabilistic surveys of fish stock condition (and expanded in 2000 to include environmental stressor information throughout the US (including the GOM LME)
- NOAA's Status and Trends Surveys (NS&T) – Targeted surveys to assessment bioavailable contaminants throughout the US (including the GOM LME)
- USGS's National Water Quality Assessment (NAWQA) – Targeted assessments by watershed to determine condition and causes of degradation in key watersheds throughout the US (including those delivering water to the GOM LME)
- DOI's National Wetland Inventory (NWI) – Survey of aerial/satellite information to ascertain the acreage of US wetlands (including those adjacent to the GOM LME)

In 2000, collaborations between the U.S. EPA and the Mexican state of Veracruz resulted in similar information to that collected in the US by EMAP being collected for the estuarine and coastal resources of Veracruz. At that time, monitoring plans were developed for further condition surveys in Tamaulipas, Tabasco, Campeche, Yucatan and Quintana Roo but these surveys were never conducted.

In the first three National Coastal Condition Reports (USEPA 2001a, 2004, 2006), the condition of our nation's coasts was assessed using data provided by the above listed surveys.

Why Be Concerned about Coastal Condition?

It is important to periodically update our assessments of coastal condition of the Gulf of Mexico LME because our nations' coasts (US, Mexico and Cuba) are valuable and productive natural ecosystems. Coastal waters are productive and diverse, including estuaries, coastal wetlands, coral reefs, mangrove forests, and upwelling areas. Critical coastal habitats provide spawning grounds, nurseries, shelter, and food for finfish, shellfish, birds, and other wildlife. Our coasts also provide essential nesting, resting, feeding, and breeding habitat for 85% of waterfowl and other migratory birds.

Because a disproportionate percentage of the population of US, Mexican, and Cuban states bordering the GOM LME lives in coastal areas, the activities of municipalities, commerce, industry, and tourism have created environmental pressures that threaten the very resources that make the coast desirable. Population pressures include increased solid waste production, higher volumes of urban nonpoint runoff, loss of green space and wildlife habitat, declines in ambient water and sediment quality, and increased demands for wastewater treatment, irrigation and potable water, and energy supplies. Development pressures have resulted in substantial physical changes along many areas of the coastal zone. Coastal wetlands continue to be lost to residential and commercial development, while the quantity and timing of freshwater flow, critical to river and estuarine function, continue to be altered. In effect it is the same human uses that we expect of our coastal waters that have the potential to lessen their value. Below, we report on the Indicators of Coastal Condition that gauge the extent to which coastal systems within the GOM LME have been altered.

Indices of Coastal Condition

Data from these programs are used to evaluate overall coastal condition in the US portion of the GOM LME using five primary indices: water quality, sediment quality, biotic (benthic) condition, coastal wetland acreage, and fish tissue contaminants. It is proposed that these five indices become adopted as the indices used to ascertain the magnitude of environmental stress and the ecological condition of the coastal resources of the Gulf of Mexico LME. These indices do not address all characteristics of estuaries and coastal waters that are valued by society, but they do provide information on both ecological condition and human use of estuaries.

Water Quality Index

This index is based on five indicators; the nutrients phosphorus and nitrogen, chlorophyll, water clarity, and dissolved oxygen. Some nutrient inputs to coastal waters are necessary for a healthy, functioning coastal ecosystem. When nutrients from various sources such as sewage and fertilizers are introduced into coastal waters, the concentration of available nutrients will increase beyond natural background levels, resulting in a process called eutrophication, which may result in a host of undesirable conditions. Excess nutrients can lead to excess primary production and thus to increased chlorophyll, which in turn can decrease water clarity and, upon decay, lower concentrations of dissolved oxygen.

Numerically the Water Quality Index is the mean of ratings among each of these five indicators. (Each index component has been rated as Poor, Fair or Good based on specific criteria). If two or more components for a site are rated poor, the Water Quality Index for that site is rated Poor. The Index rating is Fair if only one component is rated as poor or two or more components are rated as fair. The site is rated as having a good water quality index if no components are rated as poor and no more than one component is rated as fair. The details of the five components to the Water Quality Index are:

(1) *Water Clarity*: Clear waters are valued by society and contribute to the maintenance of healthy and productive ecosystems. Light penetration into estuarine waters is important for submerged aquatic vegetation, which serves as food and habitat for the resident biota. EMAP-Estuaries (EMAP-E) estimates water clarity using specialized equipment that compares the amount and type of light reaching the water surface to the light at a depth of 1 meter. Water clarity varies naturally among various parts of the GOM LME so the indicator (WCl) is based on a ratio to a reference condition whereby; WCl= (Observed Clarity at 1m)/(Reference Clarity at 1 m). A station is rated as either poor, fair, or good for water clarity depending on whether the WCl ratio is <1, 1-2, or > 2, respectively. Reference conditions for much of the Gulf of Mexico LME coastal waters is 10% of incident light observed at a depth of one meter. Variations for this norm would be to 5% for areas naturally experiencing high levels of turbidity and 20% for areas with significant submerged aquatic vegetation beds or active SAV restoration programs. Specifics regarding the calculation and use of the WC1 indicator can be found in Smith et al. (2006).

(2) *Dissolved Oxygen*: Dissolved oxygen (DO) is a fundamental requirement for all estuarine life. A threshold concentration of 4 to 5 ppm (5 parts of oxygen per million parts of water) is used by many states to set their water quality standards. Concentrations below approximately 2 ppm are thought to be stressful to many estuarine organisms (Diaz and Rosenberg, 1995; U.S. EPA, 2000a). These low levels most often occur in bottom waters and impact the organisms that live in the sediments. Low levels of oxygen (hypoxia) or lack of oxygen (anoxia) often accompany the onset of severe bacterial degradation, sometimes resulting in the presence of algal scums and noxious odors. However, in some estuaries, low levels of oxygen, at least periodically, are part of the natural ecology. Therefore, while it is easy to show the conditions of the nation’s estuaries concerning oxygen concentrations, it is difficult to interpret whether the observed effects are the result of natural processes or human intervention. The DO index is rated Poor if the concentration is less than 2ppm; Fair if the concentration is in the range of 2-5 ppm; and, Good if it exceeds 5 ppm.

(3) *Dissolved Inorganic Nitrogen (DIN)*: Surface concentrations of DIN: Poor > 1 mg/l, Fair 0.5-1.0 mg/l, Good < 0.5 mg/l [Because of their unique sensitivity to nutrient enrichment, the critical concentrations for tropical systems (Florida Bay, Mexican estuaries and Cuban estuaries) would be rated poor for DIN> 0.5 mg/l, fair for DIN of 0.1-0.5 mg/l and Good for DIN < 0.1 mg/l.]

(4) *Dissolved Inorganic Phosphorus (DIP)*: Surface concentrations of DIP: Poor >0.1 mg/l, Fair 0.01-0.1 mg/l, and Good < 0.01 mg/l [The exception would be tropical systems (Florida Bay, Mexican estuaries and Cuban estuaries) where a rating of poor would correspond to DIP > 0.05 mg/l; fair is DIP of 0.005-0.05 mg/l; and, good is DIP < 0.005 mg/l.]

(5) *Chlorophyll a*: Surface concentrations of Chl a: Poor > 40 ug/l, Fair 20-40 ug/l, Good < 20 ug/l (Regional exceptions would be for tropical ecosystems (Except tropical systems (Florida Bay, Mexican estuaries and Cuban estuaries) where Poor rating corresponds with Chl a > 1 ug/l; Fair rating with Chl a of 0.5-1 ug/l; and, a Good rating with Chl a <0.5 ug/l.]

Sediment Quality Index

Physical and chemical characteristics of surface sediments are the resultant of interacting forces controlling chemical input and particle dynamics at any particular site. In terms of coastal condition, the interest is in the potential for sediments to be toxic to bottom dwelling organisms. The Sediment Index is based on three lines of evidence; direct measures of toxicity, sediment chemistry, and the total organic carbon concentration. A standard direct test of toxicity that has been applied at thousands of sites is to measure the survival of amphipods (commonly found shrimp-like benthic crustaceans) exposed to sediments for ten days under laboratory conditions (EPA 2001b). As in all tests of toxicity to control affects unrelated to the test sediment, survival is measured relative to that of amphipods exposed to reference sediment. There are no absolute chemical concentrations that correspond to sediment toxicity but effects range low (ERL) and effects range medium (ERM) values are used as guidelines (Long et al. 1995). The ERM is the concentration of a contaminant that will result in sediment toxicity approximately 50% of the time based on literature studies. A more protective indicator of contaminant concentrations is the ERL criterion, which is the concentration of a contaminant that above which toxicity is less than 10% likely. Lastly, in areas where there is a considerable deposition of organic matter sediment can be made toxic just on the basis of its organic content. The sediment quality index is determined to be poor at a site if one of on components is rated poor; fair if no components are rated poor and the sediment contaminants component is rated fair; and, good if no components are rated poor and the sediment contaminants component is rated good. The numeric criteria for rating the components of the Sediment Index are:

(1) *Sediment Toxicity*: A poor rating is the result of testing (10-day static Ampelisca test) showing survival < 80% (adjusted for test reference); a fair rating is the result of testing of 80-90%; and a good rating results for testing showing greater than 90% survival.

(2) *Sediment Total Organic Carbon (TOC)*: A site is determined to be rated poor if TOC concentration on a dry-weight basis is greater than 5%; rated fair if 2-5%; and rated good if less than 2%.

(3) *Sediment Contaminants*: A site is rated as poor if the concentration of any contaminant is equal to or greater than the ERM guidance concentration; rated fair if no contaminant concentrations exceed the ERM concentrations and if ERL concentrations are exceeded for five or more contaminants; and, rated as good if no ERM concentrations are exceeded and less than 5 ERL concentrations are exceeded.

Benthic Index

The worms, clams, and crustaceans that inhabit the bottom substrates of estuaries are collectively called benthic macroinvertebrates or benthos. These organisms play a vital role in maintaining sediment and water quality and are an important food source for bottom feeding fish, shrimp, ducks, and marsh birds. Benthos is often used as indicators of disturbances in estuarine environments because they are not very mobile and thus cannot avoid environmental problems. Benthic population and community characteristics are sensitive indicators of contaminant and dissolved-oxygen stress, salinity fluctuations, and disturbance and serve as reliable indicators of estuarine environmental quality. US EPA, through its EMAP Program, developed a benthic index of environmental condition for GOM LME estuaries that incorporates changes in diversity and populations of indicator species to distinguish degraded benthic habitats from undegraded benthic habitats (Engle and Summers, 1999; Engle et al., 1994). This index reflects changes in benthic community diversity and the abundance of pollution-tolerant and pollution-sensitive species. A high benthic index rating for benthos means that samples taken from an estuary's sediments contain a wide variety of species, a low proportion of pollution-tolerant species, and a high proportion of pollution sensitive species. A low benthic index rating indicates that the benthic communities are less diverse than expected, are populated by more than expected pollution-tolerant species, and contain fewer than expected pollution sensitive species. New regional indices could be developed for GOM LME waters in Mexico and Cuba. Indices may vary with region because species assemblages depend on prevailing temperatures and the mud content of sediments. The Benthic Index for each site in the US portion of the GOM LME is rated as

(1) Poor if the benthic index score is less than 3.0

(2) Fair if the benthic index score is between 3.0 and 5.0

(3) Good if the benthic index score is greater than 5.0.

Coastal Habitat Index

Coastal wetlands are the vegetated interface between aquatic and terrestrial components of estuarine ecosystems. Wetland habitats are critical to the life cycles of fish, shellfish, migratory birds, and other wildlife. These habitats also filter and process residential, agricultural, and industrial wastes, thereby improving surface water quality. Wetland habitats also buffer coastal areas against storm and wave damage. An estimated 95% of commercial fish and 85% of sport fish spend a portion of their life cycles in coastal wetland and estuarine habitats. Adult stocks of commercially harvested shrimp, blue crabs, oysters, and other species throughout the United States are directly related to wetland quality and quantity (Turner and Boesch, 1988). Wetlands throughout the United States have been and are being rapidly destroyed by human activities (e.g., flood control, agriculture, waste disposal, real estate development, shipping, commercial fishing, oil/gas exploration and production) and natural processes (e.g., sea level rise, sediment compaction, droughts, hurricanes, floods).

Data on wetland acreage are available for all U.S. states bordering the GOM LME for the 1780s (estimated), mid 1970s through 2000 (surveyed). A habitat indicator has been developed that averages the historical rate of decadal wetlands loss from 1780 through 1990 and the recent decadal wetland loss (1990-2000). This loss rate acknowledges the long-term loss but emphasizes the near-term (recent decade) loss rates. This use of quantity of habitat is the only indicator element that can be consistently used, at present, for the U.S. portion of the GOM LME. It is unclear whether similar quantity estimates (at least for the most recent decade) can be compiled for the Mexico and Cuba portions of the GOM LME. There are efforts in the U.S. to develop functional measures of wetland habitat that may be available by 2010. The present habitat index is rated as:

(1) Poor if the index is greater than 1.25 (i.e. average of historical and recent decadal loss rates is greater than 1.25% per decade)

(2) Fair if the index falls between 1.00 and 1.25

(3) Good if the index is less than 1.0

Fish Contaminants Index

Chemical contaminants may enter a marine organism in several ways—direct uptake from contaminated water, consumption of contaminated sediment, or consumption of previously contaminated organisms. Once these contaminants enter an organism, they tend to remain in the animal tissues and so may build up with subsequent feedings. When fish consume contaminated organisms, they may "inherit" the levels of contaminants in the organisms they consume. This same "inheritance" of contaminants occurs when humans consume fish with contaminated tissues. Contaminant residues are examined in target fish and shellfish species and are compared to Food and Drug Administration (FDA) criteria, international standards, and EPA Guidance Values

The FDA and international criteria have some limitations, as these values were developed to protect the average consumer from contaminated fish and shellfish sold in interstate commerce. These criteria are not intended to be protective of recreational, tribal, ethnic, and subsistence fishers who typically consume larger quantities of fish than the general population and often harvest the fish and shellfish they consume from the same local water bodies repeatedly over many years. EPA has developed more stringent screening values to protect consumers from contaminants in non-commercial fish (e.g., recreational and subsistence) based on a human health risk assessment methodology that sets specific guidance value range for concentrations of tissue contaminants in relation to consumption rates (U.S. EPA, 2000b,c). This EPA methodology is currently used by most states to identify water bodies where contaminant levels in locally caught fish may pose human health risks. The fish contaminants index for a site is rated as:

(1) Poor if any contaminant exceeds the maximum value range of the Guidance criteria for risk-based consumption associated with four 8-ounce meals per month (EPA 2000c)

(2) Fair if any contaminant fall within the range of the Guidance criteria for risk-based consumption associated with four 8-ounce meals per month (EPA 2000c)

(3) Good if all contaminant concentrations fall below the minimum value of the range of the Guidance criteria for risk-based consumption associated with four 8-ounce meals per month (EPA 2000c)

Combining Indices to Assess Regional and Overall GOM LME Condition

Overall condition for each regional area (U.S., Mexico, or Cuba) of the Gulf of Mexico LME can be calculated by summing the regional scores for the five indicators and dividing by 5, where good = 5, fair = 3, and poor = 1. The U.S. estuarine portion of the GOM LME, for example in 2000, received the following scores:

Water Quality Index = 3.0 (Fair)
DIN = Good
DIP = Fair
Chlorophyll a = Fair
Water Clarity = Poor
Dissolved Oxygen = Good
Sediment Index = 1.0 (Poor)
Sediment Contaminants = Good
Sediment Toxicity = Poor
Sediment TOC = Good
Coastal Wetland Loss = 1.0 (Poor)
Benthic Index = 1.0 (Poor)
Fish Tissue Contamination = 5.0 (Good)
Total Score = 11.0
Overall Score =Total Score/5 = 2.2 (Fair to Poor)

To create the total Gulf of Mexico LME index scores, a weighted average for each of the five indicators would be calculated based on the percent area contributed by each geographic area (e.g., for estuaries, the percentage of total estuarine area in each component of the GOM LME system – United States, Mexico and Cuba). For example, the weighted average for the water quality index for the GOM LME would be calculated by summing the products of the three regional water quality index scores and the area contributed by each region. The overall Gulf of Mexico LME score would then be calculated by summing each COM LME index score and dividing by five.

Characterizing coastal areas using each of the five indices involves two value determinations. The first value is the definition of “poor” for an indicator at a site of measurement. The definition of poor condition for each indicator is based on existing criteria, guidelines, or interpretation of scientific literature. For example, dissolved oxygen conditions are considered poor if dissolved oxygen concentrations are less than 2 ppm (2 parts of oxygen per million parts of water). This value is widely accepted as representative of hypoxic conditions, so this benchmark for poor condition is strongly supported by scientific evidence (Diaz and Rosenberg, 1995; U.S. EPA, 2000a). The second determination is how widespread a “poor” condition must be to result in a poor rating for an area (e.g., U.S. Portion of the GOM LME) as measured by the index. For example, in the U.S. National Coastal Assessment in order for an area to be rated as poor with regard to the water quality index, more than 20% of a coastal area must have water quality conditions that are rated as poor. These regional of GOM LME-wide percent areas for each indicator or index are value judgments and would be largely determined by surveying environmental managers, resource experts, and the knowledgeable public when direct scientific evidence is not available.

Future needs

Constructing a Gulf of Mexico LME-wide Survey Network and Assessment

A program similar to that described above has existed in the U.S. portion of the LME since 2000 with annual surveys being conducted to ascertain condition of the coastal resources of Florida, Alabama, Mississippi, Louisiana and Texas as well as the near-coastal shelf waters adjacent to these states. Starting in 2007, a five-year rotating survey of coastal ecosystem condition will be undertaken in the U.S. portion of the GOM LME. This survey, beginning in 2010 (and following every five years afterward), will be conduct by the U.S. EPA to collect the above-described information. Annual surveys of offshore fisheries stocks and ancillary environmental stressor data similar to that described above will be conducted by NOAA in the GOM LME region.

A similar survey was conducted in the Mexican state of Veracruz in 2002 and the results of that survey will be published in 2007. Similar surveys were designed for Tamaulipas, Tabasco, Campeche, Yucatan and Quintana Roo; however, none of these surveys was executed. No surveys of this type have been undertaken in western Cuba.

The construction of a Gulf of Mexico LME-wide monitoring network for the indices described in this report will address several of the high importance needs of the GOM-LME Program determined at the National Experts Workshop in Merida, Mexico on August 22-23, 2006. Establishment of this network (which already exists on the US side of the LME and is anticipated for the Mexican coast of the LME) will provide needed information for three of the five priority transboundary issues – 1) Moving from single species to ecosystem-based management (Fish and Fisheries), 2) Eutrophication and HABs (Productivity), and 3) Habitat modification (Pollution and Ecosystem Health). It is clear from discussions at this meeting that Mexico’s National Expert contingent agrees that a Mexican LME monitoring system needs to be developed and supports its development in a way that will complement the existing US monitoring program. No discussion or evaluation of the potential of such a system was completed for the Cuban coast of the LME. Further effort is needed to ascertain the extent of additional existing environmental stressor and condition information that might be used to develop a consistent picture of the coastal resources in the GOM LME.

Reporting Ecosystem Condition and Pollution Stressor Levels

The purpose of a GOM LME Condition Report would be to present a broad baseline picture of the condition of estuaries across the LME and, where available, snapshots of the condition of coastal waters associated with the U.S., Mexico and Cuba portions of the LME. This report would use currently available data sets to discuss the condition of the nation’s coasts. This report would not be intended to be a comprehensive literature review of coastal information. This report would serve as a useful benchmark for analyzing the progress of coastal programs in the future and will be followed in subsequent years by reports for more specialized coastal issues. It would also serve as a reminder of the data gaps and other pitfalls that we are constantly faced with and must try to overcome in the future in order to make more reliable assessments of how the condition of our nation’s coastal resources may be changing with time.

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Background for the Transboundary Diagnostic Analysis

Productivity

Associated with the Gulf of Mexico Large Marine Ecosystem

August 2006

Prepared by the:
Southeast Fisheries Science Center
National Oceanic and Atmospheric Administration

The Gulf of Mexico is traditionally considered an oligotrophic system. However, Coastal Zone Color Scanner (CZCS) and MODIS satellite data indicates that this basin undergoes pronounced seasonal variation in production driven by stability of the water column in the summer, and convective cooling and stronger winds in the winter (Gonzalez et al. 2000). Circulation patterns in the GoM are driven by the Loop Current in which water enters the Gulf through the Yucatan Channel and exits through the Straits of Florida. In addition, wind stress, river discharge, and topography play an important role in shelf circulation on many scales. The inner shelf flow in the Gulf of Mexico is typically wind-driven with contributions of buoyancy forcing by river discharge, except around the Yucatan Channel where geostrophic current-induced upwelling prevails. The outer shelf circulation patterns are driven by mesoscale processes, which include large (200-300 km) warm core rings generated by the Loop current and smaller (60-110 km) cold core rings.

Differences in production in offshore and inshore waters reflect these circulation patterns, and there is close coupling of the biological and physical variability (Wiseman et al., 1999). While the warm Caribbean waters of the Loop Current are oligotrophic, the shelf waters are considerably more productive becoming eutrophic in some regions. The inner shelf coastal waters are impacted by major inputs of river nutrients, nutrient laden runoff from agriculture areas, and periodic upwelling from deep nutrient rich water driven by both wind and circulation events. The nutrient inputs from freshwater discharge have had a profound effect in the northern Gulf of Mexico. These effects include decreased Oxygen, increased phytoplankton production, and an altering of the ecosystem in the area impacted. Rabalais et al. (2002) suggest that there is evidence from long term data sets of the Mississippi River that inorganic nitrogen loads over the last 50 years are highly correlated with indicators of increased productivity resulting in a general eutrophication of the adjacent continental shelf waters.

Outer shelf productivity is extremely variable reflecting the movement of mesoscale gyres and resulting temperature and salinity fronts, periodic upwelling, seasonal flooding and large-scale wind events. Offshore, highly productive areas may be found at temperature fronts along the edge of Loop Current and warm core rings, and upwelling produced by cold core cyclonic gyres. This is reflected in the large variation in phytoplankton and zooplankton abundance as well as long-line tuna catch – on the scale of as little as 10 km. One measure of the variability of this system is the composition and abundance of ichthyoplankton measured in the annual larval bluefin tuna cruises dating from 1977. Most of this database is restricted geographically to the northern Gulf but the variability in phytoplankton, ichthyoplankton, and other zooplankton abundance on the shelf and pelagic environment is evident both on an annual and decadal scale, as well as spatial scales as small 10 km as noted above. Unfortunately, neither the biological and/or physical processes that drive production in the Gulf of Mexico, nor the circulation have been quantified. Absent such knowledge management decisions are based on professional judgment rather than quantifiable defensible scientific information. The restriction of these surveys to the northern Gulf of Mexico has hindered developing an understanding on a basin scale.

Lohrenz et al. (1999) provide more information on what controls primary production in this LME. Overall, the Gulf of Mexico Large Marine Ecosystem (LME) is considered a Class II, moderately productive (150-300 gC/m2-yr), ecosystem based on SeaWiFS global primary productivity estimates. However, the productivity of the LME is complex given the above described circulation patterns and that productivity varies considerably both spatially and temporally. Understanding this variability and its impact on living marine resources is a high priority for sustainable management of this LME

To address these knowledge gaps on a basin wide scale requires an integrated ecosystem assessment of the Gulf of Mexico. Such an assessment should be focused upon the parameters regulating primary and secondary production, larval transport and the overall recruitment process. These kinds of studies are essential to the long-term sustainability of fish populations in the Gulf of Mexico and require an ecosystem-based approach to LME's. Data needs include as long term physical oceanography studies to measure variability along the shelf and the deeper basins. These include current meter/ADCP measurements, synoptic CTD's satellite observation and general circulation studies. Of particular interest is the complex interaction at the Yucatan channel and the formation of mesoscale gyres on both the northeast and west sides of the channel, as well as the gyre often found off the southwest coast of Cuba in the Caribbean Sea. These gyres forming to the north often translate along the Loop current in to the northern Gulf of Mexico, though some which form off the northern Yucatan drift west and northwest into the western Gulf. As these gyres move north or west they affect circulation patterns and Loop current Flow (Cherubin, 2006). The impacts of these gyres and potential larval transport mechanisms into the northern Gulf of Mexico and the Florida Keys have been the focus of several research efforts (Lamkin, 1996, Lee, 1994). The Tortugas Gyre which influences circulation and larval distribution in south and southwest Florida is thought to originate in the Yucatan Channel (Cherubin, 2006, Lee, 1994). It has been suggested that the gyre located to the southwest of Cuba may strongly influence the transport of Lobster larvae into the Gulf and the Florida Keys. This strong body of research indicates that the cyclonic and anticyclonic gyres play a significant role in the biological and physical processes' in the Gulf of Mexico.

Another data need is long term monitoring of phytoplankton and zooplankton. This data would provide an ecosystem measurement on both annual and decadal scales, and provide input to population models of several commercially important species. International participation in the Southeast Area Monitoring and Assessment Program (SEAMAP) is a high priority (See below for a description of the SEAMAP program). Long term monitoring of this sort is valuable for recruitment studies and population assessments, but also as an indicator of climate impacts.

Finally the need for the biological and physical oceanographic studies and monitoring to be conducted in an interdisciplinary, integrated fisheries oceanography context is paramount. The data needs described above are important efforts that will provide management tools, but their usefulness is enhanced if the work is coordinated between disciplines and nations.

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Background for the Transboundary Diagnostic Analysis:

Socio-Economics

Associated with the Gulf of Mexico Large Marine Ecosystem

August 2006

Prepared by the:
Southeast Fisheries Science Center
National Oceanic and Atmospheric Administration

The Gulf of Mexico LME is a major asset to the three surrounding countries, in terms of fisheries, tourism, agriculture, oil, trade and shipping (see Cato and Adams, 1999).

Commercial fishing is an important component of the LME's economy. In 2004, commercial fishermen at Gulf ports in the USA landed 1.5 billion pounds of fish and shellfish worth approximately $667 million (NMFS 2005). The US Gulf region contains one-fourth of the U.S. seafood processing and wholesale establishments.

Marine sport-fishing is another industry of regional importance, providing jobs and recreational activities. Approximately 30% of the estimated recreational fishing trips taken in the U.S. in 2003, occurred in the Gulf of Mexico (NMFS 2004). In 1999, anglers spent nearly 4 billion dollars to fish in the GOM. These expenditures generated 3.5 billion dollars in sales, over 1.5 billion dollars in income, and supported over 50 thousand jobs (Steinbak et al., 2004).

Species of economic importance within Mexico's jurisdiction of the Gulf of Mexico LME include brown shrimp, white shrimp, pink shrimp, octopus, red grouper, and the brackish water clam. Octopus is currently being exploited by an artisanal fleet, and by a middle-sized fleet (see Solis et al., 1995).

In the USA, the infrastructure for oil and gas production in the Gulf of Mexico, including oil refineries, petrochemical and gas processing plants, supply and service bases for offshore oil and gas production units, platform construction yards and pipeline yards, is concentrated in coastal Louisiana and eastern Texas. Oil production has an impact on other environmental and economic resources. The Gulf of Mexico LME contains major shipping lanes. Port facilities contribute to important sources of employment. The volume and value of shipping has increased in the Gulf region (see Cato and Adams, 1999). Population along the US coast increased by 52% between 1970 and 1990, and is currently around 4 million people.

Socioeconomic aspects of a transboundary problem arise when there are disputes or disagreements over the historical usage of natural resources that are shared by more than one political entity. Hence, the transboundary problem falls into the realm of political economy in which negotiated solutions may not always follow directly from the results of quantitative economic models. Economic and social disruptions may occur when usage patterns change over time due to regulatory, environmental or economic conditions. From an economic perspective, total economic value is maximized when the extra value gained by one sector from a greater level of resource use is just equal to the loss of economic value for other sectors due to their corresponding smaller levels of resource use. From an analytical and management perspective, the list of competing uses for ecosystem resources includes conservation of a portion of the resource to insure a sustainable flow of ecosystem services into the future, as well as the traditional commercial and recreational uses.

The objective for economic research about transboundary issues in the Gulf of Mexico LME is to develop the information, methods and models required to estimate the gains or losses to user groups when use patterns change due to environmental, regulatory or economic conditions. The first research priority is to describe the different historical uses of the resources in the LME and the user groups who benefit from current use patterns. This task includes the identification of the resources and ecosystem services that are provided by the LME, the association of various user groups with each resource and/or ecosystem service, and a determination of whether resource use by each group precludes resource usage by other groups.

The next priority for economic research is to assess the benefits that accrue to the various user groups from the current uses of LME resources and/or ecosystem services. The economic value generated by resource usage is measured as a net benefit (or value added) rather than gross revenues or consumer expenditures. Hence, this task includes the collection of data about numbers of individuals or business entities that use each resource or ecosystem service, the gross value of products produced from the LME resources by each user group, and the costs of production.

The third priority for economic research is to estimate the gains and/or losses that accrue to user groups when use patterns change. This task includes the estimation of economic relationships such as demand curves, production functions, and recreational benefit functions that describe the productivity and value of each resource use, such as commercial and recreational fishing activities, and enable the development of better economic models with which to evaluate proposed management alternatives.

Socio-cultural information and models are needed to describe the effects of fishery regulation on the lifestyles, social networks and communities of the various groups that use LME resources and ecosystem services. Socio-cultural research is especially important when changes in use patterns result in large-scale redistribution of benefits among different user groups. The first priority for socio-cultural research is to assemble and characterize basic social information from secondary sources, such as the U.S. Census Bureau. The second priority is to collect primary data about lifestyles and social networks via interviews with members of the various user groups.

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Background for the Transboundary Diagnostic Analysis:

Governance

Associated with the Gulf of Mexico Large Marine Ecosystem

August 2006

Prepared by the:
Southeast Fisheries Science Center
National Oceanic and Atmospheric Administration

A project proposal has been developed for this LME by marine resource experts from Mexico, Cuba and the United States. The result will be a Transboundary Diagnostic Analysis and Strategic Action Programme. Its objective is to enhance national and regional efforts to address top priority environmental and living resource issues in the LME. A new approach is needed in order to conserve the living resources and habitats of this LME, as well as protect it from pollution. Legal, policy and institutional reforms will be developed to address the major threats to ecosystem sustainability. There is no current institutional arrangement for cooperation between the 3 countries. For more information on management and governance, see Kumpf, Steidinger and Sherman (1999).

Organizations for Gulf of Mexico Stock Assessment Research and Management

Gulf of Mexico Fishery Management Council

The Gulf of Mexico Fishery Management Council (GMFMC) is one of eight regional Fishery Management Councils established by the Fishery Conservation and Management Act of 1976. The council prepares fishery management plans designed to manage fishery resources from where state waters end, out to the 200-mile limit of the Gulf of Mexico. These waters are also known as the Exclusive Economic Zone (EEZ).

The (GMFMC) consists of 17 voting members: the Southeast Regional Administrator of NMFS (or designee), the directors of the five Gulf state marine resource management agencies (or their designees), and 11 members who are nominated by the state governors and appointed by the Secretary of Commerce. Appointments are three-year terms with a maximum of three consecutive terms. In addition, there are four nonvoting members representing the U.S. Coast Guard, U.S. Fish and Wildlife Service, Department of State, and the Gulf States Marine Fisheries Commission.

The council meets five times a year at various locations around the Gulf coast. Prior to taking final action on any proposed rule change public hearings are held throughout the Gulf. Public testimony is also heard during the meeting at which final action is scheduled. Proposed rule changes are then submitted to NMFS for further review and approval before implementation.

When reviewing potential rule changes, the council draws upon the services of knowledgeable people from other state and federal agencies, universities, and the public, who serve on panels and committees.

Gulf States Fisheries Commission

The Gulf States Marine Fisheries Commission (GSMFC) is an organization of the five states (Texas, Louisiana, Mississippi, Alabama, and Florida) with coastal waters in the Gulf of Mexico. The GSMFC is a compact among those states as authorized under Public Law 81-66 (signed by representatives of the governors of the five Gulf States on July 16, 1949, at Mobile, Alabama). Its principal objective is the conservation, development, and full use of the fishery resources of the Gulf of Mexico, and to provide food, employment, income, and recreation to the public and guests of the United States.

Southeast Fishery Data Assessment and Review (SEDAR)

The primary instrument for conducting fishery assessments for stocks occurring in the Gulf of Mexico is the Southeast Fishery Data Assessment and Review (SEDAR) process. SEDAR is designed to improve the quality and reliability of stock assessments. It is managed by the three regional fishery management councils in close coordination with NOAA Fisheries and the Interstate Fishery Commissions (Atlantic States Marine Fisheries Commission and Gulf States Marine Fisheries Commission). SEDAR benefits from the expertise of existing stock assessment scientists in many organizations and continually seeks to improve the scientific caliber of assessments and the relevance of stock assessments to existing and emerging fishery management issues. SEDAR places special emphasis on constituent and stakeholder participation to ensure a rigorous and independent scientific assessment and review.

The Southeast Fisheries Science Center, Gulf of Mexico Fishery Management Council, and Gulf States Marine Fishery Commission, individual states, non-governmental organizations, and representatives from fishing entities can participate in the SEDAR process. The products of SEDAR are scientifically sound stock assessment reports that are used by the council and state agencies as a basis for establishing wise management and regulation of recreational and commercial fishing entities. SEDAR products are produced in a series of three workshops. The first workshop is a data assessment workshop. A panel of experts, including council and other agency representatives, is assembled to review and evaluate existing reports and data sets that relate to the species that will be assessed. Based on the review workshop findings, a panel of stock assessment scientists is assembled in a second workshop to conduct the actual modeling and analysis of the relevant data and information. Finally, a review workshop of international experts is assembled to review the process and findings of the data review workshop and subsequent assessment workshop. If approved, a final SEDAR stock assessment report is produced.

International Commission for the Conservation of Atlantic Tunas (ICCAT)

The United States is a member of the International Commission for the Conservation of Atlantic Tunas (ICCAT), which is responsible for the conservation of tunas and tuna-like species in the Atlantic Ocean and adjacent seas, including the Gulf of Mexico. In this regard, the Southeast Fisheries Science Center conducts scientific data collection, analysis, and contributes expertise to ICCAT activities. The organization was established in 1969, and about 30 species are of direct concern to ICCAT: Atlantic bluefin (Thunnus thynnus thynnus), skipjack (Katsuwonus pelamis), yellowfin (Thunnus albacares), albacore (Thunnus alalunga) and bigeye tuna (Thunnus obesus); swordfish (Xiphias gladius); billfishes such as white marlin (Tetrapturus albidus), blue marlin (Makaira nigricans), sailfish (Istiophorus albicans) and spearfish (Tetrapturus pfluegeri); mackerels such as spotted Spanish mackerel (Scomberomorus maculatus) and king mackerel (Scomberomorus cavalla); and, small tunas like black skipjack (Euthynnus alletteratus), frigate tuna (Auxis thazard), and Atlantic bonito (Sarda sarda). For these species, ICCAT conducts scientific research and based on that research, it adopts a wide-range of regulatory measures that apply to member nations. Such studies include research on biometry, ecology, and oceanography, with a principal focus on the effects of fishing on stock abundance. ICCAT research requires the collection and analysis of statistical information relative to current conditions and trends of the fishery resources in the convention area. ICCAT also undertakes work in the compilation of data for other bycatch species of fish caught during tuna fishing (principally sharks) in the convention area, and which are not investigated by another international fishery organization.

MexUS-Gulf Bilateral Agreement

MexUS-Gulf is a fisheries agreement between the Instituto Nacional de Pesca of the Mexican Ministry of Fisheries and the Southeast Fisheries Center of the National Marine Fisheries Service. The focus of MexUS-Gulf is on cooperative fishery research and technology regarding projects of mutual interest in the Gulf of Mexico. The Mexico delegation consists of a lead person from the Instituto Nacional de Pesca and representative scientists. The U.S. delegation consists of a lead person from the Southeast Fisheries Science Center and representative scientists. Working groups are formed to conduct research and report on specific fishery projects. A co-leader from each institution coordinates the work. Annual meetings are held, results from the previous research are presented and discussed, and plans for future research are made.

MEXUS-Gulf had its genesis in the plan to phase out U.S. shrimp fishing in Mexican waters, which terminated in December 1979, under the November 1976 Bilateral Fisheries Agreement between the United States and Mexico. Incorporated in that agreement was a statement requiring that a bilateral scientific committee be established to maintain active fishery research in the Gulf of Mexico and to keep lines of communication open. At the request of either government, a bilateral panel could be established to deal with areas of fishery research of mutual interest.

In 1977, the directors of the Instituto Nacional de Pesca and the Southeast Fisheries Center conceived the plan of MexUS-Gulf to be sponsored by their two organizations. The first MexUS-Gulf meeting was held in Campeche, Mexico, and the second was held in Key Biscayne, Fla., where plans were made to form a series of working groups that would address specific problems in fisheries. The latest meeting was held in Miami, Florida, in March 2006.

Initial MexUS-Gulf working groups were: ichthyoplankton, shrimp, demersal fish, coastal pelagic fish, pollution, sea turtles, and hydroacoustics. Since then, some groups have been dropped and others added. Working groups in the 2006 meeting were: SEDAR-Red Grouper Tuna and Sharks Shrimp Fishing Gear Technology.

The Environmental Protection Agency's Gulf of Mexico Program

The Gulf of Mexico Program was formed in 1988 by the Environmental Protection agency as a non-regulatory, inclusive partnership to provide a broad geographic focus on the major environmental issues in the Gulf. The mission of the Program is " to facilitate collaborative actions to protect, maintain, and restore the health and productivity of the Gulf of Mexico in ways consistent with the economic well-being of the Region." The partnership includes representation from state and local governments and the citizenry in each of the five Gulf States; the private sector (business and industry); federal agencies responsible for research, monitoring, environmental protection, and natural resource management; and the academic community.

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Annex B

Stakeholders from the Gulf of Mexico Large Marine Ecosystem

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The Gulf of Mexico Program was formed in 1988 by the Environmental Protection agency as a non-regulatory, inclusive partnership to provide a broad geographic focus on the major environmental issues in the Gulf. The mission of the Program is " to facilitate collaborative actions to protect, maintain, and restore the health and productivity of the Gulf of Mexico in ways consistent with the economic well-being of the Region." The partnership includes representation from state and local governments and the citizenry in each of the five Gulf States; the private sector (business and industry); federal agencies responsible for research, monitoring, environmental protection, and natural resource management; and the academic community.

Watershed councils

There are councils for each major watershed on the Mexican Gulf of Mexico, with broad representation from academia, citizen's groups, and farmers, the National Water Board, etc.

Regional Council for Sustainable Development

It is composed of four representatives from each of the coastal Mexican states: one representative from the academic sector, one from the state government, one from the private sector and one representative of local NGOs. They meet quarterly and review different problems presented to them by the federal or state governments.

APPENDIX B- Stakeholder Analysis

Integrated Assessment and Management of the Gulf of Mexico Large Marine Ecosystem

Preliminary Stakeholder Assessment

Introduction

Background

The Gulf of Mexico Large Marine Ecosystem (GoM LME) is bordered by northwestern Cuba, Mexico (States of Tamaulipas, Veracruz, Tabasco, Campeche, and Yucatan), and the U.S. (States of Florida, Alabama, Mississippi, Louisiana, and Texas). With a surface area of 1.5 million km^2, it is the ninth largest body of water in the world. The LME is of great socio-economic importance to the bordering states (Cato and Adams, 1999; Sánchez-Gil *et al*., 2004). The coastal areas are densely populated with about 55 million inhabitants (Cato and Adams, 1999). Furthermore, the LME is a major economic asset to the bordering countries, with the value associated with various economic sectors adding up to several billions of dollars (Adams *et al*. 2004; Sánchez-Gil *et al*., 2004). Among these sectors are commercial and recreational fisheries, tourism, oil and natural gas production, and maritime shipping. Economic activities conducted in the vast drainage basin include agriculture and farming, forestry, as well as urban and industrial development.

Both *in situ* and land-based human activities, as well as natural environmental variability, impact on the LME's natural environment and its living marine resources. As a consequence, habitat degradation and fisheries overexploitation are a common feature throughout the LME, and for the concerned stakeholders, present a daunting challenge for its sustainable use and management. There is a multitude of programmes and policies by numerous institutions and other actors, to protect, restore, and enhance the LME's habitats and living resources.

Therefore, in addition to the resource users, a host of other actors influence the health of this LME, in both negative and positive ways. The perspectives of all who contribute to a problem, are affected by it, and/or are necessarily part of the solution should be considered in the decision-making process. Any discussion of stakeholders and governance of the GoM LME must therefore encompass a consideration of the major direct resource users themselves, of land-based activities that impact on the LME, as well as the governments, institutions, and the multitude of other actors that influence its health and productivity.

Recognition of the importance of stakeholder participation in the management of natural living resources in general, and of marine living resources in particular, is growing (e.g. Juda 1999; Juda and Hennessey 2001; Bavinck *et al*., 2005; Sutinen *et al*., 2005). Donor organizations such as the Global Environment Facility (GEF), also now call for greater involvement of stakeholders in the projects they support. A framework for assessment and management of LMEs based on five modules (productivity, fish and fisheries, pollution and ecosystem health, socioeconomics and governance) has been developed (Duda and Sherman, 2002). This framework is based on the ecosystem approach, which also explicitly calls for active participation of key stakeholders in LME governance.

Stakeholder involvement has been recognized as an integral part of the development phase of the GoM LME project, and will continue to be emphasized during the implementation of this project. In this regard, the project (Project Development Phase) commissioned a preliminary stakeholder assessment, in order to identify the key stakeholders at national, regional, and international levels; describe ongoing initiatives/projects/programs that are relevant to the project's objectives and outcomes; assess their roles and responsibilities; and assess their capacity to carry out their potential roles in transboundary fisheries governance at national and regional levels.

This information will provide the basis for:
- Definition of the baseline for the full sized project;
- Identification of potential partners for either parallel co-financing or to undertake and/or support project activities, including the pilot projects;

- Review of governance mechanisms that include key stakeholders;
- Definition of capacity building activities that will enable the involvement of key stakeholders in transboundary living marine resources governance; and
- Development of a stakeholder involvement plan.

Methodology

Definition of terms

The following are definitions of some key terms as used in this report:

Stakeholder: Any legal or natural person, group or institution, regardless of the place of residence, with an interest in the Gulf of Mexico, who has influence or can influence its programmes and decision-makings, and is affected directly or indirectly by decision- makings. For the purposes of this assessment, only the key stakeholders are considered.

Governance: The formal and informal arrangements, institutions, and mores that determine how resources or an environment are utilized; how problems and opportunities are evaluated and analyzed; what behavior is deemed acceptable or forbidden; and what rules and sanctions are applied to affect the pattern of resource and environmental use (Juda, 1999). As this definition suggests, governance is not equivalent to government or management, and incorporates other mechanisms and institutions (formal and informal) that influence human behaviour in particular directions (Sutinen *et al*., 2005).

Ecosystem-based management: Ecosystem-based management is an integrated approach to management that considers the entire ecosystem, including humans. The goal of ecosystem-based management is to maintain an ecosystem in a healthy, productive and resilient condition so that it can provide the services humans want and need. Ecosystem-based management differs from current approaches that usually focus on a single species, sector, activity or concern; it considers the cumulative impacts of different sectors[10]. Ecosystem-based management is now being widely implemented in the assessment and management of a number of LMEs.

Capacity: Capacity generally refers to the broad range of factors, from skills to attitudes to financial resources, which enable individuals, organizations, or systems to perform their functions and achieve their objectives (Bolger, 2000). Therefore, capacity is much more than training or technical capacity.

Identification of stakeholders

A preliminary list of stakeholders was compiled from a number of sources, including GulfBase (www.gulfbase.org), keyword Internet searches, the published literature, and inputs from project personnel. In this preliminary assessment, it was not possible to identify and describe all the major stakeholder groups (of which there is a vast multitude). Where it was not possible to identify individual groups, generic stakeholder categories were used (e.g. economic sectors such as agroforestry, tourism).

Stakeholders were organized into four broad categories: (i) Resource users; (ii) Institutions and organizations at national level grouped according to principal functions (e.g. policy and decision-making/management; research/academic; non-governmental organization) by country; (iii) Institutions and organizations at regional level; and (iv) Institutions and organizations at the international level. Identification of local level stakeholders was outside the scope of this report. A simple questionnaire was developed (English and Spanish) and distributed (Annex I) to over 600 stakeholders in Mexico and the U.S. Information on the current and potential role of the stakeholder was obtained from this survey, as well as from the agencies' websites and other literature searches.

Capacity assessment

[10]Scientific Consensus Statement on Marine Ecosystem-Based Management, Prepared by scientists and policy experts to provide information about coasts and oceans to U.S. policy-makers.
http://www.seaweb.org/resources/documents/reports_EBM.consensus.pdf, 30 April 2007.

Information on existing capacity was obtained from the survey, from stakeholders' websites and the published literature. A framework for assessing potential roles and capacity was based on the GoM LME project goals and objectives, and the requirements for effective LME governance including ecosystem-based management (EBM).

Organization of the report

The following chapter (Chapter 2) deals with the main categories of stakeholders and describes their stake in the GoM LME. Chapter 3 discusses stakeholders' potential roles, their capacity, and presents some recommendations for engaging the various stakeholder groups in the project, and conclusions.

2.0 KEY STAKEHOLDER GROUPS

Users

For resource users, Sutinen *et al*. (2005) defined two broad use sectors that are LME-related and that are involved with the consumptive and non-consumptive uses of LME resources: (i) Directly-related use sectors such as fisheries, maritime transportation; and (ii) Indirectly-related use sectors such as tourism infrastructure, land-based activities such as agriculture, manufacturing, and forestry.

Directly related use sectors

These are stakeholders who depend on the GoM and/or its natural resources for income and employment, or conduct *is situ* activities that impact directly on these resources and/or the environment. They include several sectors such as fisheries, tourism, aquaculture, private sector industries (petroleum, mining), and shipping. Examples of stakeholder groups in this category are given in Annex II.

Fisheries sector

The GoM fisheries sector accounts for an important component of the total economic value derived from the utilization of the GoM ecosystem, and is also a significant source of employment, food, and recreation. Stakeholders include those engaged in harvesting, processing, and marketing, as well as in recreational fishing. The decline in fish stocks in the Gulf can be largely attributed to overexploitation and unsustainable fishing practices. This sector would be among the most severely affected by fish stock declines, habitat degradation, as well as by pollution, harmful algal blooms (HABs), and general environmental degradation of the GoM. Major groups in this sector include:

<u>Artisanal and commercial fishers</u>: In the Mexican GoM about 104,000 persons are registered in fishing and aquaculture, a large number of whom are artisanal fishers (Flores Hernández and Ramos Miranda, 2004). These individuals are organized into fishing cooperatives, of which there are about 4,418 registered in the Mexican GoM (Flores Hernández and Ramos Miranda, 2004). In Mexico, industrial fishers are represented by the National Chamber for the Fishery and Aquaculture Industry and artisanal fishers by the National Federation of Fishery Cooperatives (Hernandez and Kempton, 2003). About 31,500 commercial fishing craft are registered in the U.S. Gulf region (Cato and Adams, 1999).

<u>Recreational fishers</u>: Some 3,500 recreational vessels are registered in the Mexican Gulf of Mexico and the Caribbean (FAO, 2007a). In the U.S., the American Sportfishing Association is the sportfishing industry's trade association, committed to looking out for the interests of the entire American sportfishing community. In addition to monitoring emerging polices, the Government Affairs professionals foster strong relationships with Members of Congress, conservation and recreation partners and state and federal government leaders to ensure that sportfishing interests are represented when policy decisions are made.

<u>Processing and marketing sub-sectors</u>: A large number of private companies engage in processing and marketing in Mexico. There are 27 processing plants in Tamaulipas, 18 in Campeche, and 54 in Yucatán (CONAPESCA, 2001). In the U.S. GoM there are 455 seafood processing plants and 702 seafood wholesaling establishments (Cato and Adams, 1999).

Aquaculture sector

In Mexico there are 38 Government owned Fish Culture Centers, 7 of which are in the Gulf, and which produce 9% of total fish fry (SAGARPA, 2002). About 1, 300 persons are involved in aquaculture in the Mexican GoM and Caribbean. In the U.S. the aquaculture industry is the most robust in the States bordering the GoM (FAO, 2007b). The aquaculture sector can have potentially deleterious environmental impacts through the unsustainable exploitation of wild fish stocks for feed, introduction of exotic species into natural areas, habitat conversion, and coastal pollution from aquaculture facilities. This sector would be among the most severely affected by pollution, HABs, and general environmental degradation of the GoM.

Tourism sector

Tourism is a major economic activity in the GoM, based mainly on its beaches and other coastal areas and its rich marine life. Under this sector are included individual tourists (foreign and local), cruise ships, recreational boats, diving, and tourism infrastructure such as marinas. This sector has the potential for significant direct and indirect impacts on the environment and living resources of the GoM LME. At the same time, environmental degradation of the Gulf could have severe socio-economic consequences for tourism. Therefore, it is in this sector's interest for the marine and coastal areas of the GoM to be maintained in a healthy state. The growing interest in ecotourism also provides an incentive for protection and conservation of the coastal and marine living resources.

Industrial sector

The petroleum and mining sector is the most economically important industrial sector in the GoM. The southern GoM is the most important area for the Mexican oil and gas industry, not only for oil production but also for proven oil reserves. The U.S. infrastructure for oil and gas production in the GoM is the most developed in the world, and is concentrated in the coastal areas of Louisiana and eastern Texas (Cato and Adams, 1999). Discharges and emissions from this sector's operations could have severe impacts on coastal and marine habitats and living marine resources, as well as on coastal residents. Members of this sector are increasingly becoming involved in conservation, environmental clean-up, and monitoring efforts, etc. as they become more aware of the environmental impacts of this sector and strive to comply with environmental regulations and to improve their public image. In recent years the oil and gas industry has intensified its efforts to develop productive and effective partnerships with local communities, academic institutions, government agencies, and non-governmental organizations with the goal of improving and protecting the health of the natural environment, support environmental education, and fund research conservation studies.

Maritime shipping sector

Maritime shipping is an important industry in the GoM, with major ports and harbours, shipping lanes and waterways in both the Mexican and U.S. sections. The volume and value of waterborne commerce has been increasing in the Gulf (Cato and Adams, 1999). This sector has the potential for significant impacts on the GoM ecosystem, including through pollution and the introduction of invasive species, for which it has already gained notoriety.

2.1.1 Indirectly-related use sectors

These stakeholders are not entirely dependent on the GoM or its living marine resources, nor do they conduct activities within the GoM itself. However, their activities in coastal and inland areas have direct and indirect impacts on the GoM. Among these stakeholders are the agriculture and coastal urbanization/construction (including tourism infrastructure in coastal areas such as hotels, etc). Examples of stakeholder groups in this category are given in Annex II.

Agroforestry sector

Agriculture and livestock farming are important activities in the drainage basin, and combined with deforestation, cause drastic changes in the GoM coastal areas from high nutrient, freshwater, and sediment runoff. The second largest zone of coastal hypoxia in the world is found on the northern Gulf of Mexico continental shelf adjacent to the outflows of the Mississippi and Atchafalaya Rivers. Hypoxic conditions became more severe since the 1950s as the nitrate flux from the Mississippi River to the Gulf tripled (Rabalais *et al*., 2002). As public awareness increases about the environmental impacts of agriculture, as well as the accumulation of chemicals in the food chain, the agriculture sector is slowly adopting more sustainable practices.

Coastal industrial/business sector

A number of industries and businesses operate on the Gulf coasts, and have high potential for environmental impacts. Many businesses are also dependent on a pristine environment (e.g. those related to tourism). There may be more awareness of environmental concerns because of environmental impact assessments required by national and international agencies, and public pressure. Industrial and business companies are represented by local and regional industrial and business associations such as Chambers of Commerce and the Rotary Club.

Coastal residents
The Gulf coast is densely populated, and this population continues to grow, with people being attracted by the region's natural beauty and benign climate and host of economic opportunities. Deterioration of the Gulf's environment would reduce the quality of life of coastal residents who are increasingly becoming involved in conservation initiatives. At the same time, urbanization and population encroachment in coastal areas are having a negative impact on nearshore habitats in both countries. Coastal residents may be represented by a number of different types of associations (e.g. homeowners associations, community based organizations, environmental groups).

National/state level stakeholders

Policy/management/regulatory bodies
These stakeholders are mainly the Federal Governments, with ultimate responsibility for sustainably managing the countries' natural resources for the benefit of the people. Each Government has a comprehensive policy and legal framework for environmental protection and conservation, including for the coastal zone and ocean and associated living resources. In each country, there are federal, state, as well as regional agencies with responsibility for particular regions of the country, including the GoM. The mandate of these agencies includes policy setting and decision-making, resource management, regulation, and research. The Federal Governments are among the principal stakeholders in the GoM, and have an important role in the implementation of the project and the Strategic Action Program (SAP). Key stakeholders in this category are given in Annex III.

Academic/research/advisory institutions
Other stakeholders at the National/State level are academic, research, and advisory institutions that seek to understand the GoM environment and ecosystem and whose scientific knowledge and expertise are required in the development of environmental and living resource management strategies for the GoM, as well as in developing academic and public education programs. In both Mexico and the U.S. a large number of such institutions are in existence, some of which are independent while others come under federal government or state jurisdiction. A number of these institutions have a long history of research in the GoM, and engage in collaborative programs within the country, as well as with institutions in the neighbouring country. U.S. institutes and agencies could provide substantial support for the project through collaborative efforts and strategic partnerships with Mexican counterparts to share experiences in regional ocean governance in the GoM, transfer of knowledge, capacity building, etc. Some key stakeholders in this category are given in Annex IV.

Non-governmental organizations
Non-governmental organizations (NGOs) at the country or local level are becoming more active and are engaging in a number of projects in the GoM, some of them in partnership with national and international organizations. NGOs have an important role in awareness raising, public education and outreach, and implementation of conservation and resource management projects in the GoM in collaboration with government and other entities. They often have well-established linkages with other NGOs and local communities, and as such, could make an important contribution to the project in helping to promote wide stakeholder participation. In the U.S. a number of NGOs are actively engaged in the protection and conservation of the coastal zone and ocean. In Mexico, the involvement of social organizations within management and conservation activities for coastal and marine resources is relatively recent (Herrmann, 2004). Some key NGOs are given in Annexes V.

Donor agencies

Several Federal agencies and private organizations at the national level support programs and projects related to the coastal zone and ocean. Among them is the U.S.Agency for International Development (USAID), an independent federal government agency that receives overall foreign policy guidance from the Secretary of

State. USAID works with Mexico to address shared development problems. A common U.S.-Mexico development agenda has emerged that includes promoting environmental protection, and alternative energy and ecotourism, among others.

Regional stakeholders

Several regional stakeholders are involved in the GoM region and operate at different regional scales. This group includes entities representing both Mexico and the U.S.; Mexico, U.S. and Canada; Latin American countries; the wider Caribbean and adjacent region; and the entire Western Central Atlantic region. Among these stakeholders are the regional programs of UN organizations (see section 2.4.2). These stakeholders have invested significant effort and resources in a large number of projects in the region, and recognize the need for collaboration between the countries in addressing issues of common concern. They bring together public officials, entrepreneurs, investors, scientists, and educators in a range of collaborative initiatives.

The functions of this group of stakeholders are wide-ranging, and include the North American Commission for Environmental Cooperation (Mexico, U.S. and Canada) and the Accord of the States of the Gulf of Mexico, which facilitate collaboration between the countries; the Western Central Atlantic Fisheries Commission (WECAFC), an advisory regional fisheries body for the Western Central Atlantic region; the Inter-American Development Bank; and the Caribbean Coastal Marine Productivity (CARICOMP) Programme, which conducts long-term, region-wide monitoring of the biodiversity and productivity of Caribbean coastal ecosystems. Regional stakeholders are given in Annex VI.

International stakeholders

Stakeholders at the international level range from International NGOs, UN Organizations, international donor agencies, and international fisheries regulatory agency. These stakeholders all demonstrate firm commitment to promoting and supporting the wise use of natural resources and conservation and environmental protection worldwide (including in Mexico and the U.S.), for sustainable development. While each has a unique mandate and role, they also have synergistic relationships among them in partnerships that have proven to be very effective in helping countries to address developmental, environmental, and natural resource management issues, among others. The work of these organizations could complement the work of the project, and *vice versa*. International stakeholders are given in Annex VII.

Non-governmental organizations

A variety of international NGOs are engaged in natural living resources protection and conservation efforts worldwide. The focus of their programs ranges from individual species, ecosystem types (e.g. coral reefs) to protected areas and entire ecoregions. Among these stakeholders is the world's largest and most important conservation network, the World Conservation Union (IUCN). A number of projects and programs are being conducted in the GoM by these NGOs, and could complement the work of the project and *vice versa* (Annex VII).

United Nations organizations

UN organizations concerned with the environment and development are very active in a variety of programs and projects at the national, sub-regional, and regional levels. At the global level, but with national importance, are the relevant binding and non-binding multilateral agreements administered by some of these organizations, and to which both countries may be parties. Among those of particular relevance to the GoM LME are the UN Convention on the Law of the Sea and its provision relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks (UN Division for Ocean Affairs and Law of the Sea - UNDOALOS), Code of Conduct for Responsible Fisheries (Food and Agriculture Organization - FAO), Global Programme of Action for the Protection of the Marine Environment from Land-based Activities (GPA) and Convention on Biological Diversity – CBD (United Nations Environment Programme -UNEP), and International Convention for the Prevention of Pollution From Ships – MARPOL (International Maritime Organization -IMO). At the regional level, UNEP Caribbean Regional Coordinating Unit is the secretariat for the Cartagena Convention. IOCARIBE is the Caribbean regional subsidiary body of the United Nations Education, Scientific and Cultural Organization Intergovernmental Oceanographic Commission - UNESCO (IOC Sub-Commission for the Caribbean and Adjacent Regions). IOC is also responsible for the regional component of the Global Ocean Observing System, IOCARIBE-GOOS.

UNEP and the United Nations Development Programme (UNDP) are GEF implementing agencies, with UNDP implementing the GoM LME project. Among GEF executing agencies are the United Nations Industrial Development Organization (UNIDO), which is executing the GoM LME project, and FAO. A list of UN organizations and their roles are given in Annex VII.

Donor agencies
Donor agencies such and the GEF and World Bank provide financial and technical support for environment and development projects in developing countries and countries with transitional economies. GEF supports projects related to biodiversity, climate change, international waters, land degradation, the ozone layer, and persistent organic pollutants. GEF is supporting a number of projects in Mexico, including the GoM LME project under its International Waters portfolio. The World Bank is supporting the Mesoamerican Barrier Reef project, which though not a major part of the GoM LME, is adjacent to, and has transboundary interactions with it.

Regulatory Body
The International Commission for the Conservation of Atlantic Tunas (ICCAT), an international regulatory body, is responsible for the conservation of tunas and tuna-like species in the Atlantic Ocean and adjacent seas, including the GoM. Both Mexico and the U.S. are members of ICCAT.

POTENTIAL ROLE AND CAPACITY OF STAKEHOLDERS AND RECOMMENDATIONS FOR THEIR ENGAGEMENT

This preliminary assessment has revealed the substantial numbers and wide diversity of stakeholders in the GoM LME (these lists are not exhaustive). This multiplicity of stakeholders represents a significant human resource and potential for opportunities to enrich the GoM LME project as well as to ensure the sustainability of its expected outcomes. The need to engage stakeholders in natural resource management is increasingly being recognized, and a wide range of processes and mechanisms have evolved (and are still evolving), to bring about this change in conventional management approaches. Increasing stakeholder participation requires increasing environmental/ecological literacy, strengthening of capacity, forging of strategic partnerships between the major stakeholders, and establishing the institutional and legal basis for active stakeholder participation at all levels, among other things. While not all stakeholders can be active participants in the project, there is a need for information flow to them concerning the issues of concern in the LME and how these stakeholders contribute to the problems or are impacted by them. In addition, there should be channels of communication for stakeholders to have easy access to information about the project's objectives and achievements, and to provide feedback and concerns.

In order for stakeholders to play an effective role in the sustainable use and management of the living marine resources of the GoM LME, they must have the required capacity, which may need to be developed or enhanced. The focus on human capacity development in fisheries management is increasing in importance, partly because of the development of new approaches to fisheries management (e.g. EBM), and partly because of changes in the international development context driven by the limited success of many previous development initiatives and the realization of the key role that capacity development must play in supporting sustainable development (Macfadyen and Huntington, 2004).

Resources Users
There is growing realization of the need for increased participation by resource users in the management of natural living resources. Participative governance and the co-management systems in which responsibility for management is shared between the state and user groups can be seen in a wide range of policies and programs worldwide. Bavinck *et al*. (2005) discuss the principles and practice of interactive fisheries governance, and mention some of the benefits of inclusion of all stakeholders in this type of governance system:

The diversity and multiplicity of stakeholders increases the knowledge and experience available;
Involving stakeholders in governance ensures better problem definition, and hence better images and visions;
Legitimacy of governance decisions is enhanced, and could mean reduced costs of enforcement and compliance, which are usually the most expensive aspects of governance;
The diversity and greater number of ideas and solutions has a higher probability of generating innovations;

The diversity, interconnectivity, and multiplicity of stakeholders working together may be better equipped to deal with the diverse, complex, and dynamic nature of natural resource exploitation and management;
Stakeholders have the opportunity to exercise their democratic right to be heard and to have the means to inform and influence processes in which they are involved or which they impact.

Among the resource management functions that could be enhanced by the joint action of users and government resource managers are: (i) data gathering; (ii) logistical decisions such as who can harvest and when; (iii) allocation decisions; (iv) protection of resource from environmental damage; (v) enforcement of regulations; (vi) enhancement of long-term planning; and (vii) more inclusive decision-making (Pinkerton, 1989).

As key users of the living marine resources of the GoM LME, the fishing sector has an important role in the project and beyond, not only in the provision of knowledge (including traditional knowledge), data (e.g. on catch and effort), and information, but also in helping with surveillance and realizing their potential role as stewards of the GoM resources. Most fisheries scientists and managers perceive that in Mexico, industrial fishermen are well organized and represented, while artisanal fishermen are fragmented, which reduces their power as group (Hernandez and Kempton, 2003). More empowered and knowledgeable, they would be more likely to act more responsibly and accept and adhere to fisheries regulations (Hernandez and Kempton, 2003). The GoM LME project would greatly benefit from the involvement of this important group of stakeholders and every attempt should be made to fully engage them in the process by enhancing awareness among them and strengthening capacity.

Recommendations for engaging user groups include:

Build awareness in a number of areas, for example, the importance of the GoM ecosystem in the provision of specific ecosystem goods and services that these groups depend on or impact negatively; the impact of their activities (individually and collectively) on the ecosystem (including transboundary impacts), and consequences for sustainable socio-economic development;
Clearly articulate the project’s expected goals and outcomes, emphasizing the potential benefits to these stakeholders;

- Develop public education materials for all levels (including schools);
- Develop mechanisms for public education and outreach, and regular information dissemination (e.g. public awareness campaigns, including for consumers; establishment of an information center(s) in strategic locations and information networks; engaging the mass media and educating and building the capacity of journalists);
- Create a forum for dialogue between stakeholder groups, such as newsletters, information services, and networking opportunities, and improve dialogue opportunities for various stakeholder groups to resolve conflicts;
- Develop a website and make all stakeholders aware of it, to provide project information and updates, as well as public education materials;
- Promote ‘champions’ from among the various groups (and persons who already have the trust and respect of the various communities), who will then assist in broadening the stakeholder engagement process;
- Designation of a Focal Point for the GoM-LME project at local/sectoral level to encourage continuity in interest, participation, and cooperation;
- Convene regular stakeholder forums for open discussion and exchange of information;
- Provide incentives for stakeholders to become involved in the project, and to sustain their participation;
- Demonstrate with examples from other projects and regions, instances of ‘good practices’ in collaborative living marine resources management, and the benefits that have accrued to the stakeholders involved;
- Help certain groups of stakeholders to become better organized (e.g. artisanal fishers in fishing associations), so that they are more empowered and thus be more effective as a group;
- Enhance stakeholders’ awareness of their responsibility towards society and future generations, and of their potential to influence decisions and processes that affect them;

- Make use of the experience of national NGOs who have already been working with stakeholders in other projects;
- Develop the capacity of the appropriate groups for specific tasks (e.g. assistance in monitoring through informal monitoring networks) and involvement in the pilot projects;
- Create opportunities for the contribution and use of traditional knowledge;
- Develop linkages between the key stakeholder groups in the two countries.

National Governments

Both the Governments of Mexico and the U.S. are the natural leaders in the sustainable use and management of the nations' coasts and oceans. They play the principal role in policy setting, decision-making, management and regulation at the national level, and also have a major role to play during the GoM LME project, as well as in ensuring the sustainability of project outcomes in the post-project period. There is a multitude of agencies that engage in programs in the GoM, which are of high relevance to the GoM LME project, and their involvement in the project needs to be effectively coordinated.

In both countries ecosystem-based management is rapidly evolving. For example, in Mexico the "Oceans and Coasts National Strategy for Ecological Use Planning" sets out the Government's goals towards oceans and coasts that aim to strengthen its public policies towards an efficient management of natural resources in coastal and marine areas based on scientific knowledge and public participation. It is grounded on ecosystem–based management approach and enhances a wider public involvement. In the U.S. the Pew Oceans Commission, the U.S. Commission on Ocean Policy, and the President's U.S. Ocean Action Plan each provides different models for an overarching framework for national ocean governance and different degrees of federal involvement with regional approaches. The two countries also have much to offer the project in the way of sharing of experiences and lessons learned in developing EBM approaches to ocean governance.

The Governments have an important role in developing the required overarching, cross-sectoral institutional and legislative framework for improved LME governance using EBM, at the regional, national, and state/municipal levels. These requirements have been widely discussed (e.g. PEW Oceans Commission, 2003; U.S. Commission on Ocean Policy, 2004; Juda 1999; Díaz de León-Corral *et al*., 2004; Sutinen *et al*., 2005;Yañez-Arancibia and Day 2005; Nugent and Cantral, 2006). At the regional level, both Governments have a role in promoting a common, bilateral agenda for addressing the numerous transboundary problems confronting the GoM environment, including negotiating and formalizing of required mechanisms and instruments for implementing this agenda, and the strengthening of capacity for developing and implementing bilateral and international agreements. Bi-national efforts to date with Mexico on the Gulf, while useful, have lacked adequate resources on both sides, and need sustained political commitment and continuity of participation. Formalization of the bi-national nature of these partnerships could help provide government officials with a mechanism for ensuring a greater measure of political buy-in and continuity. These bi-national mechanisms and processes are important for ensuring project success in addressing transboundary living marine resources issues.

At the national/local level, there are significant gaps in capacity for EBM of the GoM LME. The barriers to effective management of coastal and marine living resources are widely recognized in both Mexico (e.g. Díaz de León-Corral *et al*., 2004; Flores Hernández and Ramos Miranda 2004; Zárate Lomelí 2004) and the U.S. (e.g. Pew Oceans Commission 2003; U.S. Commission on Ocean Policy, 2004; Nugent and Cantral, 2006). The study "Priorities for Capacity Building in Environmental Management in Mexico, in Support of the North American Agreement for Environmental Cooperation", revealed the need for, among other things, significant changes in sector-based policies, to allow institutions and instruments responsible for environmental policy to have an efficient influence on the entire sector-based structure of the economy, for efficient use of financial resources, for the promotion of creative financial solutions for environmental projects (CEC, 2001).

These limitations are also pertinent to the management of the GoM LME, and include gaps in knowledge (particularly at the ecosystem level and multidisciplinary and interdisciplinary studies that integrate ecological, social, and economic dimensions); inadequate human and financial resources; lack of capacity for transboundary monitoring and assessments (including transboundary environmental impact analysis); the tendency for sectoral and single-species approaches to living marine resources management; limited interagency collaboration; a lack of coordination across jurisdictional levels; a suite of laws that are too often conflicting, overlapping, and confusing; lack of adaptive management approaches; inadequate capacity for adoption of new technologies; and limited participation by key stakeholders in the decision-making process, among others.

The GoM LME project aims to have a highly participatory approach with regard to stakeholders. Both countries already have some mechanisms and processes in place for stakeholder involvement in natural resources management, for example, the Regional Consultative Councils on Sustainable Development in Mexico and the public hearings and public testimony sessions employed by the Gulf fisheries management councils in the U.S. The project could help to strengthen these mechanisms. Overall, co-management is held to embody several attributes of 'good governance': democracy, transparency, legitimacy, accountability, and subsidiarity (Symes, 2006). If co-management initiatives are to be successful, the establishment of an appropriate government administrative structure and an enabling legal environment is an essential component in efforts to promote and sustain existing local level fisheries management systems and/or to develop new co-management systems. This project could begin to strengthen national capacity to undertake some of the reforms needed in terms of institutions, mores, and values, in order to move towards more effective participatory management of the GoM living marine resources.

In the two countries, the competent national agencies have an important role in the implementation of the relevant project components, and for continuation of these activities (e.g. assessment, monitoring). In addition, the national Governments will play an important role in implementation of the SAP, including evaluation and adaptive management.

The project could strengthen the development and implementation of an EBM framework for living marine resources at the appropriate scales in both countries. It is recognized that developing and implementing this framework is a challenging task, requiring firm and long-lasting commitment, learning by doing, developing of the required scientific, legal, and other capacity, and building strategic partnerships both within and between countries, and with agencies and other LME projects that are more advanced in EBM in order to share experiences and knowledge, and help build the required capacity. The formation of these partnerships could be facilitated through the project. Movement towards EBM does not have to occur all at once, but can result from cumulative, incremental change over time. Identification of incremental modifications would be desirable since such changes are easier to adopt and implement than more radical changes and, cumulatively, may still have substantial effects (Juda and Hennessy, 2001). Capacities built and experiences gained through the project could be considered an important stepping stone towards EBM of the GoM LME.

Of the 16 respondents to the Questionnaire, six are government agencies responsible for natural resource management and regulation (Annex VIII), although they also have departments that engage in other activities such as scientific research. One of the respondents (Florida Department of Agriculture and Consumer Services, Division of Aquaculture) is involved in the regulation of aquaculture and leasing of submerged state lands for aquaculture activities, while three are involved in the management and regulation of fisheries (Florida Fish and Wildlife Conservation Commission, Gulf of Mexico Fishery Management Council, and Gulf States Marine Fisheries Commission), and one is engaged in the management of a marine sanctuary (Florida Keys National Marine Sanctuary). The National Water Commission of Mexico (Spanish acronym CAN) is responsible for the management and monitoring of freshwater resources and of residual waters that enter the rivers and the sea. Most of the respondents in this group have some concern about transboundary issues/resources.

In response to the survey, all but one of these agencies have indicated a potential role for themselves in the GoM LME project. The majority of the respondents could share data and information and scientific expertise and opinion, while the Florida Keys Marine Sanctuary could contribute to the regional SAP, and could serve as a "sentinel site" for ecosystem-based management in the GoM LME. In terms of capacity for their potential roles, most have available human and technical capacity, as well as data and information. However, in some cases, human and financial resources for participating in the project are limited.

Recommendations for engaging government stakeholders include:

- Conduct a more detailed assessment of capacity, followed by targeted capacity building and financial support as necessary, for Government agencies;
- Clearly articulate the anticipated benefits of the project to key representatives of the relevant government ministries, as well as the expected outcomes so that all stakeholder groups are aware of the objectives of the project and why they should have an interest or investment in it;
- Convene workshops and seminars for the appropriate Government agencies on the 5–module LME approach and ecosystem based management of living marine resources, in order to promote better understanding of the need for these approaches and what changes are required (institutional, etc.) to move towards adopting these approaches;
- Develop and disseminate training and educational material at the appropriate level for government agencies and representatives;
- Encourage greater strategic linkages between Government agencies and other stakeholders, both within and between countries.

Academic/research/advisory institutions

Both countries possess significant academic and research capability related to coastal and marine living resources. Many of these institutions have a long history of activities in the GoM, and their work provides an important foundation on which the project can build through strategic partnerships. Academic and research institutions have an important role during the project and in the post-project period to strengthen the scientific basis for decision-making. In addition to providing the required scientific data and information, these institutions are also well-placed to develop programs for capacity building in the area of EBM, including developing multidisciplinary and interdisciplinary programmes. However, the capacity of these institutions needs to be enhanced in general, and for integrated and multidisciplinary research in particular (Euán Ávila *et al.*, 2004). In general, raising the technical standards of research institutions to provide a better basis for decision-making and management should be a high priority (FAO 2007a).

An evaluation of the Mexican National Fisheries Institute (Spanish acronym INP) conducted by FAO (Csirke *et al*., 2005) revealed that among the priorities for capacity building for fisheries research in Mexico were: capacity for evaluating alternative management decisions under conditions of risk and uncertainty; integration of bio-ecological, bio-economic, and socio-economic evaluation of fisheries; capacity in geographic information systems and database management; training in community development with focus on self-management and technical assistance to support artisanal fishers and training workshops with fishers and fisheries managers. A strong cooperation link of INP with academic institutions is still missing (FAO 2007a).

The project and the two countries also stand to benefit from greater sharing of data and information with the wider scientific community, and communicating such information in a form that is understandable by and of utility to decision-makers. As such, there is a greater need for strengthening partnerships between academic and research institutions and government agencies, as well as with resource user communities, and creating mechanisms for the sharing and dissemination of information. In addition to providing scientific data and information, academic and research institutions have an important role in interfacing with both decision-makers and the public in order to enhance their environmental literacy and raise awareness and improve understanding about the project and its objectives.

Eleven of the 16 respondents to the Questionnaire are governmental and non-governmental academic/research/advisory entities engaged in activities with a particular emphasis on the long-term sustainable use and conservation of the GoM (Annex VIII). These range from State universities (e.g. Texas A & M; University of Quintana Roo; University of Tamaulipas) to national research centers (e.g. EPOMEX), a regional research center (Harte Research Institute for Gulf of Mexico Studies), and a large scale ocean observation system (Gulf of Mexico Coastal Ocean Observing System, Oceanography Department, Texas A & M University). Research areas range from a specific group of animals (Center for Shark Research, Mote Marine Laboratory) to fisheries (e.g. ECOSUR, IPN), coastal zone management (e.g. EPOMEX), marine pollution and ecosystem restoration (e.g. ECOSUR; EPA Gulf Ecology Division National Health and Environmental Effects Research Laboratory). The NOAA Coastal Data Development Center provides access to coastal data and information. The universities and research centers also have academic and educational programs. All of these institutes are engaged in collaborative programs with other institutes within country, while some have collaborative programs with the other country (as well as with Cuba). All the respondents in this group are either working on transboundary issues/resources (e.g. migratory sharks), consider their work to be of transboundary significance, or have concerns about transboundary impacts. Some of the respondents are also working on ecosystem-based assessment and management programs.

In response to the survey, all of these institutes have indicated a potential role for themselves in the GoM LME project, in accordance with their respective focal areas and mandates. The majority of the respondents could share data and information and scientific expertise on a variety of topics relevant to the LME and assist with collection of data or with analyses and capacity building, while others could also assist with policy analysis and the development of decision-making mechanisms. In terms of capacity for their potential roles, most have available human and technical capacity, as well as data and information. However, some have indicated that their human and financial resources for participating in the project are limited.

Recommendations for engaging the scientific community include:

- Create fora for dialogue between the project and the scientific community (both within and between the countries);
- Clearly articulate the anticipated benefits of the project to the scientific community, as well as the expected outcomes so that they are aware of the objectives and why and how they could have an interest or investment in it, and explore with them ways in which they could most effectively participate in the project (given their existing and potential capacity), including in the pilots;
- Identify key academic/research institutions that already possess some capacity for ecosystem-based assessment and management of living marine resources, so that the project could build on this existing capacity;
- Identify opportunities to build capacity where required and sources of financial support for their involvement in the project;
- Convene workshops and seminars on EBM and with multidisciplinaty teams from the major institutions;
- Increase awareness of the multidisciplinary and interdisciplinary approach needed for effectively addressing the transboundary fisheries management and environmental challenges facing the GoM ecosystem, including the need to incorporate and integrate natural and social science perspectives;
- Identify or create opportunities for greater networking and strategic partnerships (e.g. for capacity building and data and information sharing) both within and between countries;
- Enhance involvement of these institutions in public education and outreach programs, in order to build ecological and environmental literacy, and thus promote sustainability.

NGOs (national and international)

NGOs are a recognized force and play multiple roles in affecting behavior and public policy. They are becoming more evident in political activity at local, national, and international levels; and actively and purposefully seek to influence public policy and behaviour relating to a very wide range of issues, including natural living resources use and conservation. Both national, regional and international NGOs have been very effective in implementing programs to address environmental and conservation issues, in mobilizing funding from both international sources and private sectors and in promoting effective collaboration with other stakeholders. Thus, NGOs can affect ecosystem use patterns. The existence of major national, regional, and international NGOs (from the world's largest – IUCN – to regional, national, and local NGOs) who are actively engaged in programs in both countries in general, and in the GoM in particular, bodes well for the project, in that these NGOs have already laid a certain foundation for management of the GoM and have a wealth of experience, capability, databases, and in some cases, access to funding for particular projects that could complement the work of the GoM LME project.

Recommendations for engaging NGOs include:

- Hold seminars for NGOs on the project's objectives and activities specifically outlining where their inputs would be most effective;
- Show to NGOs how the project could complement their work, and *vice versa*;

- Liaise with bilateral donors to increase their awareness of the project's activities involving civil society;
- Engage key national and regional NGOs with the relevant experience to assist with public education and awareness and outreach campaigns;
- Identify opportunities for synergies and collaborative efforts with NGOs and explore ways for making these operational (both within and between countries);
- Involve NGOs in the pilot projects;
- Support and publicize the inclusion of an NGO representative on the project Steering Committee, elected to this position by democratic means across the region;
- Enhance collaborative efforts between NGOs, scientists, and the private sector.

Regional and international organizations

These organizations have an important potential role in the project (some already play an essential role in the project, e.g. GEF, UNDP, UNIDO), which could greatly benefit from the experience, networks, databases, and capacity in the respective areas of responsibility of these important stakeholders. The participation of these stakeholders in the project is crucial for its success. They provide a mechanism for bridging gaps and facilitating greater collaboration and information sharing between the two countries, and the foundation they have established would be valuable building blocks for the project.

Recommendations engaging this group of stakeholders in the project include:

- Establish a mechanism for continuous dialogue with these organizations;
- Make use of the various meetings, conferences, and other fora of these stakeholders to create awareness of the project, provide updates, and explore opportunities for collaboration;
- Find means of building synergies with them, and to avoid duplication of effort;
- Work with the organizations that are responsible for the relevant regional and international environmental agreements (binding and non-binding) to identify ways in which the project could assist in implementation of these instruments at the national level;
- Participate in the IOC-UNESCO Annual LME Consultation, to create awareness about the project and share experiences with other LME projects, as well as to identify opportunities for strategic partnerships;
- Seek opportunities for parallel financing.

Conclusion

The large number and great diversity of stakeholders in the GoM LME, at all levels, present a challenge for the GoM LME project and for implementing a holistic approach to the governance of the LME in general. However, this situation also presents valuable opportunities for enriching and enhancing the project through engaging the key stakeholders, as well as for ensuring the sustainability of project outcomes in the post-project period. The inclusion of key stakeholders in the GoM LME project as active participants or other appropriate role is essential for the effectiveness of project implementation and to improve the sense of ownership of the project. While not all stakeholders can be active participants, it is important that channels of communication and information flow are opened or enhanced to facilitate a two-way flow of information between the project and key stakeholders, and to encourage feedback from these stakeholders.

This preliminary assessment has revealed the vast number and range of activities and programs in the GoM LME, both at the national, sub-regional and regional levels, and the equally vast numbers of agencies and institutions involved, in the two countries. This situation augers well for the project, in that it presents great potential for synergistic partnerships with key stakeholders. While a more comprehensive study might reveal otherwise, it appears that the U.S. in particular has had a longer history of programs in the GoM, with a larger number of government and non-governmental organizations and well-established programs at local, state, and regional (in-country) levels. These programs include initiatives in the watershed, estuaries and other coastal areas, as well in offshore areas and deep sea. As a participant in the project, the U.S. could provide significant guidance and valuable lessons in addressing the problems facing the GoM environment and living marine resources, and assist with capacity building. Existing collaborative efforts between the two countries should be strengthened and opportunities identified for establishing new ones. At the same time, the multitude of stakeholders and programs point to the need for greater coordination of all of these efforts. This preliminary assessment has also revealed the existence of significant human and technical capacity in the two countries. However, there is need for further capacity development to ensure the effective participation of stakeholders in the project and in the post-project period.

The recommendations made in this report are preliminary, and not exhaustive. In the full-sized project, there would be opportunities to identify a broader range of stakeholders and for extensive consultations with these stakeholders in order to refine the list of key stakeholders, identify more clearly their respective roles and capacity, and develop a concrete stakeholder capacity building and engagement plan. It is recommended that a database of all key stakeholders be developed.

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ACRONYMS AND ABBREVIATIONS

CARICOMP	Caribbean Coastal Marine Productivity Programme
CBD	Convention on Biological Diversity
CNA	Comisión Nacional Del Agua
EBM	Ecosystem-based management
ECOSUR	Colegio de la Frontera Sur
EPA	Environmental Protection Agency (U.S.)
EPOMEX	Centro de Ecología, Pesquerías y Oceanografía del Golfo de México
FAO	Food and Agriculture Organization
GEF	Global Environment Facility
GoM	Gulf of Mexico
GOOS	Global Ocean Observing System
GPA	Global Programme of Action for the Protection of the Marine Environment from Land-based Activities
HABs	Harmful algal blooms
ICCAT	International Commission for the Conservation of Atlantic Tunas
IMO	International Maritime Organization
INP	Instituto Nacional de la Pesca
IPN	Instituto Politécnico Nacional
IUCN	World Conservation Union (Int'l Union for the Conservation of Nature)
LME	Large Marine Ecosystem
MARPOL	International Convention for the Prevention of Pollution From Ships
NGO	Non-governmental organization
NOAA	National Oceanographic and Atmospheric Administration
SAP	Strategic Action Program
UNDOALOS	UN Division for Ocean Affairs and Law of the Sea
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNESCO-IOC	United Nations Education, Scientific and Cultural Organization Intergovernmental Oceanographic Commission
UNIDO	United Nations Industrial Development Organization
USAID	U.S.Agency for International Development
WECAFC	Western Central Atlantic Fisheries Commission

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ANNEXES

ANNEX I. Stakeholder Questionnaire

GEF Global Environment Facility   U N D P   UNIDO

GULF OF MEXICO LARGE MARINE ECOSYSTEM PROJECT
Brief Background and
Preliminary <u>ONE PAGE</u> stakeholders survey

The Gulf of Mexico LME – immense natural capital
The Gulf of Mexico Large Marine Ecosystem (GOM LME) is of major socio-economic importance to the three bordering countries (Mexico, USA, Cuba). It is an important centre of marine biodiversity, marine fisheries production, tourism, and oil and gas production.

An LME under threat
Human activities coupled with natural environmental changes are placing intense pressures on the LME's living resources, reducing the socio-economic benefits derived from these resources. Major threats to the LME include:

1. Overfishing and depletion of fish stocks;
2. High levels of coastal pollution and eutrophication;
3. Destruction of coastal habitats and wetlands;
4. Insufficient planning and control over multi-purpose coastal uses.

Time for concerted action
Since many of the fish stocks and water-related environmental threats in the region are transboundary in nature, the recovery of depleted fish stocks, restoration of damaged habitats, and planning and controls to reduce and eliminate coastal pollution, require a concerted effort by the bordering countries sharing a common strategy.

GEF catalyzes action – the GOM LME project

The Global Environment Facility (GEF) is supporting the GOM LME project with the principal objective of introducing an agreed, ecosystem-based approach for assessing and addressing the major threats and problems confronting the environment and living marine resources of the LME. Mexico and the USA are participating in this project, of which the ultimate goals are to:

- Build on pertinent activities already underway;
- Assist with the development of a regional Strategic Action Programme (SAP)[11] for the LME;
- Conduct on-the-ground demonstrations as part of SAP implementation along with priority reforms.

The Project is being implemented by the United Nations Development Programme (UNDP) and executed by the United Nations Industrial Development Organization (UNIDO). The Project Coordinating Unit has been established in Merida, Mexico. In order to have the information necessary to address the project goals, a Transboundary Diagnostic Analysis (TDA) of the LME must be undertaken. The TDA and SAP processes provide a mechanism for reaching country-driven, bottom-up consensus on priority actions for the recovery and sustainability of the marine resources of the GOM LME at national and regional levels. The first phase of the project is nearing completion, with the second phase (full sized project) in the planning stages. The full project is expected to begin in 2008, with duration of 4 years.

Stakeholder participation – an essential ingredient for success

The project recognizes that the involvement of key stakeholders is essential for its success and for the sustainability of project outcomes following the end of the project. At present, the project is conducting a preliminary stakeholders analysis to compile and synthesize information on key stakeholders engaged in the management and governance of transboundary living marine resources in the GOM LME. This information will provide the basis for:

- Definition of the baseline for the full project;
- Identification of potential partners for either parallel co-financing or to undertake and/or support project activities, including the pilot demonstration projects;
- Review of governance mechanisms that include key stakeholders;
- Definition of capacity building activities that will enable the involvement of key stakeholders in transboundary living marine resources governance in the GOM LME;
- Development of stakeholder involvement plan.

Tell us about your agency

To ensure that all key stakeholders are included in this analysis and to identify their potential role and assess their capacity for this role, the Project Coordinating Unit is kindly asking you to please take a few minutes to complete the attached, simple questionnaire on your agency's activities in the GOM, potential role in the project and related capacity. This information will be included in the stakeholders assessment report, which will be distributed to the Project Steering Committee and Technical Task Team, and other key project participants.

Please feel free to pass on this questionnaire to other relevant agencies.

Thank you for your time and collaboration. We look forward to your response and to building fruitful partnerships.Please send completed questionnaire by 7 May, 2007 to Dr. S. Heileman at sh_heileman@yahoo.com, copied to the Project Coordinator Dr. Gerardo Gold at gom_lme@yahoo.com

Questionnaire follows

[11] The SAP embodies specific actions (policy, legal, institutional reforms or investments) that can be adopted nationally, usually within a harmonized multinational context, to address the major priority transboundary concern(s), and over the longer term, restore or protect a specific body of water or transboundary ecosystem.

GULF OF MEXICO (GOM) LARGE MARINE ECOSYSTEM (LME) PROJECT
STAKEHOLDERS POTENTIAL ROLE & CAPACITY
QUESTIONNAIRE

1. AGENCY
Name:Address: website: Contact Person Name and Email Address:

Type (place 'X'): Private:Government:NGO:IGO:Regional: Int'l:Other (indicate):

2. CURRENT ACTIVITIES
a). What is your agency's major activity related to the GOM:

b). Does this involve transboundary resources and/or transboundary environmental issues? Briefly explain.

c). Rank in order of importance (from 1-9, with 1 most important, 9 least important; ignore if not relevant) principal role played in environmental and fisheries governance in the GOM pertaining to:
Decision-making:
Analysis & advice:
Implementation:
Review & evaluation:
Data & information:
Education:
Ecosystem-based assessment & management:
Resource exploitation:
Other (indicate):

d). Is your agency involved in any major collaborative GOM programs with other agencies? Indicate.

3. POTENTIAL ROLE IN GOM LME PROJECT
a). List your agency's 3 major concerns related to living marine resources and the environment in the GOM:

b). Given the objectives of the GOM LME project, briefly indicate the potential role that your agency could play in this project:

4. CAPACITY FOR POTENTIAL ROLE
a). Does your agency have the required capacity (human, financial, technical, data & information, etc) to play this role?Yes:No:

b). If No, briefly indicate what capacity is lacking or needs strengthening:

ANNEX II

ANNEX II. Gulf of Mexico Stakeholders: Directly and indirectly-related use sectors

Fisheries/aquaculture sector		
Stakeholder; website	**Status/function**	**Relevant activities/impacts in GoM**
American Sportfishing Association	Private trade association representing the American sportfishing community	Recreational fishing
Aquaculture industry association	Represents aquaculture interests	Aquaculture is an important economic activity (esp. in the U.S. GoM coast), with potential for severe environmental impacts (habitat destruction, pollution)
Fishing associations U.S. e.g. Southeastern Fisheries Association, Inc. (450 seafood companies, 85% located in Florida)	Represents fishing interests	Fish harvesting and processing
National Chamber for the Fishery and Aquaculture Industry (Mexico)	Trade association representing industrial fishers	Industrial fishing. Unsustainable practices contribute to overfishing
National Federation of Fishery Cooperatives (Mexico)	Trade association representing artisanal fishers	Artisanal fishing. Unsustainable practices contribute to overfishing
PROPEMEX	Parastatal entity; Processing/marketing	
Industrial/business sector		
Stakeholder/website	**Status/function**	**Relevant activities/impacts in GoM**
American Petroleum Institute; www.api.prg	National trade association representing all aspects of America's oil and natural gas industry	Works with the public, government, and others to develop and use natural resources in an environmentally sound manner
Chambers of Commerce; Rotary Club	Private associations of industries, businesses (e.g. Florida Chamber of Commerce; Mexico??). Represent businesses and industries	Some businesses are dependent on the natural GoM resources, and could also have negative environmental impacts. Also support environmental programs
Oil companies (BP Amoco, ExxonMobile, Chevron, Shell, etc.)	Petroleum exploration, production, refining	Petroleum industry (offshore and land-based) has high potential for severe environmental and living resources degradation. Companies engage in environmental monitoring, providing support for coastal and offshore conservation programs and projects, environmental training and awareness programs
PEMEX (Petróleos Mexicanos); www.pemex.com	A decentralized public entity of the Mexican Government; Petroleum exploration, production, refining, and petrochemicals	Potential for severe environmental and living resources degradation. Company engages in prevention, surveillance, monitoring and evaluation of the environmental impacts of PEMEX's activities
Shipping sector		Maritime transport and associated activities (ports, harbours, shipping). Impacts include pollution and introduction of exotic species

Tourism sector .		Coastal infrastructure, pleasure craft, cruise ships, etc. Impacts include habitat degradation and pollution
	Agroforestry sector	
Stakeholder/website	**Status/function**	**Relevant activities/impacts in GoM**
Farmers cooperatives in Mexican Gulf coast	Represents farmers	Agriculture and livestock farming are important activities in the drainage basin, and combined with deforestation, cause drastic changes in the GoM coastal areas from high nutrient, freshwater, and sediment runoff
Industry Led Solutions (US)	Coalition of leading producers of corn, soybean, rice, cotton, dairy, cattle, pork, poultry	Assists producers in addressing Clean Water Act issues. Develops, leads, and carries out a voluntary local basin wide strategy of non-point source nutrient management in each State's critical watersheds, ultimately reducing the delivery of excess nutrients to the Gulf of Mexico
National Council of Farmer Cooperatives (US)	Private cooperative	National representative and advocate for America's farmer-owned cooperative businesses. Farming in watershed could have severe impacts on the GoM (e.g. pollution)
	Coastal residents	
Stakeholder/website	**Status/function**	**Relevant activities/impacts in GoM**
Coastal residents associations (e.g. Home Owners Associations,	Represent coastal and other concerned residents	Quality of life of coastal residents dependent on condition of coastal and marine areas. Urbanization and population encroachment in coastal areas are having a negative impact on nearshore habitats

ANNEX III. Gulf of Mexico stakeholders: Policy/management/regulatory bodies (national level)
(* respondents to questionnaire)

Mexico		
Stakeholder; website	**Status/Function**	**Relevant activities in GoM**
Federal Agency for Environmental Protection (Procuraduria Federal de Proteccion al Ambiente - PROFEPA); http://www.profepa.gob.mx	Gov't agency. Environmental enforcement agency	Has coastal zone inspectors charged with enforcement of environmental norms and laws
National Commission for Aquaculture and Fishing (Comisión National de Aquacultura y Pesca - CONAPESCA) http://www.conapesca.gob.mx/	Gov't agency. Facilitates the commercialization of fisheries products in international markets; promote national fisheries development through international cooperation. Falls under SAGARPA	Fisheries and aquaculture are important economic sectors in GoM
National Commission for Protected Areas (Comisión Nacional de Areas Protegidas -CONANP); http://www.conanp.gob.mx/	Gov't agency. Directs administrative policy for natural protected areas	Responsible for Protected Areas in GoM (e.g. Terminos Lagoon)
National Water Commission (Comisión Nacional de Agua – CNA) http://www.cna.gob.mx/	Gov't agency. Administration, enforcement; preserving Mexican national waters	Responsible for preservation of quality and quantity of national waters, including inland waters that may impact the GoM through drainage
Secretary of Agriculture, Animal Production, Rural Development, Fisheries and Food (Secretaría de Agricultura, Ganadería, Desarollo Rural, Pesca y Alimentacíon- SAGARPA); http://www.sagarpa.gob.mx/	Gov't agency. Supports the development of the agriculture and fisheries sectors. The National Fisheries Institute falls under SAGARPA	Fisheries (and to lesser extent aquaculture) is a major economic sector in GoM
Secretary of Communications and Transportation (Secretaría de Communicaciones y Transportes) Port Authorities; http://www.sct.gob.mx	Gov't agency. Regulates port operations	A number of major ports are located in the GoM
Secretary of the Environment and Natural Resources (Secretaría de Medio Ambiente y Recursos Naturales- SEMARNAT); http://www.semarnat.gob.mx/	Gov't agency responsible for the environment and sustainable development throughout Mexico	Mandate covers GoM environment and natural resources
Secretary of the Navy (Secretaría de Marina Armada de México); http://www.semar.gob.mx	National military/naval sectors	Has installations and operations in GoM
Tourism Board; http://www.visitmexico.com/wb2/Visitmexico/Visi_Home	Gov't agency. Designs and operates tourism promotion strategies; promotes ecotourism	Tourism a major economic activity in GoM
United States		
Stakeholder; website	**Status/Function**	**Relevant activities in GoM**
Agriculture Department; http://www.usda.gov	Gov't agency responsible for food, agriculture, natural resources, and	Program in natural resources and environment, incl. issues related to water quality and agriculture

	related issues	
Environmental Protection Agency; http://www.epa.gov	Gov't agency. Leads the U.S. environmental science, research, education and assessment efforts; Develops and enforces regulations that implement environmental laws enacted by U.S. Congress.	Involved in a number of initiatives in the GoM to control nutrient inputs and restore coastal habitats. Partner in Gulf of Mexico Program, Gulf Ecological Management Site program, Gulf Estuaries program. Established the Mississippi River/Gulf of Mexico Watershed Nutrient Task Force, in partnership with a number of other federal and state agencies
*Florida Fish and Wildlife Conservation Commission; http://myfwc.com	Gov't agency. Conducts research, monitors and manages marine and estuarine fish and wildlife resources and their habitats and develops and implements techniques for restoring plant and animal species. FWC's Law Enforcement Division enforces state and federal fish and wildlife regulations	Mandate includes GoM
*Florida Keys Marine Sanctuary; http://floridakeys.noaa.gov	Marine Sanctuary. Manages the Florida Keys National Marine Sanctuary	Sanctuary located in GoM
*Florida Department of Agriculture and Consumer Services, Division of Aquaculture; http://www.floridaaquaculture.com	Gov't agency. Regulation of aquaculture and leasing of submerged state lands for aquacultural activities	Aquaculture is an important economic activity in the GoM, esp. in the U.S. Concerned about water quality, red tide, pollution
Gulf of Mexico Alliance; http://www.dep.state.fl.us/gulf/	A partnership among the five U.S. Gulf States	Objective is to protect and restore the environment of the GoM through greater regional cooperation. Priority issues are: improvements in water quality; restoration and conservation of coastal wetlands; environmental education; identification and classification of habitats for management; and reductions in nutrient loading. The Alliance released the Governors' Action Plan for Healthy and Resilient Coasts in 2006. Mexico is being considered as an international partner
*Gulf of Mexico Fisheries Management Council; http://www.gulfcouncil.org	Gov't agency responsible for fisheries management	Develop fishery management plans for fisheries in U.S. federal waters of the GoM
*Gulf States Marine Fisheries Commission; http://www.gsmfc.org	Gov't agency responsible for fisheries management	Fisheries management in the Gulf States. Projects include Southeast Area Monitoring and Assessment Program, Fisheries Information Network, Invasive Species Program, Interjurisdictional Fisheries Program
Minerals Management Service (Gulf of Mexico Offshore Region); http://www.mms.gov	Bureau of the U.S. Department of the Interior; manages mineral resources in an environmentally sound and safe manner.	Conducts extensive environmental studies program in the GoM to assess effects of oil and gas drilling and production on the marine, coastal and human environment (MMS Gulf of Mexico Outer Continental Shelf Region office)
National Marine Fisheries Service (U.S. Department of Commerce, NOAA); http://www.nmfs.noaa.gov	Gov't agency responsible for the management, conservation, and	SE Regional Office deals with U.S. GoM fisheries and habitat conservation.

	protection of living marine resources within the U.S. EEZ	The NMFS Highly Migratory Species Division manages fisheries for transboundary migratory species
Natural Resource Agencies of the 5 U.S. Gulf States: Alabama Department of Conservation and Natural Resources (http://www.outdooralabama.com); Florida Department of Environmental Protection (http://www.dep.state.fl.us); Louisiana Department of Natural Resources (http://dnr.louisiana.gov); Mississippi Department of Marine Resources (http://www.dmr.state.ms.us); Texas Parks and Wildlife Department(http://www.tpwd.state.tx.us)	Lead State agencies for environmental management, regulation and stewardship	Involved in a number of initiatives in the GoM. Florida Department of Environmental Protection is the main architect of the $7.8 billion funding and management plan to restore the Everglades
Texas Commission on Environmental Quality; http://www.tceq.state.tx.us	State environmental agency	Regulates activities related to water quality, air quality, and waste, and offers selected programs aimed at pollution prevention in the State, as well as in the Texas-Mexico border region, including in the GoM. Cooperates closely with the EPA and Mexican counterparts (SEMARNAT) in a formal binational environmental program called Border 2012 (http://www.epa.gov/border2012/)
U.S. Army Corps of Engineers; http://www. http://www.usace.army.mil/	Part of the U.S. Army. A public engineering, design and construction management agency	Water resources and environment included in work areas. The Corps and the National Park Service are cooperating on restoring the hydrologic regime for the Everglades. Regulates all work in wetlands and waters of the U.S.
U.S. Department of the Navy; http://www.navy.mil/	Navy/Coast Guard	Naval and coast guard installation and operations in GoM
U.S. Department of Transportation (DoT); http://www.dot.gov	Gov't agency responsible for transportation	The Maritime Administration of DoT is responsible for maritime transportation, and promotes the development and maintenance of the U.S. merchant marine, incl. in the GoM

ANNEX IV. Gulf of Mexico stakeholders: Academic/research/advisory institutes
(* respondents to questionnaire)

Mexico		
Stakeholder; website	**Status/Function**	**Relevant activities in GoM**
*Autonomous University of Campeche (Universidad Autónoma de Campeche http://www.uacam.mx/ Programa de Ecología, Pesquerías y Oceanografía del Golfo de México - EPOMEX)	Education and scientific research	Management of coastal ecosystems, fisheries management, geographic information systems, coastal pollution, aquaculture
Center for Investigation and Advanced Studies, National Polytechnic Institute (Centro de Investigación y de Estudios Avanzados del Instituto Politécnico Nacional -CINVESTAV); http://www.cinvestav.mx	Gov't institute; education and scientific research	Merida Unit of CINVESTAV conducts research on aquaculture, fisheries, biodiversity, coastal zone management, environmental health, marine biology and oceanography; Joint environmental monitoring programs in the GoM (e.g. with PEMEX)
*Colegio de la Frontera Sur (ECOSUR); http://www.ecosur.mx	Gov't institute; education and scientific research	Research on demersal fisheries resources; distribution of molluscan larvae; ecology; management and restoration of mangroves and seagrass beds
Institute of Ecology (Instituto de Ecología - INECOL); http://www.ecologia.edu.mx	Gov't institute; basic and applied scientific research	Ecology and evaluation of natural resources. One of its projects is "A Conceptual Model for Integrated Coastal Management in the Gulf of Mexico: Ecosystem Approach for Sustainable Development of Critical Areas", in collaboration with NOAA
*Institute for Investigation in Engineering (Instituto de Investigación en Ingeniería, Universidad Autonoma de Tamaulipas); http://fians.uat.edu.mx/iii	Gov't institute; scientific research	Studies on dynamics of coastal processes, principally in the Mexico-US coastal front
*Nacional Polytechnic Institute (Instituto Politécnico Nacional –IPN); http://www.ipn.mx	Gov't institute; scientific research	Research on the management of marine resources; coastal zone management
National Fisheries Institute (Instituto Nacional de la Pesca - INP); http://www.inp.sagarpa.gob.mx	Gov't institute; scientific research. Research is conducted through Centros Regionales de Investigación Pesquera (CRIP)	Fisheries assessments (shrimps, groupers, etc), sets regulations (e.g. open and closed seasons), etc. Aquaculture research is conducted through its Centros Regionales de Investigación Pesquera (CRIP). Sponsors MEXUS-GULF, in partnership with the Southeast Fisheries Center
National Commission for Knowledge and Use of Biodiversity (Comisión Nacional para el Conocimiento y Uso de la Biodiversidad - CONABIO); http://www.conabio.gob.mx	Gov't institute; promote sustainable use and studies of biodiversity; disseminate information on biodiversity; focal point for biodiversity-related conventions	
Mexican Petroleum Institute (Instituto Mexicano	Gov't institute; research and technological	Petroleum industry well-developed in GoM. Environmental

del Petróleo – IMP); http://www.imp.mx	development in the petroleum sector	impacts of petroleum industry, including in GoM
*Universidad de Quintana Roo; http://www.uqroo.mx	Gov't institute; education and scientific research	Management of natural resources, esp. commercial fisheries, integrating environmental, social, economic, legal and political aspects.
Other universities and affiliated institutes (e.g. UNAM-ICMyL, Universidad Veracruzana)	Research and education	A number of research projects in the GoM in areas incl. environmental variability, ecosystems and ecology, fisheries and aquaculture, population dynamics of marine populations, management and conservation, integrated coastal zone management. UNAM has a research vessel and the ICMyL conducts regular research cruises in the Mexican GoM (incl on living marine resources)
United States		
Stakeholder; website	**Status/Function**	**Relevant activities in GoM**
*EPA Gulf Ecology Division, Office of Research and Development, National Health and Environmental Effects Research Laboratory; www.epa.gov/ged	Gov't institute; scientific research	Conducts research to support the protection and restoration of coastal ecosystems in the GoM. Engaged with partners in Mexico to improve monitoring and assessment of GoM ecosystems through the National Coastal Assessment and the Harmful Algal Blooms Observing System (HABSOS)
Florida Institute of Oceanography; http://www.marine.usf.edu/FIO/	An independent entity established by the State University System to support and enhance Florida's coastal marine science, oceanography and related management programs through education, research, and public outreach	A number of collaborative research programs in the GoM, e.g. expedition to map and sample Pully Ridge coral reef; plans for a comprehensive regional assessment of marine resources and habitats in all of Florida's waters including the GoM
*Gulf of Mexico Coastal Ocean Observing System (GCOOS); http://www.gcoos.org	Observing system	Developing a long-term coastal ocean observing system for the GoM in the U.S. EEZ to produce observations and products for socioeconomic requirements of stakeholders in the region.
*Harte Research Institute for Gulf of Mexico Studies; http://www.hri.tamucc.edu	Research and education	Conducts science and policy research focused on the long-term sustainable use and conservation of the Gulf of Mexico with all 3 bordering countries, on environmental issues and policy in the GoM. Has Advisory Council members from all 3 countries. One of its projects is GulfBase www.gulfbase.org/
Louisiana Universities Marine Consortium; http://www.lumcon.edu	Research, education	Coordinates and stimulates Louisiana's activities in marine research and education. Focus includes enhancement of fish populations, improvement of water quality, the Mississippi River-Gulf of Mexico continuum, estuarine ecosystems, environmental effects of habitat alterations, and interaction of science and policy
Mississippi River/Gulf of Mexico Watershed Nutrient Task Force;	Task force formed by the EPA, in partnership with other federal and state agencies	Provides executive level direction and support for coordinating the actions of participating organizations

http://www.epa.gov/msbasin/taskforce/index.htm		working on nutrient management within the Mississippi River/Gulf of Mexico Watershed. A draft Action Plan for Reducing, Mitigating, and Controlling Hypoxia in the Northern GoM has been prepared.
*Mote Marine Laboratory (Center for Shark Research); http://www.mote.org/sharks	Private research and educational organization	Much effort directed toward the Southwest Florida coastal region. Shark research, education, conservation in the U.S., Mexico and Cuba, in collaboration with these countries
*National Oceanic and Atmospheric Administration (U.S. Dept. of Commerce); http://www.noaa.gov	Gov't agency focused on studies and predictions of the condition of oceans and atmosphere	Focal areas: Ecosystems, Climate, Weather and Water, and Commerce and Transportation. Supports fisheries research through the National Sea Grant College Program. The four GoM Sea Grant college programs (Florida Sea Grant, Louisiana Sea Grant, the Mississippi-Alabama Sea Grant Consortium and Texas Sea Grant) are working with state and federal agencies, universities, non-profit organizations, and private industry along the GoM to prioritize research and information needs and to develop a strategic research plan. The Gulf of Mexico Research Plan (GMRP), which highlights the stakeholder-defined research priorities for the region, will be completed in early 2008. Has several initiatives in the GoM, in collaboration with other agencies. NOAA is a major stakeholder and partner in the GoM LME project
*NOAA Coastal Data Development Center; www.ncddc.noaa.gov	Gov't agency. Provides access to coastal data resources	Provide access to coastal data and information using a web-based search capability, metadata creation, data translation, geospatial display and archive. Current programs include Harmful Algal Blooms Observing System (HABSOS), Hypoxia Mapping, Priority Habitat Information System (PHINS)
Sea Grant Gulf of Mexico Offshore Aquaculture Consortium; http://www.masgc.org/oac/	A collaborative, U.S. Gulf-wide, university-based interdisciplinary research program	Address social, environmental, and technological issues related to offshore aquaculture endeavors in the GoM
Southeast Fisheries Science Center;	Gov't agency. Scientific research	Conducts research in support of federal laws and international agreements relating to living marine resources in waters adjacent to the southeastern U.S. (incl. GoM)
*Texas A&M University-Corpus Christi, Division of Nearshore Research; http://lighthouse.tamucc.edu/Main/HomePage	Scientific research and monitoring	Measure water level, meteorology, water current velocities, water quality parameters (Salinity, DO, pH, turbidity) in Texas and Mexico
U.S. Geological Survey (U.S. Dept. of the Interior); http://www.usgs.gov	Gov't agency. U.S.'s largest water, earth, and biological science and civilian mapping agency	Collects, monitors, analyzes, and provides scientific understanding about natural resource conditions, issues and problems. Provides scientific information to support management actions intended to reduce excess nutrients in the Mississippi River Basin and hypoxia in the GoM. Participates

		in the Mississippi River/Gulf of Mexico Watershed Nutrient Task Force
Universities and affiliated research centers (see http://www.gulbase.org)	Education and scientific research	A number of environmental and living marine resource research programs in the GoM

ANNEX V. Gulf of Mexico Stakeholders: Major non-governmental organizations (national)

Mexico		
Stakeholder; website	**Status/Function**	**Relevant activities in GoM**
Centro Mexicano de Derecho Ambiental; http://www.cemda.org.mx	Private civil association. Contribute to the strengthening of national efforts in environmental protection	Focus on the sustainable management of natural resources and environmental protection, with emphasis on natural protected areas and species with priority for conservation
Mexican Fund for the Preservation of Nature (Fondo Mexicano para la Conservación de la Naturaleza – FMCN); http://www.fmcn.org	Private civil association for biodiversity conservation	Conservation of biodiversity of Mexico and ensuring sustainable use of its natural resources, through the promotion of strategic actions and medium- to long-term financial support
Pronatura; http://www.pronatura.org.mx	Private civil association. Conservation of flora, fauna, and priority ecosystems	Work program focuses on more than 500,000 ha of wetlands in five reserves in the Yucatan Peninsula, and in conservation, monitoring, environmental education, and creation and strengthening of local capacity. Among Pronatura's branches are Pronatura Península de Yucatán, Pronatura Noreste A.C., and Pronatura-Veracruz
Other environmental groups and community based organizations		
United States		
Stakeholder; website	**Status/Function**	**Relevant activities in GoM**
Gulf of Mexico Foundation; http://www.gulfmex.org	Private non-profit corporation founded by citizens representing agriculture, fisheries, business and industry, tourism, and the environment	Promote wise utilization and conservation of the GoM and its resources, through education, public awareness, research, and leadership programs. One of its projects is the Gulf of Mexico Community-based Restoration Partnership (GCRP), a regional partnership of state and federal governmental entities, non-profit organizations, citizens, and businesses to provide funding and support for coastal habitat restoration projects
Gulf of Mexico States Partnership; http://www.gulfofmexicostatespartnership.com/	Private sector advocacy organization for the GoM border states	Supports the GoM Congressional Caucus in its mission of education, consensus-building and creation of new regional initiatives in the areas of transportation, homeland security, energy, environment, economic development, education, and international trade in the border states of the GoM basin
Gulf Restoration Network; http://healthygulf.org/	Network of environmental, social justice, and citizens' groups and individuals	Committed to restoring the GoM to an ecologically and biologically sustainable condition. Formed in 1994 to raise awareness of

		environmental issues in Gulf States and to increase communication and coordination of member activities across the region. Plays a pivotal role in providing members and others with technical information, Gulf-wide networking opportunities, and communication that empowers local communities to successfully address the environmental threats that they face
The Ocean Conservancy; http://www.oceanconservancy.org/site/PageServer?pagename=home	Non-profit organization dedicated to protecting ocean environments and marine life	Has a regional GoM Office in Texas, and is engaged in programs to address overfishing and restore key fish populations in the GoM
Other environmental groups and community based organizations		

ANNEX VI. Gulf of Mexico stakeholders: Major regional organizations

Stakeholder; website	Status/Function	Relevant activities in GoM
Accord of the States of the Gulf of Mexico; http://www.gomsa.org	GoMSA was signed in the city of Campeche, Mexico on May 13, 1995 by representatives of the 11 bordering U.S. and Mexican States. It brings together public officials, entrepreneurs, investors, scientists and educators	The objective of the Accord is to establish working partnerships among the 11 States to promote economic and infrastructure development, educational and cultural exchanges
(CARICOMP Programme; http://www.ccdc.org.jm/caricomp_main.html	Conducts long-term, region-wide comparative studies of the biodiversity and productivity of Caribbean coastal ecosystems	Monitoring sites in GoM (Campeche, Cancun, Celustun). CARICOMP institutions in Mexico are UNAM-ICMyL, CINVESTAV (Merida) and EPOMEX
Gulf Ports Association of the Americas; www.gulfportsaa.com/index.htm	Association of a number of port authorities in the Mexican and U.S. Gulf coasts	Provides GoM port users with innovatively managed and environmentally responsible facilities
Gulf and Caribbean Fisheries Institute; www.gcfi.org	Independent non-profit corporation	Promotes exchange of current information and dialogue among scientific, governmental, and commercial sectors, on the use and management of marine resources in the Gulf and Caribbean region
Inter-American Development Bank; http://www.iadb.org	Initiative of the Latin American countries; a regional development financial institution to foster the economic and social development of borrowing member countries	Mexico and U.S. are members of IADB
North American Commission for Environmental Cooperation; http://www.cec.org/home/index.cfm?varlan=english	Created by Canada, Mexico and the U.S. under the North American Agreement on Environmental Cooperation	Addresses regional environmental concerns in North America, helps prevent potential trade and environmental conflicts, and promotes the effective enforcement of environmental law
OLDEPESCA; http://www.oldepesca.org	Organization of Latin American States to promote fisheries development and adequate utilization of fisheries resources. Areas of action for OLDEPESCA cooperation are research into fishery resources, exploitation of fishery resources, industrialization, support infrastructures, aquaculture, technological development, commercialization, training and international cooperation	Mexico is a member of OLDEPESCA
Regional Seas Programme (UNEP) – see International Stakeholders		
WECAFC; http://www.fao.org/fi/body/rfb/wecafc/wecafc_home.htm	Advisory Regional Fisheries Body for the Western Central Atlantic region. Facilitates the coordination of research, encourage education and training, and assist members in establishing rational policies for management of resources that are of interest for two or more countries in the Western Central Atlantic. No regulatory powers	GoM falls within the WECAFC area. Both Mexico and U.S. are members

ANNEX VII. Gulf of Mexico stakeholders: Major international organizations

International NGOs		
Stakeholder; website	**Status/Function**	**Relevant activities in GoM**
International Coral Reef Initiative (ICRI); http://www.icriforum.org	Partnership among governments, international organizations, and NGOs. Strives to preserve coral reefs and related ecosystems. ICRI operational networks include GCRMN (www.gcrmn.org) and ICRAN (www.icran.org)	A number of reef monitoring sites in the GoM
Reefcheck Foundation; www.reefcheck.org	Non-profit organization dedicated to conservation of tropical coral reefs and California rocky reefs	A number of reef monitoring sites in the GoM
The Nature Conservancy; http://www.nature.org/?src=t1	A conservation organization working worldwide to protect ecologically important lands and waters	TNC has completed an ecoregional plan for the northern GoM, which identified a network of priority sites that represents the marine biological diversity of the coastal waters of this area. The Gulf of Mexico Initiative develops and implements strategies to address the main threats to GoM coastal and marine biodiversity—habitat destruction and fragmentation. The initiative focuses on habitat restoration, ecosystem management and regional ocean governance (the latter in partnership with the GoM Alliance)
World Conservation Union; http://www.iucn.org	World's largest and most important conservation network	A number of marine protected areas in the GoM. Mexico and the U.S. fall under the North America Region of the World Commission on Protected Areas. A key partner with NOAA and IOC-UNESCO in developing and promoting the LME approach to management of living marine resources
World Wildlife Fund; http://www.wwf.org	Privately supported international conservation organization, with programs worldwide	WWF and TNC are undertaking a major regional assessment of Central America's Mesoamerican Reef to determine the impacts of climate change on coral reefs
UN Organizations		
Stakeholder; website	**Status/Function**	**Relevant activities in GoM**
FAO; http://www.fao.org	Responsible for agriculture, forestry and fisheries. Fisheries and Aquaculture Department facilitates and secures the long-term sustainable development and utilization of the world's fisheries and aquaculture. Responsible for a fisheries-related non-binding international agreements (e.g. Code of Conduct)	Mexico and U.S. are members of FAO. Implementing/executing agency of GEF project on reduction of environmental impacts from shrimp trawling
IMO; http://www.imo.org	Responsible for maritime develop and maintaining a comprehensive regulatory framework for shipping. Its remit includes	Of major relevance to the GoM considering that shipping is a major economic activity. Mexico and U.S. are members of IMO

	safety, environmental concerns, legal matters, technical co-operation, maritime security and shipping efficiency. Responsible for a number of international conventions (e.g. MARPOL, Ballast Water)	
UNDOALOS; http://www.un.org/Depts/los/index.htm	Responsible for implementation of the UN Convention on the Law of the Sea	Mexico and U.S. are parties to UNLOS Convention
UNDP; http://www.undp.org	Responsible for development at global and national levels	UNDP is the lead implementing agency for the GoM LME project
UNEP; http://www.unep.org	Responsible for the environment, and administers a number of regional and international environmental conventions (e.g. Cartagena Convention, GPA, CBD, CITES)	UNEP is represented by its Regional Office for Latin America and the Caribbean (Panama) and the Caribbean Regional Coordinating Unit (Jamaica), which administers the Caribbean Environment Programme (one of the UNEP administered Regional Seas Programme) through the Caribbean Action Plan. The GoM falls under the UNEP Regional Seas Programme (part of the Wider Caribbean Regional Sea). The CAR/RCU serves as the secretariat for the Cartagena Convention for the Protection and Development of the Marine Environment of the Wider Caribbean. UNEP/RCU is involved in the implementation of the Regional Plan of Action for the Yucatan Peninsula
UNESCO; http://www.unesco.org	Promotes education, science, culture and communication. Intergovernmental Oceanographic Commission (IOC) of UNESCO is responsible for the marine programmes	IOCARIBE is a regional subsidiary body of IOC-UNESCO (IOC Sub-Commission for the Caribbean and Adjacent Regions). IOC is responsible for the regional component of the Global Ocean Observing System, IOCARIBE-GOOS. Everglades National Park is a UNESCO World Heritage Site
UNIDO; http://www.unido.org	Responsible for sustainable industrial growth in countries with developing and transitional economies	UNIDO is the executing agency for the GoM LME project
Other UN International Conventions and (e.g. UNFCCC)		
	Donor agencies	
GEF; http://www.gefweb.org	An independent financial organization that provides grants to help developing countries protect the global environment. Support projects related to biodiversity, climate change, international waters, land degradation, the ozone layer, and persistent organic pollutants	GEF is funding a number of projects in Mexico, and is a major donor for the GoM LME project. Another GEF project in the GoM is ‘Protection of environmental services of coastal wetlands in the Gulf of Mexico to the impacts of climate change’
World Bank; http://www.worldbank.org	An international bank for reconstruction and development, and a source of financial and technical assistance to developing countries. One of the three implementing agencies of	Supporting the Mesoamerican Barrier Reef project

	the GEF	
Regulatory Body		
Stakeholder; website	**Status/Function**	**Relevant activities in GoM**
ICCAT; http://www.iccat.es	Responsible for the conservation of tunas and tuna-like species in the Atlantic Ocean and adjacent seas, including the GoM	Mandate covers the GoM. U.S. and Mexico are members of ICCAT

ANNEX VIII. Summary of stakeholder responses to questionnaire

Organization	Type	Major field of activity	Activity in GoM	Potential role in project	Capacity available/ needs
El Colegio De La Frontera Sur (Ecosur)	Gov't	Research, living marine resources assessment	Fisheries research; ecology, management, restoration of coastal wetlands/ Larval transport	ECOSUR has an integrated group of scientists in fisheries ecology, population dynamics, stock assessment and fisheries management. Much experience with species such as conch, spiny lobster, spawning aggregations	Yes
Instituto Politécnico Nacional	Gov't	Research, living marine resources assessment & management, coastal zone management	Development of integrated coastal zone management plans - Regional, state and local marine planning - Identification of land-based marine pollution, evaluation and control	Develop programs for recovery of major fish stocks in the area, establish mechanisms for public participation in decision-making, promote establishment of a Coastal Law for integration of the 3 bordering countries in governance	Yes
Universidad Autónoma de Campeche	NGO	Living marine resources assessment & management, education	Research in 5 areas: coastal zone management; fisheries management, GIS and risk management, coastal pollution, aquaculture	Generate data, information and thematic reports in the 5 areas of research; conduct governance analysis, strategic planning and design of environmental policy, conduct workshops, provide courses, edit scientific material	Partial/ needs financial resources
Universidad de	Gov't	Natural living	Management of natural	Natural coastal resources assessment, design of	Partial/

Quintana Roo		resources assessment & management, research, education	resources of commercial importance (fish, turtles) – based on integration of environmental, social, economic, legal and political considerations	decision-making mechanisms, participative and strategic planning for strengthening governance of these resources	needs financial resources and logistical support
Instituto de Investigación en Ingeniería, Universidad Autonoma de Tamaulipas	--	Research, education	Studies of coastal processes and hydrodynamics (mainly on border between Mexico and USA)	Evaluation of scenarios to establish bi-national policy re possible effects of hydrocarbon spills; evaluation of coastal risk to extreme meteorological events	Partial/ needs financial support for field work and upgrading equipment
Comisión Nacional Del Agua	Gov't	Management and monitoring of freshwater resources	Monitors and manages freshwater and residual waters that enter the GoM from landbased sources; Monitors and helps to maintain clean beaches for recreation	Provide information on quality and quantity of freshwater and residual water that enter the GoM; participate in analysis and identification of priorities regarding water and the environment	No; needs improved financial resources and human capacity for inspection and monitoring
Center for Shark Research, Mote Marine Laboratory	Private	Research, education, conservation	Shark research, education, conservation	Research on shark abundance, species composition, behavior and ecological role; Tri-national (US, Mexico, Cuba) fisheries research, management and conservation; capacity-building in Mexico and Cuba	Yes for human, technical and data/needs funding
Florida Department of Agriculture and Consumer Services, Division of	Gov't	Regulatory, data and information	Regulation of aquaculture and leasing of submerged state lands for aquacultural activities	Participate in gathering and receiving data from the GoM	Depends on level of involvement

Aquaculture					
Florida Fish and Wildlife Conservation Commission	Gov't	Research & living resources management	Conducts research, monitors and manages marine and estuarine fish and wildlife resources and their habitats and develops and implements techniques for restoring plant and animal species.	Provide data and information from Florida on transboundary species and habitat issues that could contribute to a greater understanding of ecosystem issues	Partial/ needs additional funding
Gulf of Mexico Coastal Ocean Observing System (GCOOS)	IGO	Observing system (data and information)	Develop a long-term coastal ocean observing system for the GoM	Assist with collection of data or analyses to produce needed products. Provide outreach to potential advocates	Some capacity for outreach/ needs funding
Gulf of Mexico Fishery Management Council	Gov't	Fisheries management	Develop fishery management plans for fisheries in U.S. federal waters of the Gulf of Mexico	Could incorporate agreed, ecosystem-based approaches for assessing and addressing the major threats and problems confronting the environment and living marine resources of the LME; has the capability, through its Ecosystem Scientific and Statistical Committee and its Habitat Protection Committees, to provide expert opinion and comment on environmental actions that may impact U.S. fishery resources in the GOM and vice-versa	Yes
Gulf States Marine Fisheries Commission	Gov't	--	Fisheries management	No response	NO
Harte Research Institute for Gulf of Mexico Studies	Private	Research and Education	Conducts science and policy research focused on the long-term sustainable use and conservation of the GoM	Conduct research on science and policy related issues of the GoM	Yes
NOAA/Florida Keys National Marine Sanctuary	Gov't	Management	Managing the Florida Keys National Marine Sanctuary	Contribute to the regional SAP; serve as a "sentinel site" for ecosystem-based management in the GOM LME	Yes

NOAA Coastal Data Development Center	Gov't	Data provider	Provide access to coastal data & information Current programs include: Harmful Algal Blooms Observing System (HABSOS), Hypoxia Mapping, Priority Habitat Information System (PHINS), Ecosystem Portal, Disaster Planning & Recovery (C-SIDE, NEWIS), Ecosystem Data Assembly Center (EDAC)	NOAA's role is to provide data collection, information distribution, scientific analysis, and other needed support to execute its mandated stewardship role	Yes
Texas A&M University-Corpus Christi, Division of Nearshore Research	Gov't/ Regional/ int'l	Research/ monitoring	Measure water level, meteorology, water current velocities, water quality parameters in Texas and Mexico; assist Mexico, Centro de Ciencias de la Atmósfera UNAM install water level gauges in NE Mexico	Supply historic and real time physical environmental data and sea state data in near real time	Yes
USEPA Gulf Ecology Division, Office of Research and Development, National Health and Environmental Effects Research Laboratory	Gov't	Research	Research to support the protection and restoration of coastal aquatic ecosystems	Share data, models, and scientific expertise on a variety of topics relevant to the LME	Strong technical capabilities, data and information/ human and financial resources limited

APPENDIX C- Pilot Projects

Introduction

A priority focus within the overall project is to deliver tangible global benefits within the participating countries through the selection and implementation of 'on-the-ground' activities. Consequently, clearly defined regional and national pilot demonstration projects to advance SAP implementation will be undertaken during the execution of the full project. Three priority pilot projects were jointly identified by participating countries. The pilot projects are fully incremental and will assist Mexico to participate more robustly in ongoing programmes undertaken by the United States, and both countries to strengthen regional approaches to ecosystem-based management of the LME. The objectives of the Pilot Projects in respect to the overall GoM LME project are as follows:

- To target selected national and regional hotspots of watershed and coastal impacts and threats, as well as sensitive areas which are particularly vulnerable to similar impacts and threats
- To address OP9 eligible issues 'on-the-ground' through GEF funding supported by significant co-funding
- To deliver real and concrete improvements and mitigation to GoM LME constraints and impacts
- To identify and mobilise reforms to policy, legislation and institutional realignment consistent with GoM LME objectives
- To provide transferable lessons and best practices which can serve to replicate successes elsewhere both nationally and regionally

The pilots are all sited in the same area, Terminos Lagoon, in order to achieve greater cost-effectiveness, maximize synergies and set the foundations for integrated, ecosystem-based approaches to natural resource management. By setting the pilots in the same location, the pilot strategies will generate practical experiences to address a complex baseline of overlapping policies and competencies for protected area conservation, social and economic development and threats to terrestrial, coastal and marine biodiversity. The harmonized development of the three pilots will moreover contribute to defining a stronger baseline, and help enable the development of validated integrated approaches that will facilitate upscaling to other States and at a national level. Options for replication beyond the project area will also be enhanced. Furthermore, Terminos Lagoon is located in the Yucatan Peninsula, which has been chosen as the site for a sub-national programme under the GPA. Significant synergies and exchange of information and results between the pilot projects and the GPA programme are expected.

Additionally, a State Biodiversity Study and Strategy is currently under preparation in a partnership between the Campeche State Government, the National Commission on Biodiversity Knowledge and Use (CONABIO) and the GEF Small Grants Program. The Strategy plans to identify the current level of knowledge on biodiversity in the state, identify threats and priorities and proposals for public policies that contribute to meeting the 2010 goals of the Convention of Biological Diversity and the Millennium Development Goals regarding ecosystems. The pilot projects will complement this strategy by contributing baseline information on the current state of marine and coastal biodiversity and by identifying trends and emerging issues on the sustainable use of the goods and services of the GoM LME.

The Pilot projects under Outcome 3

The three selected pilot projects are:

- Enhanced natural habitat conservation in the coastal and marine areas of the GoM LME
- Enhancing Shrimp Production through Ecosystem Based Management
- Joint Assessment and Monitoring of Coastal Conditions in the Gulf of Mexico

The distribution of funds for each pilot project is presented in the table below and each project is detailed in full in the subsequent sections.

Distribution of funding for each Pilot Project

Project	US$ GEF	US$ Co-Funding	US$ Total Funds
Pilot Project 1: Enhanced natural habitat conservation in the coastal and marine areas of the GoM LME	670,000	6,708,448	7,378,448
Pilot Project 2: Enhancing Shrimp Production through Ecosystem Based Management	720,000	2,926,332	3,646,332
Pilot Project 3: Joint Assessment and Monitoring of Coastal Conditions in the Gulf of Mexico	770,000	8,575,000	9,345,000
Total	**2,160,000**	**18,209,780**	**20,369,780**

Pilot Project 1: Enhanced natural habitat conservation in the coastal and marine areas of the Gulf of Mexico LME

1. Country(s)

Mexico and the United States of America

2. Title

NATURAL HABITAT AND ECOSYSTEM CONSERVATION OF COASTAL AND MARINE ZONES OF THE GULF OF MEXICO: WETLANDS, MANGROVES, SEA GRASS BEDS AND SAND DUNES

3. Executing Body

SEMARNAT

4. Cost of Project

GEF: US$ 0.670 million, Co-financing: US$ 12,708,448

5. Linkage to Gulf of Mexico LME Priorities

The project will contribute to achieving objectives and strategies set out in Mexico´s National Strategy for the Ecological Use Planning of Oceans and Coasts, oriented to strengthening its public policies and actions towards efficient habitat conservation and management of natural resources in coastal and marine areas. Thus, the project will provide the overall strategic framework for the conservation and sustainable use of coastal and marine natural resources. The project will include the guidelines to articulate public and sectoral policies, following the ecosystem based management approach, which is holistic, adaptive, multi-sectoral and will enhance a wider public participation.

The project aims to mitigate existing environmental impacts in selected marine and coastal areas of the GoM LME and has a particular linkage to the National Strategy for the Ecological Use Planning of Oceans and Coasts of Mexico, giving further strength to SEMARNAT´s role as a general coordinator of the Land Use Planning process based on the biophysical features of marine and terrestrial areas and in due consideration to enhance existing regional and local capacities.

This project will recommend cost-effective mitigation strategies for restoring deteriorated marine and coastal areas and habitats (based on priorities set in the TDA/SAP), with emphasis on critical coastal and marine habitats such as mangrove ecosystems, wetlands, sea grass beds and coastal dunes, and initiate the rehabilitation of selected sites.

Additionally, it is important to underline that the three pilots are all sited in the same area, Terminos Lagoon, in order to achieve greater cost-effectiveness, maximize synergies and set the foundations for integrated, ecosystem-based approaches to natural resource management. By layering the pilots in the same location, the pilot strategies will generate practical experiences to address a complex baseline of overlapping policies and competencies for protected area conservation, social and economic development and threats to terrestrial, coastal and marine biodiversity. The harmonized development of the three pilots will moreover contribute to defining a stronger baseline, and to the development of validated integrated approaches that will facilitate upscaling to other States and at a national level. Options for replication beyond the project area will also be enhanced.

6. Linkage to National Priorities and Programs

Planning

Hierarchically this project has a direct linkage to Mexico´s National Development Plan 2006-2012, the National Sectoral Program for Environment and Natural Resources 2006-2012, to guidelines established in the National Environmental Policy for the Sustainable Development of Oceans and Coasts and more specifically to goals and projects set out in the National Strategy for the Ecological Use Planning of Oceans and Coasts.

Marine and Coastal Policy

The National Strategy for the Ecological Use Planning of Oceans and Coasts provides the specific framework for the conservation and sustainable use of oceans and coasts, including projects of sea and land use planning to articulate public and sectoral policies to reach consensus among sectors and all government actors, considering regional strategies and local actions.

The project references a direct linkage to the Ecological Regional and Marine Use Planning of the Gulf of Mexico and Caribbean Sea process started by the Mexican government in 2006. The envisaged process, for a given area, runs from characterization and diagnosis, to a prognosis and definition of an action program. Strong public participation is a key component. The ecological use planning process is a key crosscutting activity that will serve as a key tool for enhancing governance issues across all sectors using marine and coastal resources to achieve the integrated management of coastal and maritime zones in the GoM LME.

The project is also directly related to the mandates of the US National Marine Fisheries Service Office of Habitat Conservation. The mission of this Office is to protect and conserve habitats important to NOAA and NMFS trust resources. The NMFS Office of Habitat Conservation focuses on ensuring that living marine resources have sufficient healthy habitat to sustain populations. Those mandates emphasize wetlands (including marshes, seagrasses, and mangroves), anadromous fish habitat, and habitat of other marine and estuarine species. These efforts frequently include close partnerships with state and federal agencies, local governments, industry, environmental groups, and academia. Within the NMFS Office of Habitat Conservation, the Restoration Center helps to achieve the mission by restoring degraded habitats, advancing the science of coastal habitat restoration, transferring restoration technology to the private sector, the public and other government agencies, and fostering habitat stewardship and a conservation ethic. There are large, on-going wetlands conservation and restoration activities in the US Gulf of Mexico. In particular, NMFS has oversight of the multi-million dollar Coastal Wetlands Planning, Protection, and Restoration Act program to reduce erosion and restore wetlands in coastal Louisiana, as well as the Community-based Restoration Program which distributes funds for in-the-ground habitat restoration actions. In addition, NMFS participates in various regional restoration efforts such as the large-scale South Florida Ecosystem Study, which is attempting to revitalize the mangrove-seagrass-marsh grass complex, and smaller seagrass and marsh restoration and evaluation efforts throughout the US Gulf states.

Climate Vulnerability and Adaptation activities in the Small Grants Program

The GEF-supported Small Grants Program has operated since 1994 in the Yucatan Peninsula and in 1999 the SGP-Mexico strategy was expanded to include the Tabasco coastal region. In addition to the traditional focus of the SGP on community-based biodiversity conservation and small-scale reductions in emissions of CO2, SGP-Mexico has gradually modified its operational strategy to include productive chains, the ecosystem approach, the establishment of revolving funds for sustainable use activities and climate risk management.

Following the interruption in implementation and loss of project infrastructure caused by Hurricane Isidore in 2002, the SGP began a pilot project of risk management in 5 micro-regions in the Yucatan Peninsula. In 2005, this pilot was expanded to include other micro-regions, including 12 communities in the Pom/Atasta/Sabancuy/El Carmen Island region. The risk management project consists of local risk analysis, the integration of community plans for risk management with volunteer brigades, emergency plans for each organization currently executing SGP projects, and a post-emergency damage evaluation protocol aimed at improving the response time of the natural disaster relief funds. An early warning system for hurricanes and other extreme hydro-meteorological events is in place in the Yucatan Peninsula and Tabasco with the participation of 154 communities, 13 local OSC and the Autonomous University of Yucatan, with the possibility of reaching an additional 500 communities through radio broadcasts in Spanish and Peninsular Maya.

Activities are supported through a blend of resources from UNDP (Bureau for Crisis Prevention and Recovery BCPR, and the UNDP Mexico Country Office), GEF-SGP through risk management provisions included in every approved project since 2004 (7% - 8% of total project cost), the Ministry of Social Development SEDESOL, the Ministry of the Interior SEGOB through its Natural Disaster Prevention Fund, and international organizations such as Oxfam. The cost of the program is approximately US$ 20,000 per micro-region per annum.

<u>Mangrove Ecosystems</u>
Mexico is one of the countries with the largest extensions of this type of ecosystem, but the annual rate of loss of mangrove vegetation in the Gulf of Mexico is calculated to be 2.8% (INE, 2005), nearly a full percentage point above the rate of loss in the Pacific coast and therefore of highest priority. The principal threats to mangrove habitat include land-use change, infrastructure, and pollution - especially hydrocarbon extraction and transformation.

Although there is no formal government program for mangroves, there is an official Standard (NOM/022/03) that sets out the specifications for conservation, sustainable use and restoration of mangroves, and CONAFOR has competitive subsidy programs for conservation and restoration of mangrove ecosystems, the most recent in September 2006. CONAFOR has established as a goal to restore 2,200 hectares of mangrove vegetation, and has signed a technical cooperation program with the International Tropical Timber Organization to develop criteria for mangrove restoration. CONANP and SEMARNAT created the National Committee of Priority Wetlands in 2005, comprised of representatives from civil society, academia, and federal, state and local government agencies.

The National Commission of Natural Protected Areas (CONANP) as the agency within SEMARNAT that covers the RAMSAR Convention began in 2005 the national priority program for wetlands (National Commission for Priority Wetlands – CNHP). In addition to this, in order to strengthen informed decision making, the Undersecretariat for Planning and Environmental Policy of SEMARNAT established in 2005 an Interim Advisory Body of Experts on Coastal Wetlands with emphasis on Mangroves that includes the participation of other relevant civil society stakeholders. Finally, under the tasks associated to the National Strategy of Ecological Use Planning of the Territory of Oceans and Coasts set out in February 2007, SEMARNAT is tasked with elaborating the National Strategy for Mangrove Conservation.

7. Name and Post of Government Representative endorsing the Demonstration Activity:

Dr. Antonio Díaz de León Corral, General Director of Environmental Policy, Regional and Sectoral Integration, Ministry of Environment and Natural Resources.

Mr. Alex Chester, Acting Director, Southeast Fisheries Science Center, National Marine Fisheries Service, National Oceanic and Atmospheric Administration

8. Project Objectives and Activities

8.1 Background

Mexico is one of the countries with the largest extensions of this type of ecosystem, following Cuba and Brazil (900,000 hectares -INEGI 2002); nevertheless this extension is estimated to be only 60% of the original coverage. The annual rate of loss of mangrove vegetation in the Gulf of Mexico is calculated to be 2.8% (INE, 2005), nearly a full percentage point above the rate of loss in the Pacific coast and therefore of highest priority. The principal threats to mangrove habitat include land-use change, infrastructure, and pollution - especially hydrocarbon extraction and transformation

The coastal margins of Mexico's six Gulf States are under continuing stress from a variety of factors, including wind-borne (eolian) erosion, hurricane damage, floods, sea level rise, and human development such as construction or altered water quality and hydrology. Degradation and loss of natural coastal habitats such as wetlands or marshes, mangrove ecosystems, sea grass beds and sand dunes have impacts not only on future use by local human populations for commerce, navigation, housing, coastline protection, water quality, and recreation but also on trans-boundary migratory organisms such as fishes and waterfowl that use these habitats at various times during their life cycles.

In the Gulf of Mexico there are extensive coastal wetlands which are critical ecosystems for the exceptional productivity of fish and shellfish. Wetlands (particularly salt marshes and mangroves) provide essential habitat for shorebirds, colonial nesting birds, and migratory waterfowl. They constitute home to an incredible array of indigenous flora and fauna, endangered species such as sea turtles, manatee, crocodiles, orchids, etc. As well, in this region the estuaries and coastal wetlands are recognized as vital in providing food and shelter for wildlife, improving water quality, sediment filtration, and flood and erosion control.

Low energy coastlines are often dominated by coastal mangrove ecosystems. In areas of low population density, these mangroves are still healthy ecosystems and represent an opportunity to protect them through zoning or purchase and declaring them marine reserves or protected areas. These areas can also be designated for use to offset impending human disruptions from sea level rise by land use planning exercises that prevent upland development, since this is where mangroves will have to migrate to as sea level rises.

Some of these pristine mangrove ecosystems have recently been damaged or destroyed by recent hurricanes, and therefore they represent opportunities for active restoration whether it is by planting new seedlings or by clearing fallen trees, re-grading the land, and restoring the hydrological cycle.

In the more populous areas around water bodies such as Terminos Lagoon with adjacent cities such as El Carmen, mangrove ecosystems have been subject to degradation from a variety of sources, including conversion to aquaculture ponds, housing or other building construction, alteration of water inflow rates or amounts, and nutrient additions. Each of these problems presents opportunities to restore mangrove structure and function to some extent while remaining in harmony with human occupation and activity.

Mangroves are often found adjacent to other wetland vegetation (salt and fresh water marshes) and next to submerged sea grass beds, at least in water bodies with relatively lower river input (and high water clarity) such as the Laguna Madre de Tamaulipas. Conservation of mangroves can be combined with that of wetlands and sea grass beds for a more holistic ecosystem restoration or protection end point.

Sea grass beds serve to stabilize sediments and to protect the coastline zone from erosion, providing a platform for the growth of flora and fauna, like fish and invertebrates such as shrimps that graze and reproduce on it, while providing an important input of organic matter food supply and being the origin of a large food web. Sea grass beds are directly affected by waterfront developments and natural hydro-meteorological events and are an important habitat for fisheries resources like shrimps in the Gulf of Mexico. The need for their conservation along with wetlands, mangroves and sand dunes in an integrated manner is considered a priority activity.

Coastal sand dunes represent a critical habitat and are flexible barriers that absorb wave and wind energy during storms by moving and adjusting their shape and position and are often found on high energy coastlines. However, their proximity to the ocean has made them wrongly desirable sites for locating tourism facilities. Coastal sand dunes and beaches provide protective features for human land uses behind them, as well as against flooding, storms, hurricanes and another natural events, hence the need of their conservation as mangroves or wetlands.

Currently, there are a number of opportunities to use available data to assess the present coastal land use patterns, to define and protect healthy ecosystems, to conduct restoration in areas with degraded or lost coastal habitats, and to protect key urban and rural natural sites through purchase or government designation and placement under local control with citizen involvement. The United States has developed much expertise in both conducting various types of habitat restoration (particularly with salt marshes, sea grasses, and mangroves) and in bringing stakeholders at all levels to consensus in designing and implementing habitat projects. This expertise will be made available to Mexico in order to increase opportunities and chances of success.

Project Area

The pilot project will be sited at Terminos Lagoon, a very complex system of estuaries, lagoons, wetlands and associated terrestrial ecosystems that cover 2500 km^2 in the southwestern Gulf of Mexico. Several rivers (most of them from the Usumacinta-Grijalva basin) drain into the lagoon. It has high biodiversity, both in terms of species and habitats, with high endemism rates. Although a protected area, it harbors many endangered, threatened and protected species. Along with another protected area, Pantanos de Centla, it receives the total discharge of the Grijalva-Usumacinta river system into the sea, the most important in Mexico since it roughly represents 35% of total freshwater runoff in the country, and it is the second most important in the Gulf of Mexico after the Mississippi. The high freshwater flow creates a seasonal front in the continental shelf, blocking water circulation and mixing across the shelf and thus trapping nutrients, suspended matter and pollutants nearshore.

Associated with the high productivity of the lagoon there is a high primary productivity, and it is considered the most important breeding ground for several species of shrimp and finfish in the southern Gulf of Mexico. The largest commercial fishing fleet in the Mexican portion of the Gulf depends on these resources. The high biological diversity and productivity of Laguna de Terminos are threatened by the large agricultural areas surrounding it (mainly rice and sugar cane), population growth and oil extraction and transport activities. Roughly 87% of domestic oil production is extracted offshore, very close to the lagoon.

This region is especially rich in salt, freshwater and brackish marshes, mangrove swamps, coastal lagoons, deltas and estuaries. Terminos Lagoon is a Ramsar site, forms part of the Man and Biosphere (MAB) global network of protected areas; is located in the wider area providing the opportunity to generate global benefits in addition to safeguarding the environmental goods and services provided to the Gulf marine ecosystem by these areas, consistent with criteria 2, 3 and 4 of the Ramsar Convention. It is expected that additional elements will be generated to also further comply with criterion 8 of the Convention, on sustaining (shared) fish stocks.

Terminos lagoon has been decreed as a federal NPA, and is an important habitat for dolphins as well as a breeding ground for shrimp, grouper and other commercially important species. The western portion of the Carmen Island and the Pom-Atasta lagoon system present important extensions of mangrove that have been affected by the urban growth of the City of El Carmen and other suburban establishments within the Pom-Atasta system. Within the lagoon there are sea grass beds associated with mangroves and many fish and invertebrate species, some with a high commercial value, that are also affected by the demographic pressure of growing human settlements. Also the Carmen Island suffers processes of coastal erosion on the windward side exacerbated by urbanization and a highway that crosses the entire island without adequate provisions for water and nutrient flows. Another threat to mangroves is the growing presence of the oil industry. Currently there is a very big nitrogen compression facility with its associated power infrastructure installed in Atasta Peninsula, a very narrow sand island that separates the Pom-Atasta system from the sea. This system is also crossed by a number of oil and associated gas ducts that transport oil and gas from the offshore oil extraction platforms to the petrochemical facilities inland.

8.2 Objectives and Activities

The overall outcomes of the project are to develop strategies and actions for natural habitat conservation in selected coastal zone areas using the ecosystem approach; to develop cost-effective strategies to mitigate impacts such as erosion due to extreme meteorological events and inappropriate coastal infrastructure; to develop methods for adapting to climate change such as sea level rise; and to restore deteriorated coastal areas and habitats with an emphasis on critical coastal habitats such as mangrove ecosystems, wetlands, sea grass beds, and coastal sand dunes.

The pilot project will build on the current state of knowledge of wetlands, mangroves, sea grass beds and sand dune distribution and health in order to develop mangrove monitoring methods, carry out restoration activities, and strengthen the regulatory framework to protect and conserve mangroves and wetlands in the future. In particular, the pilot will provide for close collaboration between Mexican and US counterparts to share expertise in habitat restoration. At the systemic level, this approach will also reinforce the country's terrestrial and marine conservation strategy by including the transition regions in coastal and near-coast marine areas as buffer and influence zones, as well as by providing appropriate value for these zones' role as alimentary reserves and bulwarks to extreme hydro-meteorological effects.

Objective: To promote the ecosystem approach for conservation and management of wetlands, particularly mangrove ecosystems, sea grass beds and sand dunes in order to maintain their functional and structural integrity, to conserve associated biodiversity, and to ensure economic and social benefits for future generations.

Activities

1. Target Restoration Sites Mapped and Selected

- Coastal habitat mapping with available data bases, aerial photography, site surveys, and other sources of information, to determine the extent of four target coastal habitat types (mangrove, sea grass, sand dune, wetlands) reviewed by experts
- Data analyzed in order to determine habitat quality of mangroves based on environmental, biological, land use, and water quality indicators, in order to plan restoration sites, protection sites, and marine reserves

2. Integrated ecosystem based management needs assessed and capacity building program implemented

- Habitat management and restoration activities defined with broad stakeholder participation, in order to assess the skill sets available, the types of actions being planned and implemented elsewhere, and the mechanisms needed to achieve mangrove, wetland sea grass beds and sand dunes restoration and protection along the Mexico coast.
- Regional and site specific training activities on coastal and marine restoration and rehabilitation techniques to strengthen capacity development carried out

3. Pilot Restoration and Rehabilitation Actions Successfully Implemented

- On-the-ground mangrove, sand dunes and sea grass beds restoration / rehabilitation carried out in both areas of low population density and high population density in the selected sites
- An environmental monitoring program, in close cooperation and linkage with the other two pilot projects, developed
- Evaluation on the geomorphology and hydrology of degraded mangrove ecosystems undertaken that estimates current water use patterns and development of methods for implementing water quality improvements.
- Cost-effective and cross-sectoral strategies for the conservation and rehabilitation of sand dunes and beaches, and for mitigating current negative impacts especially in relation to coastal erosion developed, that will feed into SAP development.

4. Public Awareness and Education Outreach Enhanced

1. Robust education outreach program developed and implemented to enhance stakeholder participation, in the areas of adaptation to climate change, sea level rise, valuation of environmental goods and services of related coastal habitats and ecosystems. This will be targeted at the different stakeholder levels and groups.
2. An integrated multi-sectoral approach to achieve sustainable development in the study zone developed that can be replicated throughout the Gulf of Mexico, and that will inform SAP development.

5. Adaptive Management and Best Management Practices

- Project implemented in a cost-effective manner in accordance with agreed work plans and budgets
- Monitoring and Evaluation Plan provides inputs for robust adaptive management
- A clearly defined mechanism for replication of the restoration programme to other estuaries and coastal lagoons in the GoM developed

8.3 End-of-Project Landscape (Outputs)

This project will develop strategies and actions for natural habitat conservation in coastal zones and to mitigate impacts and restore deteriorated coastal areas and habitats, with an emphasis on critical coastal habitats such as wetlands, mangrove ecosystems, sea grass beds and coastal sand dunes, using the ecosystem based approach.

The expected results and outputs from the project implementation are listed as follows:

Site Selection

- Coherent site selection for conservation of wetlands, mangroves, sea grass beds and sand dunes based on integrated ecosystem approaches, watersheds, aquifers, integrated management and integrated coastal zone management.
- Selected restoration of wetlands, mangroves, sea grass beds and sand dunes sites in Terminos Lagoon defined, taking into account ecosystem-based approaches.
- Site-specific mangrove vulnerability assessments incorporated into land and marine use planning and management programs
- Information on the land use and land tenure in mangrove areas updated, to ensure certainty to all programs and management actions that are implemented.
- Selected restoration sites enhances shrimp capture fisheries in the area of Campeche Bank taking into account compatible environmental criteria, structure and function of these coastal ecosystems.

Capacity Building

- Knowledge, technical skills and information of management authorities and decision-makers enhanced at federal, state, and municipal levels.
- Standard restoration and rehabilitation methodologies for coastal habitat and ecosystems developed for replication throughout the Gulf of Mexico region.

On-Ground Restoration & Rehabilitation Actions

- Rehabilitated sites will be monitored for five years beyond the project end in case replanting or more site work is needed.
- Degraded areas in Campeche Bank, such as El Carmen lagoon, and the surroundings of Terminos Lagoon subjected to on-ground wetland restoration processes, mangrove replantation activities, sea grass bed recovery, erosion prevention and protection of sand dunes.
- Evaluation and monitoring programs for management and rehabilitation of mangrove ecosystems, focused in a continuous update and correction measures approach delivered and implemented.
- Mangrove rehabilitation and restoration of areas where mangroves previously existed in selected sites
- Best sustainable use practices by local communities identified, classified and shared throughout the region.
- Cross-sectoral strategies to prevent sand dune and beach erosion processes from diverse sectoral activities such as port infrastructure, oil industry, tourism, roads, agriculture, land modification, etc, established and implemented.

Public Awareness & Public Outreach

- Monitoring system to obtain high quality, accurate and on time information on the physical and biological condition of wetlands, mangroves, sea grasses and sand dunes promoted.
- Social participation as a fundamental key element for the success of environmental actions, enhancement of the degree of consciousness, knowledge and civil co-responsibility in the instrumentation of environmental restoration projects developed and implemented.

9. Rationale for GEF Involvement and Fit with GEF Operational Programs and Strategic Priorities

This project is consistent with the Focal Area Strategies and Strategic Programming for GEF-4 as defined in the 11 May document, GEF/C.31/10, in particular Strategic Program 1 on ***Restoring and sustaining coastal and marine fish stocks and associated biological diversity***. Through policy reforms, capacity building and cost-effective restoration and mitigation strategies and techniques, the project will lay the bases for an ecosystem-based management approach that can provide for the effective restoration and protection of critical marine and coastal habitats. It therefore fully complies with SP1 which calls for the adoption of ecosystem-based approaches, habitat restoration and technical assistance. Moreover, these extensive habitats are critical ecosystem of significant productivity for fish and shellfish, so this initiative will contribute to restoring stocks, and to providing protection for the broad range of associated non-commercial species. The scope of this pilot project is enhanced as it is nested within an FSP under SO1 that provides for the requisite enabling environment through foundational capacity building and the establishment of a regional framework for strengthened regional cooperation and partnerships. The FSP is consistent with OP9, and this pilot contributes to this OP as its focus is on the coastal interface. In addition, as called for under the GEF 4 Biodiversity strategy, this pilot has contributes to the inter-linkages with this focal area as it addresses the degradation of coastal resources and processes. Additionally, this Pilot contributes to the Biodiversity Strategic Objective 1 on Protected Areas, and in particular Strategic Program 2 with its focus on management of marine protected areas. As noted in the GEF4 BD strategy, "Through the international waters focal area, the GEF has helped to establish management and policy frameworks in large marine ecosystems that provide the necessary foundation of marine protected areas to be successful". This project delivers on the cross-focal area synergies that the GEF4 Strategy encourages.

10. Project Management Structure and Accountability

This project will be executed by SEMARNAT, by the Undersecretariat of Planning and Environmental Policy leadership which currently coordinates several efforts to build a new Strategy for Conservation of Wetlands with emphasis on Mangrove Ecosystems. A Pilot Project Coordination Unit (PPCU) will be established in the Undersecretariat, which will have responsibility the successful execution of project activities in accordance with the agreed work plans and budgets, as well as for day-to-day project activities. UNDP and UNIDO will act as co-implementation agencies.

The PPCU will be comprised of a Project Coordinator, senior level technical expertise (as required), and requisite administrative and secretarial support. The Project Coordinator will liaise closely with the Chief Technical Advisor to ensure strong coordination between pilot activities and the Full-Size project. Direct and ongoing oversight of pilot project activities will be the responsibility of the Project Coordinator, in close association with the CTA. Consultants will be retained as necessary and priority will be given to the recruitment of consultants from the participating countries and the region, as available.

A Project Advisory Group (PAG) will be established to provide technical support as well as to enhance coordination between relevant agencies within SEMARNAT, and to facilitate engagement and support by USA counterparts. SEMARNAT´s administrative units are responsible within their mandated duties with environmental and ecosystem monitoring. Therefore the PAG will be comprised of the following agencies: National Commission for Natural Protected Areas (CONANP) which has responsibility for RAMSAR compliance, and is charged with the National Program of Priority Wetlands (CNHP); the National Institute of Ecology (INE) with a mandate regarding coastal ecosystem health and monitoring through GIS techniques; the National Forestry Commission (CONAFOR) which has programs devoted to mangrove rehabilitation; the National Water Commission (CONAGUA) has responsibilities over watershed management and coastal ecosystems management; and the National Commission for the Knowledge and Use of Biodiversity (CONABIO) is undertaking a national mangrove ecosystems inventory. SEMARNAT is enabled to carry out robust internal coordination through the National Environmental Policy for the Sustainable Development for Oceans and Coasts which has specific tactic objectives in regard to coastal habitats and ecosystems rehabilitation, giving particular duties and tasks to all the above mentioned agencies that will be involved. A representative of the PAG will participate in the R-TAG.

In addition to SEMARNAT's mandated coordination role, this project will facilitate strengthened and more streamlined actions with other sectors that use coastal areas and resources including transportation, tourism, energy, fisheries and human settlements by promoting mangrove ecosystem rehabilitation. These sectors will be better able to understand and recognize the goods and services provided by coastal ecosystems, and therefore ensure greater ownership of pilot project objective. In this regard the Inter-Ministerial Commission for the Integrated Management of Oceans and Coasts (CIMIOC) under SEMARNAT´s leadership will ensure that the results of this pilot project will be promoted and considered in other sectors' projects to enhance conservation of coastal ecosystems and their protection.

The Project Coordinator will report on execution of the Pilot Project through the CTA to the Steering Committee. If the Steering Committee so decides, the Project Coordinator may be invited to participate in a meeting.

11. Stakeholders and Beneficiaries:

GOVERNMENT & STAKEHOLDERS

ACRONYM	LOCAL NAME	TRANSLATION / EQUIVALENT
NPA	Áreas Naturales Protegidas	Natural Protected Areas
CECADESU	Centro de Capacitación para el Desarrollo Sustentable	Human Resource Developing Center for the Sustainable Development.
CENAPRED	Centro Nacional de Prevención de Desastres	National Center for Disasters Prevention .
CIMIOC	Comision Intersecretarial para el Manejo Integrado de Oceanos y Costas	Inter-ministerial Commission for the Integrated Management of Oceans and Coasts
CNA	Comisión Nacional del Agua	National Water Commission
CONABIO	Comisión Nacional para el Uso y Conocimiento de la Biodiversidad	National Commission on the Use and Knowledge of Biodiversity
CONAPESCA	Comisión Nacional de Acuacultura y Pesca	National Commission of Aquaculture and Fisheries
CONANP	Comisión Nacional de Áreas Naturales Protegidas	National Commission of Natural Protected Areas
CONAFOR	Comisión Nacional Forestal	National Forestry Commission
DGPAIRS	Dirección General de Política Ambiental Integración Regional y Sectorial	General Directorship for Environmental Policy, Regional and Sectoral Integration
DGZFMTAC	Dirección General de Zona Federal y Ambientes Costeros	General Directorship of Federal Coastal Zones
DGVS	Dirección General de Vida Silvestre	General Directorship for Wildlife
DGIRA	Dirección General de Impacto y Riesgo Ambiental	General Directorship for Environmental Impact and Risks Assessment
FONDEN	Fondo de Desastres Naturales	National Fund for Natural Disasters
IMTA	Instituto Méxicano deTecnolgía del Agua	Mexican Institute of Water Technology
INE	Instituto Nacional de Ecología	National Institute of Ecology
INP	Instituto Nacional de la Pesca	National Fisheries Institute
PANDSOC	Política Ambiental Nacional para el Desarrollo Sustentable de Oceános y Costas	National Environmental Policy for the Sustainable Development of Oceans and Coasts
ENOETMC	Estrategia Nacional para el Ordenamiento Ecológico del Territorio en Mares y Costas	National Strategy for the Ecological Land Use Planning of the Territorial Oceans and Coasts
PEMEX	Petroleos Mexicanos	Mexican Oil Company
SAGARPA	Secretaría de Agricultura, Ganadería, Desarrollo Rural, Pesca y Alimentación	Ministry of Agriculture, Livestock, Rural Development, Fisheries and Food
SEDESOL	Secretaría de Desarrollo Social	Ministry of Social Development
SEGOB	Secretaría de Gobernación	Ministry of the Interior
SEMAR	Secretaría de Marina	Ministry of Navy
SEMARNAT	Secretaría del Medio Ambiente y Recursos Naturales	Ministry of Environment and Natural Resources
SEP	Secretaría de Educación Pública	Ministry of Public Education
SCT	Secretaria de Comunicaciones y	Ministry of Transport and Communications

	Transportes	
SSPyPA	Subsecretaría de Planeación y Política Ambiental	Undersecretariat of Planning and Environmental Policy
	Autoridades Estatales y Municipales	State and County Authorities
	OTHER STAKEHOLDERS	
	Cooperativas Pesqueras	Small Scale Fisheries Cooperatives
	Instituciones de Investigacion	Research Institutions
	Universidades	Universities
ONG	Organismos No Gubernamentales	NGO Non Government Organizations

12. Long-term Sustainability Strategy

The implementation of this pilot project aims to preserve environmental goods and services supplied by wetlands, mangroves, sea grass beds and sand dunes. Through project activities, supported by strong outreach programs, it is expected that the productive sectors that use these resources and habitats will understand and come to support environmental criteria. In addition, a better understanding of the critical role these ecosystems play in mitigating risks from severe hydro-meteorological phenomena and the effects of the climatic change on human settlements and regional infrastructure in the Gulf of Mexico LME should also encourage greater adherence and support to pilot project outcomes.

Moreover, the development of successful experiences in the management of these coastal-marine ecosystems results in enhanced effectiveness of actions on a local scale like pragmatic expression of the environmental policy and planning schemes in meso-regional and national level.

13. Replicability

The project is the first example of integrated management approaches in these coastal habitats types for the Mexican portion of Gulf of Mexico. This will be the first type project to undertake on-ground actions to rehabilitate and restore coastal ecosystems and habitat in mangrove areas, sea grass beds and sand dunes. It has been designed as an input to ecosystem-based management approaches and will be closely linked to the other two pilot projects on ecosystem health monitoring and restoration of depleted shrimp stocks in the Gulf of Mexico. A monitoring and evaluation system will be used to determine the effectiveness of priority habitat conservation and restoration activities using GIS tools to define replication potential. The strong synergies between these three pilots will contribute to enhancing options for replication.

The benefits derived from an effective and successful demonstration of this nature will be of great value in the implementation management programs in other Mexican States, in the USA and potentially in Cuba should it decide to participate or benefit from activities in the GoM project. The benefits from this project are also replicable globally and could be applied in other regions. Particularly, the project outputs will provide integrated data bases, several indicators and a practical framework for better management practices that can be replicated in other tropical countries. If successful, this project can create crosscutting action programs and synergies between federal agencies, local governments and NGOs.

14. Monitoring and Evaluation Process

The Project Management Unit will produce a brief quarterly Progress Report updating the Steering Committee and the project Executing Agencies on the progress of the Demonstration based on the approved Logical Framework Matrix and the project work plan (Part II). Once every year a detailed report will be submitted through the Steering Committee to the Executing Agencies. This report will provide a full review of the work plan to identify project achievements and deliveries versus the approved schedule, budget expenditures, recommendations with respect to any

amendments to work plan and budget, staff contracting and performance, and any other information required by the Steering Committee and/or the Executing Agencies.
In addition to this, the project strategy and objectives, intended outputs, implementation structure, work plans and emerging issues will be regularly reviewed and evaluated annually by the Project Steering Committee. Periodic Status Reports will be prepared at the request of the Steering Committee for presentation at key meetings associated with the Project.

The pilot project will also be subject to:

- Internal Project Implementation Reviews to be conducted by the CTA and submitted to the implementing agency at the end of months 6, 12, 18 of the project program.
- An independent final project evaluation to be undertaken in month 24.

The project evaluations will be carried out in accordance with UNDP/GEF requirements and will cover all aspects of the project. They will include: an assessment of (a) the outcomes generated, (b) the processes used to generate them, (c) project impacts, and d) lessons learned. Advice will be given on how the M&E results can be used to adjust the work if needed and on how to replicate the results in the region.

15. Co-Funding

Government of Mexico
The Government of Mexico, through the SEMARNAT and other agencies (CONAFOR, CONAGUA, IMTA, INE, CONABIO, CONANP, SEGOB, SCT, CONAPESCA, SEDESOL), will assign financial resources of approximately USD 2,708,448,000 to complement the GEF grant.

US National Marine Fisheries Service (NOAA)
NOAA will spend $1,500,000 on habitat research and restoration and $1,000,000 on Marine Protected Area research across the five US Gulf states and in cooperation with each state's fisheries and habitat agencies to complement restoration and management activities by Mexico on a yearly basis during Years 1 through 4 of the project. These figures includes stakeholder meetings, in-ground restoration activities, follow-up monitoring, reporting, vessel and aircraft operations (if any), and all necessary personnel.

TOTAL PROJECT WORKPLAN AND BUDGET							
Project Title: Natural Habitat and Ecosystem Conservation of Coastal and Marine Zones of the Gulf of Mexico: Wetlands, Mangroves, Sea Grass Beds and Sand Dunes							
GEF Outcome/Atlas Activity	**Sub-components**		**Amount ($) Year 1**	**Amount ($) Year 2**	**Amount ($) Year 3**	**Amount ($) Year 4**	**Total ($) All Years**
1. Target Restoration Sites Mapped and Selected	Revision of coastal habitat mapping		10,000				10,000
	Data analyzed to determine habitat quality and plan sites		25,000				25,000
	Associated land use patterns and water quality data defined		10,000				10,000
		Sub-total	**45,000**				**45,000**
2. Integrated ecosystem based management needs assessed and capacity building program implemented	Habitat management and restoration activities defined		100,000				100,000
	Training activities on restoration & rehabilitation techniques			60,000			60,000
		Sub-total	**100,000**	**60,000**			**160,000**
3. Pilot Restoration and Rehabilitation Actions Successfully implemented	On-the-ground restoration/rehabilitation in selected sites		5,000	50,000	50,000	50,000	155,000
	Environmental monitoring program developed		5,000	10,000			15,000
	Evaluation of geomorphology & hydrology of degraded mangrove ecosystems undertaken		50,000				50,000
	Strategies for sand dune rehabilitation/conservation to mitigate coastal erosion implemented			50,000	50,000	50,000	150,000
		Sub-total	**60,000**	**110,000**	**100,000**	**100,000**	**370,000**
4. Public Awareness and Education Outreach Enhanced	Robust public education outreach program developed and implemented		5,000	10,000	10,000	15,000	40,000
	Integrated multi-sectoral approach developed		10,000	10,000			20,000
		Sub-total	**15,000**	**20,000**	**10,000**	**15,000**	**60,000**
5. Adaptive Management and Best Management Practices	Project implemented in cost-effective manner		6,000	6,000	6,000	6,000	24,000
	M&E plan developed		3,500				3,500
	Mechanism for replication defined					7,500	7,500
		Sub-total	**9,500**	**6,000**	**6,000**	**13,500**	**35,000**
		Total	**229,500**	**196,000**	**116,000**	**128,500**	**670,000**

Component and Activities	Year 1				Year 2				Year 3				Year 4			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
1. Target Restoration Sites Mapped and Selected																
Revision of coastal habitat mapping	■	■														
Data analyzed to determine habitat quality and plan sites		■	■													
Associated land use patterns and water quality data defined		■	■	■												
2. Integrated ecosystem based management needs assessed and capacity building program implemented																
Habitat management and restoration activities defined	■	■	■	■												
Training activities on restoration & rehabilitation techniques					■	■	■	■								
3. Pilot Restoration and Rehabilitation Actions Successfully Implemented																
On-the-ground restoration/rehabilitation in selected sites	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Environmental monitoring program developed	■	■	■	■	■	■	■	■								
Evaluation of geomorphology & hydrology of degraded mangrove ecosystems undertaken	■	■	■	■												
Strategies for sand dune rehabilitation/conservation to mitigate coastal erosion implemented					■	■	■	■	■	■	■	■	■	■	■	■
4. Public Awareness and Education Outreach Enhanced																
Robust public education outreach program developed and implemented	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Integrated multi-sectoral approach developed	■	■	■	■	■	■	■	■								
5. Adaptive Management and Best Management Practices																
Project implemented in cost-effective manner	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
M&E plan developed	■															
Mechanism for replication defined															■	■

LOGICAL FRAMEWORK MATRIX

Pilot Project on Natural Habitat and Ecosystem Conservation of Coastal and Marine Zones of the Gulf of Mexico: Wetlands, Mangroves, Sea Grass Beds and Sand Dunes

OBJECTIVES	INDICATOR	MEANS OF VERIFICATION	ASSUMPTIONS & RISKS
Project Objective: To promote the ecosystem approach for conservation and management of wetlands, particularly mangrove ecosystems, sea grass beds and sand dunes in order to maintain their functional and structural integrity, to conserve associated biodiversity, and to ensure economic and social benefits of future generations.	Specific project sites with emphasis on critical habitats such as mangrove ecosystems, wetlands, sea grass beds and sand dunes rehabilitation actions implemented and coastal ecosystems health improved Y4 Strategies and actions for conservation in selected sites using ecosystem approach. Y4 Cost effective strategies to mitigate impacts from erosion, meteorological events developed, Y4	Project monitoring reports and files R-TAG technical review reports Project progress reports; Project monitoring reports and files Conducted actions, skilled personnel, employed people, works made in the implementation of restoration measures, rehabilitation and improvement in coastal and marine ecosystems	Country support to facilitate the LME-wide dissemination of results of the pilot project, with participation of all sectors and stakeholders. LME-wide objectives may conflict with local interests Environmental awareness and social participation of local people is present Willingness of stakeholder and financial resources are available
Outcome 1. Target Restoration Sites Mapped and Selected.	Sites selected, extent of mangrove, sea grass, sand dune, and wetlands mapped by Q2 Y1 Habitat quality of mangroves determined based on environmental, biological, land use, and water quality indicators by Q3 Y1 Land use patterns and water quality data defined Q4 Y1	Working group reports, project monitoring reports and files Data bases, aerial photography, site surveys, and other sources of information	Countries and organisations are willing to provide data and information on mangroves, sea grasses, sand dunes, wetlands Data and studies for the sites selected are available
Outcome 2 Integrated ecosystem based management needs assessed and capacity building program implemented	Assessment of the skill sets available, the types of actions being planned and implemented, and the mechanisms needed to achieve mangrove, wetland sea grass beds and sand dunes restoration and protection along the Mexico coast undertaken by Q4 Y1 Regional and site specific training activities on coastal and marine restoration and rehabilitation techniques to strengthen capacity development carried out by Q4 Y2	Evidence of delivery of training in project monitoring reports and files	Commitment of local and national organizations and authorities will ensure that training will build capacity at the systemic and not only individual level.

Outcome 3 Pilot restoration and rehabilitation actions successfully implemented	Selected project sites (mangrove, sand dunes and sea grass beds, wetlands) rehabilitated and evidence for their restoration by Y4 Environmental monitoring program established, linking all 3 pilot projects by Q4 Y2 Geomorphology and hydrology of degraded mangrove ecosystems evaluated in order to develop methods for implementing water quality improvements by Q4 Y1. Strategies and actions implemented in selected sites for the conservation of sand dunes in order to mitigate the impacts from erosion and meteorological events by Y4	Final report on results of the conservation pilot project Project monitoring reports based on: 1 **Composition**: species present and their relative abundance; 2 **Structure**: vertical arrangement of vegetation, water and soil components (living and dead); 3 **Pattern**: horizontal arrangement of system components; 4 **Heterogeneity**: a complex variable made of components 1-3; 5 **Function**: performance of basic ecosystem process (productivity, nutrient transfer) 6 **Dynamics and resilience**: successional process, rate and amplitude of recovery from disturbance.	Country support to facilitate the LME-wide dissemination of results of the pilot project, with participation of all sectors and stakeholders. Commitment of local organizations and stakeholder groups will help ensure a successful outcome for the pilot projects Stronger links between scientists, stakeholders and decision makers; interchange information and knowledge, and development of practical advice and tools for field use.
Outcome 4 Public awareness and education outreach enhanced	Public awareness and educational outreach strategies involving national experts, private sector, civil society, NGOs and other interested parties are on-going. Y4 Integrated multi-sectoral sustainable development approach in place in the study zone by Q4 Y2	Public awareness committee meeting reports Evidence of delivery of educational outreach in project monitoring reports and files Project monitoring reports and files	Routine and effective involvement of stakeholders can only be accomplished by on-going encouragement, strengthened capacities, and financial commitment by donors and countries.
Outcome 5 Adaptive management and best management practices	Project implemented in a cost-effective manner in accordance with agreed work plans and budgets. Y4 Monitoring and evaluation Plan developed that provides timely assistance to keep project on track and recommend strategies to ease bottlenecks by Q1 Y1 Mechanism for replication of the restoration programme to other wetlands and coastal ecosystems in the GoM is drafted during Q3/Q4 Y4	SC meeting minutes; Project reports Internal project implementation reviews; final project evaluations Project reports; Final evaluations	Efficiency of start up of the project; timely appointment of pilot project staff M&E structure is operational very early in project implementation

Pilot Project 2: Enhancing Shrimp Production through Ecosystem Based Management

1. Country(s)

United States of America and Mexico

2. Title

RESTORING DEPLETED SHRIMP STOCKS THROUGH ECOSYSTEM BASED MANAGEMENT PRACTICES IN THE GULF OF MEXICO LARGE MARINE ECOSYSTEM

3. Executing Agency

SEMARNAT

5. Cost of Project

GEF: US$**720,000** Co-Funds: **US$ 18,466,332**

5. Linkage to Gulf of Mexico Large Marine Ecosystem Priorities

One of the priority transboundary problems identified during the Transboundary Diagnosis Analysis (TDA) process is that many stocks in the Gulf of Mexico are either over-fished or at (or close to) their maximum sustainable yield. This is particularly important for stocks shared between two or more countries, or stocks that are migratory or connected via egg or larval transport. One of the main problems, and challenges, identified is moving from a single-species, maximum sustainable yield management of fisheries to an ecosystem-based approach. The actions taken to address these two problems are tightly interlinked, since they are closely related.

Several multi-species and ecosystem models models have been developed, aimed at assisting in the development of fishery ecosystem policies for the Gulf of Mexico. These models have mainly focused on specific interactions and areas within the Gulf, often under very different assumptions. Current efforts are focused on the coordination of these models to address the following broad objectives:

1. To determine what models predict about the efficacy or impact of specific policy options, particularly concerning bycatch reduction in the shrimp fishery, impact of multispecies management tools such as closed areas and seasonal closures, and possible impacts of hypoxic areas and toxic algal blooms on demersal and pelagic fisheries production;

2. To develop a Gulf-wide demonstration ecosystem model for major stocks, trophic interactions, and habitat limiting factors, using data from existing models and assessments and that provides the necessary inputs for evaluating policy alternatives, particularly those related to habitat protection and regulation of shrimp and forage fish fisheries;

3. To develop a program of collaboration among the two countries to further develop the Gulf-wide model and to fill the information gaps identified during its development and testing.

This pilot activity will provide the basis for bilateral cooperation, establish a consistent and comprehensive model for LME-wide shrimp fishery management, and initiate the use of this model in the Mexican portion of the Gulf. Establishing a common model to manage this important stock will create the informational basis necessary for the development of mutually agreed management decisions.

Depth gradient throughout the Gulf of Mexico Image modified from ESRI Data & Maps (2000). M. Nipper, J.A. Sánchez Chávez, and J.W. Tunnell, Jr., Editors. 2007. GulfBase: Resource Database for Gulf of Mexico Research. World Wide Web electronic publication. http://www.gulfbase.org

Overfishing of shared, migratory or connected stocks was identified as a priority problem in the TDA. It is a cross cutting issue that has strong linkages to the other two pilot projects, *Joint Assessment and Monitoring of Coastal Conditions in the Gulf of Mexico* and *Natural Habitat and Ecosystem Conservation of Coastal and Marine Zones of the Gulf of Mexico: Wetlands, Mangroves, Sea Grass Beds and Sand Dunes*. In order to contribute to future SAP implementation, the three pilots are sited in the same area, Terminos Lagoon, in order to achieve greater cost-effectiveness, maximize synergies and set the foundations for integrated, ecosystem-based approaches to natural resource management. By setting the pilot projects in the same location, the pilot strategies will generate practical experiences to address a complex baseline of overlapping policies and competencies for protected area conservation, social and economic development and threats to terrestrial, coastal and marine biodiversity. The harmonized development of the three pilot projects will moreover contribute to defining a stronger baseline, and to the development of validated integrated approaches that will facilitate upscaling to other States and at a national level. Options for replication beyond the project area will also be enhanced.

6. Linkage to National Priorities and Programmes

Policy

Mexico is among the first 20 countries in the world in fish production, providing around 1% of the total volume of catches (Rivera-Arriaga and Villalobos, 2001). Fishing production in Mexico varies between 1.35 and 1.57 million tons per year[12], with the Gulf of California being the most productive. The second most important region for fisheries is the Gulf of Mexico, with Tabasco the most active state, followed by Tamaulipas, Campeche and Quintana Roo[13].

[12] Anuario Estadístico de Pesca 2002.

[13] In the case of the Gulf of Mexico, the states with the greatest population dedicated to fishing are Veracruz with 19 thousand people, Tabasco, Chiapas and Guerrero with over 10 thousand, even when these do not coincide with the highest levels of production.

Mexican fisheries policies cover its entire Exclusive Economic Zone (EEZ) within the Gulf of Mexico (GM) and Caribbean Sea (CS). There are 10 general bylaws that apply to fishing resources for both coastlines (Pacific and Atlantic) and 8 particular bylaws for the Mexican GM and CS resources such as shrimp, octopus, queen conch, oyster and tuna. Moreover five additional bylaw projects for the Gulf of Mexico and Caribbean Sea are being developed around red grouper and associated species, and crabs.

The Mexican Government has given special attention to fisheries where a decrease in production has been registered. Efforts have been made to define, design and develop specific strategies, programmes and policies in order to prevent further depletion. One example of the initiatives mentioned apply to the shrimp fishery which has a governmental regional research program that consists of: 1) A permanent stock assessment and sampling cruises during closures; ; 2) Monitoring programs with satellite vessel survey and coastal lagoon actions coordinated between fishing authorities and the Navy; 3) Financial and technological aspects addressed through diverse mechanisms including special subsidized prices for diesel use and technology conversion programs (such as those promoted by FAO-GEF to adopt new net designs with better performance and high tech and long lasting materials); 4) Social issues addressed through policies for co-management, and a permanent invitation to give extra value to fish products.

Considering the above, this project is compliant with the sustainable use of natural resources for oceans and coasts, based on scientific knowledge, as mentioned in the environmental policy guidelines for oceans and coasts of the "National Environmental Policy for the Sustainable Development of the Coasts and Oceans of Mexico: Strategies for their Conservation and Sustainable Use" and the new fishing Mexican law.

Fisheries

The U.S. Gulf of Mexico is the second most productive region for fishery landings, following the US Pacific coast, with 800 thousand tons or 17% of the total landings in 2003[14]. Highest fishery catches by weight in the U.S. Gulf are menhaden and shrimp. Menhaden landings were the second largest tonnage in the U.S. at 600,000 tons, and Gulf landings were valued at $70 million USD. Louisiana produced the largest menhaden tonnage. Shrimp were the second most valuable fishery in the U.S. in 2003. Gulf of Mexico shrimp landings were the largest regional fishery in the country, with 127,000 tons or 81% of the national total of shrimp landed with a valued at $424 million USD. Louisiana, Texas, and Florida produced the largest shrimp landings. Conservation of habitats and resources that support these valuable fisheries is one of the mandates of the United States.

7: Name and Post of Government Representative endorsing the Demonstration Activity

Mexico: Antonio Diaz de León Corral, General Director for Environmental Policy, and Regional and Sectoral Integration. Secretary for Environment and Natural Resources (SEMARNAT).

United States of America: Alex Chester, Acting Director, Southeast Fisheries Science Center, National Marine Fisheries Service, National Oceanic and Atmospheric Administration (NOAA).

8. Project Objectives and Activities

8.1 Background

Currently, over-exploitation of fish stocks is a common problem in Mexico due to the great demand for food and jobs, the use of modern technologies making fishing effort more efficient, and non-selective fishing gear

[14] Fisheries of the United States, 2003. US Department of Commerce, NOAA, NMFS. *Current Fishery Statistics* No. 2003

resulting in bycatch of non-target species, discards, and habitat damage. Coastal and marine habitat modifications also contribute to the depletion of fish stocks.

Management of commercially harvested species is single species-based and mostly implemented for high price species. Current models have focused on a maximum yield approach and generally do not incorporate uncertainty on natural mortality, recruitment and environmental processes. Generally, main management tools include area and temporal closures and size limits; however, increasing illegal fishing and illegal fishing gear represent a significant problem that is aggravated by weak enforcement. Most of the species are not regulated at all, leading to the current situation characterized by many species being over-exploited or exploited at or near the maximum sustainable level.

In particular, the shrimp fishery is the most valuable for the Gulf of Mexico. This fishery is characterized by particular problems associated to the shrimp life cycle. A main concern is allocation, due to the fishery's sequential nature. In Mexico, the industrial fleet targets mainly adults in offshore waters, whereas the artisanal fleet catches juveniles in estuaries and coastal lagoons or close to shore. Three species dominate catches in the Gulf of Mexico and the Mexican Caribbean Sea: brown shrimp (*Farfantepenaeus aztecus*), white shrimp (*Litopenaeus settiferus*) and pink shrimp (*Farfantepenaeu. duorarum*), the same species are caught in the USA. Administratively the Mexican shrimp fishery is divided into two main areas: the Tamaulipas-Veracruz zone and the Campeche-Tabasco zone. Currently, the Tamaulipas-Veracruz zone contributes 64% of the total landings and is composed mostly (89%) of brown shrimp (SEMARNAP, 1996). In the early 1960's, the Campeche-Tabasco zone produced 90% of total landings (FAO, 1978), but in the 1990's its production decreased to 50% of total landings, and now its current contribution is around 25% of total landings. The Campeche-Tabasco fishery is supported by three species including white, brown and pink shrimp (11, 30 and 59% of catch composition respectively). In addition, other species have local economical importance, for example, the seven barbs shrimp (*Xiphopenaeus kroyeri)* for the Isla del Carmen region.

Bycatch in the shrimp fishery is also a big concern. It is composed of more than fifty fish species and an average proportion of 1:5.7 kg [15]. Bycatch is also a main concern in the U.S.. Both countries have focused on developing and deploying effective bycatch reduction devices. In particular, in the Mexican Pacific, new fishing gear with bycatch reduction devices for turtles and fish have been developed recently; in the Atlantic this program will start this year.

Over the past decades, total shrimp landings in the Campeche-Tabasco have declined noticeably, while landings of brown shrimp along the Tamaulipas-Veracruz region show signs requiring immediate attention in order to keep profitable catches and to maintain long term sustainability of this fishery. Shrimp fisheries in the U.S. Gulf of Mexico exhibit annual variations in catch, but do not show any long term trends.

8.2. Objectives and Activities

The overall outcomes of the project are designed to:

1) Strengthen the capacities for improved stock assessments and data collection that will be required for future multi-species and ecosystem-level analysis;
2) Establish baseline information, including available environmental variability information, for tracking improvements in stock status and fisheries abundance as new regulatory and management practices are implemented;
3) Ensure fully-informed and fully-involved stakeholders representing all involved sectors and interests;
4) Employ coherent project planning and implementation through an effective communication process;
5) Establish effective and coordinated surveillance and enforcement mechanisms and enhanced capacities for enforcing compliance of regulations;
6) Improve the knowledge of: current socioeconomic conditions; the contribution of shrimp fisheries to local economies; the market chain; current and potential alternative economic activities; human population structure and key stakeholders; and estimations of the legal and illegal fishing efforts, with full integration into ecosystem based management;

[15] Sustentabilidad y Pesca Responsable en Mexico. Evaluación y Manejo 1997-1998, INP SEMARNAP

7) Achieve an enhanced understanding of the interactions of fishery species and protected species with higher and lower components of the food web, including human extractive activities, for assessing the potential impacts of fishing in non target species; and,
8) Make a contribution to the benefits represented by other commercially important species.

Activities

1. Joint Stock Assessments undertaken to define baselines for new LME-wide methodologies

- LME-wide methodologies defined in order to establish the types of data (life history, fishery landings, fishing effort etc.), gap analysis completed to determine necessary data including fishery-independent data, food habits data, and time series of environment parameters.
- Necessary data gathered including fishery-independent data, food habits data, and time series of environment parameters
- Present fishery status at the selected site diagnosed: Initial joint stock assessments of shrimps conducted in order to establish a baseline against which the new methodologies for ecosystem-based management can be compared to determine impact and effectiveness.
- Local governance structures, customs and traditional rules in local shrimp fishing, and existing or emerging conflicts among fishermen reviewed by a multi-sectoral working group to define the challenges for implementation of new management regimes.

2. Engagement of local stakeholder to achieve buy-in and conflict resolution

- The stakeholder analysis undertaken. This will provide the basis for ensuring the adequate and effective dissemination of requisite scientific information
- Stakeholder involvement plan implemented for targeted local stakeholders in support of project goals, and to identify potential conflicts.
- Conflict issues and challenges for implementing ecosystem based management identified given that the diversity of actors and interests involved in artisanal and industrial shrimp fisheries requires that professional facilitators and experts in multi-sector collaborative processes aid in the socialization of the selected management scenarios.
- Conflict issues strategy for implementing ecosystem based management defined.

3. Development of multi-species and full ecosystem models for target species

- Suite of innovative methodologies developed for the selected project sites including multi-species and full ecosystem models for the holistic management of the targeted species. These models will include trophic interactions, linkages to environmental conditions in nurseries and socio-economic considerations. This will support, and feed into, SAP development.

4. Generation of Alternative Livelihoods

- Alternative livelihood options explored for fisher folk including training technicians in environmentally sensitive aquaculture techniques
- Aquaculture outreach program initiated
- Regulations proposed to ensure environmental safe aquaculture

5. Adaptive Management and Learning

- Project implemented in a cost-effective manner in accordance with agreed work plans and budgets
- Monitoring and Evaluation Plan implemented providing inputs for robust adaptive management
- Lessons learned from the project captured and disseminated

8.3. End-of Project Landscape (Outputs)

The expected results and outputs from the project implementation are as follows:

An ecosystem based management framework will be produced, which with minor adjustments may be implemented in other parts of the Gulf of Mexico Large Marine Ecosystem. Multi-species ecosystem models that include trophic interactions will be used to assist in management decisions.

Current bi-lateral initiatives for regional surveys and stock assessments will be strengthened. Appropriate fishing, bycatch and discards limits will be determined which will thereby contribute to improved fish stocks. Regional capacity for assessing and monitoring fish stocks and promoting sustainable fisheries will be improved.

Legislative, policy and regulatory frameworks at national and LME-wide levels will be harmonized to achieve sustainable fisheries and will include means for enhancing compliance and enforcement capacities. Laws will be strengthened to ensure regional benefits through provisions for more accurate stock assessments and estimates of fishing mortality, and to provide improved and consistent national fisheries legislation designed to recover fish stocks and habitats, maintain ecosystem structure and functions in the face of uncertainty and therefore increase regional capacity for sustainable management of regional stocks. Surveillance and enforcement mechanisms in the GoM LME will be enhanced and compliance with regulations will be reinforced to prevent and reduce illegal fishing activities, as well as non-declared and unreported catches.

Current initiatives for development of recovery plans for fisheries currently overfished or otherwise degraded will be strengthened. Protective measures for non-target species and other marine flora and fauna will enable countries to sustainably manage endangered ecosystems, habitats and marine living resources.

9. Rationale for GEF Involvement and Fit with GEF Operational Programmes and Strategic Priorities

This project is consistent with the Focal Area Strategies and Strategic Programming for GEF-4 as defined in the 11 May document, GEF/C.31/10, in particular Strategic Program 1 on ***Restoring and sustaining coastal and marine fish stocks and associated biological diversity***. The selected site (Terminos Lagoon and adjacent continental shelf) has been subject to heavy exploitation of its fish stocks, where the main target species are shrimp, but due to the nonselective gear employed, there is an impact on other commercially important species (finfish and crabs). As called for under SP1, work to support policy, legal and institutional framework reform will be implemented at local, state and federal levels of government. Capacity will be built to promote sustainable alternative livelihoods (aquaculture). Stakeholder participation will be promoted to address existing and potential conflicts between fishers and other resource users (tourism, oil industry and agriculture). This pilot is complemented by the pilot on Habitat Restoration (see Pilot 1 above) that is being undertaken in the same area, precisely in order to enhance synergies. As noted above, the geographic layering of the three pilots in the same area sets the basis for an ecosystem- based management approach to address the various issues that cause stress to the environment will be implemented.

The scope of this pilot project is enhanced as it is nested within a Full Sized Project (FSP) under SO1 that provides for the requisite enabling environment through foundational capacity building and the establishment of a regional framework for strengthened regional cooperation and partnerships. The FSP is consistent with OP9, and this pilot contributes to this OP as its focus is on the coastal interface. In addition, as called for under the GEF 4 Biodiversity strategy, this pilot has contributes to the interlinkages with this focal area as it addresses the degradation of coastal resources and processes.

10. Project Management Structure and Accountability

This project will be executed by the Undersecretariat of Planning and Environmental Policy of SEMARNAT. There will be close participation with the Ministry of Agriculture Livestock, Rural Development, Fisheries and Food (SAGARPA), and the National Fisheries Institute (INP) through SEMARNAT´s *Crosscutting Agendas*.

A Pilot Project Coordination Unit (PPCU) will be established in the Undersecretariat, which will have responsibility the successful execution of project activities in accordance with the agreed work plans and budgets, as well as for day-to-day project activities. UNDP and UNIDO will act as co-implementation agencies.

The PPCU will comprise of a Project Coordinator, senior level technical expertise (as required), and requisite administrative and secretarial support. The Project Coordinator will liaise closely with the Chief Technical Advisor (CTA) to ensure strong coordination between pilot activities and the FSP. Direct and ongoing oversight of pilot project activities will be the responsibility of the Project Coordinator, in close association with the CTA. Consultants will be retained as necessary and priority will be given to the recruitment of consultants from the participating countries and the region, as available.

A Project Advisory Group (PAG) will be established to provide technical support as well as to enhance coordination between SEMARNAT and agencies with relevant mandates in particular the Ministry of Agriculture Livestock, Rural Development, Fisheries and Food (SAGARPA), and the National Fisheries Institute (INP), as well as to facilitate engagement and support by U.S. counterparts. The project will facilitate, strengthen and streamline actions with the fishery sector to establish support for ecosystem-based management approaches. In addition, the Inter-Ministerial Commission for the Integrated Management of Oceans and Coasts (CIMIOC) under SEMARNAT´s leadership will ensure that the results of this pilot project will be promoted and disseminated. The activities proposed here will be reviewed by scientists and experts of relevant agencies. This will enable existing assessment approaches to be adjusted to fit with the ecosystem based management approach and help foster linkages between fisheries actions, biodiversity, ecosystem health and conservation, thus improving the capacity of both Ministries as well as fostering cooperation between the two entities. These agencies as well as relevant USA counterpart institutions will comprise the PAG. A representative of the PAG will participate in the R-TAG.

The Project Coordinator will report on execution of the Pilot Project through the CTA to the Steering Committee. If the Steering Committee so decides, the Project Coordinator may be invited to participate in a meeting.

11. Stakeholders and Beneficiaries:

GOVERMENT STAKEHOLDERS

ACRONYM	SPANISH NAME	TRANSLATION / EQUIVALENT
ANP	Áreas Naturales Protegidas	Natural Protected Areas
CIMIOC	Comision Intersecretarial para el manejo Integrado de Oceanos y Costas	Commission for the Integrated Management of Oceans and Coasts
CAN	Comisión Nacional del Agua	National Water Commission
CONABIO	Comisión Nacional de Biodiversidad	National Biodiversity Comission
CONAPESCA	Comisión Nacional de Pesca	National Fishing and Aquaculture Commission
CONANP	Comisión Nacional de Áreas Naturales Protegidas	National Commission for Protected Natural Areas
	Consejo Consultivo Nacional para el Desarrollo Sustentable	National Advisory Council for Sustainable Development
CRDCM	Consejo Regional para el Desarrollo Costero y Marino	Regional Council for Coastal and Marine Development
DGIPEA	Dirección General de Investigación en Política y Economía Ambiental	Directorship for Research in Policy and Environmental Economy
	Direccion de Investigacion y Analisis Institucional y de Politica Publica	Department of Research and Institutional Analisys and Public Policy
	Dirección de Integración Regional	Department of Regional Integration
DGPAIRS	Dirección General de Política Ambiental Integración Regional y Sectorial	General Departmentof Environmental Policy Integration
	Director General de Política Ambiental Integración Regional y Sectorial	General Director of Environmental Policy Regional and Sectoral Integration
	Dirección General de Zona Federal y Ambientes Costeros	General Department of Federal Zone and Coastal Environments

INE	Instituto Nacional de Ecología	National Institute of Ecology
INP	Instituto Nacional de la Pesca	National Fishing Institute
PANICCO	Programa Ambiental Nacional de Investigación Científica para las Costas y Océanos	National Environmental Program for Scientific Research on Coasts and Oceans
PDU	Programa de Desarrollo Urbano	Urban Development Programs
PEMEX	Petróleos Mexicanos	Mexican Oil
PMIC	Programa de Manejo Integral Costero	Integrated Coastal Management Programs
PROFEPA	Procuraduría Federal de Protección al Ambiente	Federal Environmental Protection Agency
SAGARPA	Secretaría de Agricultura, Ganadería, Desarrollo Rural, Pesca y Alimentación	Secretariat of Agriculture, Ranching, Rural Development, Fishing and Food
SANICO	Sistema Ambiental Nacional de Información de Costas y Océanos	National Environmental Information System for Coasts and Oceans
SEDESOL	Secretaría de Desarrollo Social	Secretariat of Social Development
SEMAR	Secretaría de Marina	Navy Secretariat
SEMARNAT	Secretaría del Medio Ambiente y Recursos Naturales	Secretariat of the Environment and Natural Resources
	Autoridades Estatales y Municipales	State and County Authorities

OTHER STAKEHOLDER GROUPS

CANAIPES	Camara Nacional de la Industria Pesquera	National Chamber of the Fishing Industry
	Armadores	Private Shrimp Fishers
	Cooperativas Pesqueras Camaroneras	Shrimp Fisher Cooperatives
	Cooperativas Pesqueras	Fisher Cooperatives
CCE	Consejo Coordinador Empresarial Estatal	State Chamber of Comerce
	Instituciones de Investigacion	Research Institutions
	Universidades	Universities
ONG	Organismos no Gubernamentales	NGO Non Governmental Organizations

12. Long-term Sustainability Strategy

The implementation of this pilot project aims to restore depleted shrimp stocks through ecosystem based management practices in the Gulf of Mexico Large Marine Ecosystem. Through project activities, supported by strong outreach programs, it is expected that the productive sectors that use this resource will understand and come to support the activities proposed.

Stakeholder involvement plays an important role in the project. Their involvement in all activities and a continuous update on all stages of the project, will allow stakeholders to "see" that by reducing or eliminating stress on the environment (rivers, coastal lagoons) through better practices (changes in fishing practices, pollution reduction), they will produce an increase in shrimp catch and also other fisheries landings that are related to these areas. Society in general must also be informed and made conscious to help enforce laws and regulations that exist or that will be implemented to care for the natural ecosystems, so that all can benefit from their wealth. Individuals and groups repeat (or copy) successful projects; *seeing is believing.* Successful project implementation will encourage stakeholders and society in general to understand the importance of maintaining and protecting ecosystem services and functions, for themselves and for future generations.

13. Replicability

The benefits derived from an effective and successful demonstration of this nature will be of great value in the implementation of Ecosystem Based Management Practices programs in other Mexican States, in the U.S. and potentially in Cuba should it decide to participate or benefit from activities in the GoM project. The benefits from this project are also replicable globally and could be applied in other regions. Particularly, the project outputs will provide new methodologies and a practical framework for better management practices that can be replicated in other tropical countries. If successful, this project can create crosscutting action programs and synergies between federal agencies, local governments the fishing community.

14. Monitoring and Evaluation Process

The PCU will produce a brief quarterly Progress Report updating the Steering Committee and the project Executing Agencies on the progress of the pilot project based on the approved Logical Framework Matrix and the project work plan detailed below. Once every year a detailed report will be submitted through the Steering Committee to the Executing Agencies. This report will provide a full review of the work plan to identify project achievements and deliveries versus the approved schedule, budget expenditures, recommendations with respect to any amendments to work plan and budget, staff contracting and performance, and any other information required by the Steering Committee and/or the Executing Agencies.
In addition to this, the project strategy and objectives, intended outputs, implementation structure, work plans and emerging issues will be regularly reviewed and evaluated annually by the Project Steering Committee. Periodic Status Reports will be prepared at the request of the Steering Committee for presentation at key meetings associated with the Project.

The pilot project will also be subject to:

- Internal Project Implementation Reviews to be conducted by the CTA and submitted to the implementing agency at the end of months 6, 12, 18 of the project program.
- An independent final project evaluation to be undertaken in month 24.

The project evaluations will be carried out in accordance with UNDP/GEF requirements and will cover all aspects of the project. They will include: an assessment of (a) the outcomes generated, (b) the processes used to generate them, (c) project impacts, and d) lessons learned. Advice will be given on how the M&E results can be used to adjust the work if needed and on how to replicate the results in the region.

15. Co-Funding

Government of Mexico
The Government of Mexico, through the SEMARNAT, INP, and INE, will assign financial resources of approximately USD $ 466,332 to complement the GEF grant.

Government of the USA
NOAA will spend $2,500,000 through the Fishery Independent Monitoring Surveys (SEAMAP) and associated NOAA Vessel costs, and $2,000,000 on Stock Assessments of shrimp and finfish across the five US Gulf states and in cooperation with each state's fisheries and habitat agencies to complement activities by Mexico on a yearly basis during Years 1 through 4 of the project. These figures includes stakeholder meetings, in-ground restoration activities, follow-up monitoring, reporting, vessel and aircraft operations (if any), and all necessary personnel.

TOTAL PROJECT WORKPLAN AND BUDGET							
Project Title: Restoring Depleted Shrimp Stocks through Ecosystem Based Management Practices in the Gulf of Mexico Large Marine Ecosystem							
GEF Outcome/Atlas Activity	**Sub-components**		**Amount ($) Year 1**	**Amount ($) Year 2**	**Amount ($) Year 3**	**Amount ($) Year 4**	**Total ($) All Years**
1. Joint Stock Assessments undertaken to define baseline for new LME-wide methodologies	LME-wide methodologies and establish data defined		50,000	0.00	0.00	0.00	50,000
	Data gathered		185,000	175,000	0.00	0.00	360,000
	Present fishery status diagnosed		50,000	0.00	0.00	0.00	50,000
	Socio Economic analysis undertaken		30,000	0.00	0.00	0.00	30,000
	Challenges for implementation of new management regimes defined		0.00	0.00	7,500	7,500	15,000
		Sub-total	**315,000**	**175,000**	**7,500**	**7,500**	**505,000**
3. Engagement of local stakeholder to achieve buy-in and conflict resolution	Stakeholder analysis undertaken		5,000	4,000	0.00	0.00	9,000
	Stakeholder involvement plan developed		4,000	4,000	4,000	4,000	16,000
	Potential conflicts identified		5,000	0.00	0.00	0.00	5,000
	Conflict resolution strategy defined and implemented		5,000	0.00	0.00	5,000	10,000
		Sub-total	**19,000**	**8,000**	**4,000**	**9,000**	**40,000**
4. Development of multi-species and full ecosystem models for target species	Multi-species and full ecosystem models developed		20,000	20,000	0.00	0.00	40,000
		Sub-total	**20,000**	**20,000**	**0.00**	**0.00**	**40,000**
5. Generation of Alternative Livelihoods	Technicians trained in aquaculture techniques		15,000	10,000	10,000	10,000	45,000
	Aquaculture outreach program initiated		40,000	0.00	0.00	0.00	40,000
	Regulations proposed to ensure environmental safe aquaculture		10,000	0.00	0.00	5,000	15,000
		Sub-total	**65,000**	**10,000**	**10,000**	**15,000**	**100,000**
6. Adaptive management and learning	Project implemented in cost-effective manner		6,000	6,000	6,000	6,000	24,000
	M&E plan developed		3,500	0.00	0.00	0.00	3,500
	Mechanism for replication defined		0.00	0.00	0.00	7,500	7,500
			9,500	**6,000**	**6,000**	**13,500**	**35,000**
		TOTAL					**720,000**

Summary of Funds:	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Total**
GEF	**428,500**	**219,000**	**27,500**	**45,000**	**720,000**
SEMARNAT	134,583	69,500	7,333	12,500	223,916
INP	135,083	69,500	7,333	14,500	226,416
INE	7,000	6,000	1,000	2,000	16,000
US Government In-Kind	15,000,000	15,000,000	15,000,000	15,000,000	60,000,000
TOTAL	15,705,166	15,364,000	15,043,166	15,074,000	61,186,332

Component and Activities	Year 1				Year 2				Year 3				Year 4			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
1. Joint Stock Assessments undertaken to define baseline for new LME-wide methodologies																
LME-wide methodologies and establish data defined																
Data gathered																
Present fishery status diagnosed																
Socio Economic analysis undertaken																
2. Engagement of local stakeholder to achieve buy-in and conflict resolution																
Stakeholder analysis undertaken																
Stakeholder involvement plan developed																
Conflict issues and challenges for implementing ecosystem based management identified																
Conflict issues strategy for implementing ecosystem based management defined																
3. Development of multi-species and full ecosystem models for target species																
Multi-species and full ecosystem models developed																
4. Generation of Alternative Livelihoods																
Alternative livelihood options explored for fisher folk including training technicians in environmentally sensitive aquaculture techniques																
Aquaculture outreach program initiated																
Regulations proposed to ensure environmental safe aquaculture																
5. Adaptive Management and learning																
Project implemented in cost-effective manner																
M&E plan developed																
Mechanism for replication defined																

LOGICAL FRAMEWORK MATRIX

Pilot Project on Restoring Depleted Shrimp Stocks through Ecosystem Based Management Practices in the Gulf of Mexico Large Marine Ecosystem

OBJECTIVES/OUTCOMES	INDICATOR	MEANS OF VERIFICATION	ASSUMPTIONS & RISKS
Project Objective: To contribute to the recovery of depleted stocks through an ecosystem based management approach, focusing mainly on the shrimp fishery..	Recovered depleted stocks through an ecosystem based management approach, focusing mainly on the shrimp fisheries. Y4 Strengthened capacities for improved stock assessments and data collection. Y4 Established effective and coordinated surveillance and enforcement mechanisms. Y4 Improved knowledge of current socioeconomic conditions derived from shrimp fisheries. Y4	Project monitoring reports and files R-TAG technical review reports Project progress reports; Project monitoring reports and files	Country support to facilitate the LME-wide dissemination of results of the pilot project, with participation of all sectors and stakeholders. LME-wide objectives may conflict with local interests Conflicting interests between different stakeholder groups
1. Joint Stock Assessments undertaken to define baselines for new LME-wide methodologies	LME-wide methodologies defined in order to establish the types of data required by Q2 Y1 Necessary data gathered including fishery-independent data, food habits data, and time series of environment parameters by Q4 Y1 Present fishery status at the selected site diagnosed including an initial baseline assessment of shrimp by Q4 Y1 Review of local governance structures, customs and traditional rules in local shrimp fishing, and existing or emerging conflicts among fishermen carried out by Q4 Y1	Working group reports, project monitoring reports and files	Scientific and technical groups providing inputs are committed to joint work
2. Engagement of local stakeholder to achieve buy-in and conflict resolution	Detailed stakeholder analysis completed by Q4 Y1 Stakeholder Involvement Plan implemented for targeted local stakeholders in support of project goals, and to identify potential conflicts by Q4 Y2 Conflict issues and challenges for implementing ecosystem based management identified by Q4 Y2 Conflict issues strategy for implementing ecosystem based	Project monitoring reports and files Stakeholder Involvement Plan Project monitoring reports and files	In order to resolve conflicts there is a need for local and national support to facilitate the dissemination of results of the pilot project, with participation of all sectors and stakeholders. Country support for the Stakeholder Involvement Plan

	management defined by Q4 Y3	Project monitoring reports and files	
3. Development of multi-species and full ecosystem models for target species	Suite of innovative methodologies developed for the selected project sites including multi-species and full ecosystem models by Q2 Y4	Final report on results of the Shrimp pilot project; Project monitoring reports and files	Timely delivery of data and information from the participating countries Commitment of local organizations and stakeholder groups will help ensure a successful outcome for the pilot projects
4. Generation of Alternative Livelihoods	Alternative livelihood options explored for fisher folk including training technicians in environmentally sensitive aquaculture techniques by Q4 Y1 Aquaculture outreach program initiated by Q4 Y1 Regulations proposed to ensure environmental safe aquaculture by Q2 Y2	Evidence of delivery of training programme in project monitoring reports and files Evidence of delivery of outreach in project monitoring reports and files Project monitoring reports and files	Institutional commitment is needed to ensure that training will build capacity at the systemic and not only individual level. LME-wide objectives may conflict with local interests
5. Adaptive Management and Learning	A clearly defined mechanism for replication Project implemented in a cost-effective manner in accordance with agreed work plans and budgets. Y4 Monitoring and evaluation Plan developed that provides timely assistance to keep project on track and recommend strategies to ease bottlenecks by Q1 Y1 Mechanism for replication of the monitoring programme to other estuaries and coastal lagoons in the Mexican GoM is drafted during Q3/Q4 Y4	SC meeting minutes; Project reports Internal project implementation reviews; final project evaluations Project reports; Final evaluations	Efficiency of start up of the project; Timely appointment of pilot project staff M&E structure is operational very early in project implementation

Pilot Project 3: Joint Assessment and Monitoring of Coastal Conditions in the Gulf of Mexico

1. Country(s)

Mexico and United States of America

2. Title

JOINT ASSESSMENT AND MONITORING OF COASTAL CONDITIONS IN THE GULF OF MEXICO

3. Executing Agency

SEMARNAT

4. Cost of Project

GEF: US $ 0.770 million; Co-Finance: US $ 11.700 million

5. Linkage to Gulf of Mexico Large Marine Ecosystem Priorities

Coastal degradation is one of the main transboundary problems identified for the Gulf of Mexico. Degradation, together with an absence of ecosystem-based management information relating to fisheries, environmental quality, and other aquatic resources, makes management of the Gulf of Mexico Large Marine Ecosystem challenging. Without an LME-wide consistent and comprehensive regional monitoring system, informed management actions remain largely site specific. This proposed project will build upon the substantial knowledge and track record of coastal conditions monitoring in the U.S. portion of the Gulf of Mexico, including EPA's National Coastal Assessment, and NOAA's SEAMAP, thus creating a complimentary ecological monitoring system in Mexico's portion of the Gulf of Mexico. This joint monitoring and assessment survey will contribute to meeting the Project objective by creating a consistent baseline of environmental information throughout the LME that will be used to better define required regulatory and policy reforms as well as to target restoration areas. The survey will be implemented within the framework of the SAP for Ecosystem Based Management of the Gulf of Mexico Large Marine Ecosystem. The current pilot project proposal is thus linked to identified priorities by both countries, and sets the basis for improvements in water and sediment quality, biotic resources, coastal ecological conditions, and fisheries.

This pilot activity will provide the basis for bilateral cooperation; establish a consistent and comprehensive design for LME-wide monitoring of coastal conditions, and initiate monitoring in the Mexican portion of the Gulf. Establishing a common set of environmental condition (or health) indicators and a common sampling design framework that takes advantage of the extensive experience and activities used for monitoring the U.S. portion of the Gulf of Mexico will create the informational basis necessary for the development of mutual management decisions.

The augmentation of the existing U.S. EPA environmental monitoring system by the addition of a consistent and comprehensive monitoring system for the coastal resources of Mexico's Gulf of Mexico will permit the expansion of the monitoring system in the most efficient manner possible that will meet the management needs of both countries. In addition, it presents the opportunity for NOAA to assist in expanding EPA's monitoring protocols into offshore waters. Using the joint-integrated monitoring system to determine the status and trends of the coastal environment will enable both countries to assess the efficacy of environmental management decisions, legislation, and environmental policies - an important and integral part of fiscal and environmental accountability. The results of the joint monitoring program will allow both governments, as well as the public, to assess the performance of actions undertaken, and thus if these have improved the condition of the environment and to what extent.

Additionally, it is important to underline that this pilot project, along with the two others proposed in the Full Project are all sited in the same area, Terminos Lagoon, in order to achieve greater cost-effectiveness, maximize synergies and set the foundations for integrated, ecosystem-based approaches to natural resource management. By layering the pilots in the same location, the pilot strategies will generate practical experiences to address a complex baseline of overlapping policies and competencies for protected area conservation, social and economic development and threats to terrestrial, coastal and marine biodiversity. The harmonized development of the three pilot projects will moreover contribute to defining a stronger baseline, and to the development of validated integrated approaches that will facilitate upscaling to other States and at a national level. Options for replication beyond the project area will also be enhanced.

6. Linkage to National Priorities and Programs

This project links activities described in Mexico's National Strategy for Ecological Land Use Planning of Coastal and Marine Areas presented by the President in 2007 as a national priority, and in particular with the ongoing Ecological Land Use Planning for the Gulf of Mexico and Caribbean Sea. In the United States, it relates to the EPA-NOAA-USGS National Coastal Assessment Program, which includes the entire USA Gulf of Mexico coast.

Currently, different agencies and institutions carry out the respective monitoring of diverse parameters in accordance to their mandate (e.g., water, air, pollution, and ecosystem health). However, these are not articulated and there are considerable gaps as well as missed opportunities for harmonizing data and undertaking integrated assessments. Therefore, under NAFTA, the CEC (Commission for Environmental Cooperation of North America) in Mexico is starting to develop a National environmental programme for monitoring that will complement those already established in the United States and Canada. This programme is broad in scope as it will cover a wide array of ecosystem, biodiversity and human health parameters. The current pilot will constitute an important input to this effort. In particular it will be an important contribution in terms of, for example, definition of standardized methodologies, sampling design, and sampling sites. Of particular importance is also the selection of participating institutions and agencies, both from the public and private sectors, based on analysis of institutional capacities.

In addition to this, the National Commission for Natural Protected Areas (CONANP) has a monitoring system on Natural Protected Areas, and the National Forestry Commission has other programs devoted to mangrove rehabilitation in coastal areas. The National Water Commission will also be involved in this project as it has among its duties watershed management and linkages to coastal ecosystems management.

7. Name and Post of Government Representative endorsing the Demonstration Activity

Mexico: Antonio Diaz de León Corral, General Director for Environmental Policy, and Regional and Sectoral Integration. Secretary for Environment and Natural Resources (SEMARNAT)

United States of America: Alex Chester, Acting Director, Southeast Fisheries Center, National Marine Fisheries Service, National Oceanic and Atmospheric Administration (NOAA).

8. Project Objectives and Activities

8.1. Background

The pilot project will be sited at Terminos Lagoon, a very complex system of estuaries, lagoons, wetlands and associated terrestrial ecosystems that cover 2500 km^2 in the southwestern Gulf of Mexico. Several rivers (most of them from the Usumacinta-Grijalva basin) drain into the lagoon. It has high biodiversity, both in terms of species and habitats, with high endemism rates. Although a protected area, it harbors many endangered, threatened and protected species. Along with another protected area, Centla Marshlands, it receives the total discharge of the Grijalva-Usumacinta river system into the sea, the most important in Mexico since it roughly represents 35% of total freshwater runoff in the country, and it is the second most important in the Gulf of Mexico after the Mississippi. The high freshwater flow creates a seasonal front in the continental shelf, blocking water circulation and mixing across the shelf and thus trapping nutrients, suspended matter and pollutants nearshore.

Associated with the high productivity of the lagoon there is a high primary productivity, and it is considered the most important breeding ground for several species of shrimp and finfish in the southern Gulf of Mexico. The largest commercial fishing fleet in the Mexican portion of the Gulf depends on these resources. The high biological diversity and productivity of Terminos Lagoon are threatened by the large agricultural areas surrounding it (mainly rice and sugar cane), population growth and oil extraction and transport activities. Roughly 87% of domestic oil production is extracted offshore, very close to the lagoon.

In terms of its importance from an ecosystem-perspective and the level of impacts it receives, it constitutes an ideal site for this pilot project given its biological and socioeconomic importance. The tight relationship between environmental health and important fisheries resources in this ecosystem provides a unique opportunity to demonstrate the use of monitoring as an integral part of adaptive management, and both environmental and fiscal accountability. The main fishery in this region is shrimp, which has a short life span, thus allowing changes due to management to be visible in a relatively short time.

Traditionally, monitoring has focused on surveying or collecting information about flows, water levels and the chemical compounds in rivers, lakes and the ocean. However, such an approach does not contribute to understanding whether these traditional environmental drivers or stressors have any effect on the biological/ecological resources comprising the targeted ecosystem. Without such biological/ecological information, it is difficult to determine whether the level of nutrients, contaminants, or even temperature meaningfully impact the ecosystem or not. For this reason, there is increasing recognition (particularly in developed countries) that assessment of ecological condition of water bodies requires more than compliance to a long list of chemical and physical parameters. In any case, it is nearly impossible to effectively monitor the combination and levels of hundreds of chemical compounds in single water bodies given in particular issues of cost and time. Therefore this pilot project proposes to adopt other types of measurements that are more cost effective, and reliable methods of environmental monitoring.

One of the important lessons learnt after decades of environmental monitoring is that it is necessary to include other measures of environmental status. The experience of the National Coastal Assessment Program in the United States of America has led to a more comprehensive approach that includes water quality (nutrient analysis and primary productivity), sediment quality (pollutant concentrations), human risk from consumption of fish, etc. This approach can give a more balanced assessment of environmental status, that associated with the probability based sampling design, provides a robust, cost effective and scientifically defensible basis for adaptive management and accountability. This approach will be the basis for the monitoring strategy of the pilot project, with the changes agreed during the initial expert consultation.

It should be also noted that deterioration of water quality and ecosystem degradation are two of the five priority transboundary problems in the Gulf of Mexico identified by the countries. The proposed pilot project will address both those problems, as well as the other priority transboundary problem, which have a clear linkage with water quality and ecosystem degradation issues: ecosystem-based management.

8.1.a. Proposed Monitoring Pilot Survey Design Approach

The sampling design for the monitoring program will be probability-based, which provides a robust, unbiased and cost-effective way to get environmental results which are scientifically defensible. Figure 1 depicts a mocked-up version of a sampling strategy for Campeche estuarine resources, showing 30 probabilistic sites (red, yellow and green sites) within Campeche's estuaries. In addition, Figure 1 depicts an offshore region of Campeche where approximately 30 additional sites would be located. Offshore sampling would be similar to that available from the standard NOAA resource surveys on the U.S. continental shelf. A finalized survey design (station locations), as well as a finalized list of indicators to be sampled and the specific timing of the survey, would be determined in the workshop planned as the first outcome of this proposed pilot project.

Figure 1. *Mock-up sampling design for the estuarine and coastal resources of Campeche, Mexico*

Such an environmental monitoring program exists in the United States' portion of the Gulf of Mexico – the National Coastal Assessment (Fig. 2). A similar design to that in Figure 2 will be developed for the 2010 US coastal survey. Harmonizing a similar program in Mexico's portion of the Gulf of Mexico designated for this pilot (Campeche) would take advantage of the decades of research and progress made in the United States by its federal and state institutions, and permit the identification of geographic "hot spots" and thematic "hot issues" for individual or bilateral management intervention. The proposed program will strengthen Mexico's capacities for coastal assessments and monitoring, sample analysis and data processing, thus enabling Mexico to join the ongoing monitoring and assessment programs already in place in the U.S. and allow both countries eventually to create a Gulf-wide joint, regionally harmonized monitoring program.

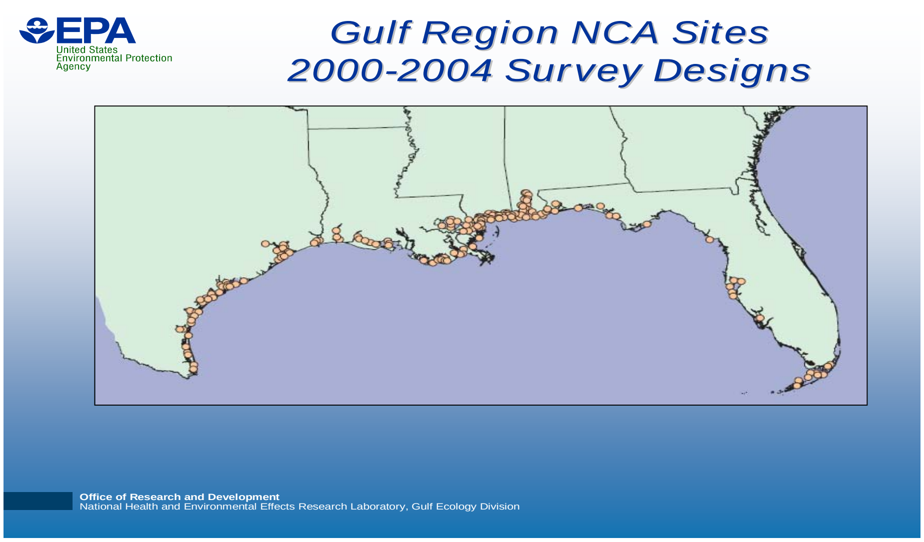

Figure 2. *National Coastal Assessment sites for monitoring in the Gulf of Mexico from 2000-2004*

An important component of this program is to ensure the quality and comparability of the results, since it is a regional program and it is foreseen that several different laboratories in all countries will participate. Thus, a regionally agreed quality control and assurance (QA/QC) component will be included to ensure the validity and comparability of all analytical results. Such a QA/QC plan already exists for the US and the development of a bi-lateral plan would be a targeted output for the first workshop.

8.2. Objectives and Activities

Objective: To strengthen capacities for joint monitoring, assessment and evaluation of the coastal environment in support of the Gulf of Mexico Large Marine Ecosystem management goals and objectives. This will be achieved through the following activities:

Activities

1. Coastal ecosystem health indicators developed

- A roster of regional and national experts to contribute to the development of a suite of regionally harmonized coastal ecosystem health indicators identified
- Terms of reference for a regional monitoring program, and a suite of regionally harmonized indicators, that includes recommendations for future local and regional assessment activities developed
- A regional stakeholder validation of the proposed terms of reference and harmonized indicators conducted.

2. Capacity building program implemented and integrated ecosystem based management needs enhanced

- Capacity needs assessment conducted in the pilot site and in relevant Mexican national institutions
- Training courses and materials prepared based on needs identified during the needs assessment
- Specialized training courses provided to a representative group of stakeholders in environmental monitoring, including sampling design, data interpretation and evaluation

3. Pilot monitoring conducted

- Complete baseline sampling for determination of the ecological condition of adjoining estuarine and coastal environments of Terminos Lagoon completed, with active participation of regional and local management authorities, scientists, and other stakeholders to complement the sites already incorporated into the existing US monitoring program
- Evaluation of the potential for extending sampling protocols to adjacent states or systems in Mexico undertaken, an exercise that will also feed into SAP development.

4. Report on ecosystem health prepared

- Data analyzed and baseline assessment of ecological health of coastal waters in the Gulf of Mexico LME as a basis for elaboration of a *State of the Coast of the Gulf of Mexico* report prepared
- The *State of the Coast of the Gulf of Mexico* report prepared
- A dissemination strategy for the *State of the Coast of the Gulf of Mexico* report implemented

5. Adaptive Management and Learning

- Project implemented in a cost-effective manner in accordance with agreed work plans and budgets
- Monitoring and Evaluation Plan provides inputs for robust adaptive management
- A clearly defined mechanism for replication of the monitoring programme to other estuaries and coastal lagoons in the Mexican GoM

8.3. End-of Project Landscape (Outputs)

The expected results and outputs from the project implementation are listed as follows:

- A set of joint, harmonized and simple screening indicators developed
- Improved scientific knowledge for joint management of coastal ecosystems and increased technical capacity for environmental monitoring in the region, including by local management authorities, scientists, and other key stakeholders
- Programs for biological monitoring designed and implemented using stakeholder input. Sample processing, data analysis, and reporting programs delineated.
- Establishment of a standardized monitoring framework which is regionally replicable and complimentary throughout the Gulf of Mexico LME
- Based on the result of the Pilot Monitoring conducted, evaluation of the potential for extending sampling protocols to adjacent states or systems in Mexico completed

- Enhanced coordination of regional monitoring activities and basis set for future inter-annual, coastal-wide monitoring in coordination with U.S. counterparts.
- National and regional capacity for ecosystem-based management enhanced. Thus providing for improved environmental quality and ecosystem integrity in the Gulf of Mexico Large Marine Ecosystem
- Improved accountability of management approaches and solutions by providing robust monitoring information on the status and trends of the coastal environment of the Gulf of Mexico
- Potential integration of biological monitoring into water quality standards and national Water Plans

9. Rationale for GEF Involvement and Fit with GEF Operational Programs and Strategic Priorities

The project is fully compliant with the ***International Waters Focal Area Strategy and Strategic Programming for GEF4.*** The objective of this pilot project is cross-cutting and will provide critical inputs that will enable the Project to deliver on Strategic Program 1 ***Restoring and sustaining coastal and marine fish stocks and associated biological diversity***, as well as Strategic Program 2 ***Reducing nutrient over-enrichment and oxygen depletion from land-based pollution of coastal waters in LMEs consistent with the GPA.*** The harmonized methodologies and data generated by this pilot will lay the bases for greater regional cooperation in this field between Mexico and the United States, and will preliminarily define the ecosystem status indicators called for by GEF. Information from the pilot will assist in defining appropriate responses to address land-based sources of marine pollution that create anoxic “dead” zones in coastal waters, as well as activities and reforms geared at reducing ecosystem stress on critical coastal areas including bays, estuaries, and wetlands. It is thus a key input to the evolution of ecosystem-based management approaches. Overall, given that it is a project under Strategic Objective 1, the pilot will contribute to expanding foundational capacity building. Finally, consistent with the OP 9 objectives, the pilot project will provide critical inputs for decision makers at the local, state and federal level for modification of the policy framework, identification of new management measures for the LME and proper scoping of the Gulf of Mexico carrying capacity.

GEF is requested to support the strategic elements of this joint approach in the short-term (3 years duration of this pilot activity) in order to consolidate the capacity necessary to ensure the longer-term sustainability of this bilateral effort in the GoM/LME. The GEF-financed segments of the pilot project include training and support for the identification and assimilation of best practices in information sharing and management in large marine ecosystems, harmonization of methodologies for impact indicators in the LME as well as support for wide stakeholder participation in the regional monitoring efforts.

10. Project Management Structure and Accountability

This project will be executed by SEMARNAT, under the leadership of the Under-Secretariat of Planning and Environmental Policy which currently coordinates coastal and marine related issues. A Pilot Project Coordination Unit (PPCU) will be established in the Under-Secretariat, which will have responsibility for the successful execution of project activities in accordance with the agreed work plans and budgets, as well as for day-to-day project activities. UNDP and UNIDO will act as co-implementation agencies.

The PPCU will be comprised of a Project Coordinator, senior level technical expertise (as required), and requisite administrative and secretarial support. The Project Coordinator will liaise closely with the Chief Technical Advisor (CTA) to ensure strong coordination between pilot activities and the Full-Size project. Direct and ongoing oversight of pilot project activities will be the responsibility of the Project Coordinator, in close association with the CTA. Consultants will be retained as necessary and priority will be given to the recruitment of consultants from the participating countries and the region, as available.

A Project Advisory Group (PAG) will be established to provide technical support as well as to enhance coordination between relevant agencies within SEMARNAT, and to facilitate engagement and support by USA counterparts. SEMARNAT´s administrative units are responsible within their mandated duties with environmental and ecosystem monitoring. These include the National Institute of Ecology which is leading most of the monitoring efforts related to air, water, biodiversity, ecosystems and human health, and establishing synergies with other government areas such as the Commission for Knowledge and Use of Biodiversity (CONABIO) for the definition of priority ecosystems areas for conservation using gap analysis. Particular linkages have been established with the National Water Commission (CONAGUA) and the Institute of Water Technology (IMTA) in regard to watershed and basin management and health conditions, as well as conservation and restoration programs. These agencies will comprise the PAG. A representative of the PAG will participate in the FSP Regional Technical Advisory Group (R-TAG).

The Project Coordinator will report on execution of the Pilot Project through the CTA to the Steering Committee. If the Steering Committee so decides, the Project Coordinator may be invited to participate in a meeting.

11. Stakeholders and Beneficiaries

Stakeholders and beneficiaries of the demonstration project are multiple. At the demonstration project site it will include:

- Ministries of Environment, or their equivalent, in Mexico and the United States of America
- State agencies in charge of water quality monitoring
- State agencies in charge of environmental compliance assurance
- Local-self government authorities, including departments of Nature Protection and Environment
- Regional environment, water and health authorities
- Water user associations
- Fishing industry
- Scientific community
- Regional and national NGOs, and their coalitions
- Local farmers, industries and businesses acting in the Gulf of Mexico
- Local population

It should be noted, however, that the list of beneficiaries of the proposed pilot project is not limited to Mexico and the United States of America. The lessons learnt can be applied throughout the whole Gulf of Mexico, and other Large Marine Ecosystems, through increasing the awareness of stakeholder organizations and the wider public. The outreach and public information activities will be used to provide relevant and easily understandable information for the different levels of stakeholders and will provide an enabling environment for more active participation.

12. Long-term Sustainability Strategy

Success of the pilot project will depend upon involvement of national and local administrations in Mexico and the United States of America, and, most importantly, local communities, without whose support improvements are unlikely to be sustained. Corresponding allocations from national budgets will be required for the continuous implementation of monitoring.

The idea of this project proposal was approved by the Mexican and USA participants in the workshop held in Merida, Yucatan, Mexico in August 2006. The fact that the Mexican and USA Governments agree to provide in-kind contributions of 1.0 and 1.6 million USD respectively, shows their commitment to this demonstration project.

The proposed biological monitoring system is easy to operate and will provide a relatively cheap alternative to existing monitoring processes over the longer term. Given the tangible and clear benefits to be derived from harmonized regional monitoring approaches, it is expected that countries will be willing to allocate corresponding financial means for continuing it in parallel with conventional monitoring.

There is a similar program already in place in the United States, and Mexico's new National Strategy for the Ecological Land Use Planning for Coasts and Oceans includes a strong component of environmental monitoring. NOAA has been conducting periodic sampling and assessment of fishery resources and habitats on the continental shelf for 30 years. The fact that the US programmes have already been under implementation for 15 years indicates a high level of commitment and continuity.

13. Replicability

The benefits derived from an effective and successful pilot within this thematic area will be of significant value both to Mexico and the United States, and within the Gulf of Mexico as a whole. Particularly, the project outputs will provide a source of lessons learnt and best practices that can be replicated throughout the Gulf and shared with other LME management frameworks given that the proposed approach is cost-effective, robust and scientifically defensible, providing invaluable inputs for adaptive, ecosystem based management and accountability.

14. Monitoring and Evaluation Process

The PCU will produce a brief quarterly Progress Report updating the Steering Committee and the project Co-implementation Agencies on the progress of the pilot project based on the approved Logical Framework Matrix and the project Workplan detailed below. Once every year a detailed report will be submitted through the Steering Committee to the Executing Agencies. This report will provide a full review of the work plan to identify project achievements and deliveries versus the approved schedule, budget expenditures, recommendations with respect to any amendments to workplan and budget, staff contracting and performance, and any other information required by the Steering Committee and/or the Executing Agencies.
In addition to this, the pilot project strategy and objectives, intended outputs, implementation structure, work plans and emerging issues will be regularly reviewed and evaluated annually by the Project Steering Committee. Periodic Status Reports will be prepared at the request of the Steering Committee for presentation at key meetings associated with the Project.

The pilot project will also be subject to:

3. Internal Project Implementation Reviews to be conducted by the CTA and submitted to the implementing agency every six months.
4. An independent final project evaluation to be undertaken in conjunction with the Terminal Evaluation for the FSP.

The project evaluations will be carried out in accordance with UNDP/GEF requirements and will cover all aspects of the project. They will include: an assessment of (a) the outcomes generated, (b) the processes used to generate them, (c) project impacts, and d) lessons learned. Advice will be given on how the M&E results can be used to adjust the work if needed and on how to replicate the results in the region.

15. Co-Funding

The GEF will finance costs related to: the establishment of a project implementation team; conducting studies in the Gulf of Mexico to identify mutually agreed indicators; sampling strategies, sample and data analysis; provision of training on sampling design, quality assurance and control (QA/QC), monitoring, incorporation of biological monitoring into existing monitoring program, and a workshop to develop and plan the joint monitoring, and to develop the mutually agreed set of common indicators. The total contribution requested from GEF is USD **770,000** for a three-year period.

<u>Government of Mexico</u>
The Government of Mexico, through the SEMARNAT, CONAGUA and INE/IMTA will assign financial resources of approximately USD $ 2,500,000 to complement the GEF grant.

Additionally, Mexico and the United States will provide in kind contributions in terms of staff support from relevant government agencies that will provide technical inputs to the project, as well as costs associated with telecommunications and provision of office space. It will be the responsibility of the two Governments to ensure the sustainability of the project upon completion of the GEF component of the project.

PEMEX

PEMEX funds a yearly monitoring of the southern Gulf of Mexico coastal and offshore waters that covers a large portion of the Mexican Gulf with a cost of US$1.2 million. It includes, among other things, pollutant analysis of water, sediments and fish, phytoplankton and zooplankton, water chemistry (dissolved oxygen, salinity, nutrients, chlorophylls, etc.), benthos, etc. During project implementation a link with this programme will be established, seeking a strong coordination and complementarity between the two projects. Of this monitoring program, and taking into account the sampling stations that are directly related to the pilot project area, the co-financing contribution amounts to $**300,000** per year.

Government of the USA

US coastal monitoring by US EPA has targeted $8.4M to conduct a national survey of estuarine resources in 2010. Of this amount, approximately $**1,000,000** per year will be expended in the Gulf of Mexico in the states of Florida, Alabama, Mississippi, Louisiana and Texas, in close coordination with this proposed pilot project. Activities will focus on sampling, sample analysis, statistical analysis and reporting. This figure includes about $100,000 per state for sample collection, and about $100,000 per state for sample analysis, statistical analysis and reporting (for a total of approximately $200,000 in each of the five states).

NOAA will spend **$1,000,000** per year for the offshore component of the sampling survey (formally called SEAMAP, the Southeast Area Monitoring and Assessment Program), expended across 5 US Gulf states and in cooperation with each state’s fisheries agency. SEAMAP provides sampling opportunities during synoptic fisheries collections to obtain appropriate samples for bio-monitoring analyses. This figure includes cooperative sample survey design (with US EPA), sample and data collection, appropriate analyses, reporting, vessel operations, and all necessary personnel.

TOTAL PROJECT WORKPLAN AND BUDGET						
Project Title: Joint Assessment and Monitoring of Coastal Conditions in the Gulf of Mexico						
GEF Outcome/Atlas Activity**	**Sub-components**	**Amount ($) Year 1**	**Amount ($) Year 2**	**Amount ($) Year 3**	**Amount ($) Year 4**	**Total ($) All Years**
1.Coastal ecosystem health indicators developed	A roster of regional and national experts identified	0.00	0.00	0.00	0.00	0.00
	Terms of reference for a regional monitoring program, developed	0.00	25,000	0.00	0.00	25,000
	Regional stakeholder validation of the proposed terms of reference carried out	0.00	15,000	0.00	0.00	15,000
	Sub-total	**0.00**	**40,000**	**0.00**	**0.00**	**40,000**
2.Capacity building program implemented and integrated ecosystem based management needs enhanced	Capacity needs assessment conducted in the pilot site and in relevant Mexican institutions	0.00	5,000	0.00	0.00	5,000
	Training courses and materials prepared	0.00	10,000	0.00	0.00	10,000
	Specialized training courses on environmental monitoring	0.00	35,000	25,000	0.00	60,000
	Sub-total	**0.00**	**50,000**	**25,000**	**0.00**	**75,000**
3. Pilot monitoring conducted	Complete baseline sampling completed	0.00	0.00	550,000	0.00	550,000
	Evaluation of the potential for extending sampling protocols undertaken	0.00	0.00	0.00	10,000	10,000
	Sub-total	**0.00**	**0.00**	**550,000**	**10,000**	**560,000**
4. Report on ecosystem health prepared	Data analyzed and baseline assessment of ecological health prepared	0.00	0.00	0.00	15,000	15,000
	State of the Coast of the Gulf of Mexico report prepared	0.00	0.00	0.00	5,000	5,000
	Dissemination strategy for the *State of the Coast of the Gulf of Mexico* report implemented	0.00	0.00	0.00	15,000	15,000
	Sub-total	**0.00**	**0.00**	**0.00**	**35,000**	**35,000**
5. Adaptive Management and Learning	Project implemented in a cost-effective manner	0.00	15,000	15,000	15,000	45,000
	Monitoring and Evaluation Plan provides inputs for robust adaptive management	0.00	0.00	0.00	5,000	5,000
	Mechanism for replication of the monitoring programme	0.00	0.00	0.00	10,000	10,000
	Sub-total	**0.00**	**15,000**	**15,000**	**30,000**	**60,000**
	Total	**0.00**	**105,000**	**590,000**	**75,000**	**770,000**

Component and Activities	Year 1				Year 2				Year 3				Year 4		
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3
Outcome 1: Coastal ecosystem health indicators developed															
1.1 Roster of experts for development harmonized coastal ecosystem health indicators															
1.2 Terms of reference developed for a regional monitoring program															
1.3 A regional stakeholder validation of indicators carried out															
Outcome 2: Capacity building program implemented and integrated ecosystem based management needs enhanced															
2.1 Capacity needs assessment conducted in the pilot site and in relevant Mexican national institutions															
2.2 Training courses and materials prepared based on needs identified during the needs assessment															
2.3 Specialized training courses provided to a stakeholders in environmental monitoring															
Outcome 3: Pilot monitoring conducted															
3.1 Complete baseline sampling in adjoining estuarine and coastal environments completed															
3.2 Evaluation of the potential for extending sampling protocols to adjacent states or systems in Mexico undertaken															
Outcome 4: Report on ecosystem health prepared															
4.1 Conduct a regional workshop to analyze the data and prepare a baseline assessment of ecological health of coastal waters in the Gulf of															
4.2 Prepare the State of the Coast of the Gulf of Mexico report															
4.3 Implement a dissemination strategy for the State of the Coast of the Gulf of Mexico report															
Outcome 5: Adaptive Management and Learning															
5.1 Project implemented in a cost-effective manner in accordance with agreed work plans and budgets															

LOGICAL FRAMEWORK MATRIX

Pilot Project on Joint Assessment and Monitoring of Coastal Conditions in the Gulf of Mexico

OBJECTIVES/OUTCOMES	INDICATOR	MEANS OF VERIFICATION	ASSUMPTIONS & RISKS
Project Objective: To strengthen capacities for joint monitoring, assessment and evaluation of the coastal environment in support of the Gulf of Mexico Large Marine Ecosystem management goals and objectives	Joint monitoring, assessment and evaluation of the coastal environment of the Gulf of Mexico Large Marine Ecosystem capacity developed. Y3	Project monitoring reports and files; R-TAG technical review reports; Final report on results of the monitoring pilot project	Country support to facilitate the LME-wide dissemination of results of the pilot project, with participation of all sectors and stakeholders. LME-wide objectives may conflict with local interests
Outcome 1. Coastal ecosystem health indicators developed	A set of joint, harmonized and simple screening indicators developed by Q2 Y2 Terms of reference for a regional monitoring program, and a suite of regionally harmonized indicators drafted by Q3 Y2 The proposed terms of reference and harmonized indicators regionally validated by the key stakeholders by Q4 Y2	Working group reports, project monitoring reports and files	Scientific and technical groups providing inputs are committed to joint work
Outcome 2 Capacity building program implemented and integrated ecosystem based management needs enhanced	Assessment of environmental monitoring skill sets available (e.g. existing sampling, monitoring, data interpretation and quality control processes) in the pilot site undertaken by Q2 Y2 Training courses and materials prepared by Q3 Y2 Specialized training courses in environmental monitoring, including sampling design, data interpretation and evaluation provided to representative groups of stakeholders carried out by Q4 Y2	Evidence of delivery of training in project monitoring reports and files Report of the training program, including type and number of instructors, number of trained people, criteria for approval, contents and evaluation of the courses.	Commitment of local and national organizations and authorities will ensure that training will build capacity at the systemic and not only individual level.
Outcome 3 Pilot monitoring conducted	Baseline sampling for determination of the ecological condition of adjoining estuarine and coastal environments of Terminos Lagoon completed, with active participation of stakeholders by Q3 Y3 Based on the result of the Pilot Monitoring conducted, evaluation of the potential for extending sampling protocols to adjacent states or systems in Mexico completed by Q4 Y3	Final report on results of the monitoring pilot project; Project monitoring reports and files Project monitoring reports and files	Country support to facilitate the LME-wide dissemination of results of the pilot project, with participation of all sectors and stakeholders. Commitment of local organizations and stakeholder

			groups will help ensure a successful outcome for the pilot projects
Outcome 4 Report on ecosystem health prepared	Baseline assessment of ecological health of coastal waters in the Gulf of Mexico LME prepared by Q1 Y4 First Bi-annual *State of the Coast of the Gulf of Mexico* report report incorporating the findings of this pilot project published by end of Y4 Dissemination strategy for the *State of the Coast of the Gulf of Mexico* report implemented by end of Y4	Project monitoring reports and files Bi-annual regional status report Project monitoring reports and files Public awareness brochure, including information about state and health of these coastal ecosystems and their environmental, social and economic importance. Dissemination strategy document published and available	Timely delivery of data and information from the participating countries Participation of regional organizations and stakeholder groups will help ensure successful dissemination of the bi-annual report Access to effective and suitable means of diffusion Wide interest and penetration in the stakeholders to spread the information and detonate sensitization and participation
Outcome 5 Adaptive Management and Learning	A clearly defined mechanism for replication Project implemented in a cost-effective manner in accordance with agreed work plans and budgets. Y4 Monitoring and evaluation Plan developed that provides timely assistance to keep project on track and recommend strategies to ease bottlenecks by Q1 Y1 Mechanism for replication of the monitoring programme to other estuaries and coastal lagoons in the Mexican GoM is drafted during Q3/Q4 Y4	SC meeting minutes; Project reports Internal project implementation reviews; final project evaluations Project reports; Final evaluations	Efficiency of start up of the project; Timely appointment of pilot project staff M&E structure is operational very early in project implementation An efficient mechanism for budget administration that facilitates the development of the project and its programmed outcomes