

Sanctuary Setting

2.1 Northwestern Gulf of Mexico

The Flower Garden and Stetson Banks are only three among dozens of reefs and banks scattered along the edge of the continental shelf of the northwestern Gulf of Mexico (Figure 3). All of these banks are part of a regional ecosystem heavily influenced by current patterns within the Gulf (Figure 4). Inflows from the large watershed that drains two-thirds of the continental United States also play a significant role in the health of this region.

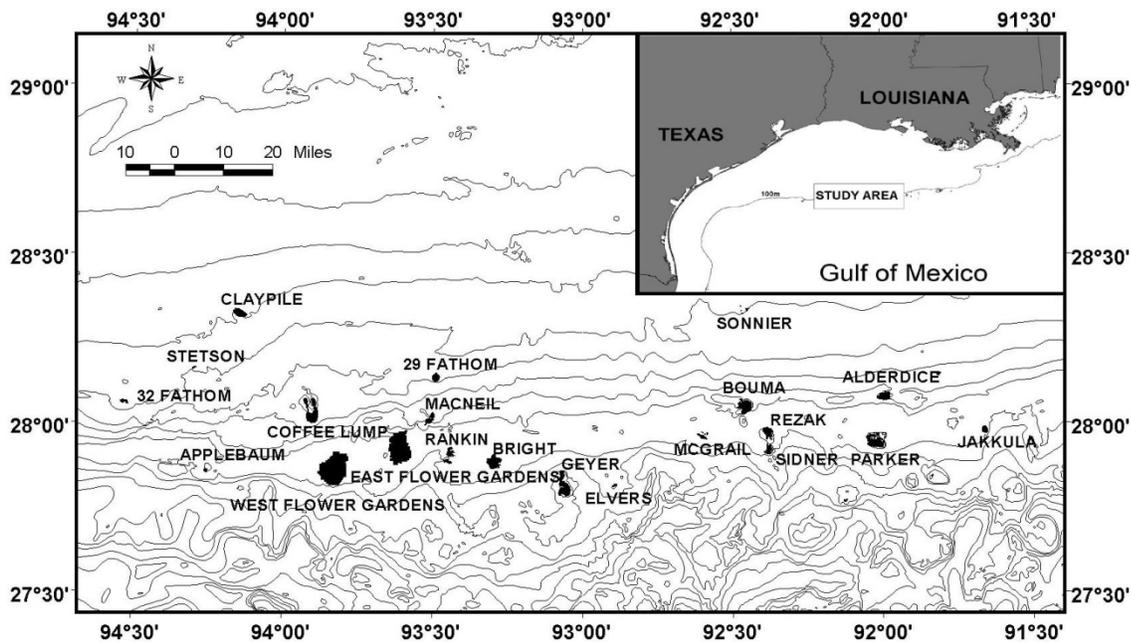


Figure 3: Selected reefs and banks of the northwestern Gulf of Mexico

Currents

From the south, the Gulf of Mexico is fed by the Yucatan Current, a current of warm water from the Caribbean that enters the Gulf between Mexico's Yucatan Peninsula and Cuba. The deeper water flows up the middle of the sea, forming the Gulf Loop Current, which curves east and south along Florida's coast and exits through the Straits of Florida.

The Gulf Loop Current is variable, sometimes barely entering the Gulf before turning, while at other times, it travels almost to Louisiana's coast before swinging toward Florida. Simultaneously, portions of the loop often break away from the main current and form circular eddies that move westward, affecting the Flower Garden, Stetson and other banks to the west. The influx of water to the Gulf brings with it animal larvae, plant spores and other imports from the south, and accounts for the many Caribbean species found in the northern Gulf of Mexico. During its progress, the loop current also picks up similar 'passengers' from the northern Gulf to deliver along its route to the northern Caribbean and western Atlantic.

Meanwhile, the shelf waters of the southern Gulf tend to travel northward, following the Mexico and Texas coastlines before turning east. These wind driven currents may also cross over the Flower Garden, Stetson and other banks and add to the Caribbean influence in the region.

Fresh water from rivers emptying into the northern Gulf of Mexico (Mississippi, Atchafalaya, Calcasieu, Sabine, Brazos, and others) generally flow west and south along the Louisiana and Texas coasts. As these waters move, they mix with nearshore waters of the continental shelf and are also forced offshore as they encounter northward flows along the Texas coast. At times, exceptionally high flow rates can extend the influence of fresh water quite far offshore in the northwestern Gulf.

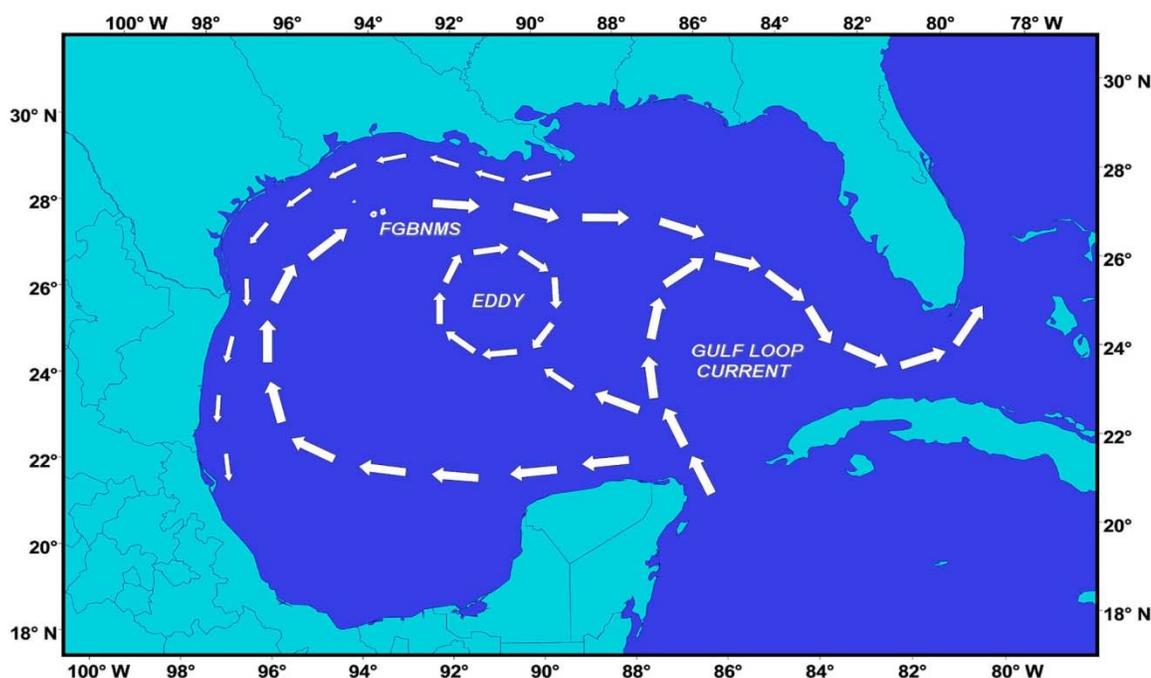


Figure 4: Currents in the Gulf of Mexico

Watershed

From the north, the Gulf of Mexico is fed by multiple rivers that drain the interior of North America. The most significant of these is the Mississippi River. Each river carries runoff accumulated from urban, suburban, and rural areas and wildlands along their respective routes. Before reaching the Gulf, this replenishing source of water is partially depleted by extractions for municipal, industrial and agricultural consumption, thus reducing freshwater inflows that sustain the estuaries. When healthy, the estuaries filter sediments and pollutants from the water, export organic material for the food chain in nearshore areas, and provide nursery areas for many species, some of which later move offshore to the system of banks along the continental shelf.

Connectivity

Scientists have long been aware that water circulation connects the dozens of banks along the continental shelf in the northern Gulf of Mexico. Recent explorations, however, have demonstrated

that there may be much more physical connection than previously believed. Technological advances have allowed the creation of high resolution maps that reveal systems of low relief geological features (such as rock outcrops) between many reefs and banks in this area. These features may allow much more direct interaction between the banks than previously thought. As we build upon the knowledge base established by the discoveries to date, we may discover that these interactions play a crucial role in maintaining the health of the sanctuary's living marine resources.

2.2 Institutional Setting

The offshore areas of the Gulf of Mexico and their resources are currently managed under multiple authorities by several federal agencies. BOEM has historically protected topographic features, including the Flower Garden Banks, through stipulations in leases that prevent drilling in sensitive areas called No Activity Zones (NAZs). National Oceanic and Atmospheric Administration (NOAA) and the Gulf of Mexico Fishery Management Council (GMFMC or Gulf Council) have designated many of these same topographic features as Habitat Areas of Particular Concern (HAPCs), which may limit the types of fishing activities that can occur in the area. NOAA Fisheries also manages endangered and threatened species through the Endangered Species Act (ESA) and protected marine mammals through the Marine Mammal Protection Act (MMPA). In addition, the Environmental Protection Agency (EPA) is responsible for protecting the quality of the nation's waterways through the Clean Water Act (CWA).

BOEM manages oil, gas, and mineral exploration and development through the Outer Continental Shelf Lands Act (OCSLA; 43 U.S.C. 1331 et seq.). The OCSLA authorizes the Secretary of the Interior to prescribe rules and regulations to administer leasing of the Outer Continental Shelf (OCS). Such rules and regulations will apply to all operations conducted under a lease.

The Gulf of Mexico Fishery Management Council is one of eight regional fishery management councils that were established by the Fishery Conservation and Management Act in 1976 (now called the Magnuson-Stevens Fishery Conservation and Management Act (MSA; 16 U.S.C. 1801 et seq.)). The Gulf Council prepares fishery management plans (FMPs) to manage fishery resources in the Exclusive Economic Zone (EEZ) of the Gulf of Mexico, the area from state (3 nautical miles) waters out to the 200 nautical mile limit. As required by the Magnuson-Stevens Act, the Gulf Council has identified essential fish habitat (EFH) in the Gulf of Mexico, and has established a number of HAPCs, including the East and West Flower Garden and Stetson Banks.

The ESA (16 U.S.C. 1531 et seq.) protects animals and plants threatened with extinction. Implementation of the ESA is the responsibility of the U.S. Fish and Wildlife Service (terrestrial species) and NOAA Fisheries (marine species). ESA-listed species that regularly occur in the vicinity of FGBNMS include loggerhead and hawksbill sea turtles, although leatherback turtles have also been observed. Sperm and fin whales may also be present in this area.

Under the MMPA (16 U.S.C. 1361 et seq.), the Secretary of Commerce (authority delegated to NOAA Fisheries) is responsible for the conservation and management of cetaceans and pinnipeds (other than walrus). Various marine mammals occur in the northern Gulf of Mexico, but most are

not common in the vicinity of FGBNMS.

The National Marine Sanctuaries Act (Appendix I) states that NOAA shall “maintain for future generations the habitat and ecological services of the natural assemblage of living resources that inhabit [sanctuaries]” (16 U.S.C. 143(a)(4)(C)). The NMSA further recognizes that “while the need to control the effects of particular activities has led to enactment of resource-specific legislation, these laws cannot in all cases provide a coordinated and comprehensive approach to the conservation and management of the marine environment” (16 U.S.C. 1431(a)(3)). Accordingly, the ONMS subscribes to a broad and comprehensive management approach to meet the NMSA’s primary objective of resource protection.

This comprehensive management approach differs from that of other national and local agencies and laws directed at managing single or limited numbers of species or specific human activities within the ocean. Comprehensive sanctuary management serves as a framework for addressing long-term protection of a wide range of living and non-living marine resources, while allowing multiple uses of the sanctuary to the extent that they are compatible with resource protection. The ecosystems managed by the ONMS span diverse geographic, administrative, political and economic boundaries. Strong partnerships among resource management agencies, the scientific community, stakeholders and the public at-large are needed to realize the coordination and program integration that the NMSA calls for in order to comprehensively manage national marine sanctuaries.

2.3 East and West Flower Garden Banks

The Flower Garden Banks are significant among ecosystems in the Gulf of Mexico. They contain the northernmost coral reefs in the continental United States. The nearest neighboring tropical coral reefs are 400 miles (643 km) away in the Bay of Campeche, off the Yucatan peninsula of Mexico, while the closest U.S. coral reefs are located 750 miles (1,207 km) southeast in the Florida Keys.

East Flower Garden Bank (Figure 5) is a pear-shaped dome, 5.4 by 3.2 miles (8.7 by 5.1 km) in size, capped by 250 acres (1 square km) of coral reef that rise to within 55 feet (17 m) of the surface. West Flower Garden Bank (Figure 6) is an oblong-shaped dome, 6.8 by 5 miles (11 by 8 km) in size, which includes 100 acres (0.4 square km) of coral reef area starting 59 feet (18 m) below the surface.

Brain and star corals dominate the coral caps of the Flower Garden Banks, with a few coral heads exceeding 20 feet (6 m) in diameter. There are at least 21 species of coral on the coral cap, covering over 50% of the bottom to depths of 100 feet (30 m), and exceeding 70% coral cover in places to at least 130 feet (40 m) (Schmahl et al. 2008, and references therein). Interestingly, the coral caps do not contain some species commonly found elsewhere in the Caribbean, such as many of the branching corals, sea whips or sea fans. In fact, despite the high cover, only about a third of Caribbean hard coral species are found in FGBNMS.

A recent observation of note is the discovery of two live *Acropora palmata* colonies, one each at East and West Flower Garden Banks. These colonies are some of the deepest records of this coral species (Zimmer et al. 2006).

Less well-known is the deepwater habitat of the Flower Garden Banks that makes up over 98% of the area within sanctuary boundaries. Habitats below recreational SCUBA limits (approximately 120 feet) include algal-sponge zones, "honeycomb" reefs (highly eroded outcroppings), mud flats, mounds, mud volcanoes and at least one brine seep system. Different assemblages of sea life reside in these deeper habitats, including extensive beds of coralline algae pavements and algal nodules, colorful sea fans, sea whips, black corals, deep reef fish, batfish, sea robins, basket starfish and feather stars.

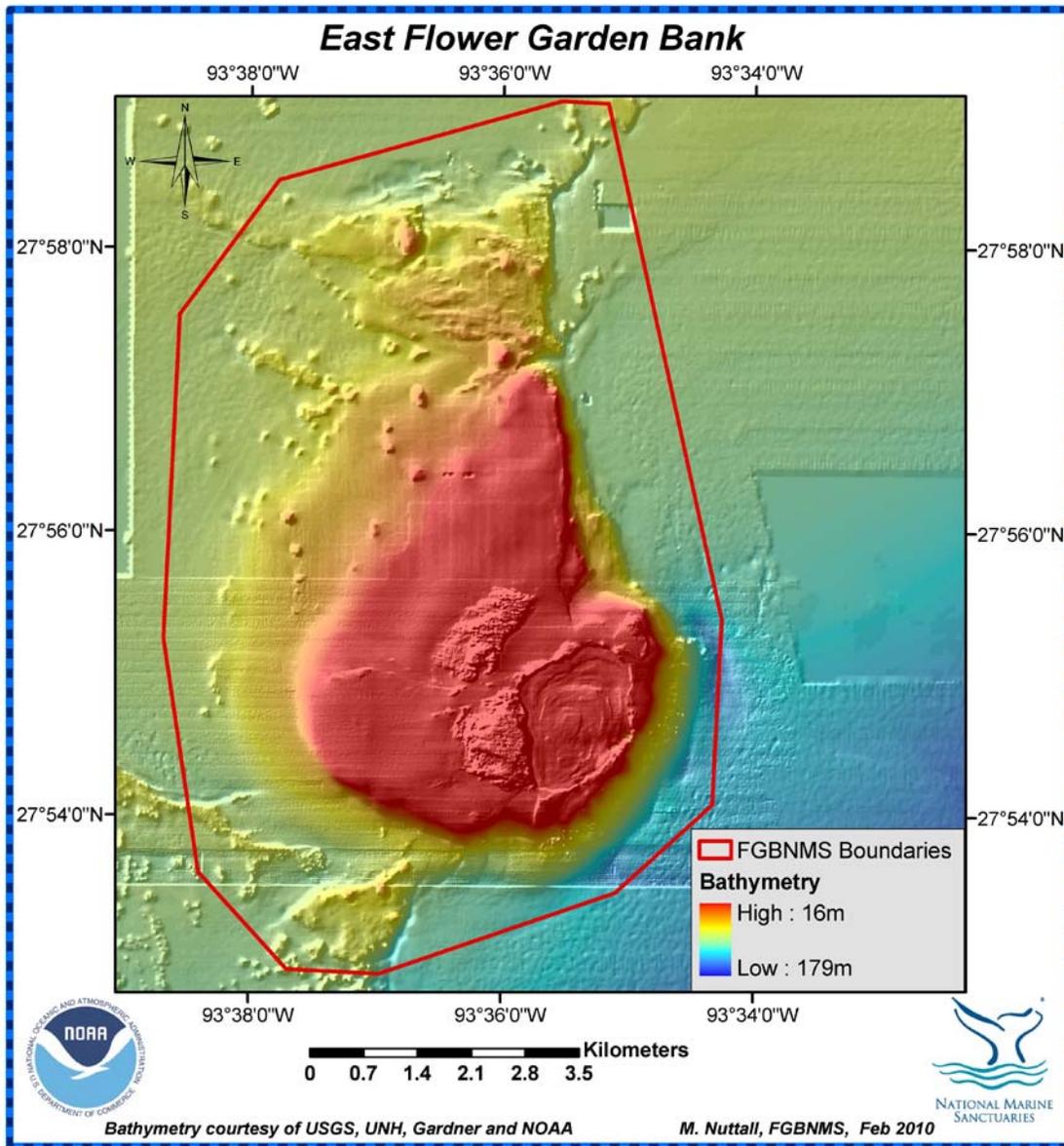


Figure 5: East Flower Garden Bank

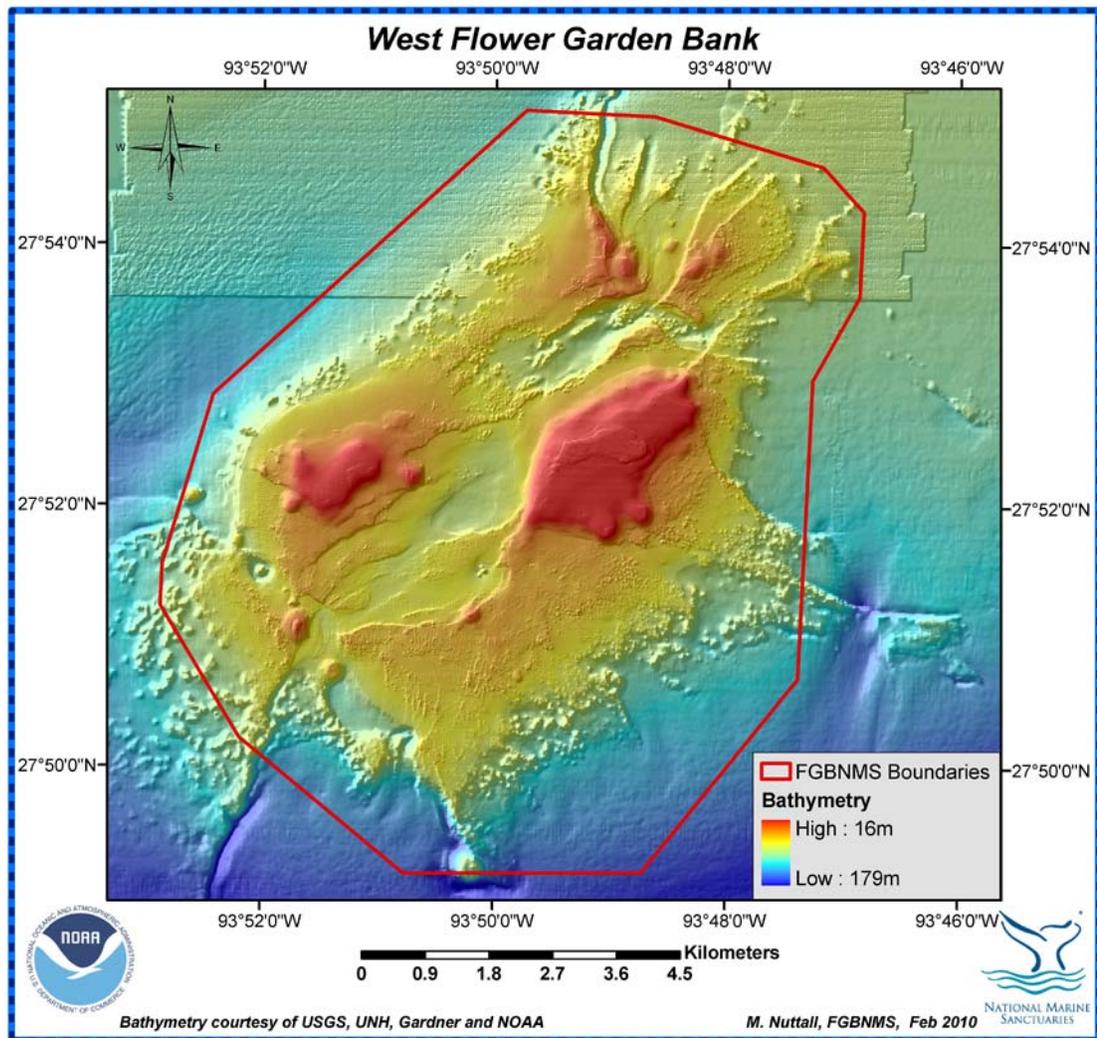


Figure 6: West Flower Garden Bank

2.4 Stetson Bank

Stetson Bank (Figure 7) is located 70 miles (113 km) south of Galveston, Texas, and 30 miles (48 km) to the northwest of West Flower Garden Bank. Depths at Stetson Bank range from about 55 feet (17 m) to 170 feet (52 m). Environmental conditions at Stetson Bank, which include more extreme fluctuations in temperature and turbidity, do not support the growth of reef forming corals like those found at East and West Flower Garden Banks. Divers have described Stetson as having a "moonscape" appearance, with distinct pinnacles that push out of the seafloor for 1,500 feet (457 m) along the northwest face of the bank. An area referred to as the "flats" stretches out behind the pinnacles region and is dotted with low relief outcroppings.

The pinnacles of Stetson Bank are dominated by fire coral and sponges, with cover exceeding 30% (Bernhardt 2000). There are at least nine coral species at Stetson Bank, but with the exception of

fire coral and a large area of *Madracis decactis*, most colonies are small and sparsely distributed. Algae, sponges and rubble dominate the flats.

A “halo” of claystone outcroppings that ring the main feature of Stetson Bank (Gardner et al. 1998) was identified through surveys after the designation of the sanctuary boundaries. Sponges, gorgonians and black corals dominate this impressive ring of outcroppings at about 165-196 feet (50-60 m). Deep reef fish and invertebrates are prominent inhabitants of the "Stetson Ring." Much of the feature is outside of the current sanctuary boundaries, an issue that has been identified as a priority for consideration through the management plan review.

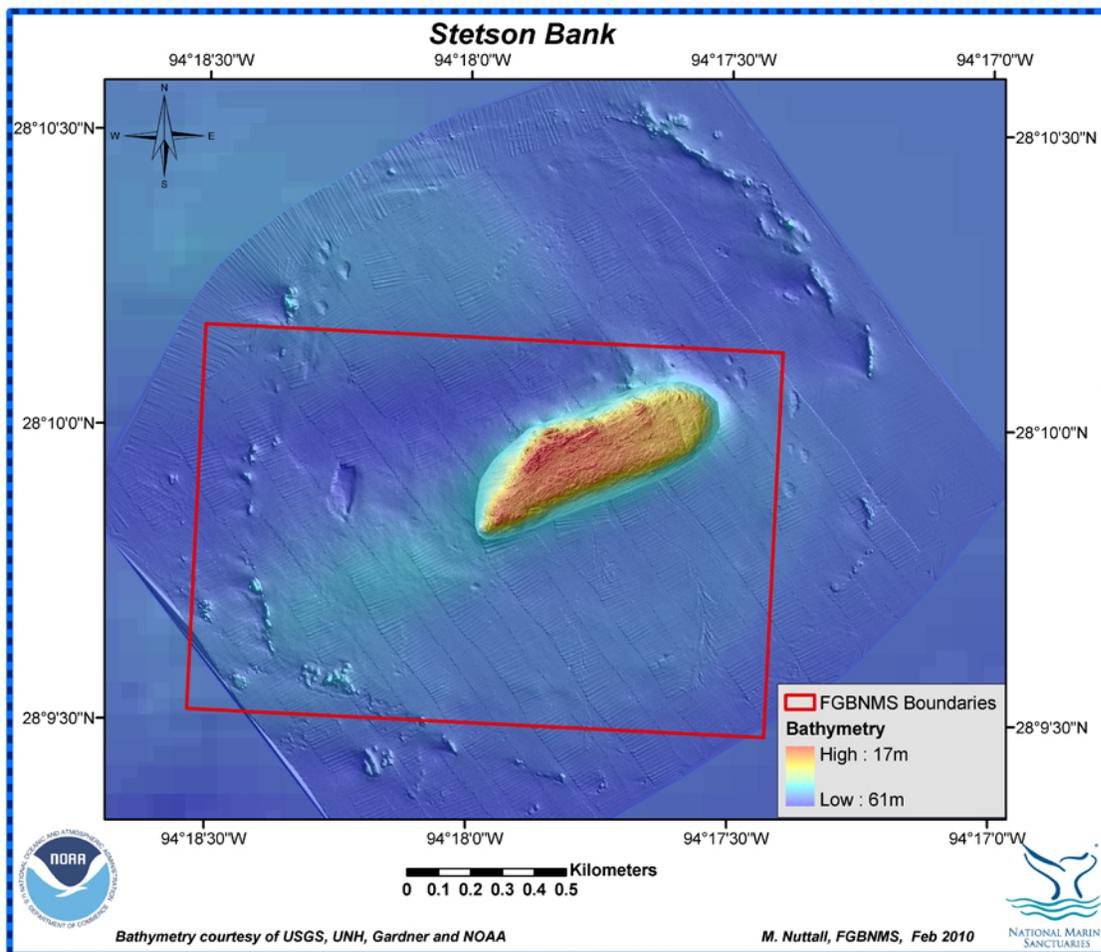


Figure 7: Stetson Bank

2.5 *Human Environment*

The reefs and banks of the northwestern Gulf of Mexico, including the Flower Garden and Stetson Banks, are utilized by a variety of user groups.

Recreational SCUBA Diving

Recreational SCUBA divers constitute the largest user group within FGBNMS. An estimated 2,500–3,000 divers visit the sanctuary each year. Although the Flower Garden Banks is often a challenging dive site, recreational divers consistently rate it among the favorite dive sites in North America. The sanctuary is also a popular site for underwater photography. Most divers access the sanctuary on commercial dive charter vessels, but some visit the area in personal boats. Diving is also popular on oil and gas platforms and other artificial reefs in the vicinity.

Fishing

Recreational and commercial fishing are common and economically important activities in the northwestern Gulf of Mexico. Primary species of importance to the fisheries in the Flower Garden Banks area include reef fish within the snapper-grouper complex, including Red Snapper, Vermilion Snapper, deepwater groupers (Yellowedge, Snowy, Speckled Hind, Warsaw) and shallow water groupers (Gag, Scamp, Yellowfin, Yellowmouth, Black, Rock Hind, Red Hind). A number of sharks and other pelagic fish, such as Wahoo, mackerel and Greater Amberjack, and other reef fish, such as Gray Triggerfish, are also sought after species. Conventional hook and line fishing, both recreational and commercial, is allowed within FGBNMS. All other fishing methods, including bottom trawling, trapping and bottom long-lining are prohibited to protect sensitive bottom habitat. Spearfishing is also prohibited. The spatial resolution of fishing data is currently not precise enough to quantitatively assess fishing pressure within the sanctuary.

Vessel Traffic

The sanctuary is located adjacent to a major shipping lane for shipping and transport headed to the Port of Houston, one of the busiest ports in the nation. In the past, this led to occasional anchoring incidents resulting in damage to the coral reefs of FGBNMS. This is now largely managed through a “no-anchor” designation from the International Maritime Organization (IMO) and sanctuary regulations. Other concerns from large vessel traffic include sewage discharge, gray water effluent, marine debris, exhaust emissions, ballast water release, and occasional towing cable impacts. Smaller vessel traffic within the sanctuary includes charter fishing and diving vessels, and personal watercraft used for recreational activities. The number of these vessels visiting the sanctuary each year is limited by the sanctuary’s distance from shore and the variability of sea conditions. Mooring buoys are provided by the sanctuary for vessels up to 100 feet in length to avoid anchoring incidents. Vessel discharge and marine debris are other concerns.

Other vessels are occasionally observed transiting the sanctuary without stopping. These include passing shrimp trawlers, as well as service boats and barges associated with oil and gas activities. In the past, significant injury to sanctuary resources has resulted from improperly attended cables between tugs and towed barges.

Oil and Gas Activities

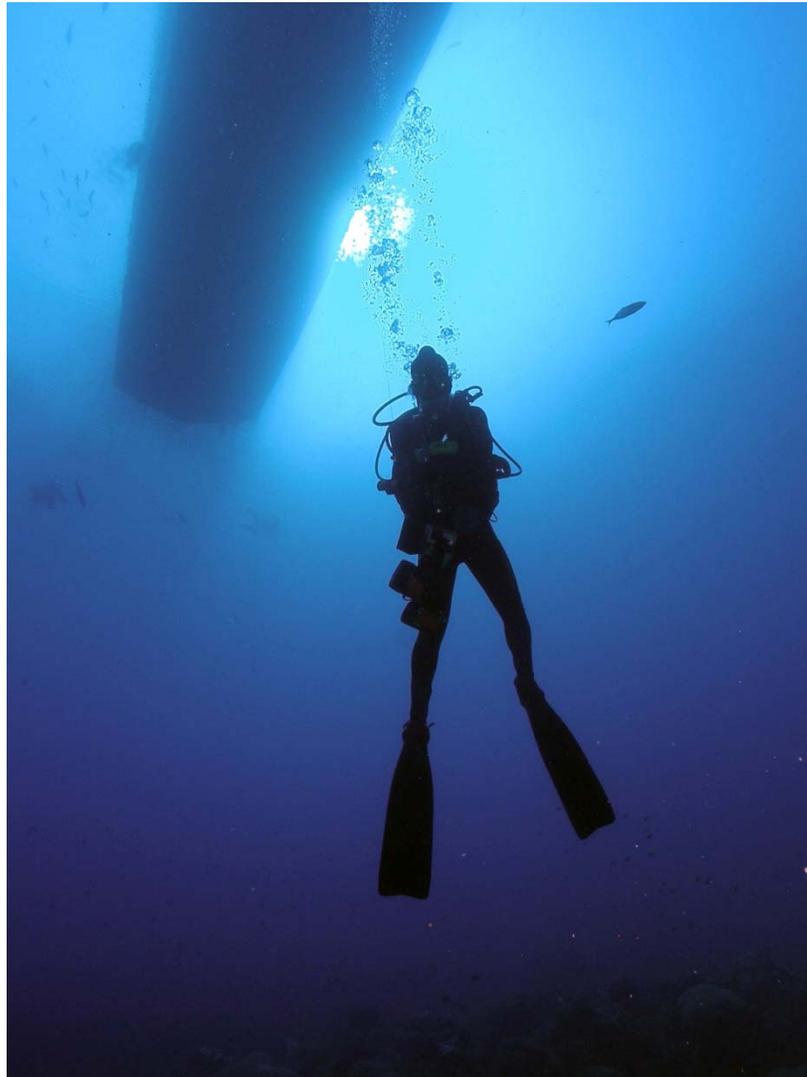
The northwestern Gulf of Mexico is home to one of the most active areas of oil and gas exploration and development in the world. Approximately 150 oil and gas platforms are located within 25 miles of the existing boundaries of Flower Garden Banks National Marine Sanctuary. One production platform, located in BOEM lease block High Island 389A, is within the boundary of East Flower Garden Bank. Constructed in 1981, prior to sanctuary designation, this platform continues to facilitate active exploration for and production of oil and gas. The structure itself also serves as an artificial reef, providing habitat for a variety of organisms that live on and around it, as well as an exciting dive opportunity for sanctuary visitors.

Research

FGBNMS has a long history of research and exploration that continues today. Scientists from a variety of universities, research foundations, and government agencies are constantly monitoring and evaluating the fauna and flora of the sanctuary. Many recent studies have focused on the deepwater areas surrounding and between the various reefs and banks, utilizing remotely operated vehicles (ROV) and other technologies. Because of the remote location, the coral reefs of the sanctuary have remained relatively buffered from problems that plague many other reefs in the world and have become a benchmark for evaluating the health of other reef systems.

Education and Outreach

As the only coral reef ecosystem in this region, the Flower Garden Banks is a valuable experiential learning site for educational programming. Instead of just learning about coral reefs, program participants can experience them first-hand, thus adding another dimension to their appreciation of this resource in the northwestern Gulf of Mexico. For example, FGBNMS staff organizes workshops that train between 500 and 1,000 teachers every year.



A diver floats beneath a boat within the sanctuary. Photo: FGBNMS