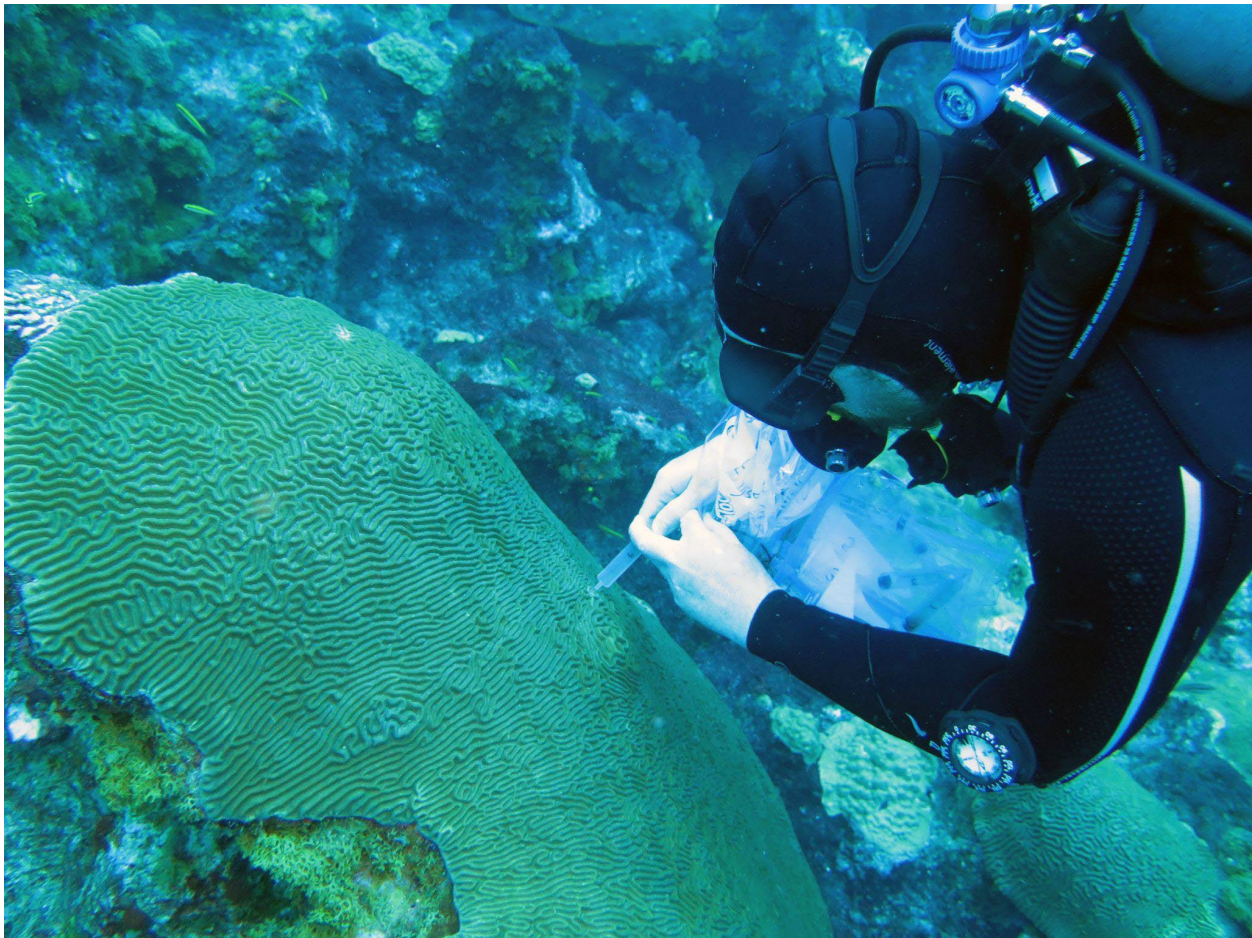




# Flower Garden Banks National Marine Sanctuary 2022 Research, Monitoring, and Resource Protection Report



**December 2022**

U.S. Department of Commerce  
Gina Raimondo, Secretary

National Oceanic and Atmospheric Administration  
Richard W. Spinrad, Ph.D., Under Secretary of Commerce for Oceans and Atmosphere and  
NOAA Administrator

National Ocean Service  
Nicole LeBoeuf, Assistant Administrator

Office of National Marine Sanctuaries  
John Armor, Director



**NATIONAL  
MARINE  
SANCTUARIES**

Flower Garden Banks National Marine Sanctuary Research, Monitoring, and Resource  
Protection Staff  
G.P. Schmahl, Superintendent  
Michelle A. Johnston, Ph.D.

Research, Monitoring, and Resource Protection Support Staff  
Raven Blakeway, Ph.D.  
Jacque Emmert, Ph.D.  
Olivia Eisenbach  
Donavon French  
Ryan Hannum  
Emma L. Hickerson  
Jessica Lee  
Marissa Nuttall  
Kelly O'Connell

Cover photo: A diver collects a coral mucus sample. Photo: Michelle Johnston/NOAA



## Table of Contents

<b>Overview</b>	1
<b>Research Staff Projects</b>	2
<b>FY2022 Highlights</b>	3
<b>Cruises and Expeditions</b>	5
<b>Additional Research, Monitoring, and Resource Protection Activities</b>	6
<b>Publications</b>	12
<b>Science Interpretation Activities</b>	13
<b>Trainings, Meetings, Conferences</b>	14



## Disclaimer

The scientific results and conclusions, as well as any views or opinions expressed herein, are those of the authors and do not necessarily reflect the views of NOAA or the Department of Commerce. The mention of trade names or commercial products does not constitute endorsement or recommendation for use.

## Report Availability

Electronic copies of this report may be downloaded from the Flower Garden Banks National Marine Sanctuaries website at <https://flowergarden.noaa.gov>.

For more information contact:

Michelle A. Johnston, Ph.D.

Research Coordinator

Flower Garden Banks National Marine Sanctuary

[Michelle.A.Johnston@noaa.gov](mailto:Michelle.A.Johnston@noaa.gov)

<https://flowergarden.noaa.gov>

## 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 (FY) 2022.

Fifteen cruises were completed from October 1, 2021 to September 30, 2022. The team utilized a hybrid work schedule, however, many COVID-19 pandemic restrictions were lifted, allowing research cruises to resume at full capacity in FY22. Research efforts were primarily focused on supporting the mesophotic and deep-benthic communities (MDBC) project efforts, reef monitoring, and data analysis. A pool of almost 30 sanctuary personnel, scientists, reciprocity divers, and NOAA dive center personnel conducted 468 scuba dives. Fifty percent of the dives were conducted by contract divers. Activities were focused on mooring buoy inspections and installations, collection of long-term monitoring data, and coral disease response (Figure 1). Eight sanctuary permits were processed and 11 additional permits were ongoing.



Figure 1. Scuba divers treat a coral disease lesion with antibiotic paste at East Flower Garden Bank. Photo: Kelly O'Connell/CPC, Inc.



## Research Staff Projects

Raven Blakeway (departure date April 22, 2022)

- Stetson Bank Long-Term Monitoring Program Project Manager
- Southeast Deep Coral Initiative Deep-Sea Coral Research and Technology Program Report Lead

Olivia Eisenbach (start date June 21, 2022)

- Research program support

Jacque Emmert (start date May 25, 2022)

- Seasonal diver
- Research program support

Donavon French (start date May 25, 2022)

- Seasonal diver
- Research program support

Ryan Hannum

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

Emma Hickerson (departure date 12/5/2021; National Marine Sanctuary Foundation contract beginning 2/1/2022)

- Research and Monitoring Coordinator
- Permit Coordinator
- Resource Protection Coordinator
- Mesophotic monitoring support

Michelle Johnston (Lead Ecologist from 12/6/2021-08/14/2022; Research Coordinator start date 08/15/2022)

- East and West Flower Garden Banks Long-Term Monitoring Project Manager
- HI-A-389-A Report Lead
- Invasive Species Lead
- Climate Lead
- Stony Coral Tissue Loss Disease Lead
- Cruise Coordinator
- Condition Report Lead
- Research and Monitoring Coordinator
- Permit Coordinator

Jessica Lee (start date May 25, 2022)

- Seasonal diver

Marissa Nuttall

- CPC Team Lead
- Unit Diving Supervisor
- GIS Lead
- Deep Fish Habitat (DFH) Lead
- Deep Water Horizon Lead
- Acoustics Lead
- Resource Protection Coordinator

Kelly O'Connell

- Stetson Bank Long-Term Monitoring Program Project Manager
- Manta Ray Catalog Lead
- Marine Debris Report Lead
- Research program support

## FY2022 Highlights

### ***Coral Disease Response at East and West Flower Garden Banks***

During routine monitoring of the coral reefs in late August 2022, stony coral tissue loss disease (SCTLD)-like lesions were observed on brain and star corals at East and West Flower Garden Banks (FGB). Suspecting that the observed lesions were SCTLD, two rapid response cruises were carried out in September 2022 focusing on: 1) assessing the signs and potential causes of disease lesions; 2) determining host species affected in the FGB long-term monitoring sites; 3) treating affected coral colonies with Base 2B plus amoxicillin (Figure 1); 4) collecting baseline repetitive photostation and random transect images; and 5) collecting colonies for genetic banking in partnership with Moody Gardens Aquarium. All of these disease response efforts were action items in the FGBNMS [SCTLD prevention and response plan](#), created in 2021 (Johnston 2021).

### ***Acoustic Anchor Array Installed***

Texas A&M University at Galveston (TAMUG) and Louisiana State University, in partnership with Flower Garden Banks National Marine Sanctuary divers, completed the installation of an acoustic array to track the movement of fish in and around FGBNMS (Figure 2). The study, led by Dr. Jay Rooker at TAMUG and funded by NOAA's National Centers for Coastal Ocean Science (NCCOS), will investigate migration ecology and habitat requirements of reef fishes in the Gulf of Mexico ([NA21NOS4780151](#)) and will examine how native and invasive mesopredators, foundation reef fish, and demersal/pelagic fishes that form aggregations utilize habitats within and outside of the sanctuary using acoustic and satellite telemetry, biophysical modeling, and sound. Understanding how fish populations use habitats within FGBNMS, and how the protected area benefits areas outside its boundaries, will help managers develop boundaries that are effective and benefit present and future generations.

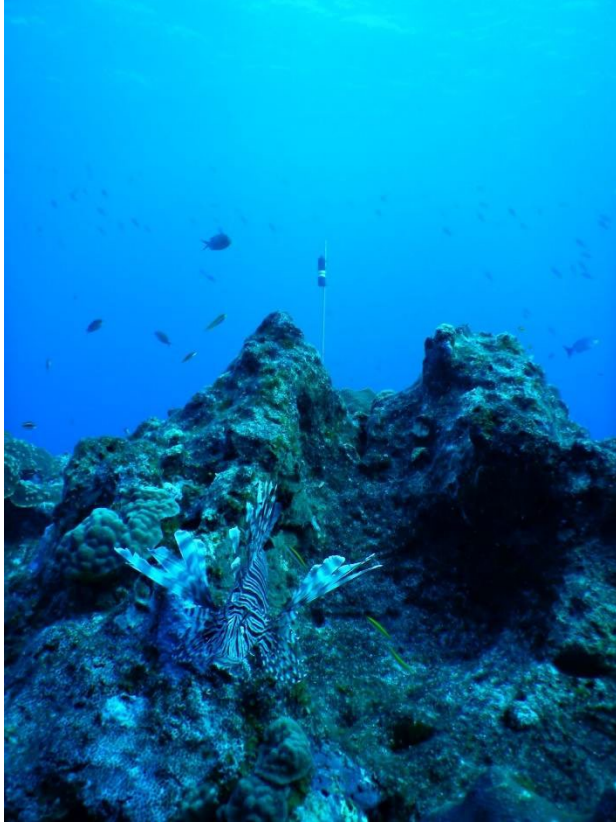


Figure 2. A lionfish with an acoustic receiver in the background. Receivers will track the movement of

### ***Condition Report Workshops***

FGBNMS hosted eight virtual Condition Report Status and Trends workshops in April and May 2022. Over 40 subject matter experts met with FGBNMS and Office of National Marine Sanctuary (ONMS) staff to determine the status and trends for water quality, habitat, living resources, and ecosystem services by evaluating responses to a set of questions. The previous condition report was completed in 2008. This information will be used to draft the new FGBNMS Condition Report and provide a summary of resources in FGBNMS.

### ***Climate Vulnerability Assessment Workshop***

Staff from FGBNMS, ONMS, and Greater Farallones National Marine Sanctuary hosted a Climate Vulnerability Assessment virtual workshop in July 2022. During the workshop, over 30 participants from academia, partner agencies, and NGOs were provided with information about current and projected priority climate conditions of FGBNMS and then applied this knowledge to key habitats and species to determine their vulnerability to changing conditions. Participants used a modified version of the Commission for Environmental Cooperation's North American Marine Protected Area [Rapid Vulnerability Assessment](#) tool to generate a vulnerability score for key habitats and species. An adaptation planning exercise was held at the end of the workshop to come up with management actions that could be used to help reduce ecosystem stress with projected changing climate conditions in the future. The workshop material will be used to draft



a FGBNMS Climate Vulnerability Assessment, which will be an important resource to accompany our [condition report](#) and help guide the next FGBNMS management plan.

## Cruises and Expeditions

The following cruises were conducted on board the R/V *Manta* (Figure 3), unless indicated otherwise:

November 2-3, 2021 – Water Quality changeout and sampling, Acoustic Anchor test

December 2-3, 2021 – Acoustic Anchor installation and Ocean Acidification Instrument deployment at West Flower Garden Bank

March 1, 2022 – Water Quality sample collection

May 13-14, 2022 – Mooring Buoy inspections and Water Quality sample collection

May 16-17, 2022 – Acoustic installations

June 26-29, 2022 – Lionfish Invitational I (M/V *Fling*)

July 22, 2022 – ROV Manta Expeditions for Restoration of Corals (MERC) Shakedown

July 25-29, 2022 – ROV MERC I

August 2-3, 2022 – Stetson Bank Monitoring and Mooring inspections

August 25-27, 2022 – National Coral Reef Monitoring Program (NCRMP) Reefwide Surveys I

August 30-September 2, 2022 – NCRMP Reefwide Surveys II

September 6-9, 2022 – East and West Flower Garden Banks Long-Term Monitoring (LTM) and Disease Response I

September 11, 2022 – Lionfish Invitational II (M/V *Fling* returned due to engine failure)

September 13-16, 2022 – ROV Stetson Bank LTM and MERC II

September 22-22, 2022 – East and West Flower Garden Banks LTM and Disease Response II



Figure 3. FGBNMS Research Vessel *Manta*. Photo Credit: Voss Lab/FAU

## Additional Research, Monitoring, and Resource Protection Activities

### *Archiving Monitoring Data*

Sanctuary staff are working with NOAA's National Centers for Environmental Information (NCEI) to archive East, West, and Stetson Banks long-term monitoring data. Staff have successfully archived several years of data, including 2014, 2016, and 2018, and will continue working to archive additional years. The data can be located using the NCEI Geoportal (<https://www.ncei.noaa.gov/metadata/geoportal/#searchPane>).

### *Bureau of Ocean Energy Management Transfer Meeting*

FGBNMS researchers provided virtual presentations for the Bureau of Ocean Energy Management (BOEM) Information Transfer Meeting, to give updates on funded projects at the sanctuary. Michelle Johnston presented on long-term monitoring at East and West Flower Garden Banks, including status and trends of coral cover and fish community density and biomass. Marissa Nuttall presented on multibeam mapping of No Activity zones in the northern Gulf of Mexico, showing before and after seafloor imagery that highlighted previously unknown patch reefs, ridges, and escarpments that serve as potential habitat for vulnerable biological communities. BOEM's information transfer meetings are important in communicating the current status and findings of BOEM funded research.

## ***Ciguatera Monitoring Collaboration***

Sanctuary staff have an ongoing collaboration with NOAA National Centers for Coastal Ocean Science (NCCOS) and the Food and Drug Administration (FDA) to monitor ciguatera in samples collected by National Marine Fisheries Service Southeast Area Monitoring Assessment Program (SEAMAP) activities. NCCOS received samples from SEAMAP 2021 collections for preliminary analysis. Ten percent of samples tested positive for ciguatera and were sent on to the FDA for reanalysis, confirmation, and response, if needed for public awareness.

## ***Coral Reef Conservation Program and FGBNMS Data Integration Project***

FGBNMS and the National Coral Reef Monitoring Program (NCRMP) data integration project, funded by the Coral Reef Conservation Program (CRCP), was revised into a two-year project to account for COVID-19 delays. This data integration project will aim to calibrate benthic data between the two separate monitoring programs. Michelle Johnston and Erica Towle (NCRMP) are co-Principle Investigators on this project. Field work was completed for this project during NCRMP cruises in August 2022.

## ***Historical Data Mining to Identify Mesophotic and Deep Benthic Communities for Deep Water Horizon Restoration Efforts***

Staff reviewed archived deep-water imagery from ROV exploration and surveys to identify images that had not been reviewed for species composition and density. The team processed these images to develop species lists and density maps in support of the characterization of mesophotic and deep-benthic communities for Deep Water Horizon restoration efforts. Additionally, a subset of ROV transects were processed to quantify size demographics of black coral and octocoral species that will be used to help age communities.

## ***Diving Reciprocity Agreements with Texas State Aquarium and Audubon Aquarium of the Americas***

The NOAA Dive Program finalized reciprocity agreements with Texas State Aquarium and Audubon Aquarium of the Americas. Both aquariums are participating in the Aquarium-Sanctuary Partnership program, and this qualification helps further these partnerships. The reciprocity agreements enable the aquarium dive teams to join NOAA divers to support research and resource protection activities at FGBNMS and expands the pool of knowledgeable divers FGBNMS can draw from to support the sanctuary. In FY22, aquarium divers supported coral disease response efforts and invasive species removals.

## ***FGBNMS Data Dashboards***

Staff from FGBNMS worked with research partners from the University of South Florida to update the [FGBNMS data dashboard](#), which has now been updated to include expanded bank locations as well as key features. The dashboard now uses MODIS satellite data and includes time series back to 2003. Users can choose which metrics to display (mean, climatology, etc.) for select locations. Satellite image time series are displayed on the dashboard, and time series data

can be exported as CSV files. In addition, FGBNMS worked with a graduate student at University of Redlands to create a [current conditions dashboard](#) for visitors to FGBNMS. J. Keaton Thompson developed the user-friendly dashboard, which accesses satellite datasets to provide visitors with up-to-date water temperature, salinity, turbidity, wind, and wave height information. This dashboard is available on the FGBNMS website and will serve as a tool to help people plan their trips to the sanctuary.

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

Historic random transect slides and still photos from 1990 to 2000 are being digitized. All files have been inventoried and are being processed with Coral Point Count software to determine benthic cover in an effort to reassess historic macroalgae cover. Analysis on the historic random transect images from 1998 and 1999 are complete for both banks. Staff are currently working on images from 1996 and 1997.

## **Lionfish**

Volunteer divers and research partners from Florida, Texas, Louisiana, Washington, Maryland, Georgia, New York, and Dominica participated in the seventh Lionfish Invitational from June 27-29, 2022, on board the M/V *Fling* for the permitted three-day public lionfish removal event. The dive group removed 84 invasive lionfish from Stetson Bank, 26 from East Flower Garden Bank, and 118 from West Flower Garden Bank, totaling 228 lionfish. A new Texas state record was recorded for the largest lionfish (17.5 in/445 mm), which was removed from Stetson Bank by Alex Fogg (Figure 4). In addition to removals, three lionfish were acoustically tagged and allowed to remain in the sanctuary, where they will be tracked as part of the “Habitat requirements and ecosystem connectivity of reef-associated fishes in the Gulf of Mexico” project lead by researchers at Texas A&M University Galveston and Louisiana State University. Lionfish Invitational Inc., Moody Gardens, and Texas Caribbean Charters supported the event. The removal cruise in September 2022 was canceled due to mechanical issues on the vessel.



Figure 4. The full team of divers that participated in the June 2022 Lionfish Invitational (left); Alex Fogg holding the new Texas record lionfish removed from Stetson Bank (right). Photos: Michelle Johnston/NOAA

## Manta Ray Catalog

Sanctuary staff are working to convert the manta ray catalog to a more user-friendly web format and have uploaded the sanctuary's manta sighting data to Manta Matcher (<https://mantamatcher.org>). This website uses an algorithm similar to facial recognition software to automatically distinguish individual mantas using photos of their bellies. Any diver or snorkeler with a camera can submit manta ray photos for identification. By uploading photos and information about manta encounters, recreational divers can participate in citizen science and assist with global manta ray research and conservation. In FY22, seven manta rays were spotted in FGBNMS and three of those individuals were cataloged, bringing the total number of individuals to 105, with 25 individual re-sightings.

## Mooring Buoys

Ryan Hannum took on the role of lead for the mooring buoy program. One mooring buoy was provided to Texas Caribbean Charters for installation while sanctuary staff were unable to get offshore due to extended the R/V *Manta* maintenance. Additional moorings were prepared to build up an inventory of mooring buoys and supplies for future installations along with renovating a new workshop space. Buoys and u-bolts were inspected in May (Figure 5), and an additional five buoys were installed at East Flower Garden Bank (2), West Flower Garden Bank (1), and Stetson Bank (2). A land-based training was held in July to train FGBNMS staff how to operate the gas-powered pump connected to the hydraulic drill.

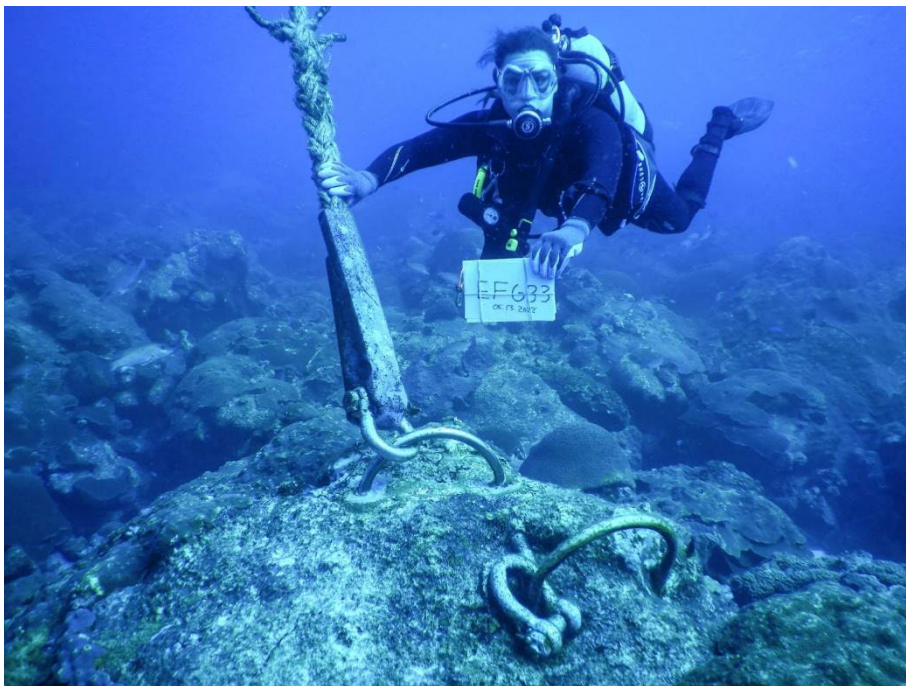


Figure 5. LTJG Kait Brogan inspects mooring anchor #3 at East Flower Garden Bank in May 2022. Photo: G.P. Schmah/NOAA

## Mesophotic Deep Benthic Communities Cruise

Researchers from NOAA's Mesophotic and Deep Benthic Communities Coral Propagation Techniques project participated in a cruise to FGBNMS aboard the R/V *Manta*, along with sanctuary and University of North Carolina Wilmington-Undersea Vehicles Program (UNCW-UVP) staff. Completed objectives included collecting snippets of live *Swiftia exserta* from large colonies, along with tissue samples for reproductive and genetic analysis (Figure 6). Researchers collected a total of 15 live samples of *Swiftia exserta* and distributed them to the Galveston NOAA Southeast Fisheries Science Center lab and United States Geological Survey lab in Gainesville, Florida. These samples, which were collected near the predicted spawning time and showed signs of developing oocytes, subsequently spawned in the laboratories. *Swiftia exserta* are being studied to determine the most effective propagation techniques for eventual restoration of the Deepwater Horizon oil spill site.

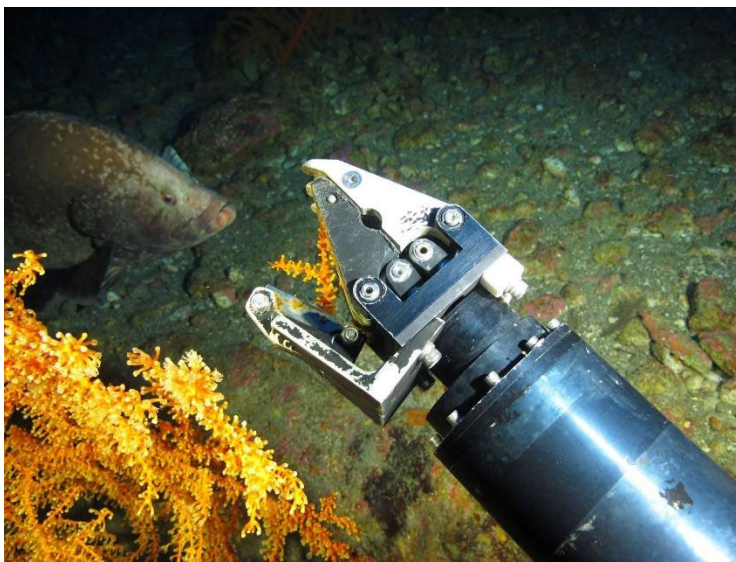


Figure 6. A marbled grouper (*Dermatolepis inermis*) observes *Swiftia exserta* collection. Photo: NOAA/UNCW-UVP

## Mesophotic Sponge Project

Through funds provided by NOAA's Deep Sea Coral Research and Technology Program, National Marine Sanctuary Foundation hired Dr. Cris Diaz to develop a field guide of mesophotic sponges for the FGBNMS region based on historic samples. The resulting publication (in press) provides images and diagnostic features to aid in the identification of over 50 sponge species in the field, as well as distribution information for the greater region. Through the development of the guide, several new sponge species were identified and will be described and named in a second publication.

## National Coral Reef Monitoring Cruises Completed

Divers from National Coral Reef Monitoring Program (NCRMP) partnered with FGBNMS and AAUS divers from Moody Gardens and Texas A&M University-Corpus Christi to conduct two monitoring cruises at East and West Flower Garden Banks. The team completed fish and benthic surveys at stratified random sites on both banks. These surveys included fish counts

using the Reef Visual Census (RVC) method and benthic surveys using the Line Point Intercept (LPI) method, the Coral Demographic method, and the photo transect method. On leg II, SCTLD-like disease lesions were observed on both brain and star corals at East and West Flower Garden Banks (Figure 7).

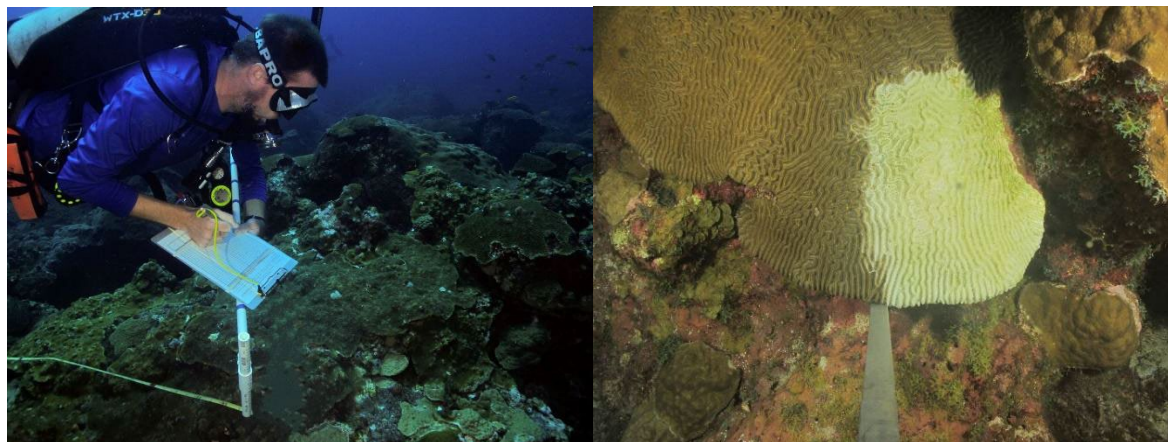


Figure 7. A diver conducts a coral demographic benthic survey (left); a brain coral with a disease lesion (right). Photos: Kelly O'Connell/CPC, Inc.

### ***New Seafloor Mapping Data Available via NCEI Mapping Portal***

As part of an agreement between Bureau of Ocean Energy Management (BOEM) and FGBNMS, NOAA's Mobile Navigational Response Team conducted high resolution multibeam bathymetry surveys along the continental shelf in the northern Gulf of Mexico between 2018 and 2020. The targeted locations lacked complete high resolution seafloor topography essential for supporting research and management of those areas. The mapped banks included Adeline, Alaminos, Antoine, Assumption Dome, Berwick, Big and Small Dunn Bar, Claypile, Coffee Lump, Davis, Elvers, Ewing, Henderson Ridge, Patterson, Sackett, Sweet, and Viosca Knolls. Starting in 2022, the data from these surveys are publicly available for download via the [NCEI Bathymetry data portal](#). This mapping effort contributes to the collection of critical data to guide decision making, and provide baseline imagery for future exploration and characterization.

### ***NOAA SCTLD Implementation Plan***

Michelle Johnston lead NOAA Stony Coral Tissue Loss Disease (SCTLD) working groups and helped co-author the [NOAA Strategy for Stony Coral Tissue Loss Disease: An Implementation Plan for Response and Prevention](#) to help scientists study potential causes, understand how the disease spreads, identify high-risk locations and vessels at risk of transporting the disease, develop new treatments and diagnostic tools, and evaluate the vulnerability of Pacific coral species. The strategy also increases the local capacity for disease response by supporting field

### ***PROTEUS Pilot***

Sanctuary staff are participating in a pilot project to help understand vessel activity in the sanctuary. The pilot program is supported by the U.S. Naval Research Lab and allows users to

monitor VMS and AIS vessel tracks and set up alerts. This tool will help managers better understand vessel use within the remote sanctuary and has potential enforcement uses.

## **Memorandum of Understanding between TAMUG and FGBNMS**

A memorandum of understanding (MOU) between FGBNMS and Texas A&M Galveston (TAMUG) was signed in January 2022. This agreement outlines partnership opportunities between the university and the sanctuary. Both parties participated in an MOU kickoff meeting to discuss current and potential future collaborations.

## **Publications**

Blakeway, RD, Fogg, AQ, Johnston, MA, Rooker, JR, and Jones GA. 2022. Key life history attributes and removal efforts of Invasive lionfish (*Pterois volitans*) in the Flower Garden Banks National Marine Sanctuary, Northwestern Gulf of Mexico. *Frontiers in Marine Science*, 9:774407. <https://doi.org/10.3389/fmars.2022.774407>.

Blakeway RD, O'Connell K, Nuttall MF, Hannum R, Johnston MA, Hu X, Hickerson EL, Schmahl GP, Sinclair J. 2022. Stetson Bank long-term monitoring: 2020 and 2021 annual report. National Marine Sanctuaries Conservation Series ONMS-22-02. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Flower Garden Banks National Marine Sanctuary. 32 pp.

Clements KR, Karp P, Harris HE, Ali F, Candelmo A, Rodríguez SJ, Balcázar-Escalera C, Fogg AQ, Green SJ, Solomon JN. 2021. The Role of Citizen Science in the Research and Management of Invasive Lionfish across the Western Atlantic. *Diversity* 13(12):673. <https://doi.org/10.3390/d13120673>.

Etnoyer, P., R. Bassett, C. Adams, T. Battista, R. Blakeway, S. Harter, J. Howell, J. Lunden, R. McGuinn, M. Nizinski, K. Overly, M. Poti, E. Salgado, A. Shuler, A. Skarke, H. Coleman, and T. Hourigan. 2021. Southeast Deep Coral Initiative (SEDCI) 2016-2019: Final Report to NOAA Deep Sea Coral Research and Technology Program. NOAA Tech. Memo. NMFS-OHC-9, 116 p

Johnston MA, Nuttall MF, Hickerson EL, O'Connell K, Blakeway RD, Embesi JA, MacMillan J, Peter D, Schmahl GP. 2022. Characterizing the biological community before and after partial removal of an offshore gas platform in the northwestern Gulf of Mexico. *Environmental Management*. <https://doi.org/10.1007/s00267-022-01714-8>.

Johnston MA, O'Connell K., Blakeway RD, Hannum R, Nuttall MF, Hickerson EL, Schmahl GP. 2022. Long-term monitoring at East and West Flower Garden Banks: 2020 and 2021 annual report. National Marine Sanctuaries Conservation Series ONMS-22-01. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Flower Garden Banks National Marine Sanctuary. 57 pp.



Johnston MA, Nuttall MF, O'Connell K, Drinnen K. 2022. Flower Garden Banks National Marine Sanctuary 2021 Research, Monitoring, and Resource Protection Report. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Flower Garden Banks National Marine Sanctuary, Galveston, TX. 15 pp.

McLaughlin C, Wusinich-Mendez D, Johnston MA, et al. 2022. NOAA Strategy for Stony Coral Tissue Loss Disease: An Implementation Plan for Response and Prevention. US DOC. NOAA. 94 p.

Nuttall MF, Hickerson EH, Blakeway RD, Schmahl GP, Sammarco PW. 2022. Do Oil and Gas Lease Stipulations in the Northwestern Gulf of Mexico Need Expansion to Better Protect Vulnerable Coral Communities? How Low Relief Habitats Support High Coral Biodiversity. *Frontiers in Marine Science Coral Reef Research*  
<https://doi.org/10.3389/fmars.2021.780248>.


Richards, Joseph, Kittle, Ronald P., Schmidt, William E., Sauvage, Thomas, Gurgel, Carlos F. D., Gabriel, Daniela, Fredericq, Suzanne. 2022. Assessment of Rhodolith Diversity in the Northwestern Gulf of Mexico Including the Description of *Sporolithon gracile* sp. nov. (Sporolithales, Rhodophyta), and Three New Species of *Roseolithon* (Hapalidiales, Rhodophyta). *Frontiers in Marine Science* 9. <https://doi.org/10.3389/fmars.2022.906679>.

Shawn M. Doyle, Miabel J. Self, Joseph Hayes, Kathryn E.F. Shamberger, Adrienne M.S. Correa, Sarah W. Davies, Lory Z. Santiago-Vázquez, Jason B. Sylvan. 2022. Microbial Community Dynamics Provide Evidence for Hypoxia During a Coral Reef Mortality Event. *bioRxiv* 2022.02.24.481904; doi: <https://doi.org/10.1101/2022.02.24.481904>.

Yudelman, Eleanor and Slowey, Niall. 2022. Coral extension rate analysis using computed axial tomography. *Coral Reefs*. 41. 10.1007/s00338-022-02235-w.


## Science Interpretation Activities


1. Created presentations on Coral Identification and Coral Point Count development of a coral monitoring practice package for students at Ball High School (Johnston, O'Connell)
2. Provided scientific support for exhibition by artist Janavi Mahimtura Folmsbee at Heidi Vaughan Fine Art Gallery, and for installation at George Bush Intercontinental Airport (Nuttall, Schmahl, Hickerson)
3. Interviewed with Houston Chronicle regarding SCTL D Preparedness Plan (Johnston)
4. Served on Bailey Anderson's high school honors committee for marine biology senior shark finning project, Heathwood Hall, Columbia, South Carolina (Johnston)
5. Organized a diversity and inclusion mini-grant event for Big Brother Big Sisters at Moody Gardens Aquarium (O'Connell)

- 
6. Provided materials and contacts to Alan Wilde for FGBNMS history book (Hickerson)
  7. Highlighted in NOAA Women in Science Story (Johnston)
  8. Included in web story for ONMS Women's History Month (Johnston)
  9. Reviewed NOAA Knauss Fellowship Applications (Johnston)
  10. Planned for Get into Your Sanctuary veteran dive mission with WAVES project (Nuttall/Johnston)
  11. Planned for Minorities in Shark Science diversity and inclusion mini-grant (Nuttall)
  12. Contributed to ONMS web story about coral spawning (Johnston)
  13. Interviewed about lionfish for St. Francis high school senior research paper (Johnston)
  14. Interviewed about professional development by University of Hawai'i master's student (Johnston)
  15. Posted about urchin disease awareness post and AGRA reporting on FGBNMS social media (Johnston)
  16. Interviewed for Outdoor Adventure series [podcast](#) (Johnston)
  17. Provided science interpretation at anniversary event held at BakFish Brewing Company in Pearland, Texas
  18. Contributed to ONMS web story on FGBNMS disease outbreak (Johnston)
  19. Interviewed with Houston Chronicle regarding FGBNMS disease outbreak (Johnston)
  20. Interviewed with Houston Public Media regarding FGBNMS disease outbreak (Johnston)
  21. Conducted presentations on Diving for Research and Resource Protection at TAMUG (Nuttall)
  22. Hosted Safe Diving Operations from Vessels workshop for AAUS symposium (Nuttall/O'Connell/Blake/Brogan)
  23. Instructed TAMUG scientific divers in FGBNMS Fish Identification (Nuttall)

## **Trainings, Meetings, Conferences**

1. ONMS All Hands meetings
2. ONMS Office Hours meetings
3. Coral Collaboration Seminars (Johnston)
4. AAUS Safe Vessel Diving Operations Workshop (Nuttall)
5. Presentation to Sanctuary Advisory Council on NCCOS Connectivity Study (Nuttall)

- 
6. Presentation to Sanctuary Advisory Council on Condition Report and Climate Vulnerability Assessment (Johnston)
  7. East Coast Region Team Building Meeting (Johnston)
  8. AAUS Science Symposium (Nuttall/O'Connell)
  9. NCCOS habitat connectivity project presentation to MDBC habitat team (Nuttall)
  10. Core Policy MOU Training (Johnston)
  11. NOAA Listening Sessions for Uvalde Shooting (Johnston)
  12. Kick off TAMUG/FGBNMS MOU meeting (Schmahl/Johnston)
  13. BOEM Interagency Transfer Meeting (Johnston/Nuttall)
  14. Presentation to Sanctuary Advisory Council on Coral Disease Response (Johnston)
  15. Reef Futures Abstract and Presentation (Johnston)
  16. CRCP Lightning Talk on FGBNMS/NCRMP Benthic Methods Collaboration (Johnston)
  17. FGBNMS coral disease update to Disease Advisory Council and NOAA disease working group (Johnston)
  18. Bay Area Divers scientific diving outreach presentation (O'Connell)
  19. Moody Gardens Aquarium Dive Expo
  20. MDBC meetings: MDBC modeling workshop, mapping workshop
  21. Dive presentation at the Tremont Hotel in Galveston with Texas SCUBA Adventures (Schmahl)
  22. Panel discussion on climate change impacts at the Society of Environmental Journalists conference in Houston (Schmahl)
  23. Travel refresher training webinar (Johnston)
  24. ONMS RAD (Resist, Accept, Direct) Climate webinars (Johnston/Nuttall)
  25. Grant Reviewer webinar (Johnston/Blakeway)
  26. NOAA Meeting Facilitation training (Johnston)
  27. NOAA science and economic development webinar (Johnston)
  28. NOAA Dive Master training (Brogan/O'Connell)
  29. Primer-e statistical program training (O'Connell)
  30. Defensive driving training (O'Connell/French/Emmert/Eisenbach/Hannum/Nuttall)
  31. ONMS webinar on navigating disruption and change (Johnston)

- 
32. Indigenous engagement webinar (Johnston)
  33. CPR/First Aid training (Blake/O'Connell/Schmahl/Hannum/Eisenbach/Nuttall/Johnston)
  34. Harassment and discrimination training (Johnston)
  35. No Fear Act Training (Johnston)
  36. Shipping Hazards Training (Johnston/Eisenbach)
  37. NOAA Fisheries DisMAP Demo: Visualizing changing distributions (Nuttall)
  38. NCRMP Data Dashboard webinar (Johnston)
  39. ONMS Webinar on burnout signs, symptoms and strategies (Johnston)
  40. ONMS Acoustics and Sound Meetings (Nuttall)
  41. Deep Sea Coral Meetings (Nuttall)



NATIONAL MARINE  
**SANCTUARIES**

AMERICA'S UNDERWATER TREASURES