



# Flower Garden Banks National Marine Sanctuary



## 2011 Research, Science Interpretation, and R/V MANTA Cruise Summary

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### A. OVERVIEW

The purpose of this document is to report the activities of the Flower Garden Banks Research Team during FY2011.

### B. SUMMARY

The FGBNMS research team was involved in 17 research and response cruises in the 2011 field season. A pool of 43 sanctuary personnel, scientists, and reciprocity divers conducted approximately 674 SCUBA dives and 72 technical SCUBA dives during the season. Activities included monitoring, biological surveys, sample collection, whale shark tagging, lionfish removal, response activities related to Deepwater Horizon oil spill, equipment maintenance, image collection, and installation of moorings and monitoring perimeter and corner pins. In addition to these cruises, 12 cruises were supported by the R/V MANTA with partner organizations. Four sanctuary permits and four amendments were processed, and an additional five are ongoing.

### C. HIGHLIGHTS

R/V MANTA traveled 10,355 nautical miles during the 2011 missions, exceeding the number of miles traveled in all previous years combined.

Significant improvement was made to the long-term monitoring study site at East Flower Garden Bank. Corner posts were re-surveyed and installed, along with 16 guide pins along the boundaries and crosshairs. The repetitive photostations were mapped in using the corner posts and guide pins.

The research team tagged a whale shark at West Flower Garden Bank – the first whale shark to be tagged in the sanctuary!

2011 marked the arrival of the invasive Pacific lionfish, *Pterois sp.* FGBNMS staff developed an informational Powerpoint presentation to share with the public, educators, dive clubs, etc. The first lionfish documented at West Flower Garden Bank was collected and is being kept at the sanctuary offices as a science interpretation tool. Sighting markers were developed and provided to the recreational charter operators to enable recreational to mark lionfish locations. Dive operators were also permitted to remove lionfish from sanctuary waters.

The research team was instrumental in collaborating with marine artist/educator and FGBNMS advisory council member, Jacqui Stanley, in creating and implementing a sanctuary mural for Ocean Discovery Day.

The research team, in conjunction with education staff, kept the Facebook® page up to date with interesting posts after each cruise and event. The FGBNMS page ended the year with 2260 friends.

## **D. CRUISES**

Cruises on board the R/V MANTA beginning in 2010 were crewed by Blue Star Marine.

### **1. NRDA CRUISE #3a**

**R/V MANTA**

**OCTOBER 8-9, 2010**

**FUND: NRDA**

FGBNMS research staff installed a new anchor and subsurface buoy line at Sonnier Bank and attached a new set of semi-permeable membrane devices (SPMDs) to the new line. The last deployment of SPMDs (and acoustic receiver) was lost when the M/V *Fling* pulled out the mooring at Sonnier. Water collections were made for an ongoing George Mason University water quality study. Sediment samples were collected for the Deepwater Horizon NRDA effort. FGBNMS and TAMUG research divers searched for lionfish on the main peak at Sonnier but did not encounter any. No significant coral bleaching was observed on the main peak. Two rehabilitated Hawksbill Sea Turtles were released at an oil platform adjacent to Sonnier Bank by biologists from NMFS and the Kemah Aquarium.

### **2. NRDA CRUISE #3b**

**M/V FLING**

**OCTOBER 11-12, 2010**

**FUND: NRDA**

FGBNMS research team and TAMUG reciprocity divers completed random transect photography and fish counts at West Flower Garden Bank as part of the long-term monitoring effort. SPMDs were changed out at East and West Flower Garden Banks, and Stetson Bank, as part of the ongoing Deepwater Horizon oil spill response effort. Temperatures at depth had decreased to 79F, which should alleviate the bleaching event.

**3. NRDA CRUISE #4**  
**R/V MANTA**  
**DECEMBER 3-4, 2010**  
**FUND: NRDA**

The FGBNMS research team headed back to Sonnier Bank to change out the SPMDs once more. They also retrieved the temporary mooring (an anchor) and deployed a mooring anchor (cement block) for the SPMDs. Water temperature was 73F and visibility was down to 25 feet. Seas were 3-5 feet, winds 15-18 knots. After the tasks were completed at Sonnier Bank, the team headed to East Flower Garden Bank where conditions were clearer – 100 foot visibility, and seas had dropped to 2-3 feet. The team headed back to Galveston in front of a weather system.

**4. HRI/MISSION BLUE RESEARCH CRUISE**  
**ALABAMA PINNACLES**  
**JANUARY 3-8, 2011**

Research Assistant Marissa Nuttall participated in a week-long cruise with Dr. Sylvia Earle (National Geographic Society) and the Harte Research Institute for Gulf of Mexico Studies at Texas A&M Corpus Christi. The expedition took researchers to an area near the Deepwater Horizon well site called the Alabama Pinnacles, a series of natural reefs and banks along the continental shelf edge of Alabama that support a diverse mesophotic community. Researchers hoped to explore these sites using a dual “Deepworker” submersible to investigate possible impacts from the oil spill. However, high winds and bumpy seas prevented launching the submersible at the target locations and forced the vessel into dock early. Although the submersible was unable to launch, two successful deployments of the Ocean Research and Conservation Association (ORCA) Medusa lander were conducted. Despite minimal data collection on this expedition, the cruise provided an opportunity for the sanctuary to make connections with researchers, nature writers and videographers.

**5. NRDA CRUISE #5 and WATER QUALITY**  
**R/V MANTA**  
**FEBRUARY 16-17, 2011**  
**FUND: NRDA**

The Flower Garden Banks Research Team conducted a cruise to Sonnier Bank, East Flower Garden Bank, West Flower Garden Bank, and Stetson Bank to continue the NRDA monitoring effort and collect quarterly water quality data. Sea states ranged from 1-2 feet to 3-4 feet and water temperature on the reef ranged from 62F at Sonnier Bank to 68F at West Flower Garden Bank. Two Manta Rays were encountered at East Flower Garden Bank, and *Montastrea cavernosa* was observed to be regaining color from the summer bleaching event.

## **6. NRDA CRUISE #6**

**R/V MANTA**

**MARCH 29-30, 2011**

**FUND: NRDA**

The Flower Garden Banks research team and R/V MANTA crew successfully conducted the final retrieval cruise for the semi-permeable membrane devices (SPMDs) in response to the Deepwater Horizon Oil Spill. The team visited Stetson Bank, East and West Flower Garden Banks, and Sonnier Bank. Rough seas were encountered, however underwater conditions were favorable--minimal currents and 60-100 foot visibility. Temperatures ranged from approximately 64F to 68F. A manta ray, and several hammerhead, tiger, and sandbar sharks were sighted. Three invasive Pacific lionfish were captured at Sonnier Bank. They will be assessed for gut content, age, and genetics. No lionfish have been sighted yet within sanctuary boundaries, although they are expected to reach FGBNMS this year.

## **7. FGBNMS/NCCOS/CIOERT DFH15 CRCP ROV CRUISE**

**R/V MANTA**

**MAY 15-18, 2011**

**FUND: GEORGIOS M**

The Flower Garden Banks research team and partners from NCCOS, Harbor Branch, and UNCW (CIOERT), participated in a research cruise May 15-18 using a remotely operated vehicle (ROV). Surveys were conducted to evaluate fish populations and benthic cover in the deeper portions of the sanctuary. Despite losing a day and a half to rough seas, the team was able to conduct over 19 hours of ROV diving, capturing a total of 55 transects. The transects covered a variety of habitats at both East and West Flower Garden Banks, including the Algal Nodule Zone, Coralline Algae Reefs, Deep Coral Reefs, Soft Bottom, and a mud volcano! The information gathered from these transects will feed into the establishment of fish population and benthic cover baselines to explore the possibility for a proposed research area. In addition, acoustic fish surveys were conducted to evaluate fish biomass using non-invasive methods. Quarterly water samples and water quality instrument maintenance was completed at East Flower Garden, West Flower Garden and Stetson Banks.

## **8. EWING BANK – WHALE SHARKS AND MAPPING**

**R/V MANTA**

**JUNE 15-21, 2011**

**FUND: GEORGIOS M**

The Flower Garden Banks Research Team and NOAA Fisheries' Eric Hoffmayer conducted a productive research cruise to Ewing Bank. While the team did not encounter a large aggregation of Whale Sharks, with the help of a spotter plane, approximately 6 of the sharks were seen around the bank, two of which researchers were able to observe from the water, and one of which was tagged with a satellite tag. The tagged Whale Shark was nicknamed "Bessie," and her location information was made available online. Some of the satellite tags and the spotter plane overflights were funded by the The International Foundation for Animal Welfare. For more information about the tagging and tracking of Whale Sharks in the northern Gulf of Mexico, visit

<http://www.gtopp.org/about-gtopp/animals/whale-sharks.html>. In addition to the Whale Shark research, the team collected video images from Ewing Bank using a drop camera. Little information is available about the habitat that occurs at Ewing Bank, so these videos will help add to our understanding of the structure of the bank. Temperature, salinity, and oxygen saturation were also measured around the bank in an attempt to detect if any discharge from the Mississippi River had expanded to the area. These casts showed that the waters currently around Ewing Bank were well mixed and oxygenated.

## **9. STETSON BANK LONG-TERM MONITORING**

**R/V MANTA**

**JULY 5-8, 2011**

**FUND: CIMPSHIP**

The FGBNMS research team, including Office of National Marine Sanctuaries and Texas A&M University-Galveston divers, completed a very successful Stetson Bank Long-Term Monitoring cruise on board the R/V MANTA. Divers located and photographed 42 repetitive photostations, established 13 new stations, and completed 16 random transects and several belt transects. Lobster and urchin surveys were conducted during night dives. Things got a little exciting at one point as a shark feeding frenzy erupted on the surface not far from the R/V MANTA just as divers were preparing to enter the water! We enjoyed flat surface conditions, although a little current and less than perfect visibility was encountered. This was the 22nd Stetson Bank long-term monitoring cruise.

## **10. FGBNMS LONG-TERM MONITORING (LEG 1)**

**R/V MANTA**

**JULY 11-15, 2011**

**FUND: CIMPSHIP**

The Flower Garden Banks research team, and Steve Gittings and Michelle Johnston from ONMS HQ, along with Bureau of Ocean Energy Management, Regulation and Enforcement (BOEMRE) and Texas A&M University-Galveston reciprocity divers, conducted long-term monitoring field work at East and West Flower Garden Banks in the record time of 3.5 days. Near perfect conditions, a strong field/dive team, and the high quality of the R/V MANTA crew and platform led to the success of the week. Divers located close to 150 photostations, collected video collected of the perimeter lines, accomplished 48 fish counts, completed 32 ten-meter random photo surveys, and conducted four 100m x 2m night surveys for lobster and spiny sea urchins. This project represents one of the longest running coral reef monitoring programs in the world. Highlights included the discovery of upwards of 100 colonies of invasive orange cup coral (*Tubastraea* sp.) at West Flower Garden Bank, sightings of at least four manta rays, and a mobulid ray.

## **11. FGBNMS LONG-TERM MONITORING (LEG 2)**

**R/V MANTA**

**JULY 18-22, 2011**

**FUND: CIMPSHIP**

The Flower Garden Banks research team, including the crew of the R/V MANTA, and Texas A&M University Galveston reciprocity divers, successfully completed a week of

maintenance and upgrading at the long-term monitoring site at East Flower Garden Bank. Tasks included drilling holes and installing eye bolts every 25 meters around the perimeter of the 100m x 100m study site, as well as along the crosshairs of the site. This will allow for more repeatable surveys along these lines in the future. Approximately 40 repetitive photostations were mapped into the site using the new eye bolts as reference. In addition to the bolt installation, a new mooring was drilled and installed close to the center of the study site. This was the first opportunity to utilize the hydraulic quick disconnect capabilities of the R/V MANTA. The visibility dropped from about 80ft to 20ft in a matter of minutes. Other observations of note were the sighting of four mardi gras wrasse--an intermediate male and three females, a manta ray, a pair of curious juvenile caribbean reef sharks, marbled grouper, and a loggerhead sea turtle on the surface. Strong currents and poor visibility slowed the progress somewhat. Water temperature was around 85F. Surface conditions ranged from 0-1ft to 3-4ft. An unexpected mass spawning event of bivalves and Christmas tree worms was observed during one afternoon dive.

## **12. FGBNMS/NCCOS/CIOERT CRCP Fish and Benthic Fish Surveys**

**R/V MANTA**

**AUGUST 1-5, 2011**

**FUND: CIMPSHIP**

The FGBNMS research team, HBOI/FAU, CRCP, and NCCOS joined together to conduct about 80 fish and benthic surveys at East and West Flower Garden Banks as part of a proposed research area suggested by the Management Review Plan process. Conditions were perfect--hardly any current, well over 100ft visibility, flat calm surface conditions, and around 85F water temperature. Divers sighted a manta ray and several sharks. An item of note is the collection of a lionfish at West Flower Garden Bank by NOAA Divers Marissa Nuttall and Amy Uhrin. This is the third official sighting of the invasive species in the sanctuary. The fish is now in a tank at the FGBNMS Galveston office. A reconnaissance dive was also conducted at Stetson Bank.

## **13. HARTE RESEARCH INSTITUTE FGBNMS CRUISE**

**M/V FLING**

**AUGUST 8-12, 2011**

Sylvia Earle along with professors, faculty, and graduate students from the Harte Research Institute (HRI) at Texas A&M University Corpus Christi, and sanctuary staff, visited Flower Garden Banks National Marine Sanctuary. The cruise was designed to promote the unique research opportunities of the Flower Garden Banks and introduce the use of SCUBA diving as a scientific tool. The group visited all three banks in the sanctuary, in addition to conducting one dive on HI-389A.

## **14. CORAL SPAWNING**

**R/V MANTA**

**AUGUST 19-21, 2011**

**FUND: CIMPSHIP**

The Flower Garden Banks research team, along with researchers from the University of Texas (UT) and the Navy Research Laboratory (NRL), conducted a cruise to document

the annual coral spawning event at the sanctuary. UT divers collected coral fragments and spawn for genetic analysis, and researchers from the NRL collected data on current movement around the banks. The corals spawned spectacularly, and as predicted. Following the spawning, the researchers were treated to an encounter with a friendly male Whale Shark, about 19 feet in length, at West Flower Garden Bank. The FGBNMS research team successfully tagged the shark with a Pop-up Archival Tag (PAT).

**15. FGBNMS/NCCOS/CIOERT CRCP TECH DIVING  
NOAA SHIP NANCY FOSTER**

**AUGUST 20 – SEPTEMBER 2, 2011**

Divers from NCCOS, CIOERT, TAMUG, and FGBNMS conducted technical diving operations to collect the first round of fish and benthic surveys at depths between 100 and 150 feet. A total of 35 surveys were conducted at East (26) and West (9) Flower Garden Banks. Close to 100 camera drops were conducted to groundtruth the habitat maps. Acoustic surveys were conducted to identify fish densities and aggregations, in addition to features such as gas seeps.

**16. GEYER BANK MARBLED GROUPEL SPAWNING AGGREGATION  
INVESTIGATIONS**

**R/V MANTA**

**AUGUST 25-29, 2011**

**FUND: CIMPSHIP**

FGBNMS research team was joined by Dr. Will Heyman (TAMU) on a cruise to conduct ROV and acoustic surveys with the goal of identifying marbled grouper populations at Geyer Bank, as well as continue characterization of the bank. Just one marbled grouper was observed by ROV. No significant aggregations were observed by any method. A scuba dive was conducted to assess the status and fish populations on the bank crest. A dense field of Sargassum was observed and documented. A sample of this sargassum was collected on a follow-up cruise and sent to Dr. Suzanne Fredericq for identification.

**17. FGBNMS/GEYER – RESOURCE PROTECTION CRUISE**

**R/V MANTA**

**SEPTEMBER 15-16, 2011**

**FUND: ROWAN**

The Flower Garden Banks research team conducted a successful cruise to conduct maintenance and inspections on the sanctuary mooring buoy system and removed marine debris. Four mooring buoys were inspected at East Flower Garden Bank and 3 were inspected at West Flower Garden Bank. In addition to the mooring inspections, algae samples were taken at Stetson and Geyer Bank for identification and analysis by Dr. Suzanne Fredericq at the University of Louisiana at Lafayette. Increased levels of algae have raised concern at Stetson Bank, and an unusual field of attached Sargassum had been recently observed at Geyer Bank. Dr. Fredericq will be identifying the algae samples to assist us in learning about the events. Following the algae sample collection, the researchers and R/V MANTA crew were treated to an encounter with a friendly manta ray at Geyer Bank.

## **E. ADDITIONAL R/V MANTA CRUISES**

The R/V MANTA was chartered by several different user groups during the 2011 research season. TAMUG has a reduced day rate of \$2500/day. Other charters are charge approximately \$5000/day. Some charters are charged an additional fuel cost, based on fuel use.

### **1. TAMUG – DELLAPENNA**

**December 17-20, 2010**

Nearshore survey lines off the coast of Galveston. Students were studying the erosion effects around Galveston Bay.

### **2. TAMUG – DELLAPENNA**

**February 8-10, 2011**

### **3. TAMUG- DELLAPENNA**

**March 15-17, 2011**

Between the two (#2 & #3) cruises over 100GB of data was collected, and some of their survey revealed data that differed from previous surveys.

### **4. GERG – Windfarm**

**March 31, 2011**

R/VMANTA was used to take A&M divers out to the windfarm buoy, drop the divers into the water to look for submerged instrumentation, and retrieve it. The mission was a success and the package was found, then craned off the vessel when it arrived at the fuel dock at the end of the day.

### **5. NOSB Field Trip**

**April 29, 2011**

A&M hosted the National Ocean Sciences Bowl on the island and the afternoon before the bowl, some of the students came aboard R/V MANTA for a day trip out past the jetties. They underwent a familiarization with the vessel, its safety features and protocols, and conducted sampling techniques while underway. It was a great opportunity for high school students to get first-hand experience aboard a research vessel.

### **6. UTMSI – Mapping Cruise**

**May 21-28, 2011**

R/V MANTA traveled a little over 1000 miles during the cruise (about 560 transit, and almost 500 in operations). The purpose of the cruise was to train students in marine geology and geophysics field techniques. Thanks to the efforts of the crew, the dive compressors were used for the air gun tanks, allowing ability to shoot more often and at higher capacity. Data was collected at the Mississippi Canyon and along the Grand Isle shoreface. Students later analyzed data to investigate issues regarding sediment transport at these two locations.

**7. Navy Research Laboratory (Leg 1)**  
**June 4-7, 2011**

**8. Navy Research Laboratory (Leg 2)**  
**June 9-12, 2011**

The objectives for the 2 MORT cruises (#7 & #8) were (1) to map turbulence, hydrography, and water flow and (2) to evaluate inherent optical properties over East Flower Garden Bank. Over 400 profiles of salinity, temperature, and current shear were acquired.

**9. TAMUG – DIMARCO (Leg 1)**  
**June 24-July 1, 2011**

The cruise traveled 1359 nautical miles, successfully conducting surveys mapping the extent of the dead zone from the Mississippi River along the Texas coast.

**10. NOAA Ship Foster personnel transfer**  
**August 1, 2011**

R/V MANTA responded to the need to get a scientist transferred to shore for medical reasons. R/V MANTA can travel about twice the speed of Foster, so with approval from the sanctuary superintendent, R/V MANTA responded, and met Foster on their transit back to Galveston. After the transfer, R/V MANTA returned to port with the scientist and Foster resumed its cruise and was able to salvage an extra day of collection.

**11. TAMU – DIMARCO (LEG 2)**  
**August 9-15, 2011**

**12. TAMUG – DELLAPENNA**  
**September 19-23, 2011**

**F. ADDITIONAL SCIENCE ACTIVITIES:**

1. Deepwater Horizon Oil Spill Response
2. Permitting
3. Scheduling of R/V MANTA
4. Coordination of scuba operations, including coordination with TAMUG Scientific Diving
5. Coordination of shipboard research equipment and activities
6. Submission of NOAA fleet shiptime requests and needs
7. Regional GIS support
8. Science presence at SAC meetings
9. Compilation of Reel Report of fishing activities.
10. Participation in NOAA DeepSea Coral calls
11. Participation in NOAA Coral calls
12. Participation in development of NOAA Gulf of Mexico Digital Atlas
13. Participation in preparation and development of materials for NASA/NEEMO mission

14. Participation in the ONMS Dive Operations Council
15. Participation in TAMUG Dive Safety Board

#### **G. SCIENTIFIC INTERPRETATION/OUTREACH ACTIVITIES**

1. JASON LIVE!
2. Continued development and update of NCDDC/FGBNMS mapping tool
3. Development of Sanctuary Mural with Jacqui Stanley
4. Development of material for Google Ocean
5. Posting of cruises and research activities on FGBNMS Facebook Page
6. Maintenance of lionfish and supporting material
7. Development of material and collaboration with the Gulf Quest Museum for their Virtual ROV Dive Exhibit.
8. Collection of images for presentations, exhibits, interpretation.
9. Development of PowerPoint presentations for various events
10. Web-based research reports and blogs
11. Presentations: Patton Elementary School (Austin), Rice University (Houston)

#### **H. CONFERENCES, MEETINGS, PRESENTATIONS, TRAINING, ETC.**

1. January 10-28, 2011 NOAA Working Diving Training. Key West, FL. Darrell Walker and Michael Shetler
2. March 22-24, 2011 BOEMRE Information Transfer Meeting. New Orleans, LA. Nuttall, Hickerson
3. May 12-14, 2011 IMCC2 Focus Meeting – NOAA Deep Coral Program. Victoria, BC, Canada. Hickerson
4. May 19, 2011 Patton Elementary School, Austin, TX - Hickerson
5. April 3, 2011 Unit Refresher Training, including O2 Refresher Training
6. April 11-14, 2011 Hyperlite Training Embesi, Eckert, Nuttall, Weekley, Schmahl
7. September 30, 2011 Lionfish Presentation, Rice University. Johnston

#### **I. ABSTRACTS AND PUBLICATIONS:**

Driggers, W. B, E. R. Hoffmayer and E. L. Hickerson. Validating the occurrence of Caribbean reef sharks, *Carcharhinus perezii* (Poey), (Chondrichthyes: Carcharhiniformes) in the northern Gulf of Mexico, with a key for sharks of the family Carcharhinidae inhabiting the region. *Zootaxa*. In press.

Goodbody-Gringley, G., R. M. Woollacott, and G. Giribet. 2011. Population structure and connectivity in the Atlantic scleractinian coral *Montastraea cavernosa* (Linnaeus, 1767). *Marine Ecology* (2011)1-17

Levesque, Juan C. Commercial fisheries in the northwestern Gulf of Mexico: possible implications for conservation management at the Flower Garden Banks National Marine Sanctuary. *ICES Journal of Marine Science*, doi:10.1093/icesjms/fsr155.

Submitted two abstracts for 2011 BOEMRE Information Transfer Meeting

1. Long-Term Monitoring at the East and West Flower Garden Banks, 2009-2010. Nuttall, Schmahl, Hickerson, Embesi, Eckert
2. Draft Management Plan – Sanctuary Expansion Proposal. Hickerson, Schmahl

Submitted two abstracts for 2012 International Coral Reef Symposium being held in July, 2012 in Cairns, Australia

1. Science-based design of coral protected areas in the Gulf of Mexico
2. Flower Garden Banks – A Refuge in the Gulf of Mexico

## **J. FUNDING**

- Submitted proposal to NOAA's Deep Coral Program entitled: Antipatharian Distribution and Suitability Mapping in the Mesophotic Zone of the Northwestern Gulf of Mexico \$39K
- Submitted proposal to BOEM for Refurbishment of East and West FGB LTM sites \$79,100
- Received \$46,664 from BOEM to conduct Potentially Sensitive Biological Features project
- Partner with the Environmental Cooperative Science Center (ECSC) at Florida A&M University (FAMU), TAMU-CC, Delaware State, Jackson State, UT-Brownsville, Creighton University, and three National Estuarine Research Reserves, Gulf of Mexico Alliance, and Gulf of Mexico Coastal Ocean Observing Systems, in a \$15M Gulf of Mexico grant from NOAA to train new generation of scientists

## **K. NEW SANCTUARY BIOLOGICAL RECORDS**

July 21, 2011 – First report of invasive Pacific lionfish (*Pterois sp.*)

## **L. RESEARCH AND SCIENCE PARTNERSHIPS**

- Bureau of Ocean Energy Management (BOEM)
- Cooperative Institute of Ocean Exploration, Research and Technology (CIOERT)
- Harte Research Institute for Gulf of Mexico Studies
- Louisiana Universities Marine Consortium (LUMCON)
- National Centers for Coastal Ocean Science (NCCOS)
- National Coastal Data Development Center (NCDDC)
- National Geographic Society (NGS), Mission Blue
- Navy Research Laboratory, Stennis Space Center
- Smithsonian Institute
- Texas A&M University (TAMU)
- Texas A&M University–Galveston (TAMUG)

- Texas A&M University-Corpus Christi (TAMU-CC)
- University of North Carolina-Wilmington (UNCW)
- University of Texas
- Wildlife Conservation Society (WCS)

## **M. RESEARCH STAFFING**

1. Ryan Eckert, Research Assistant
2. John Embesi, Research Specialist
3. Emma Hickerson, Research Coordinator
4. Michelle Johnston, Project Manager
5. Marissa Nuttall, Research Assistant
6. G.P. Schmahl, Sanctuary Superintendent

R/V MANTA crew:

1. Captain Darrell Walker
2. First Mate Michael Shetler

FGBNMS NOAA Divers:

1. Kelly Drinnen
2. Ryan Eckert
3. John Embesi
4. Emma Hickerson (Unit Diving Supervisor)
5. Marissa Nuttall
6. G.P. Schmahl
7. Michael Shetler
8. Darrell Walker
9. Marc Weekley