



# Gulf 360°

State of the Gulf of Mexico

Harte Research Institute's Gulf 360° website and associated products such as the *Gulf 360°: State of the Gulf of Mexico* booklet represent an important part of the State of the Gulf of Mexico series which includes conferences, publications, and other out-reach materials.

**Visit: [Gulf360.org](http://Gulf360.org) and [Golfo360.org](http://Golfo360.org)**

This document is a publication of the Harte Research Institute for Gulf of Mexico Studies at Texas A&M University-Corpus Christi. The figures within are not intended for navigational purposes.

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When we first laid eyes on *Gulf at a Glance: A Second Glance* produced by the Special Projects Division of NOAA, and released in June of 2011, we were so impressed with the effort that we wanted to see if we could take that same idea and expand it to include all three countries of the Gulf of Mexico: Cuba, Mexico, and the United States. During the State of the Gulf of Mexico: Summit 2011 we were fortunate to find a partner in Shell Exploration and Production Company to support this project.

*Gulf 360°: State of the Gulf of Mexico* is a tremendous effort by a lot of people to bring together data and information from many different sources. In fact, we like to say that we weren't comparing oranges to oranges, but oranges to limes to grapefruit. They are all still citrus, but just a little bit different.

We hope this first edition of *Gulf 360°* begins to tell a story and help citizens from around the Gulf of Mexico gain a deeper appreciation for what is similar amongst the three nations, what is different, and what connects us. In the end, it is a better understanding of our complex natural, social, and economic systems that will lead to effective management of our coastal and marine resources.

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# Gulf 360°

## State of the Gulf of Mexico

### March 2013

This document is a product of the Harte Research Institute for Gulf of Mexico Studies, Texas A&M University-Corpus Christi (U.S.), developed in partnership with the Centro de Especialistas en Gestión Ambiental (Mexico), National Oceanic and Atmospheric Administration (U.S.), Instituto Nacional de Estadística y Geografía (Mexico), and with funding provided by Shell Exploration and Production Company.



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# INTRODUCTION



Chichen Itza, Yucatán, Mexico. Credit: Mario Roberto Duran Ortiz (Wikimedia Commons)



Flower Garden Banks, Credit: NOAA

## Why was it important to do this project?

The aim of this booklet is to show the Gulf of Mexico region in a new light by blurring the boundaries between countries at times, but highlighting what we have in common, what connects us, and what is different. As “neighbors” in this greater region, we share resources, landscapes, atmospheric and oceanic phenomena, and cultural bonds. The need for visualizing this region as a whole, its components and interconnections as well as future trends is desirable in order to effectively address the resources and issues we have in common.

Geopolitical divisions and governmental structures deal only with portions of the landscape, or with fractions of a watershed, and with pieces of a habitat. As is shown in this booklet, much of our economic activity and ecology goes beyond borders.

There are three key elements that define this geographic “space” called the Gulf of Mexico: The land-ocean interaction, the human activities that occur and shape the landscape/seascape, and the natural resources that feed the needs of the population.

As was so aptly said in *Gulf at a Glance: A Second Glance* about the United States portion of the Gulf, but is relevant for the entire region:

*“The well-being of the Gulf of Mexico region depends on a suite of benefits that flow from healthy coasts: food, clean water, jobs, recreation, and protection from hurricanes. But the ability of the Gulf Coast to deliver these benefits is being eroded by the extensive environmental alterations we have made to the region’s coastal ecosystems. In some cases, these benefits are further eroded by changes in climate. Whatever the cause, these changes threaten to compromise the health and economic well-being of our coastal communities...”*



United States



Mexico



Cuba

The three countries that define the region are: la República de Cuba (Cuba), los Estados Unidos Mexicanos (Mexico), and the United States of America (U.S.). For a holistic perspective it is essential, as a first step, to show and integrate geographical, ecological, and socio-economic data and information. In order to take this step we provide a workable context of the coastal region in the form of a “Coastal Belt”. It is within this “belt”, that circles the entire region, that we can begin to examine, at a coarse level, the intersection of the built and natural environment.

The idea of interconnections, interdependence or the “belonging” to the Gulf of Mexico is not yet fully acknowledged. Can we claim a link between the Totonac people of Veracruz and the Cajuns of Louisiana? Maybe not culturally, but connections do arise in other ways and our objective is to show that potential. As the Gulf of Mexico, and the world, becomes more urbanized and coastal, assessing the benefits of a balanced approach of environmental fitness, cultural vitality, and economic vigor becomes more relevant. The resilience of communities to the uncertainty related to global change forces us to explore scenarios and trends on a regional scale.

*Gulf 360°* is a first attempt to bring this amount of interdisciplinary information together from the three countries of the Gulf of Mexico. It is purposefully visual, rather than heavy with text, in order to clearly show the regional similarities and differences. In most cases we use the “Coastal Belt” in our analysis, but in some cases the data would not fit at this scale. It is envisioned that moving forward there will be more work that incorporates a Gulf-wide perspective and that stakeholders and decision makers will see the benefit in this approach.

Voladores in Papantla, Veracruz. Credit: Alejandro Linares Garcia (Wikimedia Commons)

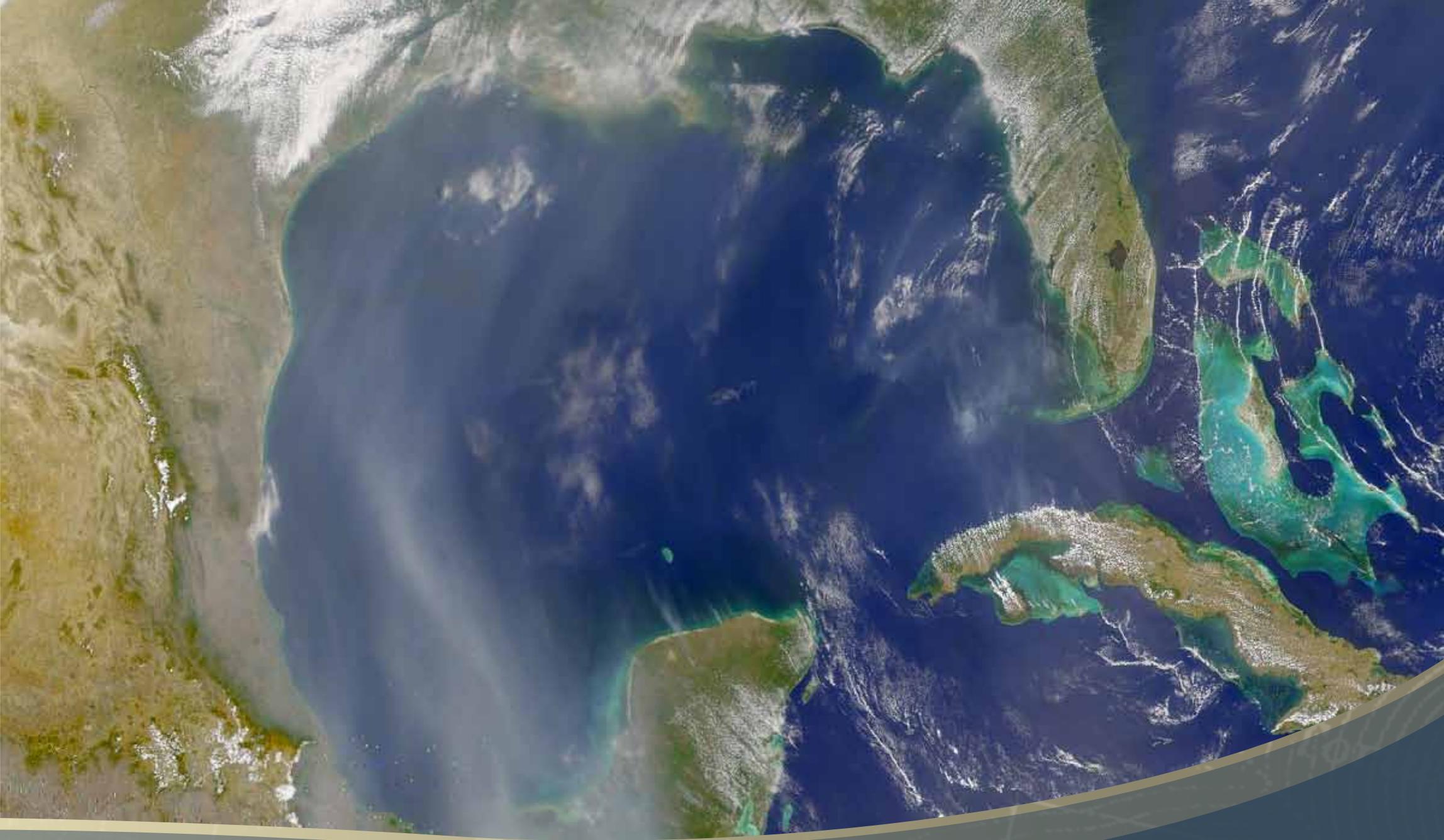




# GULF 360°

“He always thought of the sea as *'la mar'* which is what people call her in Spanish when they love her. Sometimes those who love her say bad things of her but they are always said as though she were a woman. Some of the younger fishermen, those who used buoys as floats for their lines and had motorboats, bought when the shark livers had brought much money, spoke of her as *'el mar'* which is masculine. They spoke of her as a contestant or a place or even an enemy. But the old man always thought of her as feminine and as something that gave or withheld great favours, and if she did wild or wicked things it was because she could not help them. The moon affects her as it does a woman, he thought.”

—Ernest Hemingway, *The Old Man and the Sea*





# DEFINING THE GULF



Nautical chart of the Gulf of Mexico, 1762. Credit: Biblioteca Nacional de España

The Gulf of Mexico is part of the American Mediterranean Sea, and as a result, connections between cities and their ports, through the trade of tobacco, sugar cane, rum, and music helped define the cultural heritage of the region early on. Like then, today we find strong connections around the Gulf of Mexico, but for the most part we trade different goods, such as hydrocarbons, tourism, and labor.

People have represented the Gulf of Mexico differently over time. Many of the early maps of the region had shown a maritime perspective, highlighting the shape and contour of the Gulf of Mexico for basic navigational purposes. As technology has advanced so has the cartographic detail as illustrated by the two nautical charts on these pages.

In the pages of this booklet we will show a 'modern' Gulf of Mexico where what happens on the land is as important as what happens in the water. The interconnection between land, water, and human well-being is a recurring theme throughout the history of the Gulf.

To define the Gulf of Mexico can be at once, very easy, but also quite difficult. Physically, the Gulf is very well defined. As noted in GulfBase:

*"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 Yucatán 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."*

The Gulf of Mexico is not only defined by its physical features but as equally, if not more, by the people that inhabit the region. As this booklet will show, humans have created a Gulf that fits their needs and desires by forming the administrative and economic structure in which communities and countries can succeed.

## Important early dates in the exploration of the Gulf:

**1494** Columbus' second voyage takes him to the western end of Cuba, but he does not enter the Gulf of Mexico.

**1497** Amerigo Vespucci finds safe harbor in Campeche Bay, north of Tabasco.

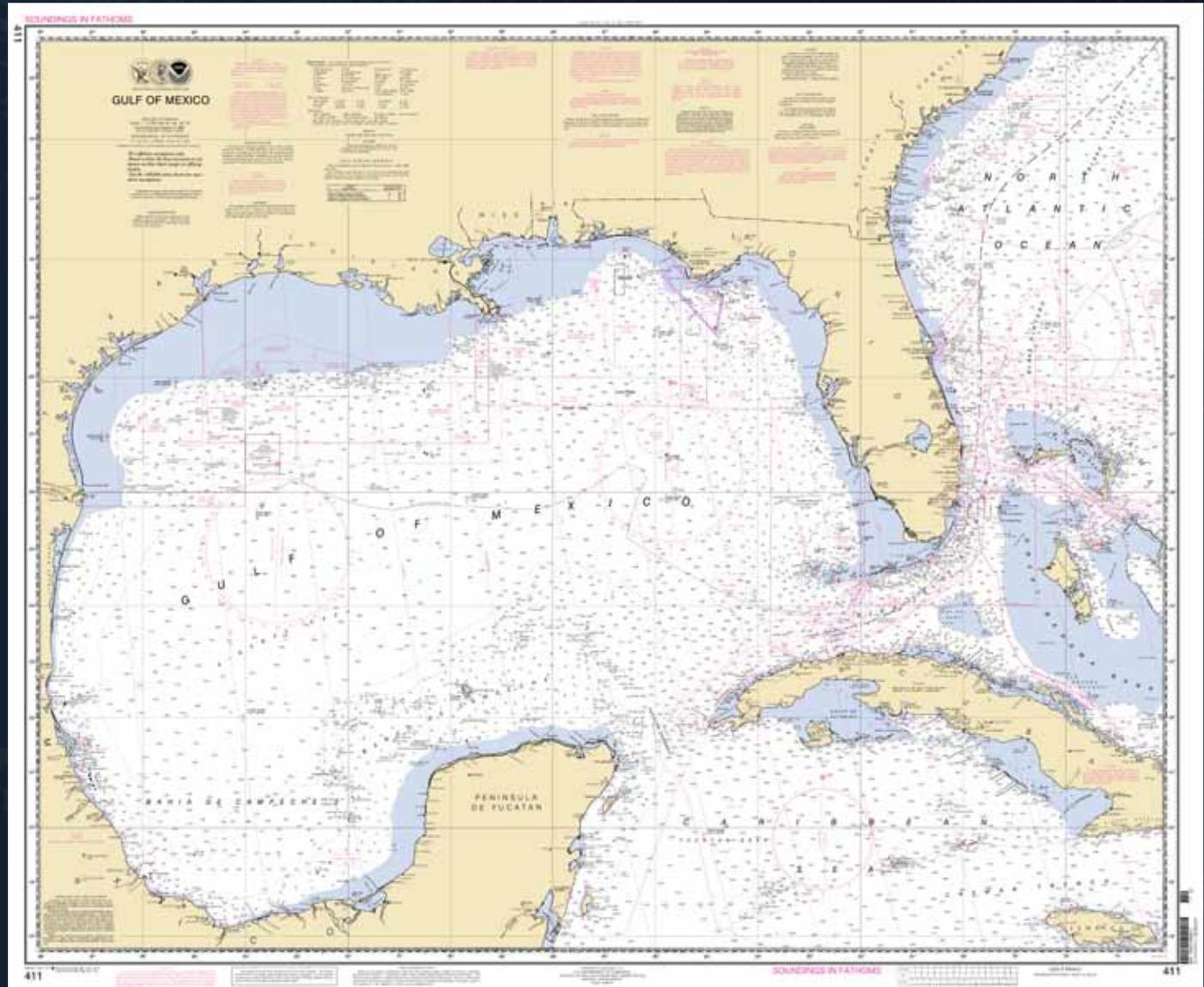
**1507** German cartographer Waldseemüller produces a map of the world showing the new world labeled as "America". The Gulf of Mexico is crudely visible next to the newly discovered continent.

**1513** Ponce de León officially discovers Florida and sails to the Florida Keys and the Dry Tortugas. He notes the existence of a strong current on the east coast of Florida, which represents the first record of the Gulf Stream.

**1517** Fernando de Córdoba and Antonio de Alaminos explore the northern and western coasts of the Yucatán Peninsula.

**1528** Pánfilo de Narváez and Álvaro Núñez Cabeza de Vaca sail north to Florida from Cuba; Cabeza de Vaca travels west and documents the Mississippi River.

**1682** LaSalle leads an expedition south from Illinois to the mouth of the Mississippi and claims the area for the French.



Nautical chart of the Gulf of Mexico, 2011. Credit: NOAA



# COASTAL BELT



Coastal Belt

The Gulf 360 study area is composed of aggregated counties/parishes/municipios of U.S., Mexico, and Cuba.

Sources: U.S. Census/TIGER (2010); INEGI (2010); ONE (2010); ESRI (2008); NationalAtlas.gov (2004); Jarvis et al. (2008); CONABIO (2002)

## A Shared Definition

It is not so easy to develop a common definition of the “Coast” in one country, much less across three.

The three countries surrounding the Gulf of Mexico are defined by political boundaries laid on top of terrestrial and maritime ecosystems but it is the political framework that drives management decisions. The United States has a legal framework to define the coast known as a Coastal Management Act. Cuba also has defined coastal zone management in its Decreto-Ley Número 212-2000.

However, Mexico does not yet have a comparable legal definition of the coast but does have policy guidance at the federal level. None of these definitions are the same nor easy to represent at the scale we are working at in this publication, but with the “Coastal Belt” we begin to see what a similarly defined coast would look like. Inside this belt are multiple pieces, like a puzzle, that conform and explain the landscape and the processes that shape and change this region.

In the United States, the coastal belt is comprised of counties that are entirely contained within or intersect the boundaries of Coastal and Estuarine Drainage Areas (CDAs and EDAs) as defined by NOAA’s Coastal Assessment Framework. Similarly, the Mexican Gulf Coast Region consists of municipios that are entirely contained within or intersect coastal watersheds (cuencas hidrológicas) boundaries. Finally, the Cuban Gulf Coast Region includes all municipios of the five provincias that front the Gulf of Mexico.

## The Coastal Belt



**United States**



**Mexico**



**Cuba**

### Definition by Country

**Counties that are entirely contained within or intersect the boundaries of Coastal and Estuarine Drainage Areas (CDAs and EDAs).**

**Municipios that are entirely contained within or intersect coastal watersheds (cuencas hidrológicas) boundaries.**

**All municipios of the five provincias that front the Gulf of Mexico.**

### Coastal Management Zone Legal Structure

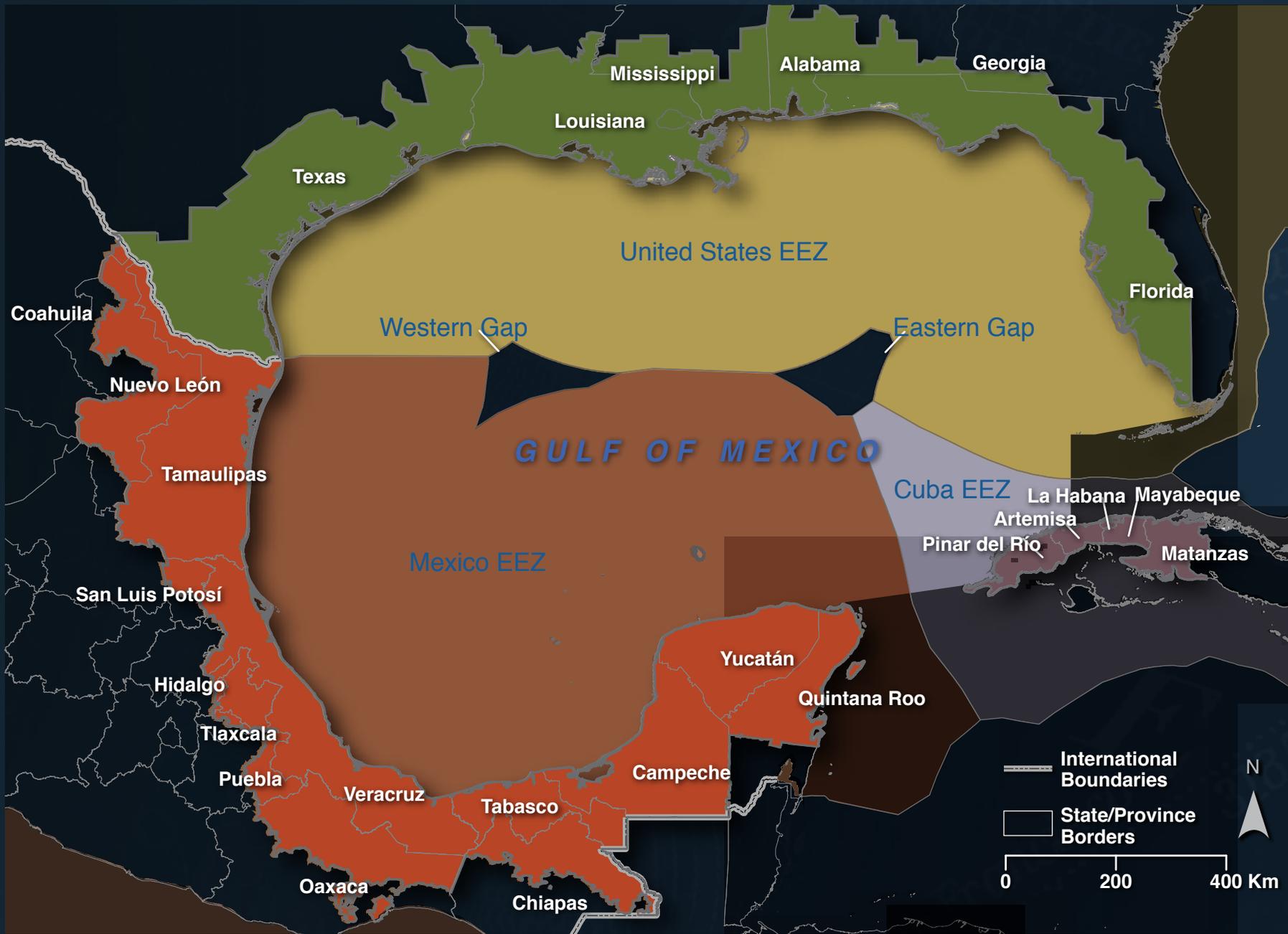
**Coastal Zone Management Act**

**Policy guidance at the federal level. No comparable legal definition of the coast.**

**Decreto-Ley Número 212-2000**



# BOUNDARIES



## Exclusive Economic Zone (EEZ)

Defines Marine Surface Area

- Cuba
- Mexico
- United States

Outside of Coastal Belt

- 
- 
- 

## Coastal Belt by Country

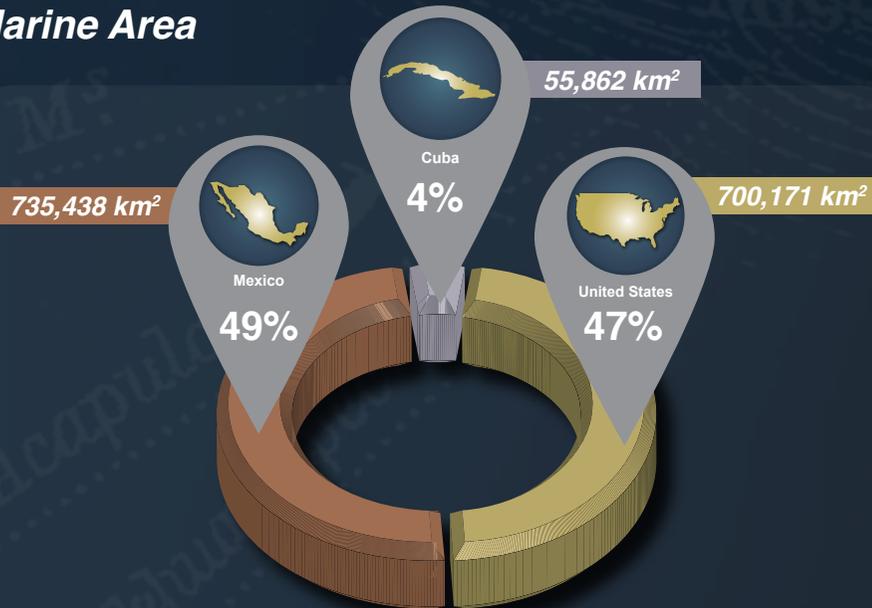
Defines Terrestrial Surface Area

- Cuba
- Mexico
- United States

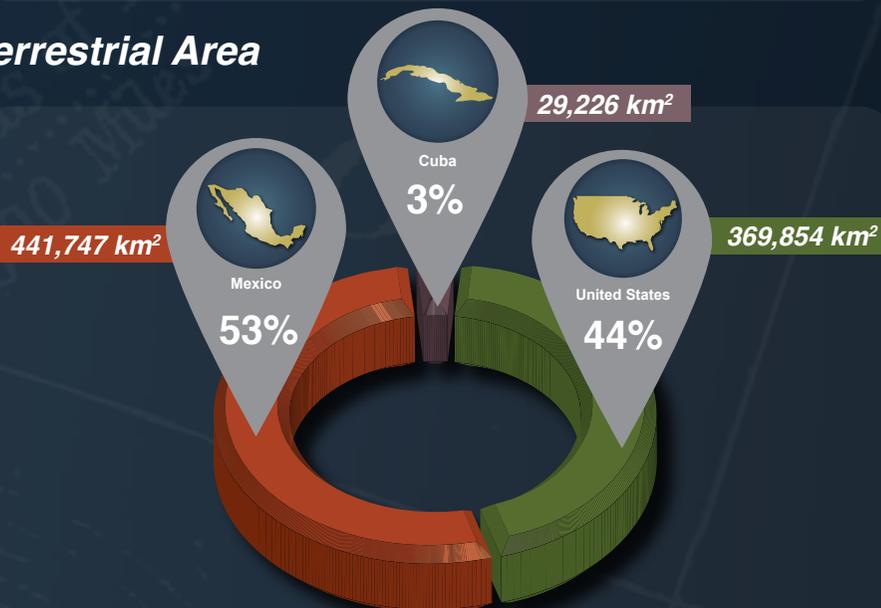


Sources: U.S. Census/TIGER (2010); INEGI (2010); ONE (2010); ESRI (2008); NationalAtlas.gov (2004); VLIZ (2010, 2011)

## Marine Area



## Terrestrial Area



## Marine Surface Area



In the Gulf of Mexico, an area of more than 35 thousand km<sup>2</sup> falls outside of the jurisdiction of Mexico, United States and Cuba. These areas are commonly referred to as the Western and Eastern Gaps.

**TOTAL AREA 1,500,000 km<sup>2</sup>**

## Terrestrial Surface Area



**1006** Counties/Parishes/Municipios  
**16** States/Provinces  
**3** Countries

**TOTAL AREA 840,000 km<sup>2</sup>**



# COUNTIES AND MUNICIPIOS



Sources: U.S. Census/TIGER (2010); INEGI (2010); ONE (2010); ESRI (2008); NationalAtlas.gov (2004)

## Political Boundaries

The governments of Mexico and the United States are federal systems with their administrative divisions made up of states. Cuba is a communist state with its administrative divisions designated as provinces.

In the United States, the states are further divided into counties, or in the case of Louisiana, parishes.

Some countries are still sub-dividing their territory, for instance Mexico is constantly creating new municipios in each state. In Cuba, two provinces were created in 2010 by splitting Havana province into two new provinces: Artemisa and Mayabeque.

In the Coastal Belt, Mexican municipios are more numerous than United States and Cuban equivalents with over four times the number of United States counties and parishes, even though the land area is only about 20% more: 442,000 km<sup>2</sup> for Mexico and 370,000 km<sup>2</sup> for the United States.

### Counties and Municipios by Country



United States

169



Mexico

776

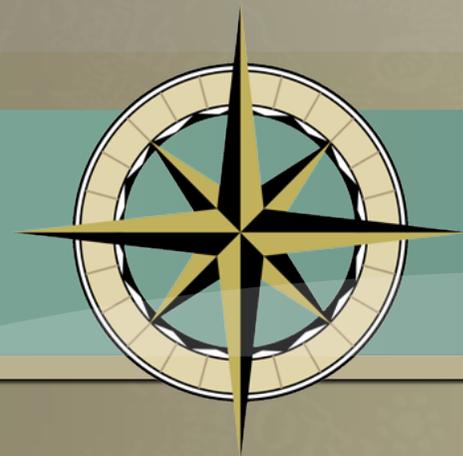


Cuba

61



Havana, Cuba. Credit: Global Images

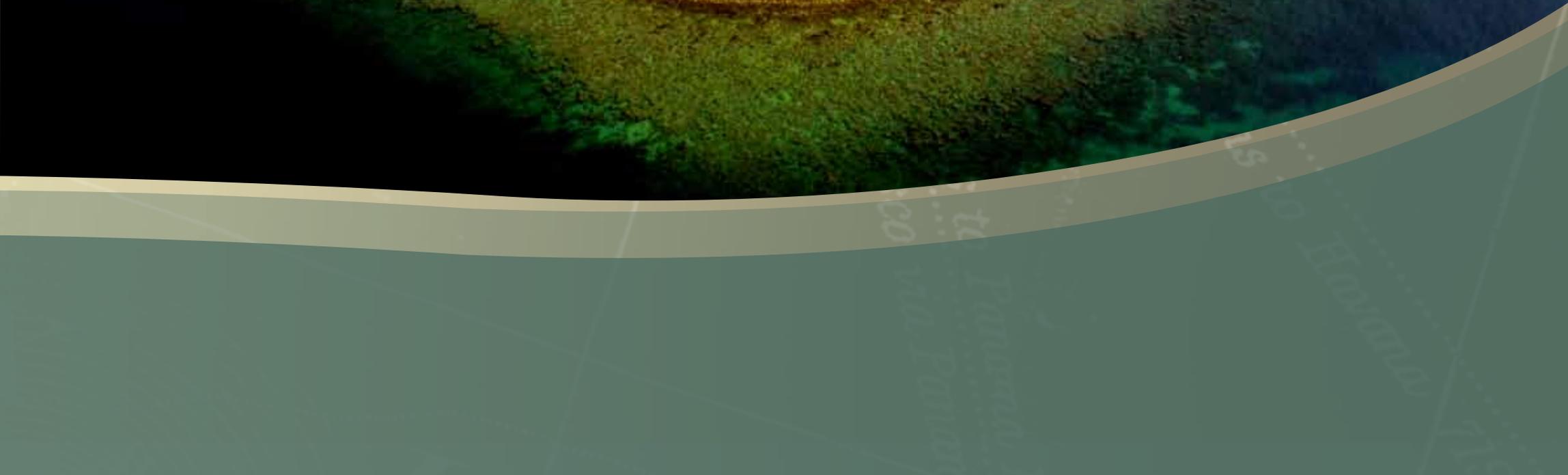


# LAND & SEASCAPE

*Pies, para qué los quiero  
Si tengo alas para volar.*

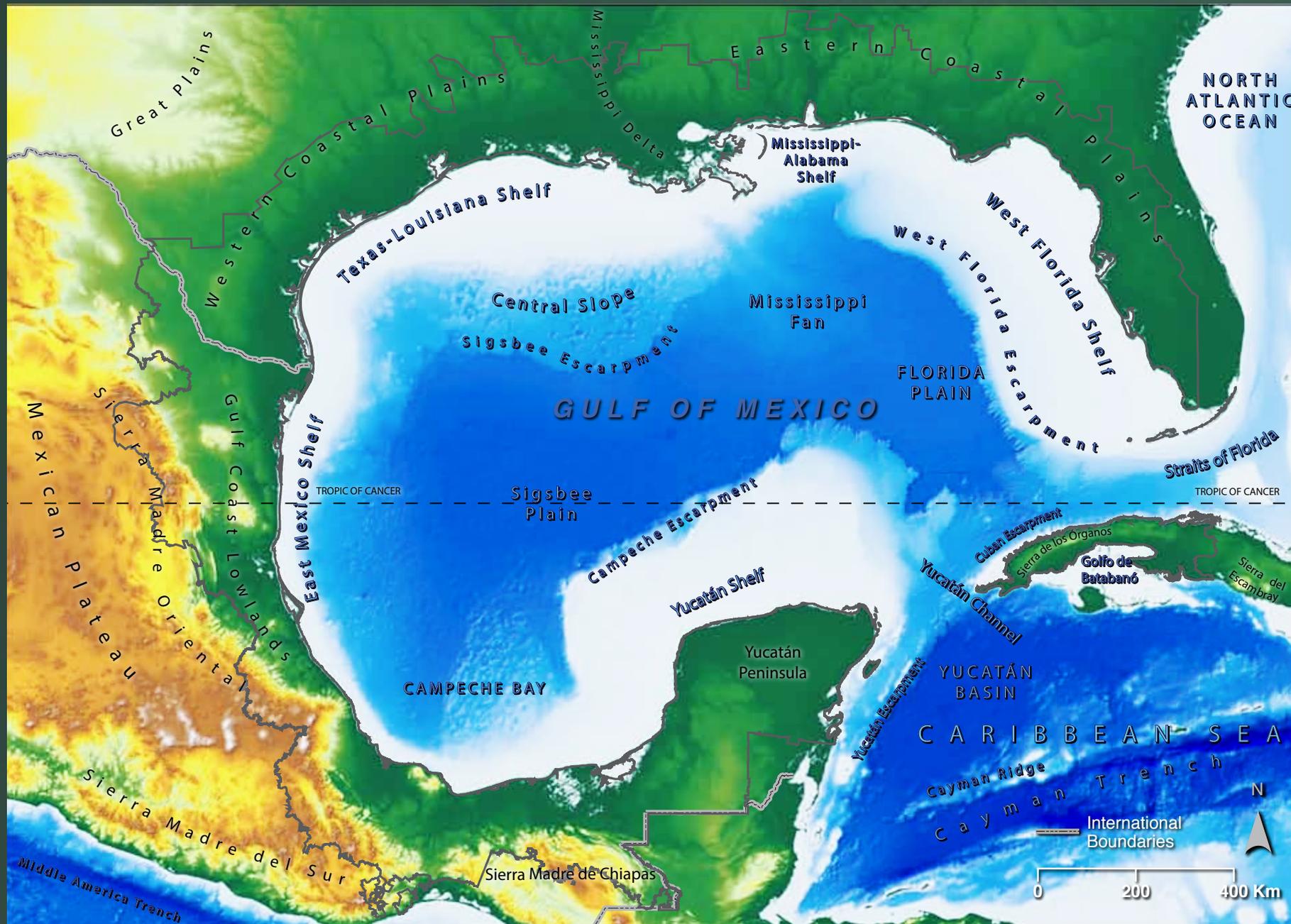
Feet, what do I need them for  
If I have wings to fly.

—Frida Kahlo





# PHYSIOGRAPHY



## Land and Seascape

Coastal Belt

## Elevation and Depth (in meters)



Natural geography of the Gulf of Mexico and surrounding lands.

Sources: U.S. Census/TIGER (2010); INEGI (2010); ONE (2010); ESRI (2008); NationalAtlas.gov (2004); NGA-GNS (2012); USGS (2000); Goode's World Atlas 20th Edition (2000); SIO, NOAA, U.S. Navy, NGA, GEBCO (2012)

## Diversified Land and Water

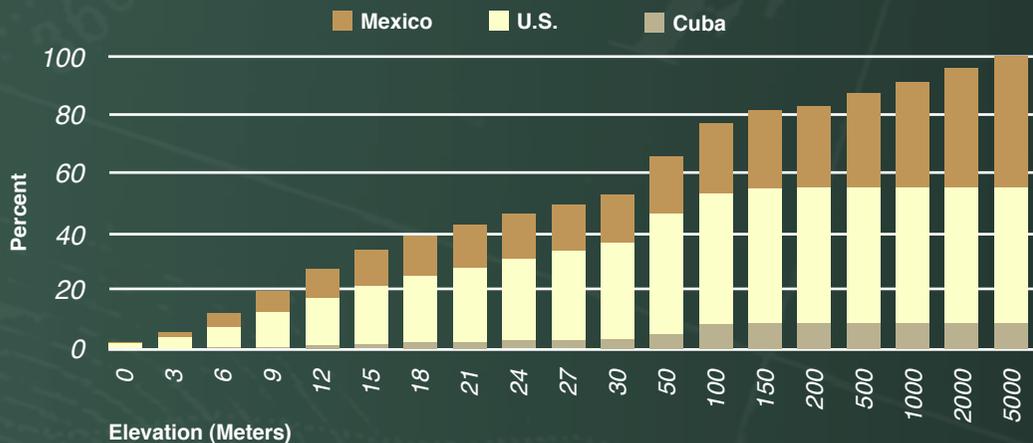
Natural features, living and nonliving, are what create the regional links in the Gulf of Mexico. Throughout the region natural processes are driven by diverse latitudinal weather patterns and ocean currents, creating differing topography from mountains to beaches and different types of soils in a continuing gradient from North to South, East to West.

The Gulf of Mexico is the ninth largest body of water in the world and is referred to as the "Mediterranean of the Americas." It contains by volume 2,434,000 cubic kilometers of water, or 643 quadrillion gallons, and it is believed to have been formed approximately 300 million years ago as a result of seafloor subsidence, i.e., gradual sinking of the seafloor.

The land that forms the Gulf's coast is mostly low-lying and characterized by marshes, swamps, and sandy beaches. It is this condition that makes the Gulf especially susceptible to storm surge and sea level rise.

About 5.7% of the total population in the Coastal Belt lives in areas with elevations below 3 m; 27.2 % of the total population lives below 12 m.

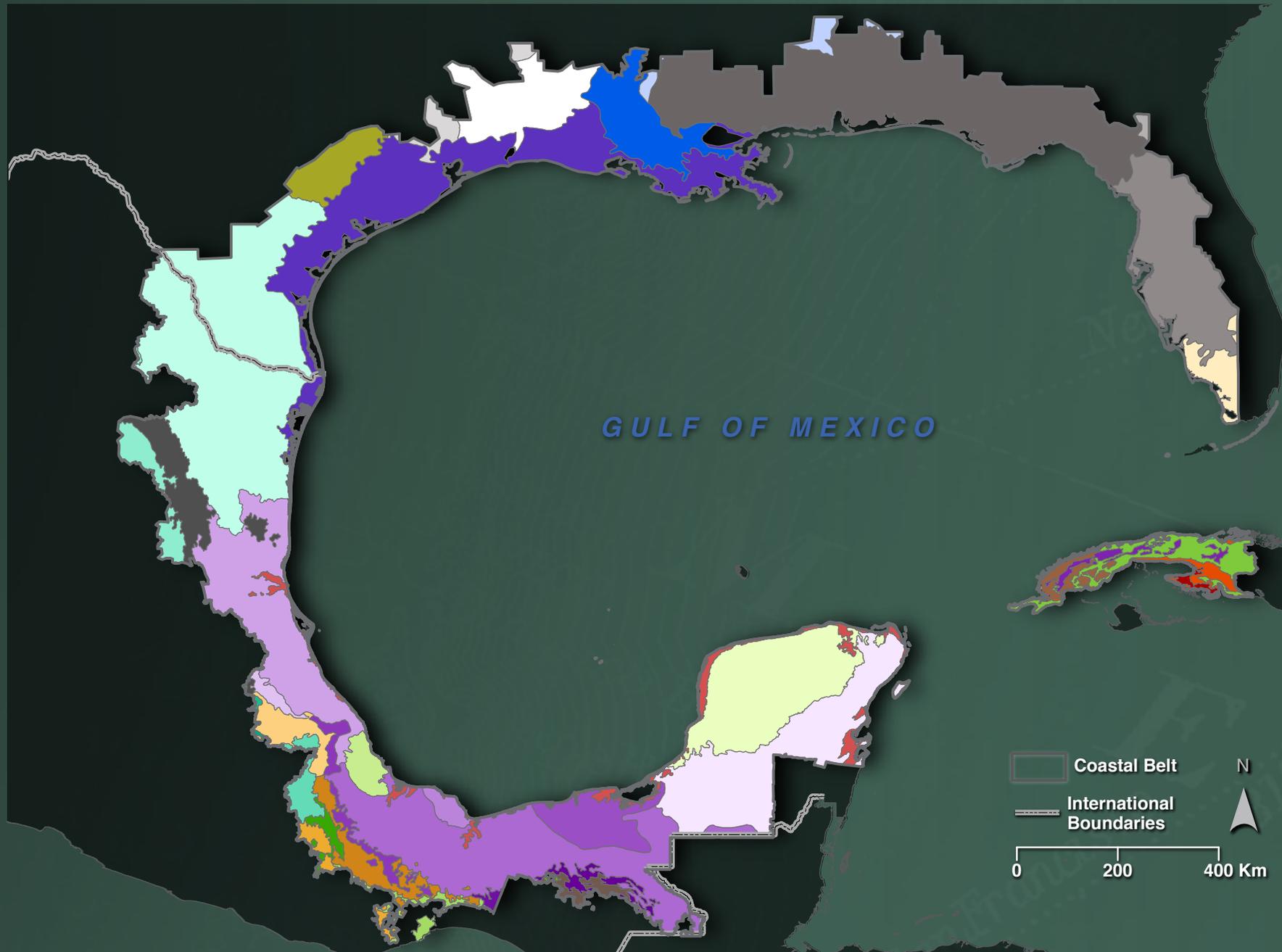
### Percent of Total Population Living Below a Certain Elevation in the Coastal Belt, 2010



Aerial view of East Timbalier Island, Louisiana, USA. Photo Credit: Erik Zobrist (NOAA Restoration Center)



# ECOREGIONS



## Tropical and Subtropical Moist Broadleaf Forests (27.5%)

- Chiapas Montane Forests
- Chimalapas Montane Forests
- Cuban Moist Forests
- Oaxacan Montane Forests
- Pantanos De Centla
- Petén-Veracruz Moist Forests
- Sierra De Los Tuxtlas
- Veracruz Moist Forests
- Veracruz Montan Forests
- Yucatán Moist Forests

## Tropical and Subtropical Dry Broadleaf Forests (9.4%)

- Balsas Dry Forests
- Chiapas Depression Dry Forests
- Cuban Dry Forests
- Southern Pacific Dry Forests
- Veracruz Dry Forests
- Yucatán Dry Forests



Sources: U.S. Census/TIGER (2010); INEGI (2010); ONE (2010); ESRI (2008); NationalAtlas.gov (2004); TNC (2009)

**Tropical and Subtropical Coniferous Forests (6.0%)**

- Sierra Madre Oriental Pine-Oak Forests
- Central American Pine-Oak Forests
- Cuban Pine Forests
- Sierra Madre De Oaxaca Pine-Oak Forests
- Sierra Madre Del Sur Pine-Oak Forests
- Trans-Mexican Volcanic Belt Pine-Oak Forests

**Temperate Broadleaf and Mixed Forests (3.4%)**

- Mississippi River Alluvial Plain
- Upper East Gulf Coastal Plain

**Temperate Conifer Forests (23.2%)**

- East Gulf Coastal Plain
- Florida Peninsula
- South Atlantic Coastal Plain
- Upper West Gulf Coastal Plain
- West Gulf Coastal Plain

**Tropical/Subtropical Grasslands/ Savannas/Shrublands (9.1%)**

- Gulf Coast Prairies And Marshes
- Crosstimbers And Southern Tallgrass Prairie
- Cuban Wetlands
- Tropical Florida

**Temperate Grasslands, Savannas and Shrublands (1.5%)**

**Flooded Grasslands and Savannas (1.5%)**

**Deserts and Xeric Shrublands (16.5%)**

- Central Mexican Matorral
- Meseta Central Matorral
- Cuban Cactus Scrub
- Tehuacan Valley Matorral
- Chihuahuan Desert
- Tamaulipan Thorn Scrub

**Mangroves (2.0%)**

- Bahamian-Antillean Mangroves
- Mesoamerican Gulf-Caribbean Mangroves
- Northern Mesoamerican Pacific Mangroves

**Ecoregions Per Country**



United States  
**11**



Mexico  
**27**



Cuba  
**6**

**Ecoregion Definition**

One way to measure the richness in the Gulf of Mexico region is to account for environmental habitat or landform diversity.

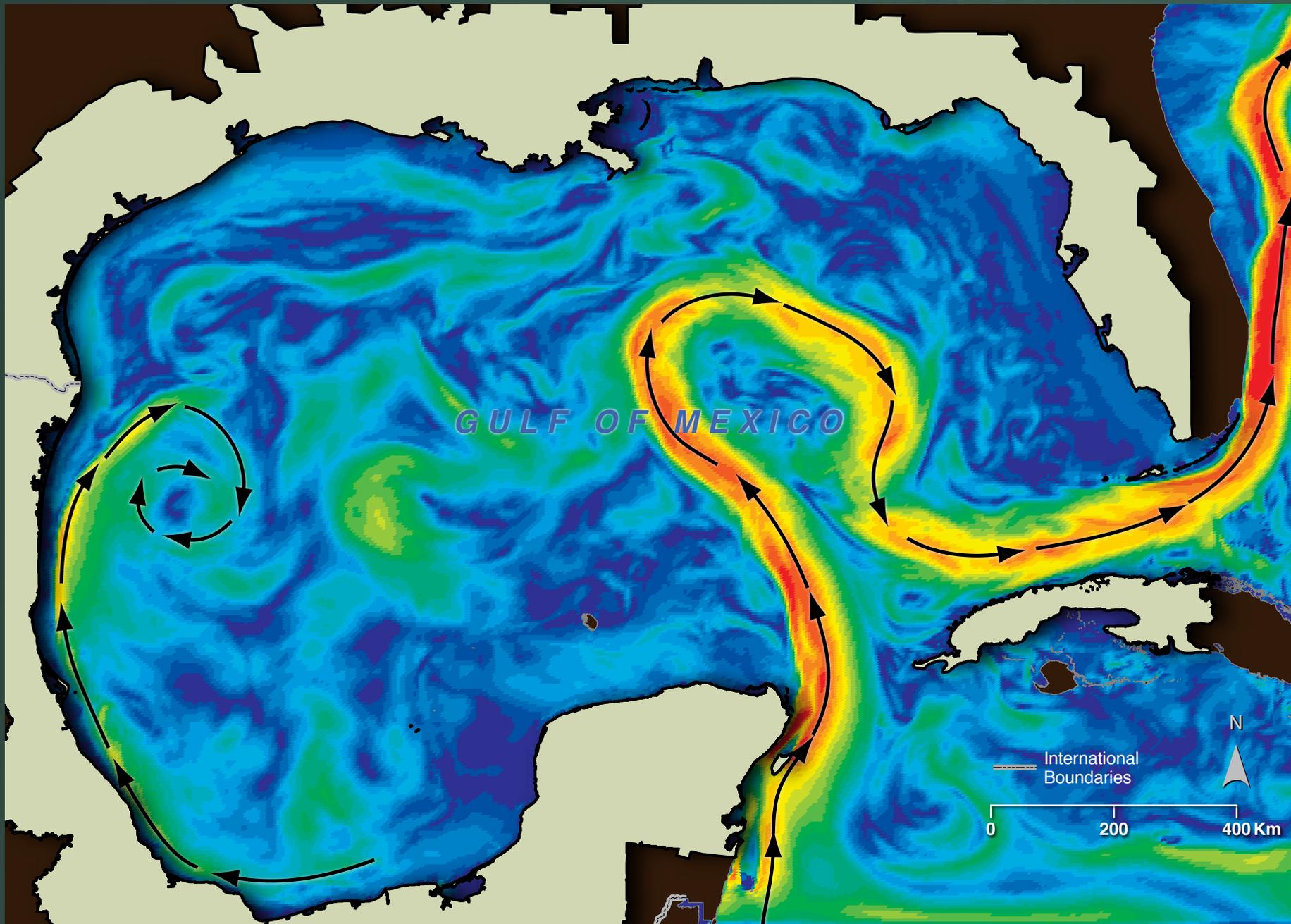
A new mosaic of highly varied landscapes emerges when the Gulf of Mexico is seen as a whole. Patchy natural boundaries can be distinguished in contrast to the geopolitical boundaries; they are not the same and overlap one another. Distinctive natural boundaries do not readily mesh with political boundaries, complicating sustainable governance of natural resources.

Ecoregions are ecosystems which have similar patterns of climate, geology, environmental resources, and biodiversity. The World Wildlife Fund defines an ecoregion as a "...large unit of land or water containing a geographically distinct assemblage of species, natural communities, and environmental conditions." The general purpose of ecoregions is to assist in development and implementation of ecosystem management and policy.

Modern ecoregions have been explicitly defined since the mid-1980s, but recent modifications have been led by The Nature Conservancy and are based on ecological, biophysical, and political rationales.



# OCEAN CURRENTS



## Surface Ocean Currents

Magnitude (meters/sec)



Coastal Belt

This map represents modeled ocean current magnitudes in meters per second at a depth of zero meters on 03/25/2011. Ocean currents were developed using the Hybrid Coordinate Ocean Model (HYCOM) + Navy Coupled Ocean Data Assimilation (NCODA) Gulf of Mexico 1/25° model.

Sources: U.S. Census/TIGER (2010); INEGI (2010); ONE (2010); ESRI (2008); NationalAtlas.gov (2004); HYCOM (2011); NOAA/AOML (2011)

## Currents and Oil Spills

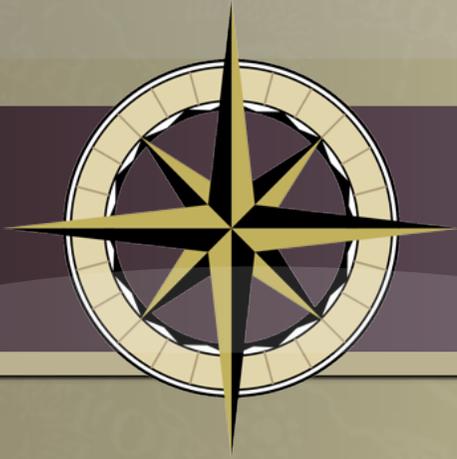
Water enters the Gulf through the Yucatán Strait, circulates as the “Loop Current”, and exits through the Florida Strait, eventually becoming the Gulf Stream in the Atlantic Ocean. Portions of the Loop Current frequently separate forming what are called “eddies”, which affect regional current patterns.

These complex patterns allow for transport of life, nutrient, and pollutants all across the Gulf. The Loop Current allows Caribbean influences throughout the Gulf. Eddies create isolated lenses of water that can incubate red tides, affect intensity of hurricanes, and transport invasive species to almost any part of the Gulf. Smaller wind-driven and tidal currents are created in nearshore environments.

Due to the circulation within the Gulf of Mexico, invasive species can spread easily, conquer new niches, and displace the original ones thus triggering economic and ecosystem changes. In Fall 2012 lionfish were discovered offshore in the South Texas Banks.



The Ixtoc oil spill occurred in the Bay of Campeche, Mexico in 1979 and released 3.3 million barrels of oil into the Gulf of Mexico over nearly 10 months. Due to Gulf currents, a significant part of the oil was transported northward into the U.S. coastal waters impacting 260 kilometers of U.S. beaches. The Deepwater Horizon oil spill occurred in 2010 off the coast of Louisiana and released an estimated 4.9 million barrels of oil over a 3-month period. The oil was confined to the northern Gulf Coast by the formation of a blocking eddy. If caught in the Loop Current, it would have been transported toward southeast Florida and possibly reached very sensitive areas such as the Florida Keys.



# PEOPLE

“Individually, we are one drop. Together, we are an ocean.”

—Ryunosuke Satoro





# POPULATION DENSITY



Sources: U.S. Census/TIGER (2010, 2012); INEGI (2010, 2012); ONE (2010, 2012); ESRI (2008); NationalAtlas.gov (2004)

# The total population in the Coastal Belt is 50 Million People

Surprisingly only 46% of the total population lives in counties and municipios over 200,000 people

## Nighttime Lights

 Coastal Belt

Nighttime composite imagery is cloud-free and contains lights from cities, towns, and other sites with persistent lighting, including gas flares for 2010. Ephemeral events, such as fires have been discarded. Background noise was identified and replaced with values of zero.

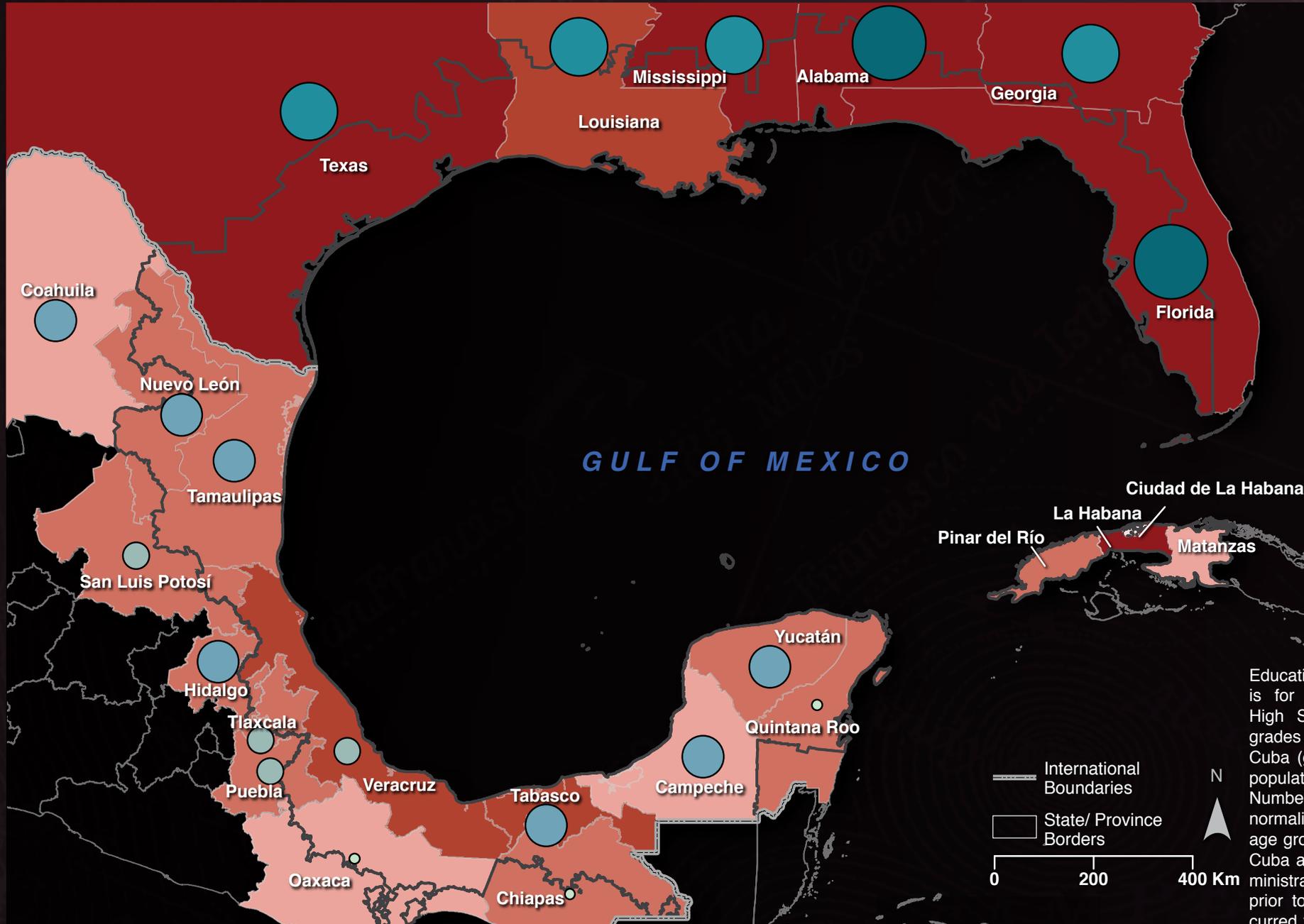
Cuba administrative boundaries are depicted prior to provincial changes that took effect in January 2011.



Sources: U.S. Census/TIGER (2010); INEGI (2010); ONE (2010); ESRI (2008); NationalAtlas.gov (2004); NOAA-NGDC-EOG (2010)

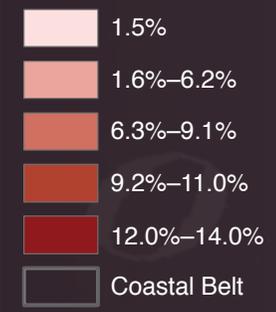


# POPULATION DEMOGRAPHICS



## Education

Number of High School Graduates by State/Population Age 15–19 by State, 2010



Number of Bachelor Degrees Awarded by State/Population Age 20–29 by State, 2010



Education data for all three countries is for academic term 2009–2010. High School graduates represents grades 9–12 with the exception of Cuba (grades 10–12) normalized by population count of age group 15–19. Number of Bachelors graduates are normalized by population count of age group 20–29. Bachelors data for Cuba are not represented. Cuba administrative boundaries are depicted prior to provincial changes that occurred 1/1/2011.



Sources: U.S. Census/TIGER (2010, 2012); INEGI (2010, 2011); ONE (2010, 2012); ESRI (2008); NationalAtlas.gov (2004); NCES(2012)

## 40% Increase in the U.S. Gulf Coast Population (1995-2025)

In the U.S., the coastal population of the five Gulf States is projected to increase from 44.2 million in 1995 to 61.4 million in 2025, approximately a 40% increase with Texas and Florida leading the way. This increase will significantly affect the natural infrastructure of the Gulf of Mexico and stress already overburdened governance structures charged with meeting the demands of a growing population while also assuring the health and productivity of the region. It will take coordination between all countries to be successful.

According to the Human Development Report for 2011, at country level, Cuba is ranked 51<sup>st</sup> and Mexico 58<sup>th</sup>, both considered within the High Human Development group. The United States is ranked 4<sup>th</sup>, within the Very High Human Development group. However the Gulf of Mexico is not a homogeneous region and inside each state and country it is possible to find varying levels of quality of life.



Houston, Texas. Credit: Globe Images



Sarasota, Florida. Credit: Patrick Braga (Wikimedia Commons)

### Median Household Income and GDP

— GDP Per Capita (2010 USD) — Household Income (2011 USD)



United States

\$47,800

\$51,144



Mexico

\$14,300

\$2,699



Cuba

\$9,900

N/A



# HUMAN ACTIVITIES

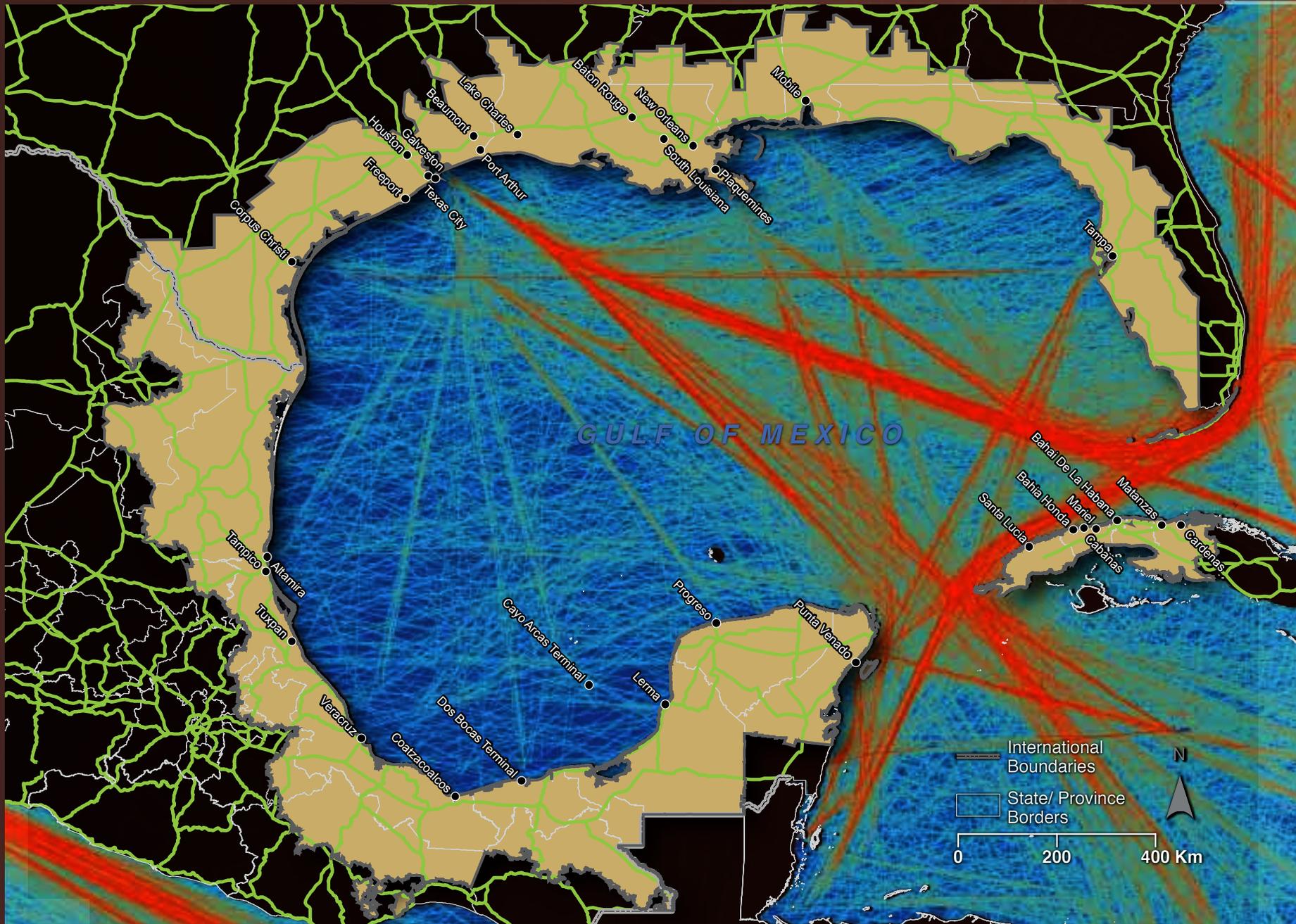
“The whole fauna of human fantasies, their marine vegetation, drifts and luxuriates in the dimly lit zones of human activity, as though plaiting thick tresses of darkness. Here, too, appear the lighthouses of the mind, with their outward resemblance to less pure symbols. The gateway to mystery swings open at the touch of human weakness and we have entered the realms of darkness. One false step, one slurred syllable together reveal a man’s thoughts.”

—Louis Aragon





# TRANSPORTATION



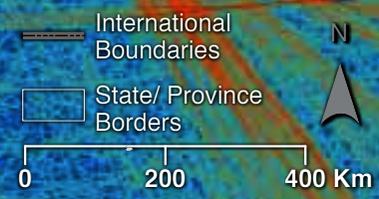
## Transportation: Roads and Commercial Shipping

- Major Ports
- Major Roads
- Coastal Belt

Commercial Shipping  
Activity October 2004 to  
October 2005



Roads connect major centers of population or selected frontier roads. Roads under construction are not shown. Ports for U.S. and Mexico represent major ports by tonnage in 2010. Cuban ports represent all known ports in the study area. Commercial shipping activity is based on World Meteorological Organization Voluntary Observing Ships (VOS) observations.



Sources: U.S. Census/TIGER (2010); INEGI (2010); ONE (2010); ESRI (2008); NationalAtlas.gov (2004); NCEAS (2008); Govt. of Canada (2010); SCT (2010); NGA (2012); Padilla y Sotello, L.S. (2010); USACE (2012)

The movement of people and commerce between the three countries in the Coastal Belt is an important element that binds us together. For example, the north and south crossings of non-commercial vehicles in South Texas was 29.9 million in 2011. Commercial crossings of trucks and rail-box cars in the same region in 2011 amounted to 5.4 million.

This transportation infrastructure provides invaluable connections. Whether by train, plane, automobile, or marine vessel, the benefits of these resources are undeniable. Yet, by their very nature, each has the potential to fragment the landscape.



United States

U.S. Rank*	Port	Metric Tons (Millions)
1	Port of South Louisiana, LA	214
2	Houston, TX	206
4	Beaumont, TX	70
6	Corpus Christi, TX	66
7	New Orleans, LA	65
10	Texas City, TX	52
11	Plaquemines, LA	51
12	Mobile, AL	51
13	Baton Rouge, LA	51
14	Lake Charles, LA	50
17	Pascagoula, MS	34
20	Tampa, FL	31
25	Port Arthur, TX	27
27	Freeport, TX	24
41	Galveston, TX	13

\*Year is 2010



Mexico

Mexican Rank*	Port	Metric Tons (Millions)
3	Veracruz, Veracruz	15
5	Altamira, Tamaulipas	12
6	Punta Venado, Quintana Roo	8
8	Coatzacoalcos, Veracruz	5
12	Tampico, Tamaulipas	2
14	Progreso, Yucatán	2
17	Dos Bocas, Tabasco	1
22	Tuxpan, Veracruz	1
23	Cozumel, Quintana Roo	1

\*Year is 2010



Sources: U.S. Census/TIGER (2010); INEGI (2010); ONE (2010); ESRI (2008); NationalAtlas.gov (2004); OpenFlights.org (2012)



Sources: U.S. Census/TIGER (2010); INEGI (2010); ONE (2010); ESRI (2008); NationalAtlas.gov (2004)



# OIL AND GAS



## Oil and Gas Current and Removed\*

- Platforms
- Pipelines
- - - Exclusive Economic Zone (EEZ)
- Coastal Belt

Platform features for the United States are current as of 03/22/2012 and pipelines 12/18/2012. Mexico and Cuba platforms and pipelines were digitized from digital nautical charts and vary in time period between 2007 to 2011. \*The U.S. portion includes both current and removed platforms and pipelines.

Sources: U.S. Census/TIGER (2010); INEGI (2010); ONE (2010); ESRI (2008); NationalAtlas.gov (2004); USGS, NGA, NASA, GEBCO, CGIAR, Intermap, Oregon Metro (2012); BOEM (2012); Garmin (2012); VLIZ (2012)

## Past, Present, and Future

### Total number of current platforms

U.S. **3,095** (2013) Mexico **183** (2007–2011)

### Total current pipeline length

U.S. **74,000km** (2013) Mexico **1,600km** (2007–2011)

The Gulf of Mexico region, onshore and offshore, is one of the most important regions for energy resources and infrastructure in North America. Oil and gas revenue are fundamental underpinnings for the economies of Mexico and the United States.



Platform off the coast of Texas. Credit: S. Flory



#### United States

In the five Gulf states and federal offshore area, oil production accounted for 54% of the U.S. total and natural gas production accounted for 47% of the U.S. total in 2011.

The Gulf Coast is home to more than 44% of total U.S. petroleum refining capacity and 30% of total U.S. natural gas processing capacity in 2012.

Since 1973 approximately **3,800** platforms have been **removed** from the Gulf.



#### Mexico

Mexico is a major non-OPEC (Organization of Petroleum Exporting Countries) oil producer and among the largest sources of U.S. oil imports. However, its oil production has declined in recent years as well as its position as a net oil exporter to the United States. Crude petroleum production for Mexico in 2011 was 2,550,100 barrels per day, down 1% from 2010. Seventy-five percent (or 1,903,300 barrels a day) of this activity occurred in the Gulf of Mexico waters.

Mexico is a net importer of natural gas, mostly via pipeline from the United States. Its demand for natural gas continues to increase due to a greater use of this source of energy for power generation.



#### Cuba

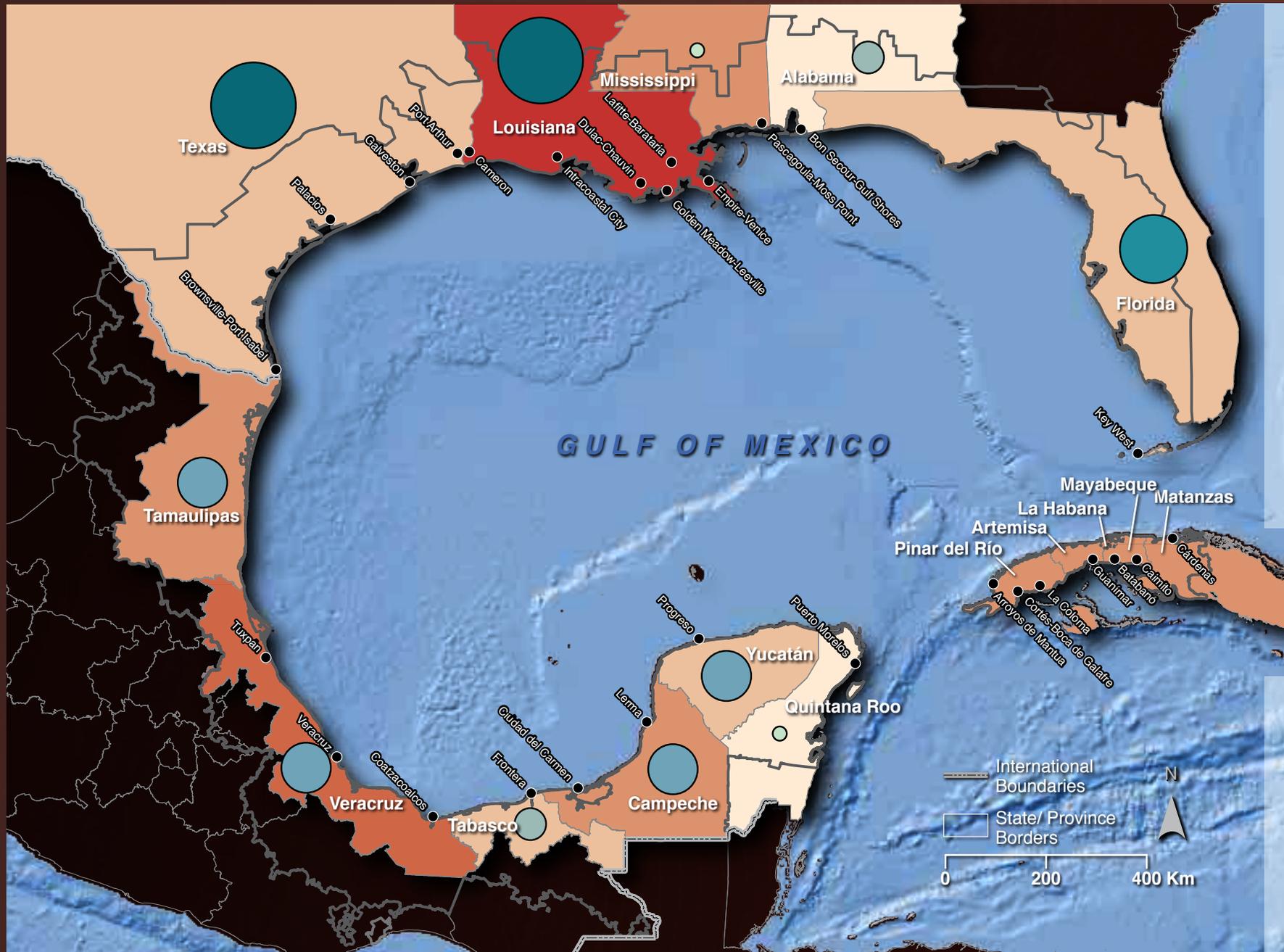
In 2011, Cuba produced 55,000 barrels of oil per day, while consuming over 170,000, making the island a net oil importer.

Most of Cuba's oil production occurs in the northern Matanzas province and most happens onshore, though there is some small offshore production in shallow coastal waters.

There has been significant interest in exploring Cuba's offshore basins, especially in the Gulf of Mexico. The U.S. Geological Survey (USGS) estimates that undiscovered oil reserves in the North Cuba Basin may total 4.6 billion barrels. There are exploratory wells currently being drilled off the northwest coast.



# FISHERIES



## Fisheries

○ Fishing Ports

▭ Coastal Belt

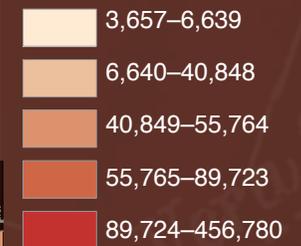
## Landing Value by State

In U.S. Dollars (millions)



## Landing Weight by State

In Metric Tons



U.S. fishing ports represent top commercial fishing ports by landing weight in 2010. Mexico and Cuba fishing ports represent major commercial fishing ports derived from two separate studies. Florida landings represent Florida's West Coast. Mexico and Cuba landings include aquaculture production where as U.S. landings do not. Landing weight for Cuba represents weight of fish captured for the entire country.

Sources: U.S. Census/TIGER (2010); INEGI (2010); ONE (2010, 2011); ESRI (2008); NationalAtlas.gov (2004); USGS, NGA, NASA, GEBCO, CGIAR, Intermap, Oregon Metro (2012); NOAA-NMFS (2012); CONAPESCA (2012); USACE (2012); NGA (2012); Hernández, J.A.B. (2006); Padilla y Sotello, L.S. (2010)

Commercial, artisanal, and subsistence fishing are an important part of life in the Gulf of Mexico. From the coast of Louisiana to the lagoons of Veracruz and the mangroves of Cuba, the attachment to the sea for sustenance is universal. Yet, this important resource can be compromised and there exists a delicate balance between human activities that can influence the health of a system and human needs of that system. The fishery closures that took place after the Deepwater Horizon spill is but one example of the interconnectedness of the economic interests and the ecosystem. At its maximum, the closed area to fishing occupied 37% of U.S. Gulf of Mexico federal waters on June 2, 2010.

### Commercial Fishery Landings, 2010

#### United States



STATE	LANDING WEIGHT (Metric Tons)	VALUE OF LANDING WEIGHT (Dollars)
Alabama	6,639	\$27,660,333
Florida West Coast	28,393	\$137,457,176
Louisiana	456,780	\$247,772,040
Mississippi	50,549	\$21,912,956
Texas	40,848	\$204,468,991

#### Mexico



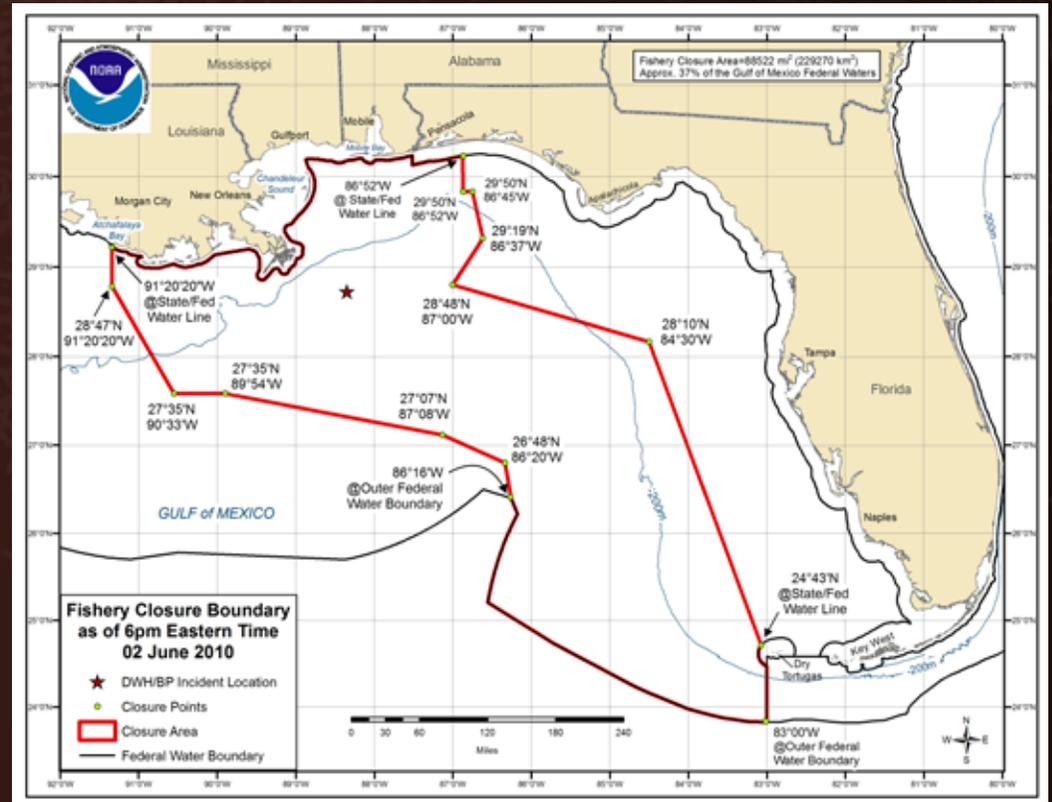
STATE	LANDING WEIGHT (Metric Tons)	VALUE OF LANDING WEIGHT (Dollars*)
Tamaulipas	55,764	\$84,535,092
Veracruz	89,723	\$86,843,662
Tabasco	38,879	\$34,682,534
Campeche	48,168	\$74,050,338
Yucatán	33,180	\$60,059,463
Quintana Roo	3,657	\$13,838,719

#### Cuba



LANDING WEIGHT (Metric Tons)	VALUE OF LANDING WEIGHT (Dollars*)
Cuba	N/A

(\*converted from Mexican pesos)



Largest fishery closure boundary in response to the BP oil spill. Source: NOAA Fisheries Service



Fishermen in Veracruz, Mexico. Credit: Arturo Osorno (Dreamstime)

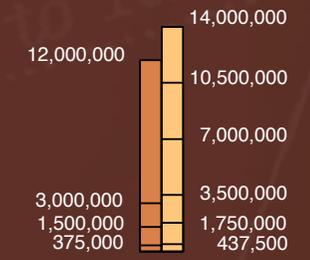


# TOURISM



## Tourism

Coastal Belt



█ Total Population  
█ Number of Visitors

Visitors and total population for selected cities and regions during 2010.



Sources: U.S. Census/TIGER (2010); INEGI (2010, 2012); ONE (2010, 2011); ESRI (2008); NationalAtlas.gov (2004); SECTUR (2011, 2012); Please see references for a complete listing of tourism data.

As an industry, tourism is the second most important economic driver in the Gulf of Mexico region after oil and gas exploration and production. It has been estimated that the productive value of Gulf of Mexico tourism for the United States and Mexico is more than \$45 billion a year.

Cuba has made great leaps in developing tourism. The National Statistics and Information Office (ONEI) confirmed the arrival of 2.2 million foreign visitors in 2011. This translated into revenues of over \$1.7 billion linked to all aspects of tourism infrastructure.

## Gulf Coast Tourism

### United States



AREA	TOURISTS	UNITS (Yearly)
Corpus Christi	6.6 Million	Yearly visitors
Key West	2.65 Million	Includes overnight, day trippers, and cruise passengers
Houston	9.01 Million	Includes overnight, day trippers
Mississippi Gulf Coast	4.9 Million	Not specified
Mobile Bay	7.3 Million	Not specified
New Orleans	8.3 Million	Not specified
Pensacola	3.96 Million	Overnight visitors only
Tampa Bay	13.93 Million	Day tripper, overnight, and VFR-staying with friends and relatives
Sarasota	756,400	Not specified
South Padre Island	5.15 Million (2005)	Day trippers, overnights, seasonal visitors

### Mexico



Cancun	4.04 Million	Yearly visitors
Merida	916,214 (2009)	Yearly visitors
Campeche (municipio)	181,033	Yearly visitors
Veracruz	1.95 Million	Yearly visitors
Tampico	350,000 (2005)	Yearly visitors

### Cuba



Cuba	2.5 Million	Yearly visitors
------	-------------	-----------------



Tourists sailing in a catamaran in Varadero, Cuba. Credit: 123RF

(Year 2010 unless noted otherwise)



# LAND USE



## Land Cover

- Cropland
- Forest
- Grassland/Shrubland
- Wetlands
- Urban
- Water
- Coastal Belt

Classified land cover types derived from satellite imagery dated January and December 2009. Land cover types have been re-classified from source classifications based on the majority of land cover type.

Sources: U.S. Census/TIGER (2010); INEGI (2010); ONE (2010); NationalAtlas.gov (2004); USGS, NGA, NASA, GEBCO, CGIAR, Intermap, Oregon Metro (2012); ESA Globcover (2010)

## Land Cover and Land Use

**Land cover** categorizes natural (forests, wetlands, grasslands) and manmade (cities, croplands) features. When quantified and observed over time, it provides important information to resource managers.

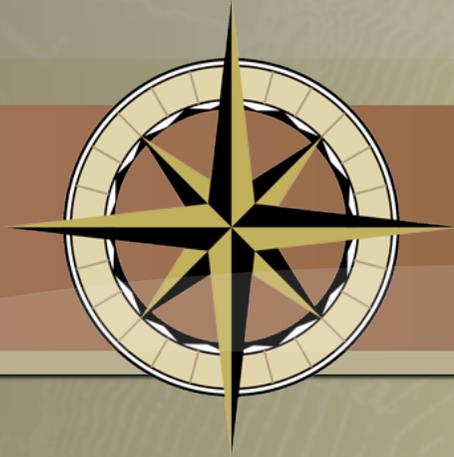
**Land use** describes how humans use biophysical or ecological properties of land. It includes the alteration and/or management of land for settlements, forestry, agriculture, or other purposes, including uses that exclude humans from land, such as in the designation of protected areas or reserves for conservation.



Dunes at Padre Island National Seashore, Texas. Credit: S. Flory

### Percent Land Cover by Type

TYPE	COASTAL BELT	UNITED STATES	MEXICO	CUBA
Cropland	17.8%	14.1%	19.7%	42.3%
Forest	51.0%	50.4%	53.0%	28.1%
Grassland/Shrubland	21.9%	18.9%	24.6%	24.9%
Wetlands	2.5%	5.1%	0.1%	0.7%
Urban	0.3%	0.6%	0.1%	0.7%
Water	6.5%	10.9%	2.5%	3.3%



# CONNECTIONS

“We cannot live only for ourselves. A thousand fibers connect us with our fellow men; and among those fibers, as sympathetic threads, our actions run as causes, and they come back to us as effects.”

— Herman Melville





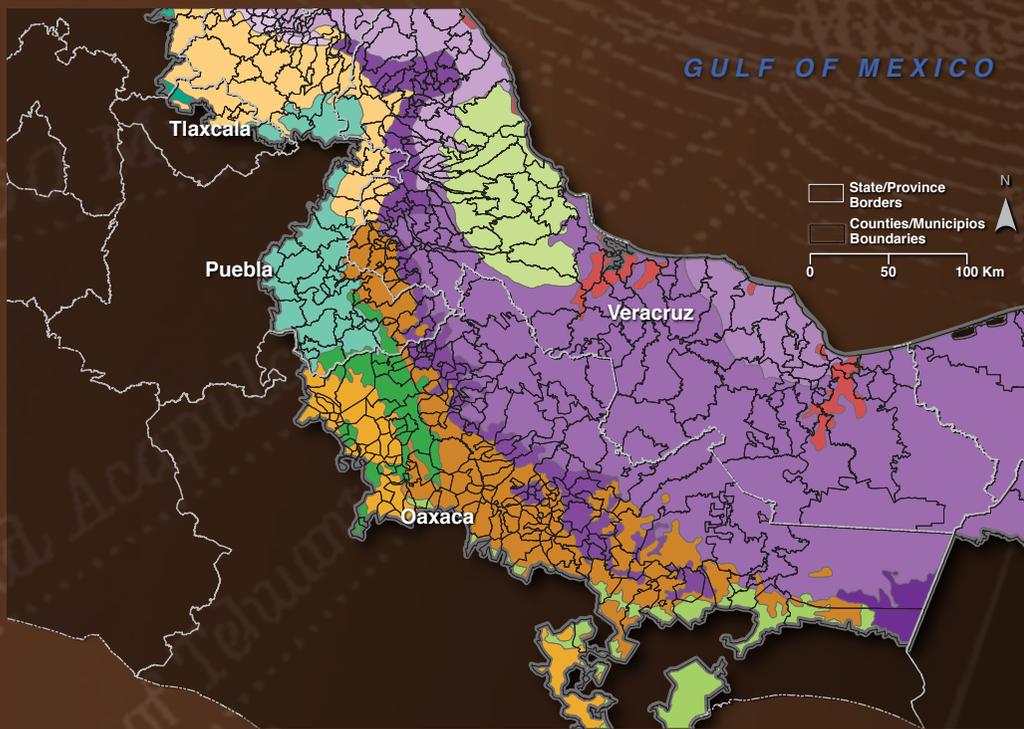
# ECOREGIONS AND COUNTIES/MUNICIPIOS



\*Please See Ecoregions Unit on pages 19–20 for Map Legend

 Coastal Belt

Sources: U.S. Census/TIGER (2010); INEGI (2010); ONE (2010); ESRI (2008); NationalAtlas.gov (2004); TNC (2009)

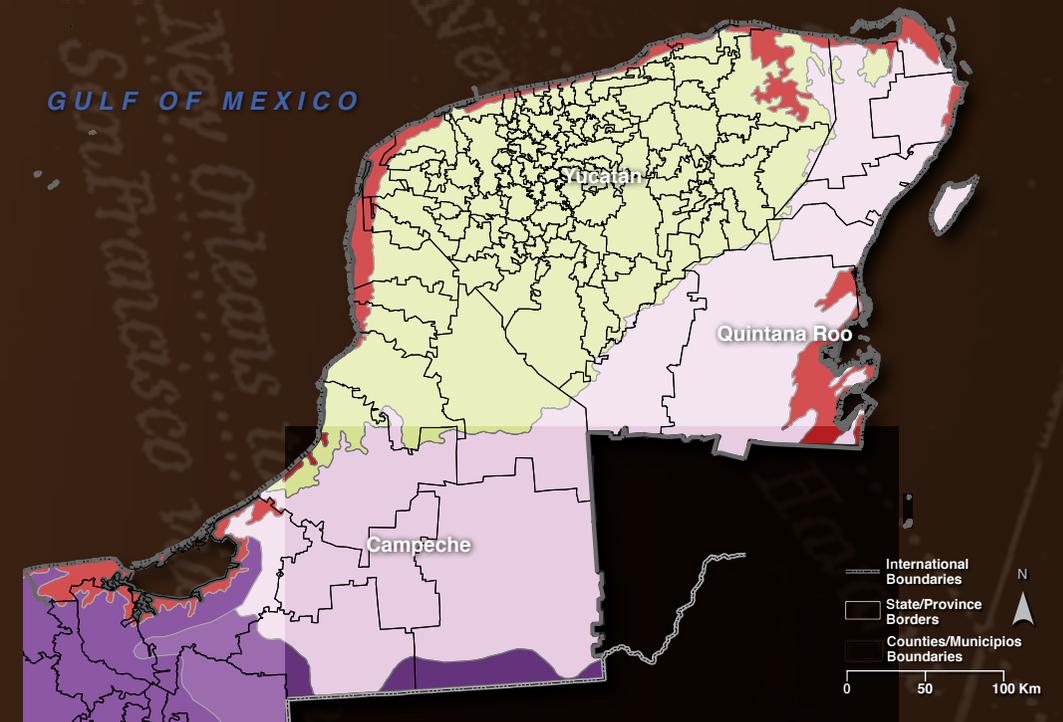


County and municipio borders create administrative units that do not necessarily match natural borders like watersheds, geomorphologic units (rivers, coastal lagoons, mountains, highlands, slopes) or ecoregions. Coastal lagoons, coral reefs or rivers form functional ecosystems that impose a significant challenge for resource managers as they cross the political boundaries of many administrative units. For instance, in the northern Yucatán there are 117 municipios that intersect the “dry forest” region.



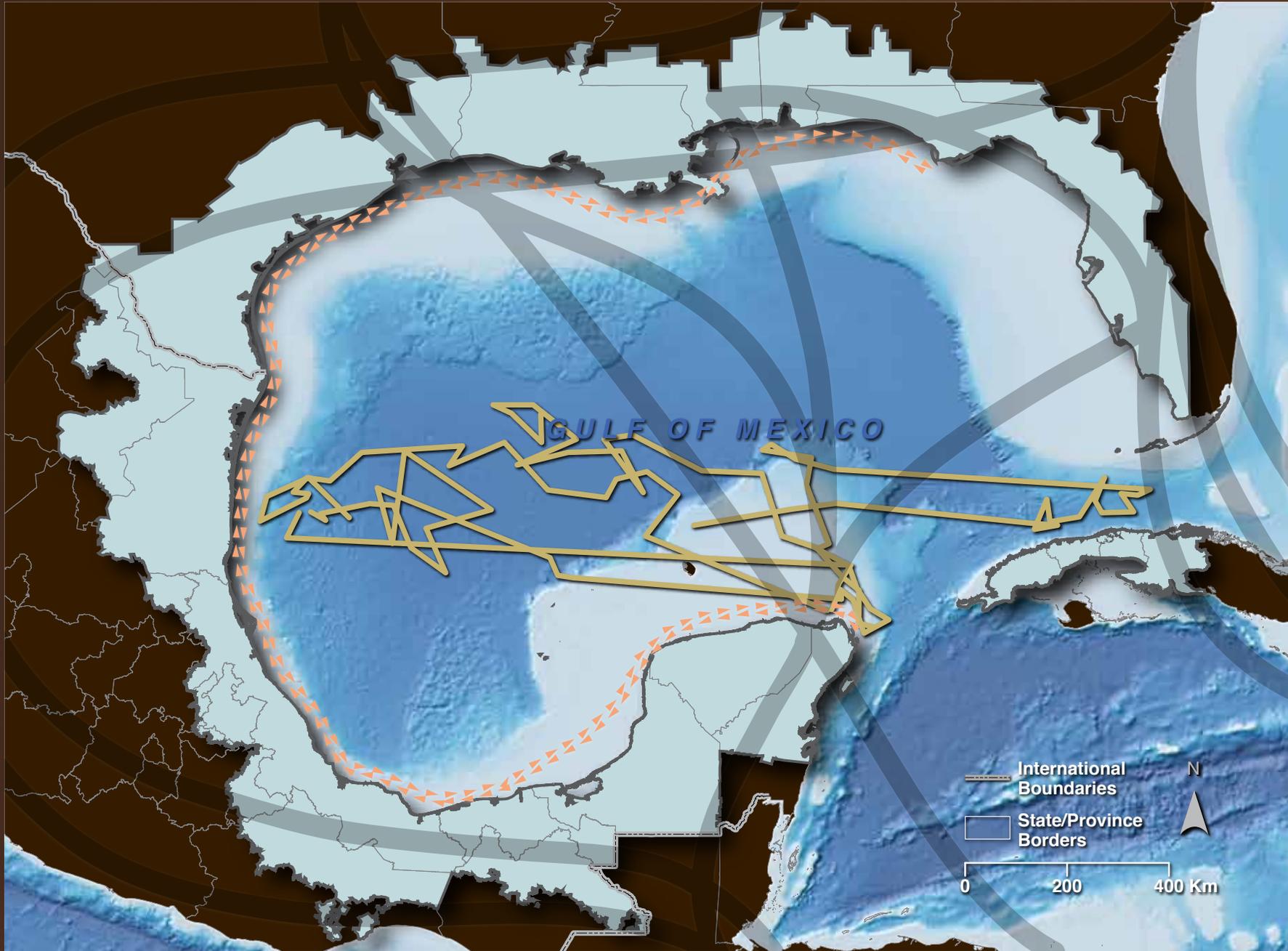
Bayou front homes in Cajun Country, Louisiana. Credit: JC Winkler (Wikimedia Commons)

ECOREGIONS OF THE COASTAL BELT	# OF COUNTIES & MUNICIPIOS THAT INTERSECT	SURFACE AREA (KM <sup>2</sup> )
Tropical and Subtropical Moist Broadleaf Forests	512	226,428
Tropical and Subtropical Dry Broadleaf Forests	278	77,007
Tropical and Subtropical Coniferous Forests	335	48,935
Temperate Broadleaf and Mixed Forests	38	27,720
Temperate Conifer Forests	109	190,518
Tropical and Subtropical Grasslands, Savannas and Shrublands	58	74,413
Temperate Grasslands, Savannas and Shrublands	10	12,576
Flooded Grasslands and Savannas	28	12,130
Deserts and Xeric Shrublands	139	135,642
Mangroves	112	16,513





# WILDLIFE MIGRATION



## Bird, Turtle, and Whale Shark Migration

- Bird
- - - Turtle
- Whale Shark (Southern Gulf Only)
- Coastal Belt

These tracks and flyways are examples of the many migratory routes that exist in the Gulf of Mexico region. Additional routes are known to exist and making that data available for mapping would aid in the decision making process for our Gulf-wide natural resources.

Sources: U.S. Census/TIGER (2010); INEGI (2010); ONE (2010); ESRI (2008); NationalAtlas.gov (2004); USGS, NGA, NASA, GEBCO, CGIAR, Intermap, Oregon Metro (2012); Shaver, D. (2011); National Audubon Society (2012); De La Parra Venegas, R. (2008)

Animals have ports-of-call and transportation routes just like humans. Nesting grounds for local and migratory birds are the natural ports dispersed around the Gulf of Mexico. The connections between nesting and feeding grounds are nature's shipping lanes. While we know more about birds, turtles and to some extent whale sharks, many other species use these natural transportation routes and habitats. Minimizing the interaction of hu-

man and natural ports and transportation routes benefits all and promotes sustainable economic activity. Even more, many activities take advantage of this and have positive impacts on the economy such as tourism, recreational and commercial fishing, hunting, and bird watching. Sea turtles, birds, and whale sharks described below are just a few of the diverse fauna that journey around the Gulf of Mexico.

## Sea Turtles



*Credit: Andy Bruckner, NOAA*

The Gulf of Mexico is home to five of the world's seven sea turtles. They are the Green, Loggerhead, Hawksbill, Leatherback and Kemp's Ridley.

All these five species are listed under the International Union for Conservation of Nature Red List of Threatened Species, the U.S. Endangered Species Act, as well as the NOM-059 of Mexico as either "endangered" or "critically endangered."

Practices such as incidental catching by the fishing industry, capture for food or for consumer products and harvesting of their eggs have contributed toward the decline of these species.

## Birds



*Credit: Michael L. Baird, TPWD*

Gulf of Mexico habitats are essential to the annual cycles of many species of breeding, wintering, and migrating waterfowl, wading birds, shorebirds and songbirds. Many species of birds, called neotropical migrants, nest in North America and spend the winter in Latin America. They use the Gulf of Mexico as a migratory pathway. It is believed that up to a billion migratory birds fly through the Gulf of Mexico region on their annual migratory journeys.

## Whale Sharks



*Credit: C. Ledford, TPWD*

Whale sharks are found both in oceanic waters and inshore where surface sea temperatures are between 18° to 30°C. They are highly migratory and thus use an extensive habitat area. The longest recorded Whale shark journey covered 13,000 km over a 36-months period.

The migratory behavior of whale sharks in the Gulf of Mexico is just beginning to be understood. Available information suggests they occur most frequently in the northern Gulf during warmer months of the year (May–November).



# PROTECTED AREAS



## Protected Areas: Terrestrial and Marine

- Protected Areas Inside Coastal Belt
- Protected Areas Outside Coastal Belt
- Coastal Belt

This map represents designated terrestrial and marine protected areas on the international, national, and local levels as of September 2012 for U.S./Mexico and 2010 for Cuba. U.S. marine protected areas that have been designated as gear-restricted areas, fishery closures, and reef fish stressed areas by the National Marine Fisheries Service (NMFS) have been excluded. Most Cuban protected areas on the local level are not shown due to data unavailability.

Sources: U.S. Census/TIGER (2010); INEGI (2010); ONE (2010); ESRI (2008); NationalAtlas.gov (2004); USGS, NGA, NASA, GEMCO, CGIAR, Intermap, Oregon Metro (2012); SNAP (2010); IUCN and UNEP-WCMC (2012); FNAI (2004)

Cuba, Mexico and the United States have recognized the special value of certain areas because of their high biodiversity; productivity, distinctive nature and ecological or biological value. In many cases they have created marine protected areas (MPAs) to conserve those values. MPAs encompass a broad array of protection from limiting activities to excluding access, the latter of which has created considerable controversy. This is unfortunate as resource managers need as many tools as possible to accomplish what all wish to see, a healthy and sustainable Gulf of Mexico. Many examples exist where stakeholders of disparate interests have come together, like the Flower Garden and Florida Keys National Marine Sanctuaries, to conserve these areas for future generations. These are hopeful models for future conservation efforts.



Arrecife Alacranes or Scorpion Reef is the largest reef in the Southern Gulf of Mexico. It contains five vegetated islands: Isla Desertora, Isla Pérez, Isla Pájaros, Isla Chica, and Isla Desterrada. The reef was declared a National Park, and a “Reserve of the Biosphere” by the United Nations in 1994. *Credit: CONANP*

**4.3%** of the Coastal Belt are protected areas

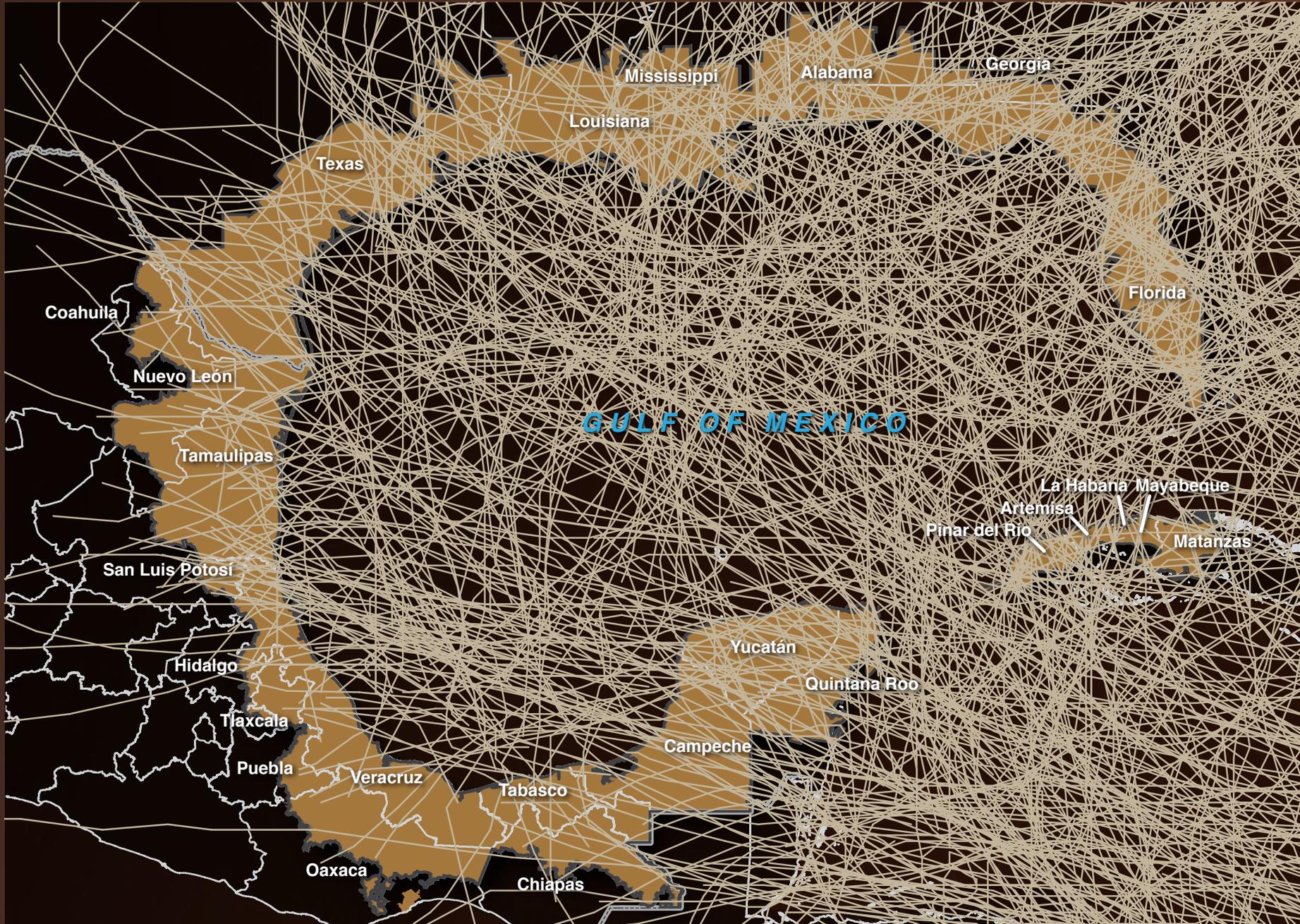
Area protected inside the Coastal Belt **105,700 km<sup>2</sup>**



The Flower Garden Banks were discovered by snapper and grouper fishermen in the early 1900's and named after the brightly colored sponges, plants, and other marine life living in the banks. In 1992, they were designated as a National Marine Sanctuary under the National Marine Sanctuary Act. *Credit: NOAA*



# STORMS



## Hurricanes and Tropical Storms, 1900 to 2011

— Storm Tracks

Coastal Belt

International Boundaries

State/Province Borders

N

0 200 400 Km

Sources: U.S. Census/TIGER (2010); INEGI (2010); ONE (2010); ESRI (2008); NationalAtlas.gov (2004); Knapp et al. (2010)

## Significant Hurricanes of the Gulf and Damages

STORM	YEAR	DAMAGES U.S. \$ 2010: BILLIONS
Katrina	2005	\$105.4
Andrew	1992	\$45.6
Ike	2008	\$27.8
Wilma	2005	\$20.6
Ivan	2004	\$19.8
Charley	2004	\$15.8
Rita	2005	\$11.8
Agnes	1972	\$11.8
Gilberto	1988	\$9.2
Alex	2010	\$1.8

Every part of the Gulf of Mexico is susceptible to hurricanes. Efforts to promote coastal resiliency both for natural and man made infrastructure, are critical to the economic health and well-being of the Gulf of Mexico and its residents.

There are many positive, connecting aspects in the Gulf of Mexico. Hurricanes and tropical storms are included as they bring much needed rain to arid regions, filling up reservoirs and replenishing aquifers. However, intense storms can adversely impact people, property, and infrastructure.



1900 Galveston Hurricane. Credit: NOAA



Sources: U.S. Census/TIGER (2010); INEGI (2010); ONE (2010); ESRI (2008); NationalAtlas.gov (2004); Knapp et al. (2010)

## Significant Hurricanes of the Gulf and Deaths





# ACKNOWLEDGEMENTS & REFERENCES

\*For a complete list of references visit [www.gulf360.org](http://www.gulf360.org)

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### Transition Pages Photo Credits

#### Introduction

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#### Gulf 360 Section

NASA image courtesy the SeaWiFS Project, NASA/Goddard Space Flight Center, and ORBIMAGE

#### Land and Seascapes

Isla Verde and Reef, Veracruz, Mexico. Credit: © Kip Evans (National Geographic Society)

#### People

Holy week celebrations in Mexico. Credit: Dreamstime

#### Human Activities

Shrimp Boats at Dawn. Credit: Dreamstime

#### Connections

Kemp's Ridley Sea Turtle hatchling release, South Padre Island (2010). Credit: Texas Parks and Wildlife

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