



Flower Garden Banks National Marine Sanctuary 2023 Research, Monitoring, and Resource Protection Report



April 2024

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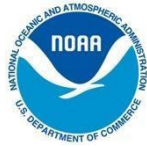
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Cover photo: Creolefish swims over a symmetrical brain coral. Photo: Tiffany
Crumbley/*Crumbley Photography*



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Report Availability

Electronic copies of this report may be downloaded from the Flower Garden Banks National Marine Sanctuary [website](#).

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Overview

The purpose of this document is to report the activities of the Flower Garden Banks National Marine Sanctuary (FGBNMS) Research, Monitoring, and Resource Protection team during fiscal year 2023 (FY 2023).

Fifteen cruises were completed from October 1, 2022 to September 30, 2023. The team utilized a hybrid work schedule; however, many COVID-19 pandemic restrictions were lifted, allowing research cruises to resume at full capacity. Research efforts were primarily focused on coral disease analysis, climate stressors and vulnerability, reef monitoring, and data analysis, while resource protection activities focused on improved designs of moorings for increased durability (Figure 1). A pool of approximately 27 sanctuary personnel, scientists, reciprocity divers, and NOAA dive center staff conducted 637 scuba dives. Fifty percent of the dives were conducted by contract divers. Diving activities were focused on mooring buoy inspections and installations, installation of new u-bolts, collection of long-term monitoring data, and coral bleaching response. Seven sanctuary permits were processed and six additional permits were ongoing.



Figure 1. Scuba divers install a new mooring buoy. Photo: Jacque Emmert/CPC Inc.



Research Staff Projects

Kaitlin Buhler (start date April 2023)

- Seasonal diver

Tess Collman (start date April 2023)

- Seasonal outreach and research program support

Olivia Eisenbach

- Manta Ray Catalog Lead
- Wahoo Working Group FGBNMS Lead
- Long-Term Monitoring Fish Lead
- Research program support

Jacque Emmert

- Seasonal diver
- Research program support

Donavon French

- Camera Lead
- Research program support

Ryan Hannum

- Water Quality Lead
- Mooring Buoy Lead
- Research program support

Josh Harvey (start date 06/21/2023)

- Seasonal diver
- Research program support
- Mooring Buoy support

Michelle Johnston

- East and West Flower Garden Banks Long-Term Monitoring Project Manager
- Invasive Species Lead
- Climate Lead
- Stony Coral Tissue Loss Disease Lead
- Condition Report Lead
- Research and Monitoring Coordinator
- Permit Coordinator

Marissa Nuttall

- CPC Team Lead
- Unit Diving Supervisor
- GIS Lead
- Deep Fish Habitat Lead
- Deep Water Horizon Lead
- Acoustics Lead

- 
- Resource Protection Coordinator

Kelly O'Connell

- Stetson Bank Long-Term Monitoring Program Project Manager
- Marine Debris Report Lead
- Cruise Coordinator
- Research program support
- Outreach support

FY2023 Highlights

Big Brother Big Sister Outreach Events

FGBNMS collaborated with Moody Gardens and Big Brothers Big Sisters Gulf Coast (BBBS-GC) to host an event at Moody Gardens Aquarium that would help remove barriers for underrepresented groups to learn more about sanctuaries. The “Bigs and Littles” (adult volunteer mentors and youth) of BBBS-GC toured Moody Gardens Aquarium exhibits, listened to a presentation about the fish and coral of FGBNMS (Figure 2), learned about careers in marine sciences, engaged in a scavenger hunt, and participated in a feeding activity led by an aquarium biologist. The event was captured by a videographer to create an education and outreach [video](#), with the hopes of securing partnerships between sanctuaries and Big Brothers Big Sisters nationwide. This outreach effort was funded by the Office of National Marine Sanctuaries (ONMS) diversity and inclusion mini-grant program through the support of the National Marine Sanctuary Foundation.

Remaining funds from the mini-grant were used to collaborate with the local dive shop, Texas Scuba Adventures, to introduce interested Bigs and Littles to scuba diving activities in a Try Scuba diving event later in the year. Participants were able to try scuba equipment in a shallow water pool environment with a quick and easy introduction on what it takes to explore the underwater world (Figure 2). They used tools underwater to collect "samples" and worked together to make species identifications on the surface, simulating the work that scientific divers do in the sanctuary.



Figure 2. Sanctuary researcher Kelly O'Connell teaches BBBS-GC event participants about FGBNMS (left). Instructors from Texas Scuba Adventures teach BBS-GC participants about scuba safety and techniques (right). Photo: Leslie Cliff/National Marine Sanctuary Foundation (left), Kelly O'Connell/CPC Inc. (right)

Wahoo Working Group

A wahoo working group was formed at the February 2, 2023 Sanctuary Advisory Council (SAC) meeting after two local fishers shared their concerns about overfishing of wahoo and lack of management within FGBNMS boundaries and the wider Gulf of Mexico. The working group aimed to explore and understand wahoo interactions and aggregations inside the sanctuary and collected data and information from a variety of sources to make recommendations. The concerns and recommendations were presented to the SAC at the May 25, 2023 meeting, then submitted to the FGBNMS superintendent, who supported the recommendations and forwarded them to the regional director of the ONMS Eastern Region for further review. The primary concern of the SAC is the vulnerability of this aggregating species to overfishing due to the lack of a fishery management plan. With no regional management of wahoo and the increase of wahoo fishing tournaments in the area, there is a need for protection of this species. At this time, the Flower Garden Banks SAC is waiting to present the issues and concerns to the Gulf of Mexico Fishery Management Council.

Sofar Buoy Installed at East Flower Garden Bank

The Flower Garden Banks research team, with the assistance from Dr. Xinpeng Hu of Texas A&M Corpus Christi, and the National Marine Sanctuary Foundation, installed a new Sofar data buoy at East Flower Garden Bank on June 22, 2023 (Figure 3). The buoy provides real-time data on wave height, wind speed, and temperature data at the surface and at reef depth. FGBNMS has lacked this capability since the removal of a nearby, state funded Texas Automated Buoy in 2019. Real-time data will help the sanctuary team in understanding bleaching events and disease outbreaks while also providing important off-shore sailing conditions specific to FGBNMS. This data is publicly available and being incorporated into the GCOOS data stream, as well as the NOAA National Hurricane Center and Tropical Analysis & Forecast Branch. A public [data dashboard](#) is available online.



Figure 3. Members of FGBNMS research staff hold the Sofar buoy before installation at East Flower Garden Bank. Photo: Taylor Philip/CPC Inc.

New Mooring Testing

New prototype moorings were installed at two new u-bolts within the sanctuary (Figure 4). The new design features a subsurface buoy, intended to keep the heavy shackle connecting the buoy line to the u-bolt at a constant state of tension. Previously, the shackle would move across the u-bolt with wave action. The new design limits this movement, meaning less friction and a longer lasting shackle and u-bolt. One of the new buoys also incorporates a “soft shackle” made of Dyneema line, which is projected to further increase the lifetime of the buoy. The other prototype buoy uses the traditional metal shackle, serving as a control and a test for what could be done with pre-existing buoys. Both designs are likely to increase the lifespan of each buoy, resulting in less maintenance and reduced impact on the reef.



Figure 4. New mooring design prototypes installed at FGBNMS using subsurface buoys and a Dyneema shackle (left) vs the original metal shackle (right) to compare effectiveness. Photos: Josh Harvey/CPC Inc.

Cruises and Expeditions in FY2023

The following cruises were conducted on board the R/V *Manta* (Figure 5) and lead by FGBNMS, unless indicated otherwise:

October 4–7, 2022 — National Coral Reef Monitoring Program (NCRMP) Climate and Disease response. Lead by: Dr. Ian Enochs.

January 9–10, 2023 — Water Quality changeout and sampling, Acoustic receiver exchange.

March 5–10, 2023 — Nation Science Foundation Disease response (R/V *Pelican*). Lead by: Dr. Adrienne MS Correa.

May 3–4, 2023 — Water Quality sample collection and instrument changeout. Acoustic receiver exchange.

May 16–20, 2023 — Voss Cycle Coral and Sponge Connectivity. Lead by: Dr. Joshua Voss.

June 6–9, 2023 — Mooring Buoy inspections and exchanges. Acoustic receiver array installation at Stetson Bank.

June 12–13, 2023 — Lionfish Invitational I (M/V *Fling*). Lead by: Rachel Bowman.

June 20–23, 2023 — Sofar Buoy and U-bolt installations at East Flower Garden Bank.

June 26–29, 2023 — U-bolt installations at East Flower Garden Bank.

July 10–14, 2023 —Stetson Bank Long-Term Monitoring.

July 18–21, 2023 — Manta tagging with Florida Manta Project. Lead by: Dr. Nick Farmer.

July 23–26, 2023 — Lionfish Invitational II (M/V *Fling*). Lead by: Rachel Bowman.

August 14–18, 2023 — East and West Flower Garden Banks Long-Term Monitoring.

September 1–2, 2023 — Mooring Buoy installation and Bleaching surveys.

September 18–22, 2023 — National Coral Reef Monitoring Program (NCRMP) Fish Calibration (M/V *Fling*). Lead by: Dr. Jay Grove.



Figure 5. FGBNMS Research Vessel *Manta*. Photo: All American Marine

Research, Monitoring, and Resource Protection Activities

Dive Support for NOAA Fisheries Training

In December 2022, FGBNMS staff supported NOAA Fisheries Observer Program safety training in Galveston, Texas. Staff provided a site clearance assessment and in-water safety support for trainees while they practiced water entries, survival skills, and raft righting and boarding (Figure 6). This event was a joint effort between the two NOAA offices (Office of National Marine Sanctuaries and National Marine Fisheries Service) and provided trainees with safe training in a more realistic open water environment.



Figure 6. NOAA Fisheries Observer Program trainees practice survival skills while FGBNMS staff provide in-water diver support. Photo: LTJG Kaitlyn Brogan/NOAA

Historic East and West Bank Long-Term Monitoring Benthic Data Reanalysis

Historic random transect slides and film negatives from 1991 to 2001 were digitized. All files were inventoried and processed with Coral Point Count software to estimate benthic cover, in an effort to reassess historic macroalgae cover. This reanalysis is being conducted following the same method as current data analysis, which will allow FGBNMS staff to directly compare historic and current data and examine long-term trends. Statistical analysis is underway and a scientific report is currently being developed by staff.

New Biodegradable Hydraulic Fluid and Hydraulic Connections for R/V Manta

In spring 2023, a biodegradable hydraulic fluid was installed on the R/V *Manta* for all hydraulic equipment replacing the old, environmentally hazardous, hydraulic fluid (Figure 7). This more environmentally friendly fluid will help reduce the carbon footprint of the vessel and FGBNMS. A new hydraulic connection was also developed and installed on the vessel. This connection will allow for easier and safer connection of hydraulic tools, such as the hydraulic drill used to install u-bolts for mooring buoys.

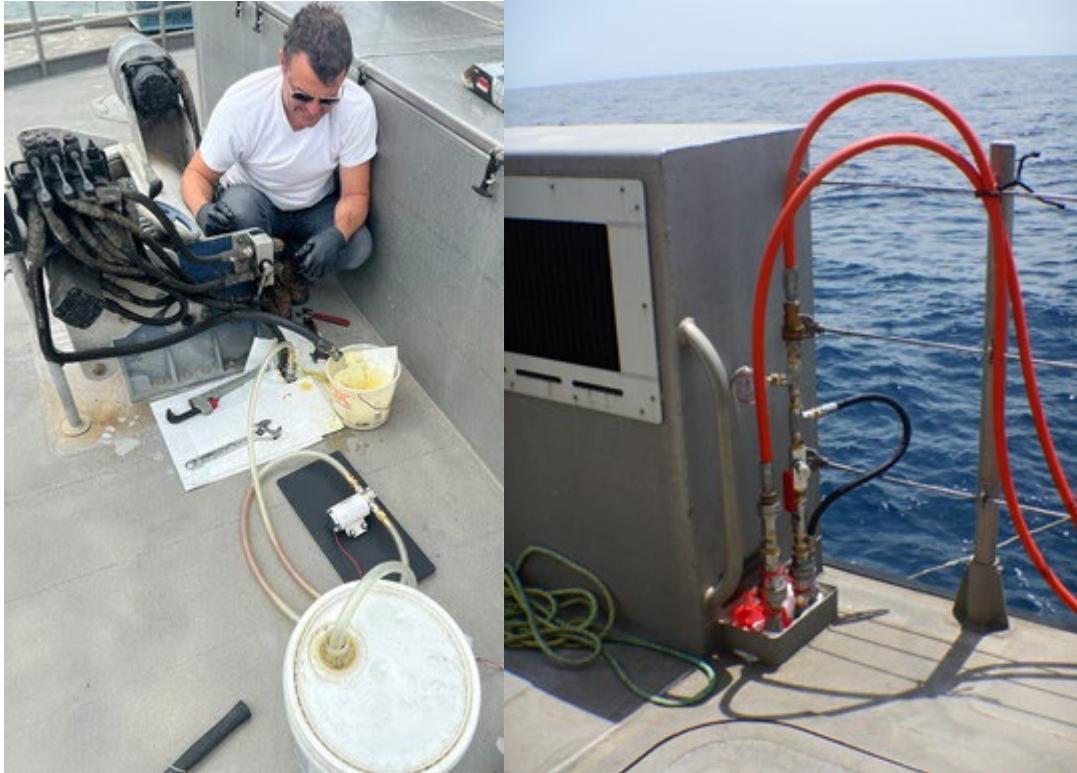


Figure 7. Captain Justin Blake replaces old hydraulic fluid with new biodegradable hydraulic fluid on board the R/V *Manta* (left). A new hydraulic connection was also installed on the R/V *Manta* for drilling operations (right). Photo: LTJG Kaitlyn Brogan/NOAA (left), Ryan Hannum/CPC Inc. (right).

Lionfish

Research partners and volunteer divers from across the country participated in the eighth and ninth Lionfish Invitational cruises June 12–13, 2023 and July 23–26, 2023 on board the M/V *Fling*. A total of 250 lionfish were removed from FGBNMS (26 from Stetson Bank, 132 from East Flower Garden Bank, and 92 from West Flower Garden Bank). On the June cruise, two staff from the Tennessee Aquarium joined the science team, learning more about FGBNMS and lionfish in the process. On the July cruise, the sanctuary partnered with Texas Parks and Wildlife Department to dive the *Kraken* (an artificial reef sunken shipwreck) and removed an additional 37 lionfish from the shipwreck. In addition to the removals, divers collected live lionfish for acoustic tagging to support the Texas A&M University at Galveston (TAMUG) “Habitat requirements and ecosystem connectivity of reef-associated fishes in the Gulf of Mexico” project (Figure 8)([NA21NOS4780151](#)).

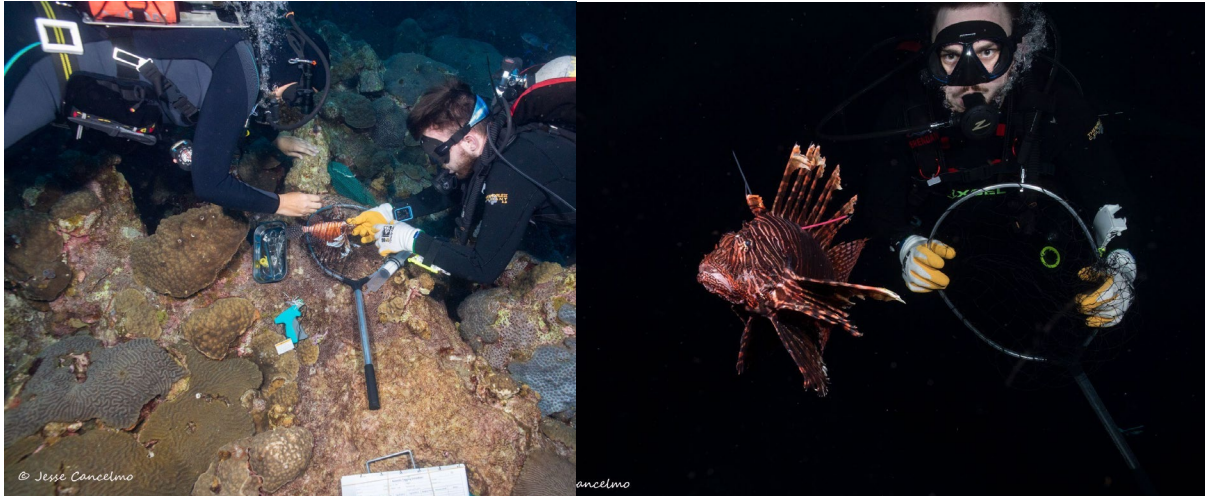


Figure 8. Divers surgically tag a lionfish with an acoustic transmitter on the reef at East Flower Garden Bank (left). A post-surgery lionfish is released back to the reef, where an external red tag is visible to alert divers that this is a tagged Lionfish (right). Photos: Jesse Cancelmo

USCG Helicopter Drills on board R/V Manta

In June 2023, Flower Garden Banks staff collaborated with the United States Coast Guard (USCG) to practice emergency helicopter evacuation drills aboard the R/V *Manta*. Use of a USCG helicopter is likely in the event of an offshore emergency, due to the remote nature of FGBNMS and the frequent use of scuba divers in research and resource protection activities. With participants from Moody Gardens Aquarium and TAMUG, crew and divers practiced intercepting a USCG helicopter in the open ocean, boarding a USCG team member from the helicopter to the R/V *Manta*, and the retrieval and deployment of a rescue basket between the two vehicles (Figure 9). These drills helped the sanctuary team’s emergency preparedness skills and extended the response capabilities of each member.



Figure 9. USCG diver is lowered to the top deck of the R/V *Manta* to give instructions during safety drills (left). FGBNMS staff and other participants practice pulling the rescue basket onto the R/V *Manta* (right). Photos: LTJG Kaitlyn Brogan/NOAA

Buoy Maintenance and New U-Bolts Installations

Throughout summer 2023, the sanctuary research team made significant efforts in installing and drilling new mooring systems. From June 7 - 9, 2023, the team conducted maintenance on existing buoys, replacing old moorings with clean ones across East Flower Garden, West Flower Garden, and Stetson Banks. In total, eight buoys were swapped out, and an additional buoy was installed on an empty u-bolt at Stetson Bank. With assistance from the NOAA Diving Program, the FGBNMS dive team was recertified in hydraulic drilling operations and over the course of two cruises in June 2023, new u-bolts were drilled at East Flower Garden Bank buoy sites #5 and #7. In order to make this happen, the team worked with the vessel engineer to develop and successfully test a new temporary mooring method that allowed them to connect to the old broken u-bolt and enable divers to redrill a mooring at that location (Figure 10). While additional testing at different sites is still needed, the use of a temporary mooring helps streamline installations and reduce risk while drilling. The sanctuary team is working to further improve the buoy system in the coming years and the work accomplished this year has helped reclaim some of the sites lost during the pandemic.



Figure 10. A temporary u-bolt attachment apparatus (left) was used to moor at the site while drilling for a new u-bolt (right) took place. Photo: Donavon French/CPC Inc.

SoundTrap Successfully Deployed at Stetson Bank

A passive acoustic recording device, called a SoundTrap, was installed at Stetson Bank in May 2023. This device records continuous underwater sound and is funded by ONMS. The project supports the installation of passive acoustic recording devices across many sanctuary sites and aims to build soundscape information across FGBNMS. Acoustic data can be used to quantify vessel noise at the bank to assess vessel usage, explore biodiversity, identify fish aggregations, and examine marine mammal visitation. Recordings of underwater noise are important to better understand anthropogenic uses of the marine environment, as well as the presence and absence of marine species and their activities.

Bleaching Response

In late August 2023, the FGBNMS research team and recreational divers began reporting paling and bleaching corals at East and West Flower Garden Banks. These reports coincided with sustained high temperatures, both at the water's surface and at reef depth, as recorded and transmitted by the newly installed Sofar buoy (Figure 11). In response, the sanctuary team organized a bleaching response cruise in early September 2023 to document and monitor the corals. The team collected images at repetitive photostations across East and West Flower Garden Banks to quantify thermally stressed corals (Figure 11). Initial observations revealed thermal stress in five major coral species, four of which are considered reef builders. Due to the persistence of high temperatures until early October, bleaching response efforts were incorporated into the NCRMP Fish Calibration cruise from September 18–22, 2023. During the NCRMP cruise, both banks exhibited signs of progressed bleaching, with higher numbers of

species and individual corals showing thermal stress, with a heavier impact noted at East Flower Garden Bank. Although temperatures have since dropped below the bleaching threshold and the reef has begun to show signs of recovery, more bleaching response measures are being considered for 2024.

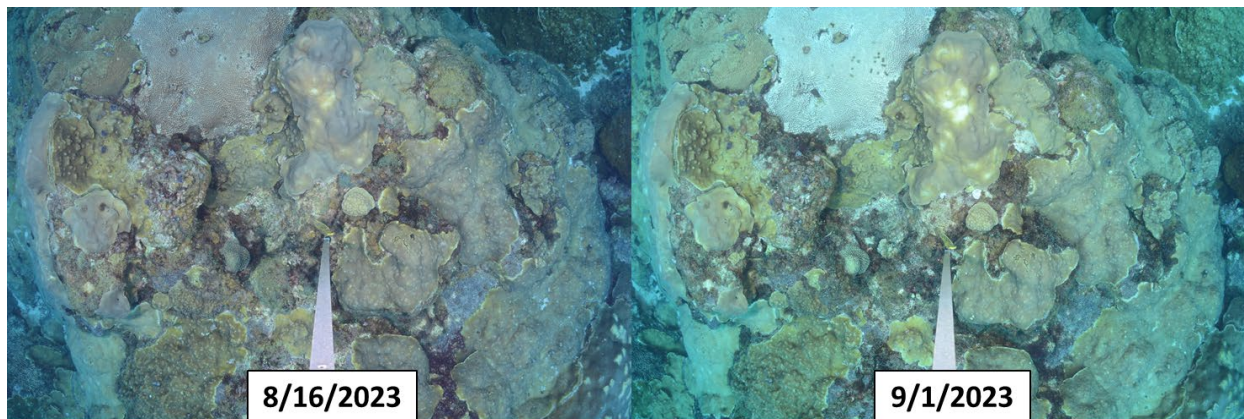
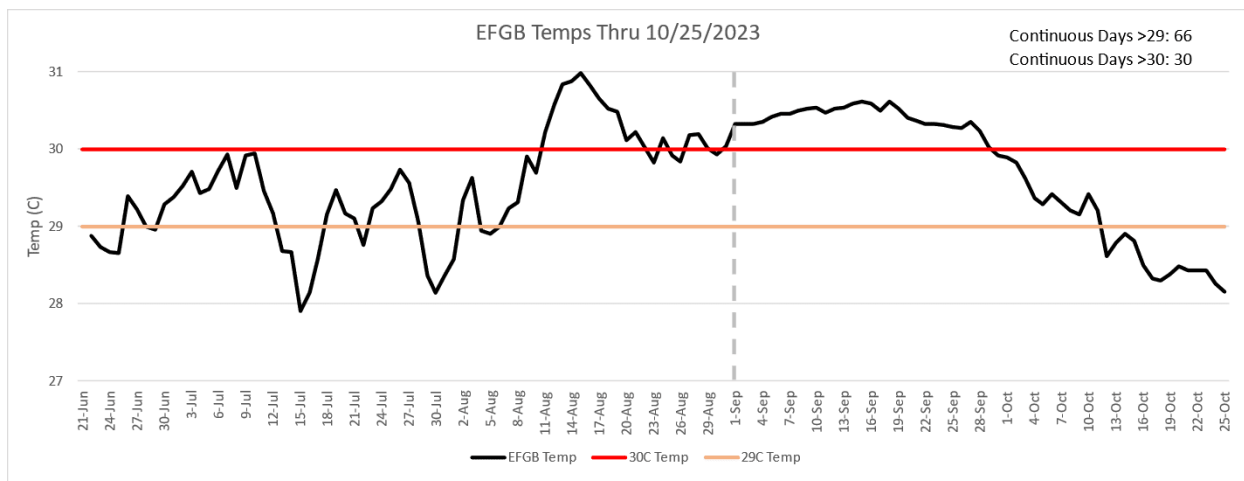


Figure 11. Reef depth water temperatures exceeded the bleaching threshold for 46 days at East Flower Garden Bank, as seen in this Sofar buoy data during the summer of 2023 (top). Photos from repetitive photostation 305 at East Flower Garden Bank show the progression of bleaching and paling at a single location over a two-week period (bottom). Image: Marissa Nuttall/CPC Inc, Source: Sofar. Photo: NOAA

National Coral Reef Monitoring Program Fish Calibration Cruise

From September 18–22, 2023, members of the FGBNMS research team joined the National Coral Reef Monitoring Program (NCRMP) aboard the M/V *Fling* to assist with fish calibration surveys. This cruise aimed to compare methods of two different fish surveys: belt transects and reef visual census surveys. Two FGBNMS photographers joined the cruise to conduct photographic random transects at each of NCRMP’s sites across East and West Flower Garden Banks. Divers completed fish surveys at 74 sites, while sanctuary photographers conducted 30 photo transects across both banks.

Partner Research and Cruises

Josh Voss

Nine divers from three organizations, Florida Atlantic University, Moody Gardens Aquarium, and Texas State University, participated in shallow and technical dives to collect 219 sponge and coral biopsy tissue samples. This was the final cruise associated with the National Center for Coastal Ocean Science (NCCOS) supported Connectivity of Coral Ecosystems project. Technical dives collected samples at 60m from East Flower Garden Bank, West Flower Garden Bank, and Geyer Bank to support population genetic connectivity research. As of April 2024, all samples from FGBNMS have been sequenced and are currently being analyzed. Results of this project are expected by Fall 2024.

Manta Rays Tagged in FGBNMS

Manta rays, *Mobula birostris*, are commonly seen and considered a foundation species in FGBNMS, however, they are considered threatened under the Endangered Species Act. With research partners from NMFS Species Conservation Branch and Florida Manta Project, two manta rays were successfully tagged with acoustic and satellite tags at East and West Flower Garden Banks in July 2023 (Figure 12). Tracking manta rays allows researchers to learn more about their life history, behavior, and habitat use so that resource managers can better protect and manage the species and the resources they require.



Figure 12. This juvenile manta ray received a satellite tag on its left wing. This tag will help researchers understand the movement of manta rays in and around the sanctuary. Photo: Jessica Pate/Florida Manta Project

Coral Disease Outbreak Response

FGBNMS researchers supported a mission to the sanctuary to investigate the coral disease outbreak documented in the fall of 2022, leading dive operations for the multi-partner expedition (Figure 13). Funded by the National Science Foundation, researchers from Rice University, University of the Virgin Islands, Louisiana State University, Woods Hole Oceanographic Institute, and NOAA’s National Coral Reef Monitoring Program collected samples from three species of diseased and healthy coral, took water and sediment samples, collected fireworms, and conducted photomosaics. The team will use these samples to better identify the disease, understand what is causing the disease and its spread, and inform management actions.



Figure 13. Researchers and vessel crew pose alongside R/V *Pelican* before the disease response cruise. Photo: Marissa Nuttall/CPC Inc

Habitat Requirements and Connectivity of Reef Fishes in the Northwestern Gulf of Mexico

Habitat Requirements and Connectivity of Reef Fishes in the Northwestern Gulf of Mexico is a collaboration between five universities (TAMUG, Louisiana State University, Mississippi State University, University of Florida, and University of Texas Rio Grande Valley), National Marine Fisheries Service (NMFS), and FGBNMS. 2023 represents the second year of this five-year study

to investigate migration ecology and habitat requirements of reef fishes in the Gulf of Mexico (NA21NOS4780151). The study, led by Dr. Jay Rooker at TAMUG and funded by NCCOS, will examine how native and invasive mesopredators, foundation reef fish, and demersal/pelagic fishes that form aggregations utilize habitats within and outside FGBNMS using acoustic and satellite telemetry, biophysical modeling, and sound. To-date, infrastructure has been deployed across the entire sanctuary to detect tagged fish and roughly 50% of the tags for this project have been deployed on target species, including greater amberjack, silky sharks, scalloped hammerhead sharks, sandbar sharks, wahoo, black durgon, Atlantic creolefish, yellowmouth grouper, gray snapper, graysby, and lionfish (Figure 14). Initial data is being processed to examine home range, movement distances, and connectivity across banks and within habitats. Understanding how fish populations use habitats both within and outside FGBNMS will help managers develop effective ecosystem management strategies that support the health and stability of FGBNMS.

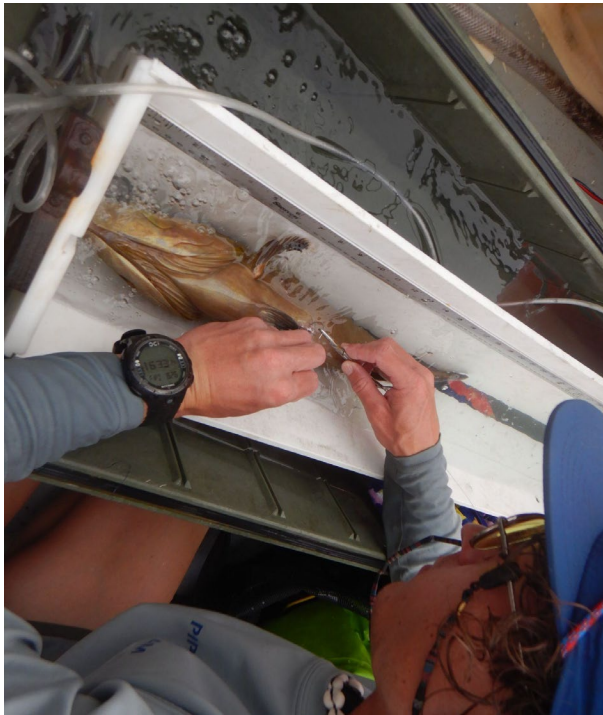


Figure14. Researchers from LSU surgically place an acoustic tag in a yellowmouth grouper collected at East Flower Garden Bank. Photo: Marissa Nuttall/CPC Inc.

Publications

Dias, L. M., Johnston, M.A., O'Connell, K., Clift, L. W., Eisenbach, O., Hannum, R., Williams, K., French, D., Cannizzo, Z., Hutto, S. (2023). Rapid Climate Vulnerability Assessment for Flower Garden Banks National Marine Sanctuary. <https://doi.org/10.25923/jdpb-zw04>

Díaz M.C., Nuttall M., Pomponi S.A., Rützler K., Klontz S., Adams C., Hickerson E.L., Schmahl G.P. (2023). An annotated and illustrated identification guide to common mesophotic reef sponges (Porifera, Demospongiae, Hexactinellida, and Homoscleromorpha) inhabiting Flower Garden Banks National Marine Sanctuary and vicinities. *ZooKeys*. 1161: 1-68. <https://doi.org/10.3897/zookeys.1161.93754>

Johnston M.A., Studivan M.S., Enochs I.C., Correa A., Besemer N., Eckert R.J., Edwards K., Hannum R., Hu X., Nuttall M., O'Connell K. (2023). Coral disease outbreak at the remote Flower Garden Banks, Gulf of Mexico. *Frontiers in Marine Science*. 10, 100. <https://doi.org/10.3389/fmars.2023.1111749>

Johnston M.A. (2022). Flower Garden Banks National Marine Sanctuary 2022 Research, Monitoring, and Resource Protection Report. *National Marine Sanctuaries Conservation Series ONMS-22-12*. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Flower Garden Banks National Marine Sanctuary, Galveston, TX. 16 pp.

O'Connell K., Nuttall M.F., Blakeway R.D., Hickerson E.L., Schmahl G.P. (2023). Marine debris on reefs and banks in the vicinity of Flower Garden Banks National Marine Sanctuary. *National Marine Sanctuaries Conservation Series ONMS-23-02*. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Flower Garden Banks National Marine Sanctuary, Galveston, TX. 65 pp.


Science Interpretation Activities

1. Interviewed with Houston Public Media (National Public Radio) and Houston Chronicle on suspected Stony Coral Tissue Loss Disease (Johnston).
2. Attended the Aquarius Art Tunnel opening for Janavi Mahimtura Folmsbee at George Bush Intercontinental Airport (Johnston/Nuttall/French/Eisenbach).
3. Diversity and Inclusion Mini-grant – Led Big Brothers Big Sisters Gulf Coast program at Moody Gardens (O'Connell).
4. Taught a Coral ID class for TAMUG advanced diving methods class (Johnston).
5. Toured NOAA Ship *Thomas Jefferson* (all staff).
6. Interviewed by Dylan Stanley for 8th grade science class project (Johnston).
7. Trained to use the Oceanbotics remotely operated vehicle (all staff).
8. Diversity and Inclusion Mini-grant – Coordinated Big Brothers Big Sisters Gulf Coast and Urban Strategies Try Scuba event at Lasker Pool (O'Connell/Collman).



Trainings, Meetings, Conferences

1. ONMS All Hands meetings
2. ONMS Office Hours meetings
3. NOAA Microplastics webinar (Johnston)
4. SeaGIS training (O'Connell/Nuttall)
5. CoastWatch Satellite course (Hannum/Eisenbach)
6. Making eDNA Count webinar (Johnston/Nuttall)
7. East Region ONMS Sound and Monitoring meeting (Nuttall/Johnston)
8. CYCLE Project Management Transition Advisory Group (MTAG) meetings - virtual and in-person (Nuttall)
9. Argo Float Planning meeting with Jen McWhorter from NOAA Atlantic Oceanographic & Meteorological Laboratory (Johnston)
10. ONMS Dive Council meetings (Nuttall)
11. Habitat Requirements and Connectivity of Reef Fishes MTAG meeting (Johnston/Nuttall/Schmahl)
12. Unit Dive Supervisor meeting (Nuttall)
13. GoMIEA regional meeting (Johnston)
14. CRCP National Priorities workshop (Johnston)
15. Ocean Acidification Program Annual meeting at Texas A&M University (Johnston)
16. Wahoo Working Group meetings (Schmahl/Johnston/Nuttall/Eisenbach)
17. US Coast Guard Helicopter safety training and exercise (all staff)
18. Dive Propulsion Vehicle training at Mammoth Lake (all staff)
19. Hydraulic Drilling training aboard R/V *Manta* (all staff)
20. Climate Monitoring Inventory Results meeting (Nuttall)
21. Mesophotic and Deep Benthic Communities Restoration: Updates and Planned Activities meetings (Nuttall)
22. C-STARR training with NMSF (Johnston)
23. Deep Water Horizon Sharepoint training (Johnston)
24. ONMS Ocean Noise & Acoustics Working Group meeting (Nuttall)

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25. Climate Program Office-Sanctuary Task Force meetings (Johnston)
 26. Stony Coral Tissue Loss Disease taskers for Coral Reef Task Force meeting (Johnston)
 27. MBON/GCOOS data gathering meeting (Johnston)
 28. Resource Protection/Permitting Cross-cut meetings (Nuttall/Johnston)
 29. Climate Adaptation workshop, part 3 (Johnston)
 30. Climate Team semi-annual meeting (Johnston)
 31. ONMS LT Meeting in Alpena, MI (Johnston)
 32. NOS Sargassum meeting (Johnston)
 33. Primer 7 online workshop (Eisenbach)
 34. Accessible Mapping webinar (Nuttall)
 35. MBON Virtual Co-Design workshop (Johnston)
 36. Ocean Acidification Program Climate meeting (Johnston)
 37. Meeting with Branch Chief Dr. Christopher Landsea with the Tropical Analysis and Forecast Branch/NOAA/National Weather Service/National Centers for Environmental Prediction/National Hurricane Center regarding the use of the Sofar Buoy in their weather modeling system (all staff)

Acknowledgments

FGBNMS staff appreciates the numerous research partners that assisted with the 2023 field season including LTJG Brogan, NOAA Dive Center, Moody Gardens, TAMUG, TAMUCC, NCRMP, BOEM, and BSEE.



NATIONAL MARINE
SANCTUARIES

AMERICA'S UNDERWATER TREASURES