### 1.2.2 The Gulf of Mexico Large Marine Ecosystem: Background and Strategic Action Program Implementation

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#### 1.2.2.1 Executive Summary

The *Transboundary Diagnostic Analysis of the Gulf of Mexico Large Marine Ecosystem* (TDA) was developed with scientists, experts, managers, and stakeholders, recognizing the high importance and commitment towards a healthy and productive GOM LME. It determined the baseline for transboundary priority issues in the Gulf region and serves as the basis for the immediate and long-term actions needed to modify sectoral policies, activities, and investments included in the Strategic Action Programme (SAP).

The TDA is a scientific and technical fact-finding analysis used to scale the relative importance of sources, causes, and impacts of transboundary water problems. It should be an objective assessment and not a negotiated document. To make the analysis more effective and sustainable it should include a governance analysis that considers the local institutional, legal, and policy environment.

The TDA was developed under four key points: 1) fact-finding, 2) prioritization, 3) participation, and 4) consensus, that jointly act as a diagnostic tool for measuring the effectiveness of the SAP implementation.

The SAP is a policy document negotiated by the governments of the United States and Mexico, through the coordination of the appointed Technical National Focal Points, including NOAA in the United States and the SEMARNAT in Mexico.

The SAP identifies six strategic areas to outline 71 priority actions within 21 action lines:

1. Improve water quality
2. Enhance economic vitality by avoiding depletion and recover degraded living marine resources (LMR)
3. Conserve coastal and marine ecosystems
4. Mitigate and adapt to climate change and sea-level rise
5. Improve science education and outreach
6. Cross-cutting issues

After validating the TDA and SAP the United States and Mexican governments collectively design and implement concrete actions for the protection and conservation of the GOM LME to promote shared policy goals and legal and institutional actions to address priority transboundary problems that have been previously identified by both NOAA and SEMARNAT.

To achieve the long-term objectives for the GOM LME, the SAP implementation prioritized the implementation of coordinated and integrated sustainable ecosystem-based management (EBM) approaches to address the three main transboundary challenges, and achieve the long-term Ecosystem Quality Objective (ECoQO):

- Control and reduce pollution
- Recovery of LMR
- Rehabilitation of marine and coastal ecosystems

During the second phase (2016–2021) there will be seven program executing agencies, who will collaborate to implement the activities outlined in the SAP under the supervision of scientific-technical staff from the United Nations Environment Programme (UN Environment) and with the close collaboration of the National Programme Coordinator and the Programme Management Unit.

#### 1.2.2.2 Background

Out of the 64 large marine ecosystems of the world, the GOM LME stands out for its unique cultural, economic, and ecological interconnectivity, and as a result for its high multisectorial economic value.

The nations bordering the GOM (Mexico, Cuba, and the United States) are increasingly aware of the threats, risks, and other relevant issues related to the management of the GOM LME, including its natural assets, socioeconomic value, and derived benefits to society, as well as their importance in the overall regional economic wealth.

Among these threats, the deterioration of coastal areas adjacent to urban centers due to pollution, oil spills, habitat loss, and unsustainable exploitation of marine and coastal natural resources stand out. Among the most outstanding consequences are an increase in algal blooms, extended low oxygen events or hypoxia, recent oil spill events, boat groundings on delicate coral reefs, and continuous oil exploration and contamination along the coast and beyond, with the respective risks of contamination threats to coastal and marine biodiversity in a basin that is highly vulnerable to storms and fluctuating climate conditions. Given that scenario, it is necessary to adopt new integrated management schemes to organize human activities in the GOM, with the objective of avoiding more serious economic and social consequences.

An apparent rise in the frequency of marked environmental changes in this ecosystem is evidenced by fluctuations in the distribution and abundance of fish such as tunas and herrings, pelagic birds (gannet and boobies), and cetaceans. This causes serious problems requiring different management levels for coastal and marine areas of the GOM LME (Duncan and Havard 1980; Pitkitch et al 2012; Roberts et al. 2016; Chen 2017).

The modular approach to LMEs is designed to link scientific assessments to states of change of coastal ecosystems, with the objective of supporting long-term sustainability and environmental quality.

The integrated EBM concept or approach seeks to ensure intergenerational sustainability of the ecosystem assets and services or processes, including hydrological and productivity cycles. This approach represents a change in paradigm and allows multisectorial interventions and a broader vision entailing an integrated ecosystem management approach that moves spatially from small to larger scales and from short-term to long-term management practices.

These efforts are geared towards intrasectorial integration in management of coastal productivity, fisheries and ecosystem contamination/health relative to socioeconomic benefits and government systems. The application of such assessments within the sphere of an ecosystem and its management is partly supported by funds from the Global Environment Facility (GEF) in collaboration with the national governments of the United States and Mexico.

GEF's operational strategy calls for the development and implementation of projects within the International Waters (IW) Program, designed to attain global benefits. In such a context, the GOM LME is currently implemented by Mexico and the United States under a more structured approach to restore and protect the environment in international waters.

The goal of the IW Program is to give countries the necessary support to make pertinent changes in human activities carried out by different sectors and to promote sustainable maintenance of a particular body of water and the numerous basins of each country. GEF has given special priority to the change of sectorial policies and activities responsible for the most important and serious basic causes of transboundary environmental concerns.

Based on the above, Mexico and the United States started a long-term partnership in 2009 towards the integrated management of the GOM LME. The two products resulting from the first phase of this program (2009–2011), the TDA and the SAP, are the foundations for the second phase, SAP implementation, to be conducted from 2016–2021.

#### 1.2.2.3 The Gulf of Mexico

The GOM LME is important in terms of biological productivity and includes a very high diversity of marine habitats including tropical and temperate ecosystems, estuaries, shallow inshore waters with soft bottoms, rocky bottoms and reef communities, as well as a large extension of deep sea that sustains an ample biodiversity of LMR. There are more than 300 species sustaining regional fisheries (including fishes, crustaceans, mollusks, echinoderms, and other invertebrates) in addition to LMR with unique ecosystem value in the trophic structure, such as seabirds, marine mammals, and sea turtles (Chen 2017).

Additionally, the GOM LME is a major asset to the surrounding countries, in terms of fisheries, tourism, agriculture, oil, infrastructure, trade and shipping. Commercial fishing and seafood processing are important components of the LME's economy. The infrastructure for oil and gas production in the GOM (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 United States and Mexico. Eighty-five percent of Mexico's oil extraction isundertaken in this region, as well as 72% of US offshore petroleum production. The GOM LME contains major shipping lanes, and the volume and value of shipping and port activities has increased in the region. The tourism industry has been rapidly increasing. Approximately 55 million people live in the coastal states of the GOM, nearly 40 million in the United States and around 15 million in Mexico.

However, this high biological importance and economic productivity are at risk from a suite of anthropogenic threats.

Many stocks in the GOM are overfished or are at or near their maximum yield. Intensive fishing is considered the primary force driving biomass changes in the GOM LME. Depletion and impacts on fish stocks affects both countries given that many stocks are shared, migratory, or connected via egg or larval transport (NOAA 2016).

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 of sand dunes, estuaries, marshes, seagrasses, coral reefs, mangroves, and other critical habitats.

Pollution and nutrient enrichment are important threats. The GOM is a semienclosed sea, which can aggravate pollution problems. The recent spill from the Macondo Block 252 oil well is a clear warning that more needs to be done to prevent this type of accident, but it also showed the limitations of current knowledge about the fate and effects of oil spills in the deep sea. Other industrial activities, urban wastewater, and particularly agriculture, are also important inputs of pollutants to the Gulf. All these activities introduce pollutants, such as metals (mercury is the main cause for fish consumption advisories in the United States), hydrocarbons (from the oil industry activities, but also from vehicle exhausts, industrial sources, rivers, urban runoff, etc.), pesticides from agricultural and urban use, and a recently recognized threat: emerging pollutants such as pharmaceuticals for human and veterinary use, personal care products, etc. As a relevant example, nutrient enrichment resulting from discharges in the Mississippi River results in a "dead zone" that forms every year in the northern GoM—one of the largest hypoxic zones of water in the world.

The Gulf Coast region is also especially vulnerable to the effects of a changing climate because of its relatively flat topography, rapid rates of land subsidence, water engineering systems, extensive shoreline development, and exposure to major storms.

These growing anthropogenic threats, and their potentially widespread impacts, evidence the tight interdependencies in terms of causes and effects and an LME-wide, EBM approach is required to effectively mitigate them in the long run. However, existing management approaches are not consistent with an ecosystem-based perspective and there are currently no agreed upon binational programs for managing the GOM's resources taking into account ecosystem-based requirements. Furthermore, the two countries have institutional frameworks for coastal and marine resources protection, but no effective regional intersectoral project coordination mechanism currently exists.

The principal global benefit of the project will be 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 EBM practices that will contribute to the protection and maintenance of ecosystem functions and services.

#### 1.2.2.4 GOM LME Objectives

The long-term Ecosystem Specific Quality Objectives (EcoQO) for the marine environment of the GOM LME and its social benefits are to:

> Improve water quality; enhance economic vitality by avoiding depletion and recover LMR; and conserve and restore coastal and marine ecosystems.
>
> Establish strategies and actions for the reduction and control of nutrient over enrichment, harmful algal blooms, and for the elimination of dead zones.
>
> Safeguard the habitats and community structure of the ecosystems from harmful impacts, including those caused by fisheries and pollution, that would diminish the contributions of these systems for enhancing livelihoods and human well-being.

Achieving these EcoQO will allow the GOM LME region to ensure societal benefits under a complex trans boundary scope:

> The provision of goods and services by the marine ecosystems of the GOM LME are such that they optimize the systems' contributions to societal well-being such as socioeconomic development, food security and enhanced livelihoods. The goods and services provided by the ecosystems are optimized to the region's development needs including the preservation of aesthetic, cultural, traditional, health, and scientific values of the ecosystems.

#### 1.2.2.5 Results Phase I

##### 1.2.2.5.1 Transboundary Diagnostic Analysis (TDA)

The TDA is a scientific and technical assessment, through which the water-related environmental issues and problems of a region are identified and quantified, their causes analyzed, and their impacts, both environmental and economic, assessed. The TDA is an objective assessment that uses the best available verified scientific and technical information to examine the state of the environment and the root causes for its degradation. The role of the TDA is to identify the relative importance of the sources and causes of transboundary water problems.

The analysis was carried out in a cross-sectoral manner, focusing on transboundary problems without ignoring national concerns and priorities. It involved the identification and prioritization of problems, their impacts (and associated uncertainties), and their causes at national, regional, and global levels, and the socioeconomic, political, and institutional context within which they occur.

The environmental impacts and socioeconomic consequences of the relevant transboundary problems were identified and indicated which elements are clearly transboundary in character like regional and/or national issues with transboundary causes (e.g., habitat destruction from urban development), transboundary issues with national causes (like point sources of pollution with ecosystem-wide impacts), national issues that are common to at least two of the countries and that require a common strategy (e.g., overexploitation of fisheries) and collective action to address issues that have transboundary elements or implications (e.g., climate change).

The objectives of the TDA for the GOM LME were to: (1) provide, on the basis of clearly established evidence, structured information relating to the scale and the relative importance of the causes and sources of the transboundary problems, and (2) identify practical preventative and remedial lines of action to ensure the sustainable integrated management of this LME, and (3) provide the technical basis for the development of an SAP.

#### 1.2.2.5.2 Strategic Action Programme

Through the SAP, the participating countries in the GoM LME region are adopting the following long-term vision:

> A healthy and resilient GoM where coastal communities enjoy high standards of quality of life and the region's socioeconomic activities are competitive and sustainable. Likewise, the region's natural resources, biophysical structure and landscape quality provide environmental services that halt threats and reduce vulnerability of the population and infrastructure.

The GOM LME SAP (Figure 1) purpose was to identify concrete actions, individually and collectively, at the national, sub-regional and regional levels to guarantee transboundary cooperation and the integrated assessment and management of the GOM LME in keeping with the following general guidelines:

1. The concept of sustainable development should be used in a manner that guarantees the use and enjoyment by future generations of the GOM and does not compromise the health of the GOM LME ecosystems.
2. Preventive actions should start with cooperation between the two countries, taking into consideration impacts of political decisions, programs, and plans.
3. The use of clean technologies should be promoted by addressing problems related to the ecosystem, gradually replacing the technologies currently in use that generate large quantities of waste.
4. The use of economic instruments and policies to accelerate sustainable development should be promoted, such as the application of economic incentives for the use of technologies and practices that are respectful of the environment.
5. Consideration for the health of humans and ecosystems should be promoted in the main sectoral policies and development plans of the countries, especially those relating to industrial development, fishing and aquaculture, coastal development, and maritime transport.
6. Participation and cooperation of the private sector should be encouraged and considered as an integral part of the successful management and implementation of the SAP.
7. Promoting transparency, public participation and cooperation are tasks of the GoM LME that should be encouraged through wide dissemination of information to improve integrated sustainable management.

ENVIRONMENTAL QUALITY STRATEGIC AREAS

| I. Improve Water Quality | II. Avoid Depletion & Recover Degraded Marine Resources | III. Conserve Coastal & Marine Ecosystems | IV. Mitigate & Adapt to Climate Change & Sea-Level Rise | V. Improve Science Education & Outreach |
|---|---|---|---|---|

ACTION LINES

| | | | | |
|---|---|---|---|---|
| A. Reduce pollution | A. Identify priority areas for maintenance of biodiversity | A. Promote restoration of natural processes in watersheds | A. Document potential impacts from climate change on the GOM-LME | A. Communicate & disseminate the goals & results of the LME program |
| B. Improve management practices | B. Promote sustainable fisheries | B. Protect marine & coastal connectivity | B. Support community adaptation to climate change & sea-level rise | |
| | C. Utilize traditional ecological knowledge | C. Promote community-based conservation programs | | |
| | | D. Reduce impacts of invasive species | | |
| | | E. promote community resilience & sustainable livelihoods | | |

**Figure 1. SAP components.**

In working collectively to design and implement concrete actions for the protection and conservation of the GOM LME living marine resources, the United States and Mexico recognized the following challenges:

- Control and reduce pollution: Reduce and control nutrient overenrichment, HABs and areas of hypoxia.
- Recovery of LMR: Achieve sustainable management and use of LMR, and work towards rebuilding overfished stocks.

Rehabilitation of marine and coastal ecosystems: Conserve biodiversity and habitats in marine and coastal ecosystems through regional cooperation and development of management plans while strengthening collaborations among multiple users of marine and coastal habitats to address these challenges.

The SAP presents 71 priority actions that are necessary for the long-term vision to be achieved. In identifying the actions, both agencies recognize the importance of promoting the improvement of general social and economic welfare. All the work related to the SAP considers that the health of coastal societies and their economies are directly related to the health of coastal and marine ecosystems. It is expected that the SAP implementation will be reached through the achievement of the EcoQOs during the second phase of the project.

#### 1.2.2.6 Next Steps

Building on the success of the GOM SAP Development Project, GEF awarded a second phase, to Mexico and the US for the development of the GOM SAP implementation project, and would have a shift of agency and would be entrusted to the United Nations Environment Program (UN Environment).

The UN Environment/GEF Project "Implementation of the Strategic Action Program of the Gulf of Mexico Large Marine Ecosystem" (GEF ID 6952; 2016-2020 – GOM SAP Implementation Project) is a five-year project specifically aimed at facilitating the implementation of the Mexico/US endorsed Transboundary Diagnostic Analysis (TDA–2011) and Strategic Action Plan (SAP–2013) for the integrated management of the GOM LME.

The project will achieve this by prioritizing the implementation of coordinated and integrated sustainable EBM approaches to address the transboundary concerns of countries bordering the GOM. Specifically, the actions proposed for the protection and conservation of the GOM LME have been designed and will be implemented to address the three main "challenges" identified by the SAP: controlling and reducing pollution, recovering LMR, and rehabilitating marine and coastal ecosystems. The SAP Environmental Quality Strategic Areas are:

- Improve water quality
- Avoid depletion and recover degraded LMR
- Conserve and restore coastal and marine ecosystems
- Mitigate and adapt to climate change and sea-level rise
- Improve science education and outreach
- Crosscutting strategic areas
- Promote compliance with existing institutional, policy and legal arrangements
- Create monitoring and evaluation indicators pursuant to GEF guidelines to measure success and progress to reach goals
- Enhance information and knowledge exchange and promote awareness and participation
- Incorporate sustainability, new technology and innovative economic instruments

The SAP's long-term EcoQO for the marine environment of the GOM is to improve water quality, enhance economic vitality by avoiding depletion and recover LMR, and conserve and restore coastal and marine ecosystems and contribute to global environmental benefits (Table 1). In particular, the EcoQO to improve water quality aims to establish strategies and actions to reduce and control nutrient enrichment, HABs, and dead zones. Its most relevant transboundary issues are: habitat alteration and/or loss; eutrophication and hypoxia; effects from hydrocarbons, pesticides, metals, emergent pollutants; and floating marine debris, especially plastics. Another EcoQO considers the safeguard of the habitats and community structure of the ecosystems from harmful impacts, including those caused by fisheries and pollution, that would diminish the contributions of these systems for enhancing livelihoods and human well-being.

**Table 1. Project's target contributions to global environmental benefits.**

| Corporate Results | Replenishment Targets | Project Target units |
|---|---|---|
| Maintain globally significant biodiversity and the ecosystem goods and services that it provides to society | Improved management of landscapes and seascapes covering 300 million hectares | Ha |
| Sustainable land management in production systems (agriculture, rangelands, and forest landscapes) | 120 million hectares under sustainable land management | Ha |
| Promotion of collective management of transboundary water systems and implementation of the full range of policy, legal, and institutional reforms and investments contributing to sustainable use and maintenance of ecosystem services | 20% of globally overexploited fisheries (by volume) moved to more sustainable levels | Percent of fisheries, by volume |
| Support to transformational shifts towards a low-emission and resilient development path | 750 million tons of $CO_{2e}$ mitigated (include both direct and indirect) | metric tons |
| Increase in phase-out, disposal and reduction of releases of POPs, ODS, mercury and other chemicals of global concern | Disposal of 80,000 tons of POPs (PCB, obsolete pesticides) | metric tons |
| | Reduction of 1,000 tons of Mercury | metric tons |
| | Phase-out of 303.44 tons of ODP (HCFC) | ODP tons |
| Enhance capacity of countries to implement MEAs (multilateral environmental agreements) and mainstream into national and sub-national policy, planning financial and legal frameworks | Development and sectoral planning frameworks integrate measurable targets drawn from the MEAs in at least 10 countries | Number of Countries |
| | Functional environmental information systems are established to support decision-making in at least 10 countries | Number of Countries |

#### 1.2.2.6.1 Component 1: Improve Water Quality in the Papaloapan, Panuco, Grijalva-Usumacinta, and Lower Coatzacoalcos River Basins

Under Component 1 the project will deliver the following outputs:

- Output 1.1: Assess water pollution indicators and reinforce the water quality monitoring mechanisms
- Output 1.2: Strengthen the dialogue between government and industry to jointly identify pollution hot spots in the 4 river basins
- Output 1.3: Implementation of the UNIDO Transfer of Environmentally Sound Technologies (TEST) methodology in priority hot spots identified
- Output 1.4: Implementation of the Environmental Monitoring Programme (coastal conditions monitoring program and early warning system)

The outcome of Component 1 will be:

- Water quality will be improved using pollution reduction measures through an EBM approach
- Specifically, for 50 industries with the highest pollution emissions:
    - Biological oxygen demand, N, and P emissions to water bodies will be reduced by 15%
    - Industrial water consumption will be reduced by at least 10%

The Mexican Institute of Water Technology (Instituto Mexicano de Tecnología del Agua—IMTA), the National Cleaner Production Center—Tabasco Unit (NCPC-TU), the Center for Research and Advanced Studies (CINVESTAV) and the National Commission for Knowledge and Use of Biodiversity (Comisión Nacional para el Conocimiento y Uso de la Biodiversidad [CONABIO]) will be entrusted as National Executing Agencies in line with their mandates and their comparative advantages.

#### 1.2.2.6.2 Component 2: Avoid Depletion and Recover LMR (Fish and Shellfish)

Under Component 2, the project will deliver the following outputs:

- Output 2.1: Implementation of a joint stock assessment for king mackerel (*Scomberomorus cavalla*) and spanish mackerel (*Scomberomorus maculatus*)
- Output 2.2: Use the results of the joint stock assessment for the development of new management plans for these transboundary species in Mexico and the amendment of existing management plans in the United States
- Output 2.3: Provide technical support to implement already existing management plans for red grouper (*Epinephelus morio*) and brown shrimp (*Farfantepenaeus aztecus*)
- Output 2.4: Implementation of Food and Agriculture Organization of the United Nations (FAO) Voluntary Guidelines on Small Scale Fisheries

The outcome of Component 2 will be:

- The recovery of LMR, specifically of targeted species, when compared to baseline levels, through establishment of no-take zones, effective reduction/closing of fishing season, reduction of number of fishing boats and strengthened role of women in fisheries and post-harvest activities resulting in:
    - Rebuilding of red grouper stock to at least 80% of the biomass necessary to produce maximum sustainable yield (BMSY)
    - Brown shrimp stock maintained at BMSY
- The sustainable exploitation of these species specifically with 21,000 tons of spanish mackerel caught in a sustainable manner as well as 40,000 tons of red grouper, shrimp and other fish species
- The improved management of other species achieved as a result of official agreements and cooperation mechanisms between the United States and Mexico, contributing to further recovery of LMR.

The National Fisheries Institute (Instituto Nacional de Pesca [INAPESCA]) will be entrusted as National Executing Agency with technical assistance to be provided by the FAO.

#### 1.2.2.6.3 Component 3: Conserve and Restore the Quality of the Coastal and Marine Ecosystem through Community Involvement and Enhanced Bilateral Cooperation

Under Component 3, the project will deliver the following outputs:

- Output 3.1: Community education programs focusing on domestic wastewater and solid waste sources will be implemented
- Output 3.2: Community-based wetland restoration in selected sites will be supported
- Output 3.3: Improved coordination and bilateral cooperation will be achieved through strengthening of networks
- Output 3.4: The effectiveness of MPAs will be enhanced by linking them into networks

The outcome of Component 3 will be:

- Improved ecosystem health from reduced pollution and nutrient loads into the mangroves and wetlands, in particular:
    - 30% reduction of the discharge of pollutants (waste and sewage)
    - 30% decrease in the amounts of waste handled incorrectly
    - Decrease in nutrient content and other pollutants resulting in a measurable reduction of contaminated mangrove areas
    - Accelerated recovery of the mangroves and wetlands cover
    - Significant and measurable carbon sequestration and water quality improvement
    - A network of MPAs in the Gulf of Mexico to focus science, education and management at special places that are critical for the conservation of the Gulf ecosystem. MPAs are the references for the strategies used to protect the Gulf's ecosystem and manage its resources.
- In addition, habitats will be recovered for ecologically important and/or commercially important fish species, as well as for resident and migratory bird species through promotion of protection and sustainable use of natural resources from an economic, touristic and food security perspective.

The outputs under Component 3 will be delivered by the Universidad Autónoma de Yucatán and the Instituto de Ecología, A.C. as National Executing Agencies as well as by the Project Management Unit (PMU). The PMU, via the Network of MPAs, has been allied with the work done in the TDA/SAP phase with NOAA´s National Marine Sanctuaries and National Protected Areas Offices The PMU has also made a recent alliance with The Ocean Foundation and CubaMar, with the work for more than 10 years on their "Trinational Initiative" 3NI, between Mexico, US, and Cuba, putting together RedGolfo de México.

The GOM SAP implementation project will address some of the issues and challenges identified by the SAP and in so doing will seek and support targeted actions to operationalize the implementation of the endorsed SAP. This will be achieved with an investment by GEF of $12.9 million (USD) and cofinancing by Mexico and the United States amounting to $124.2 million (USD) through implementation of three "action" components, the first aimed at improving water quality, the second at recovering depleted stocks of LMR, and the third, addressing the dual challenge of conservation and restoration of the ecosystem, and one management component, aimed at supporting effective monitoring and evaluation by UN Environment, and the widest possible dissemination of results and lessons learned.

#### 1.2.2.7 References

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