

# 3 Gulf of Mexico

## Overview

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), six Mexican states to the west (Quintana Roo, Tamaulipas, Veracruz, Tabasco, Campeche, Yucatan), and the island of Cuba to the southeast.

The Gulf measures approximately 1,600 km from east to west, 900 km from north to south, and has a surface area of 1,592,800 km<sup>2</sup>.<sup>1,21</sup>

## Location

### Basic information<sup>21</sup>

Surface area : 1,592,800 km<sup>2</sup>

Volume : 2,366,901 km<sup>3</sup>

Average depth : 1,486 m

Maximum depth : 3,787 m

## Nature

### < Background >

Drainage into the Gulf of Mexico is extensive and includes 20 major river systems (>150 rivers) covering over 3,800,000 km<sup>2</sup> of the continental United States. Annual freshwater inflow to the Gulf is approximately 1,060 km<sup>3</sup> per year. Of this inflow, 85% comes from the United States, with 64% originating from the Mississippi River alone. Additional freshwater inputs originate in Mexico, the Yucatan Peninsula, and Cuba.<sup>1</sup>



### Climate

Virtually every kind of weather condition has been known to occur in Texas State of the United States. January temperatures in the Rio Grande Valley have been known to register about 32 °C, while blizzards have blocked highways in the Panhandle section of the state during the same month. The Gulf Coast area around Houston has average annual temperatures around 21 °C and precipitation of some 1,100 mm, whereas the Panhandle averages about 16 °C with less than 500 mm of rain.<sup>2</sup>

### Topography

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%. The Sigsbee Deep, located in the southwestern quadrant, is the deepest region of the Gulf of Mexico. Its exact maximum depth is 3,787 m. Mean (average) water depth of the Gulf is 1,486 m and the basin contains a volume of 2,366,901 km<sup>3</sup> of water.<sup>1,21</sup>

### Hydrology

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.<sup>1</sup>

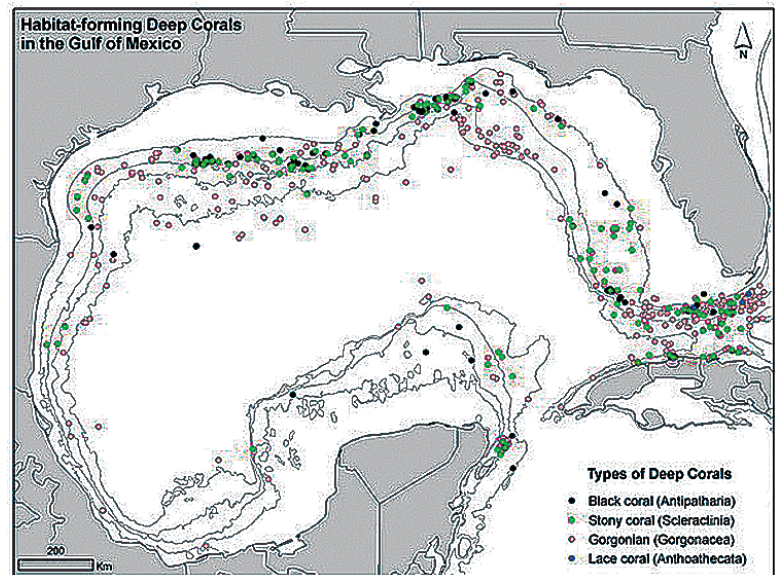
### < Surrounding environment >

The Gulf of Mexico estuaries provide critical habitats for a rich assemblage of fish, wildlife and plant species. Hundreds of species of birds, recreational and commercial fish and shellfish species, native cypress and mangroves, and threatened and endangered species such as sea turtles, Gulf sturgeon, beach mice and manatees can be found in the Gulf estuary. Also, these estuaries support submerged aquatic vegetation communities that stabilize shorelines against erosion, reduce non-point source loadings, improve water clarity and provide habitat.<sup>3</sup>

### Biota

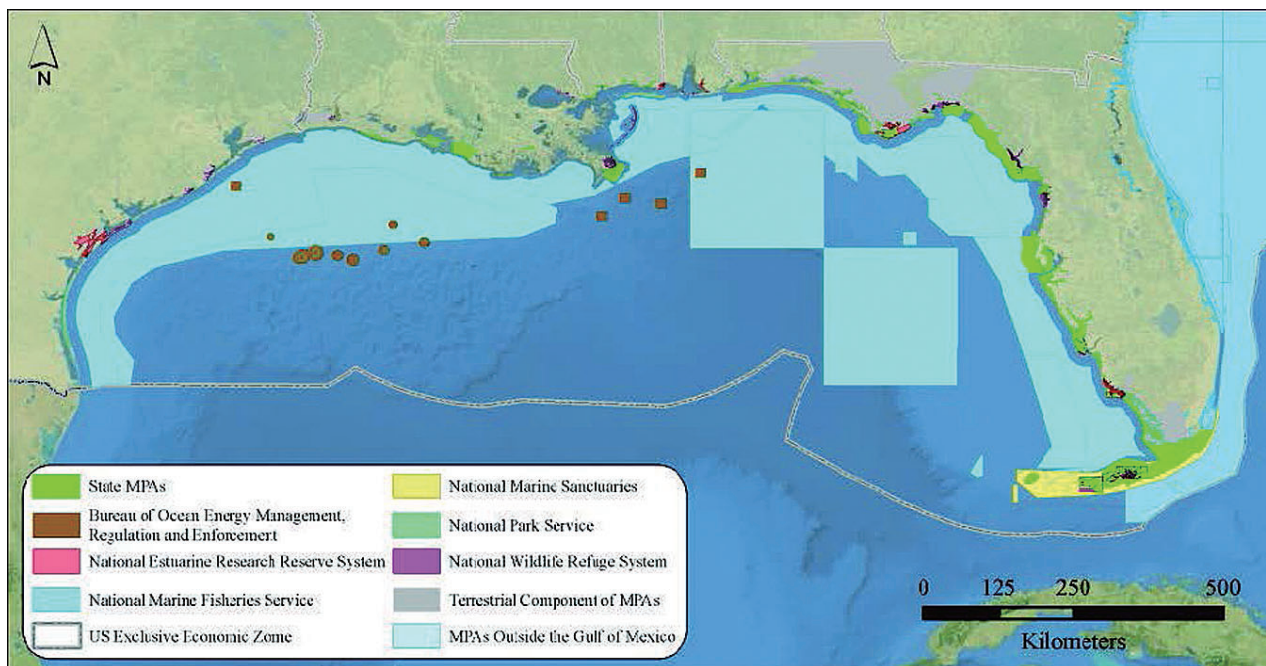
Coral reefs are found in a discontinuous arc around the Gulf, with the greatest development along the Florida Keys and Cuba.<sup>4</sup>

The Gulf of Mexico contains some of the most spectacular wildlife in the world, including manatees, bottlenose dolphins, migrating whooping cranes, American crocodiles and alligators, roseate spoonbills, sea turtles and whale sharks, to name a few.<sup>6</sup>



Distribution of deep corals in the Gulf of Mexico<sup>5</sup>

### Protected Areas



Marine Protected Areas in the Gulf of Mexico<sup>7</sup>

#### • The Florida Keys National Marine Sanctuary (United States)

The most extensive living coral reef in the United States is adjacent to the island chain of the Florida Keys. The Florida Reef Tract which extends from Soldier Key, located in Biscayne Bay, to the Tortugas Banks possesses coral formations very similar to those found in the Bahamas and Caribbean Sea. The Florida Reef Tract is nearly 240 km long and about 6 km wide extending to the edge of the Florida Straits. It is the third largest barrier reef ecosystem in the world. All but the northernmost extent of the reef tract lies within the boundaries of the Florida Keys National Marine Sanctuary. The 7,252 km<sup>2</sup> Florida Keys National Marine Sanctuary (FKNMS), designated in 1992, surrounds the entire archipelago of the Florida Keys and includes the productive waters of Florida Bay, the Gulf of Mexico and the Atlantic Ocean. Discontinuous and less biologically diverse coral reef communities continue northward along western Florida shores to the Florida Middle Grounds, a series of submerged pinnacles rising to within 18-24 m of the surface, about 160 km northwest of St. Petersburg.<sup>8</sup>

#### • Flower Garden Banks National Marine Sanctuary (U.S.)

Flower Garden Banks National Marine Sanctuary is one of 14 federally designated underwater areas protected by NOAA's (National Oceanic and Atmospheric Administration) Office of National Marine Sanctuaries.

Situated about 110 to 180 km off the coasts of Texas and Louisiana, the Flower Garden Banks sanctuary includes underwater communities that rise from the depths of the Gulf of Mexico atop underwater mountains called salt domes.<sup>9</sup>

## History and Culture

It is thought that the Gulf of Mexico formed approximately 300 million years ago. Many theories exist as to the exact mechanism of formation, but most scientists agree that the Gulf was formed as a result of seafloor subsidence.<sup>10</sup>

The Gulf's coastal areas were first settled by American Indian groups, including those representing various advanced cultures of Mexico. Since then, the Gulf region has settled by African slaves, and French and Spanish colonists. Caribs boated from Havana to Tampa, Florida and Mexican mound-builders are believed to have brought religion up the Mississippi. During the period of European exploration and colonization, the entire region became a theatre of contention between the Spanish, French and English. The present-day culture of the coastal region is primarily Spanish-American (Mexico, Cuba) and Anglo-American (U.S.).<sup>11</sup>

## Social Environment

### < Population >

In the United States, the total population of the 5 states of the Gulf of Mexico is projected by the Census Bureau to increase from a total of 44.2 million in 1995 to an estimated 61.4 million in 2025, nearly a 40% increase.<sup>11</sup> Gulf Coast Region population for the Gulf states in 2010 was 21 million, and accounted for about 37% of their total.<sup>12</sup>

### < Land use >

About 58% of the Mississippi River basin is cropland. Other significant land uses (and their percentages) of the basin include woodland (18%), range and barren land (21%), wetlands (2.4%) and urban land (0.6%).<sup>13</sup> Water from these lands drain into streams and reservoirs, flowing into the Mississippi River and eventually reaching the Gulf.

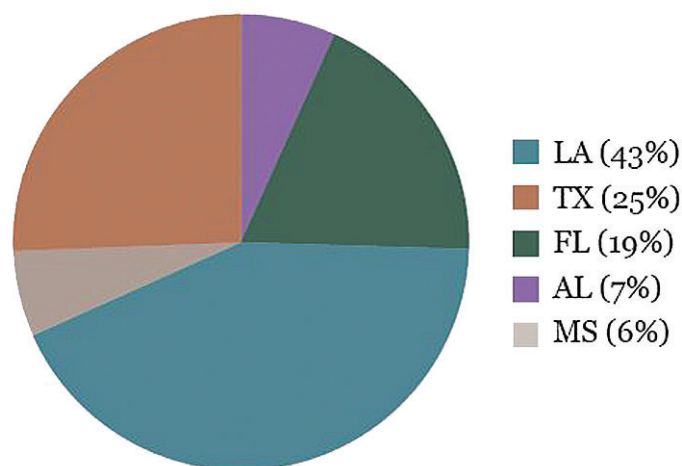
Range land is the predominant land use in the Rio Grande Basin constituting about 77% of the basin (about 81% on the US side and 71% on the Mexico side).<sup>14</sup>

### < Industry >

The Gulf of Mexico ecosystem provides a wide array of valuable resources to the nations on its shores. Collectively, the U.S. Gulf States' Gross Domestic Product (GDP) was 2.4 trillion dollars, accounting for 17% of the total national GDP of the country (2009).<sup>12</sup>

#### Fisheries

Fisheries of the 5 Gulf states provides the U.S. with abundant seafood, and its top commercial species are menhaden, brown and white shrimp, blue crab, and eastern oyster. Commercial fish and shellfish harvest from the five states was estimated to be about 635,000 tons, which represents about 16% (average of 2007 to 2009) of the total domestic landings in the United States. In the same year, commercial catches in the Gulf were valued at over 660 million dollars. The Gulf also supports a productive recreational fishery. U.S. Gulf states accounted for over 44% of the U.S. recreational fish harvest in 2009.<sup>12</sup>



Distribution of the commercial fishing landings in the Gulf of Mexico by state (average annual percentage from 2007 to 2009)<sup>12</sup>

Note: LA= Louisiana, TX= Texas, FL= Florida, AL= Alabama, MS= Mississippi

#### Petroleum Industry

The Gulf Region's crude oil and natural gas production accounts for about half of the U.S. total (based on an average from 2008 to 2010). There were 3,701 active oil and gas platforms in the Gulf in 2011. In addition, the offshore petroleum industry employed over 120,676 U.S. workers in the Gulf in 2009.<sup>12</sup> In Mexico, the Secretariat of Energy (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 m<sup>3</sup>, respectively.<sup>15</sup>



## **Environmental Problems**

### **< Water and Sediment Quality >**

The primary problem in Gulf Coast estuaries is coastal wetland loss. Fish tissue contaminants, benthic condition, and sediment quality were also of concern. Fish tissue contaminant concentrations exceeded risk-based EPA Guidance levels in 14% of sites in Gulf Coast estuaries sampled for fish. These sites were dominated by elevated tissue concentrations of total PCBs and DDT, with some instances of dieldrin, mercury, cadmium, and toxaphene. Benthic index values that combine population and diversity of benthic species, were lower than expected in 17% of Gulf Coast estuarine sediments. Elevated sediment contaminant concentrations were found in 11% of estuarine sediments. About 2.5% of wetlands were lost per decade from 1780 to 1980, and about 0.25% of wetlands were lost between 1990 and 2000.<sup>16</sup>

### **Oil Spills**

There have also been widespread environmental effects from the Deepwater Horizon oil spill of April 20, 2010 that released more than 757 million liters (780,000 m<sup>3</sup>) of oil into the surrounding ocean. According to the National Wildlife Federation (NWF), they have found over 900 dead or stranded dolphins, and 500 stranded sea turtles in the oil spill affected area, not to mention the harmful effects on other marine organisms, fish, and birds that inhabit the Gulf. Scientists at NOAA are also conducting research in the area but the information will not be made public until the civil trial is concluded.<sup>17</sup>

### **< Other Environmental Problems >**

Given the dependence of living coastal and marine resources on coastal habitats, continued loss or degradation with no intervention to reverse the trend has resulted in declining fish populations which can result in food web disruptions that threaten ecosystem diversity and stability. Stocks will likely no longer be sustainable, which in turn will adversely affect coastal communities and the coastal economy.<sup>18</sup>

### **< Environmental Protection Measures >**

Florida Fish and Wildlife Conservation Commission (FWC) commented on its environmental protection measures as below.

- ☐ FWC should support actions at the federal fishery management councils to promptly end overfishing and rebuild depleted fish populations to healthy levels as quickly as possible.
- ☐ FWC needs to support strong measures at the federal fishery management councils to reduce bycatch of marine fish and other marine life in fishing operations;
- ☐ FWC should support measures at the federal fishery management councils to protect deep water corals, reefs of all kinds, hard bottoms and other habitat areas of particular concern, and essential fish habitat from destructive fishing practices as well as from other activities that impair these habitats.<sup>19</sup>

### **Monitoring program**

Products and analysis focused on the monitoring of the ocean conditions in the Gulf of Mexico, in response to selected extreme events are presented, such as:

- Mississippi River water discharge during May, June and July of 2011
- Deepwater Horizon oil spill during the summer of 2010

As part of NOAA's mission to study the role of the ocean in climate and ecosystems, Atlantic Oceanographic & Meteorological Laboratory (AOML) scientists have for many years devised methods and tools to allow for the real-time monitoring of ocean conditions. The website (<http://www.aoml.noaa.gov/phod/dhos/index.php>) is designed to provide some of these tools and products showing the condition of several parameters in the Gulf of Mexico, including information about ocean currents, sea surface temperature, sea level, and ocean color. The products presented here have been obtained using both direct ocean measurements and remote observations collected via satellite, as well as using outputs from numerical models. Also included is a list of links to other web sites and resources dedicated to monitoring the Gulf of Mexico region.<sup>20</sup>

### **Related organizations and NGOs**

- US EPA (U.S. Environmental Protection Agency) Gulf of Mexico Program <<http://www.epa.gov/gmpo/>>
- Centro de Ecología, Pesquerías y Oceanografía del Golfo de México (EPOMEX) <<http://epomex.uacam.mx/>>
- Centro de Investigaciones Marinas (CIM) <<http://www.cim.uh.cu/portada.php?lang=es>>

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