

Office of National Marine Sanctuaries  
National Oceanic and Atmospheric Administration

FLOWER GARDEN BANKS NATIONAL MARINE SANCTUARY



## 2014 RESEARCH AND MONITORING REPORT



January 2015

The purpose of this document is to report the activities of the Flower Garden Banks Research Team during FY2014.

National Oceanic and Atmospheric Administration

Office of National Marine Sanctuaries

Director

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Flower Garden Banks National Marine Sanctuary

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Cover Photo

A squadron of Spotted Eagle Rays (*Aetobatus narinari*) Image credit:  
Hickerson/FGBNMS



## ACRONYMS

BOEM – Bureau of Ocean Energy Management  
BSEE – Bureau of Safety and Environmental Enforcement  
DFH – Deepwater Fish Habitat  
F.E.T. – Forum Engineering Technologies  
GIS – Geographic Information System  
CIOERT – Cooperative Institute of Ocean Exploration, Research and Technology  
CRCP – Coral Reef Conservation Program  
EFGB – East Flower Garden Bank  
FDA – Food and Drug Administration  
FGBNMS – Flower Garden Banks National Marine Sanctuary  
FKNMS – Florida Keys National Marine Sanctuary  
GCFI – Gulf Coast Fisheries Institute  
GIS – Geographic Information Systems  
HD – High Definition  
LTM – Long-Term Monitoring  
MOCNESS – Multiple Opening/Closing Net Environmental Sensing System  
NABS – National Association of Black Scuba Divers  
NASA – National Aeronautics and Space Administration  
NCCOS – National Centers for Coastal Ocean Science  
NCDDC - National Coastal Data Development Center (NCDDC)  
NCRMP – National Coral Reef Monitoring Program  
NDC – NOAA Dive Center  
NMSF – National Marine Sanctuary Foundation  
NOAA – National Oceanic and Atmospheric Administration  
NOS – National Ocean Service  
NPR – National Public Radio  
OA – Ocean Acidification  
ONMS – Office of National Marine Sanctuaries  
OCS – Outer continental shelf  
PSBF – Potentially Sensitive Biological Features  
REEF – Reef Environmental Education Foundation  
ROV – Remotely Operated Vehicle  
SAC – Sanctuary Advisory Council  
SCUBA – Self Contained Underwater Breathing Apparatus  
TAMUCC – Texas A&M University – Corpus Christi  
TAMUG – Texas A&M at Galveston  
TNC – The Nature Conservancy  
UNCW – University of North Carolina – Wilmington  
UT – University of Texas  
UTB – University of Texas - Brownsville  
UVP – Underwater Vehicle Program  
WFGB – West Flower Garden Bank

## Overview

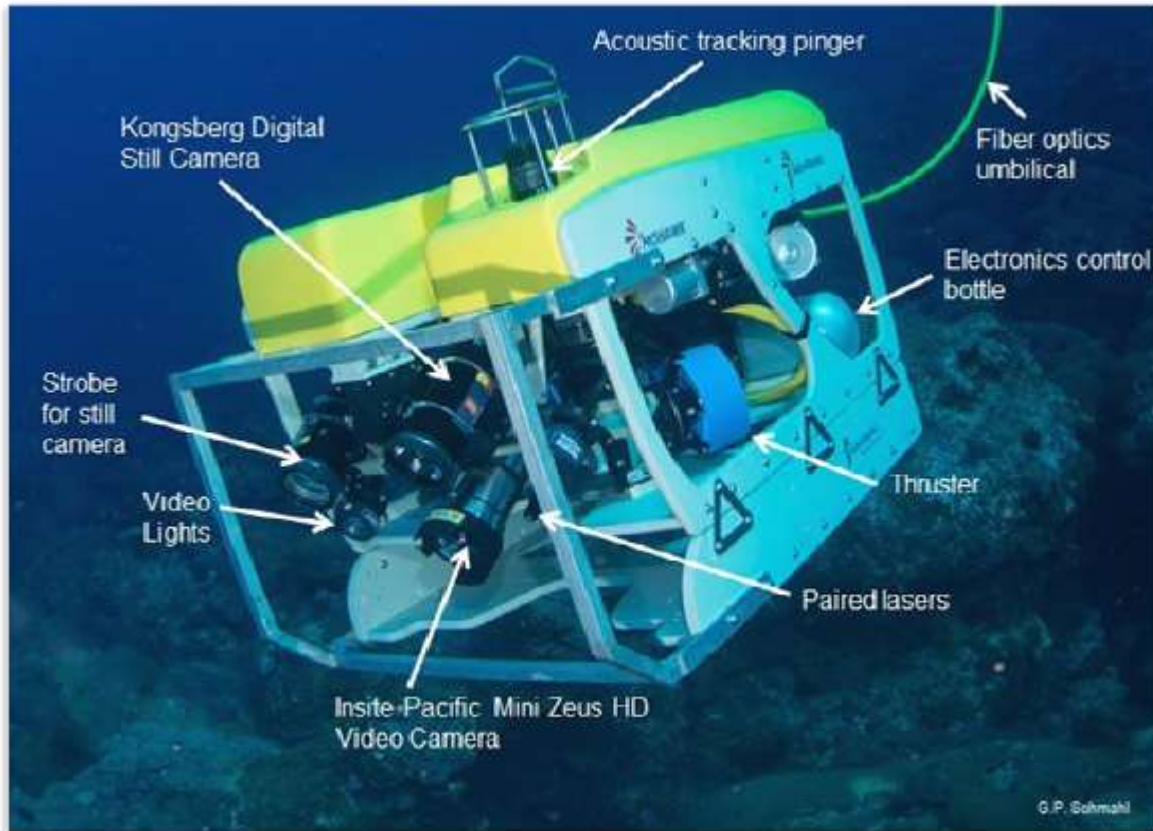
The Flower Garden Banks National Marine Sanctuary (FGBNMS) research team was involved in 12 research cruises and expeditions during the 2014 field season. R/V MANTA was utilized by the research team for a period of 58 days to conduct operations. A pool of 30 sanctuary personnel, scientists, and reciprocity divers conducted 593 SCUBA dives. Activities included biological surveys and sample collection, removal of invasive species, equipment maintenance, and image collection. Thirteen sanctuary permits were processed, and an additional eight were/are ongoing. A new FGBNMS Sanctuary Superintendent permit was issued and utilized to install long-term monitoring stations and remove invasive species.



Sea cucumbers at Stetson Bank exhibit pre-spawning behavior by standing on end, preparing to release gametes.  
Image credit: FGBNMS/G.P. Schmahl

## FY 2014 HIGHLIGHTS

### INAUGURAL CRUISES CONDUCTED WITH MOHAWK REMOTELY OPERATED VEHICLE



NMSF/FGBNMS F.E.T. "Mohawk" ROV photographed on the reef crest during the inaugural cruise in October 2013.





The ROV purchased by National Marine Sanctuary Foundation (NMSF) for use by the FGBNMS and partners was brought to the FGBNMS to conduct inaugural cruises (<http://flowergarden.noaa.gov/science/dfh24.html>). This ROV has been built with 300m capabilities, but can be upgraded to 1000m depth rating. The system will provide enhanced visualization through HD cameras, increased sampling capabilities, and an upgrade to fiber optic umbilical technology. A custom collection carousel/tool skid will be designed and built by Harbor Branch Oceanographic Institute (HBOI). The NMSF and University of North Carolina at Wilmington (UNCW) – Undersea Vehicles Program (UVP) have developed an agreement so that NMSF maintains ownership of the system, and UNCW will operate and maintain the new system, which will be available as a regional asset for the ONMS/NOAA programs. HBOI has designed and manufactured a tool skid with full collection capabilities for the ROV – to be fully functional for FY 2015 operations. Funding for the tool skid was provided by National Marine Sanctuary Foundation. Download full specs on the ROV here: [http://flowergarden.noaa.gov/document\\_library/scidocs/mohawkrov.pdf](http://flowergarden.noaa.gov/document_library/scidocs/mohawkrov.pdf)

### **FGBNMS CONTINUES TO TRACK AND RESPOND TO LIONFISH INVASION**

Since the introduction of lionfish (*Pterois volitans/miles*) into the Western Atlantic in the late 1980's, lionfish entered the Gulf of Mexico by means of larval transport in 2009. In the fall of 2010, lionfish were observed at Sonnier Bank (one of numerous shallow banks in the northwestern Gulf) and nearby oil and gas platforms. In July of 2011, lionfish were observed by divers on all three banks of the sanctuary.

The Flower Garden Banks long-term monitoring program has helped document the appearance and rapid spread of lionfishes in the sanctuary. Between 2011 and 2012, lionfish sightings have increased 10-fold. The 2013 reporting year marked the first documentation of Lionfish in the long-term monitoring dataset with a sighting frequency of 16.7%, ranking Lionfish the 37<sup>th</sup> most frequently sighted species, of 75.

Since the first lionfish was observed at the sanctuary in 2011, numerous actions have taken place, and many projects adapted or created, to manage this invasive species. To date, the primary responses, projects, and areas of focus on the lionfish invasion involving control, research, monitoring, and education and outreach at the FGBNMS are listed below in Table 1.

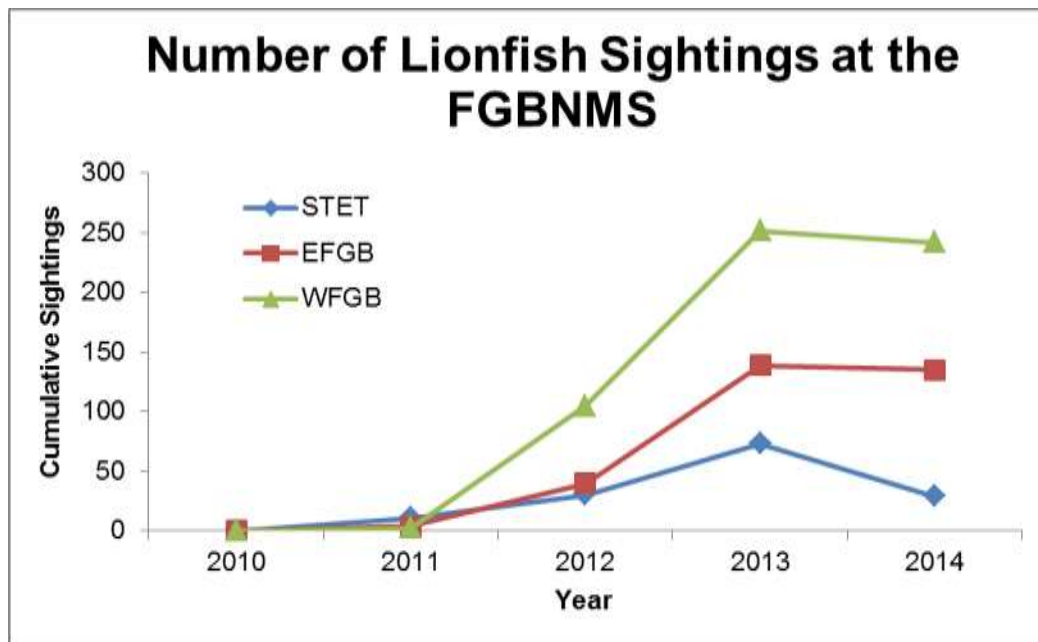


Table 1. Priority activities currently conducted by staff and partners at Flower Garden Banks National Marine Sanctuary.

Category	Focus Area/Project	Brief Description
<b>Monitoring</b>	CRCP NCRMP	National Coral Reef Monitoring Program. Lionfish abundance and size conducted along reef-wide random belt transects.
	FGB Long-Term Monitoring	Lionfish abundance and size documented on Bohnsack fish surveys within study sites.
	Stetson Monitoring	Lionfish abundance and size documented on Bohnsack fish surveys within study sites.
	Citizen science reporting	Lionfish sightings reported to the Sanctuary through an online report form.
<b>Control</b>	Identify Priority Areas	Priority areas for lionfish control include buoyed areas on the FGBNMS reef cap.
	Permitting Mechanisms	Select individuals are authorized via a permit and letter of authorization to remove lionfish from priority areas.
	Targeted Removals	Staff and permitted volunteers are trained and issued permits to safely remove lionfish.
<b>Research</b>	Diet	Stomach contents analyzed from all lionfish fish removed from the FGBNMS.
	Ciguatera	Partner with NOAA NCCOS and FDA to test lionfish for ciguatera fish poisoning.
	Mercury	Lionfish screened for mercury levels at the FGB.
	Habitat Utilization	Collect data on density, distribution, and habitats utilized on shallow and deep reefs through diver surveys and ROV surveys.
	Age and Growth	Partner with NOAA NCCOS and TAMU-CC for otolith analysis.
	Tissue collection	Partner with TAMU-CC and UTB for genetic analysis and gene mapping.
	Gulf Mapping	Partner with TNC for GIS analysis and map products documenting a time series of the Gulf of Mexico invasion.
<b>Education &amp; Outreach</b>	Training and Handling Workshops	Partner with REEF, Houston Zoo, and Texas State Aquarium to host lionfish safe handling workshops.
	Lionfish messaging	Development of messages and facts incorporated in presentations given to dive clubs and community organizations. Work with local schools on "Host a Lionfish" in your classroom week.
	Partnerships	Key partners to date have included Fling Charters, REEF, NOAA NCCOS, TX State Aquarium, TAMU-CC, TAMUG, UTB, The Nature Conservancy, the FDA, Haven, and The Houston Zoo.
	Special Events	Host Ocean Discovery Day and partner with Houston restaurants to hold special lionfish dinner events.
	Outreach Materials	Develop facts sheets and sighting forms. Partner with Moody Gardens and Gladys Porter Zoo on aquarium exhibits and provide lionfish for aquaria.

Researchers are studying lionfish diet through stomach content analysis and providing data and samples for age/growth, genetic, and ciguatera studies. While fish biomass at the FGBNMS remains high, the invasion is still in the early stages, and negative impacts on the reef community may not be seen for several years. The FGBNMS currently works to remove lionfish when possible. However, a more focused effort is needed to control the population and to understand control targets and other effective control mechanisms that would minimize ecosystem-level impacts.

To date, approximately 1600 Lionfish have been observed around the NW Gulf of Mexico banks and surrounding oil and gas platforms, and approximately 700 of those have been removed from sanctuary waters. The most common identifiable gut contents include crustaceans (39%), wrasses (12%), blennies (5%), and damselfishes (4%).



Sanctuary staff are tracking the invasion at FGBNMS and surrounding banks by documenting the locations of Lionfish removals and observations. These observations include sightings using SCUBA and during ROV surveys in deep water habitat. Lionfish sighting forms (on the FGBNMS website) are available for recreational divers to report sightings and pictures. FGBNMS is also working with the recreational dive charter M/V Fling, REEF, TX State Aquarium, and the National Marine Sanctuary Foundation to hold a permitted lionfish research and removal event in 2015. As the invasion spreads, community involvement to conduct targeted removals will be an important control strategy.

More about Lionfish: <http://flowergarden.noaa.gov/education/invasivelionfish.htm>



## CRUISES and EXPEDITIONS

- Water Quality – November 18-19, 2013
- Inaugural ROV
  - o October 21-25, 2013
  - o October 28-November 1, 2013
- Water Quality – February 23-25, 2014
- Multibeam Mapping - Coffee Lump Bank, USS Hatteras – January 17-19, 2014
- Mooring Buoy/Water Quality – May 16-17, 2014
- Stetson Bank Long-Term Monitoring – July 2–5, 2014
- FGB Long-Term Monitoring Refurbishment – July 7-11, 2014
- FGB Long-Term Monitoring – July 21-25, 2014
- Coral Spawning – August 16-17, 2014
- Water Quality/EFGB LTM Repetitive Photographs/Catlin Seaview Tripod image collection – September 8-10, 2014
- Lionfish removal – September 16-18, 2014

FGBNMS Divers participated in the following projects and cruises:

- NCCOS Biogeography Cruise – FKNMS – Nuttall and Eckert – June 2-12, 2014
- Catlin-Seaview Training – FKNMS – Hickerson – August 4-14, 2014
- Industry/Agency Cruise – FGBNMS – Schmahl – July 28-30, 2014



## ADDITIONAL *R/V MANTA* CRUISES

The *R/V Manta* was chartered by several different user groups during the 2014 research season.

- May 18-23, 2014 University of Texas Marine Science Institute
- May 26 – June 1, 2014 Dr. T. Dellapenna, Texas A&M University
- June 16-23, 2014 Dr. S. DiMarco, Texas A&M University - Hypoxia
- August 11-13, 2014 Dr. J. Rooker, Texas A&M University – MOCNESS Training
- August 29 – 31, 2014 Dr. S. DiMarco, Texas A&M University – Glider Deployment
- September 4-5, 2014 Dr. S. DiMarco, Texas A&M University – Glider Recovery

## ADDITIONAL SCIENCE ACTIVITIES

1. Successful completion of Dive Unit Safety Assessment
2. NOAA Working Diver Training – Eckert, Johnston, Nuttall
3. NOAA DiveMaster Training – Embesi
4. Conducted second TAMUG/FGBNMS Specialty Course
5. Completed analysis of PSBF images (6760 images)
6. Continued acoustic array discussions and asset acquisition
7. Continued building technical diving equipment inventory
8. Development of IIS with BOEM for Ocean Iridium
9. Development of IIS with BSEE for Stetson Bank Long-Term Monitoring and HIA389A Monitoring
10. Permitting
11. Mooring buoy installation and maintenance
12. Scheduling of *R/V Manta*
13. Coordination of SCUBA operations
14. Coordination of shipboard research equipment and activities
15. Submitted NOAA fleet shiptime requests and needs
16. Regional GIS support
17. Science presence at SAC meetings
18. Participation in NOAA Coral Collaboration calls
19. Participation in NOAA Deep Sea Coral calls
20. Provided input for 2014 OKEANOS target sites for mapping and ROV
21. Development of Catlin Seaview Tripod System user manual



2014 Ocean Discovery Day interactive mural project – Marine Mammals of the Gulf of Mexico. The original artwork (above) is gridded out for visitors to pick a square to recreate. Original artwork by Marine Educator/Artist, Jacqui Stanley

## SCIENTIFIC INTERPRETATION/OUTREACH

1. Ocean Discovery Day – Marine Mammals of the Gulf of Mexico Mural
2. Interview – FGBNMS – KHOU11 News (Hickerson)
3. Interview – Lionfish – Austin American Statesman (Johnston)
4. Interview – NPR (Johnston, Hickerson)
5. Interview – Lionfish – TX Parks and Wildlife (Johnston)
6. ONMS Quickchats – Lionfish (Johnston)
7. Developed collaboration with Bryan Museum, Galveston
8. Input for coral spawning article – Galveston Daily News
9. Prepared HD clips for traveling exhibit
10. Development of HD B-ROLL Media package
11. Development of Still Images Media package
12. Contribution to digital slide catalog/library
13. Contribution to video library, including annotations
14. Development of PowerPoint presentations for various events
15. Provided significant content for Sanctuary website
16. Facebook postings
17. Web-based research reports and blogs
18. Response to “Into the Sea” mail (Hickerson)



2014 Final mural – Marine Mammals of the Gulf of Mexico. Ocean Discovery Day participants replicated a portion of the original mural on an 8"x8" canvas – a total of 162 individuals, mostly children, contributed a square to create this 12'x6' mural.

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

1. Attended GCFI in Corpus Christi, TX – November 4-8, 2013 (Johnston)
2. Development of four posters for GCFI: Lionfish, HIA389A, DFH Fish/Zones, and Ciguatera
3. Patton Elementary School – Austin, TX (Hickerson)
4. TAMUG Scientific Methods Class – SCUBA for science (Nuttall)
5. SAC/FAC Meeting and Manta tours
6. TAMUG graduate student seminar – January 23 (Hickerson)
7. Seaside Chat – Deepwater Exploration and Technology – February 12 (Hickerson)
8. Seaside Chat – Shallow water science and technology – February 19 (Johnston, Eckert, Embesi, Nuttall)
9. Seaside Chat – Tracking animals – February 26 (David Wells – TAMUG)
10. Rice University presentation - Galveston Surfriders Presentation – March 4 (Johnston)



11. National Marine Sanctuary Foundation Board Members presentation – March 11 (Hickerson)
12. Kathy Caraway Elementary School Science Night – March 27 (Hickerson)
13. Westwood High School, Austin, AP Environmental Studies class – April 10 (Hickerson)
14. TAMUG Scientific Diving Class - April 14 (Nuttall)
15. Lionfish 5<sup>th</sup> Grade Education and outreach – Marietta City Schools, Marietta, Ohio (Johnston) – May 7 (Johnston)
16. Patton Elementary School – May 22 (Hickerson)
17. NABS YES Red Hat Talk – June (Johnston)
18. TAMUG Seminar – October 3 (Hickerson)
19. Research Coordinator Meeting (Hickerson)



A three-spot damselfish (*Stegastes planifrons*) tends an algae farm in amongst a mosaic of hermatypic corals on the reef.  
Image credit: FGBNMS/G.P. Schmahl



## ABSTRACTS AND PUBLICATIONS

- Clark, R., J. C. Taylor, C.A. Bucket, and L.M. Kracker (eds). 2014. Fish and Benthic Communities of the Flower Garden Banks National Marine Sanctuary: Science to Support Sanctuary Management. NOAA Technical Memorandum NOS NCCOS 179. Silver Spring, MD. 317 pp.
- Eckert, R.J., Robertson, A., Loeffler, C., Hickerson, E.L., Johnston, M.A., Schmahl, G.P. Ciguatera Fish Poisoning in the Northwestern Gulf of Mexico (2014). Poster. Gulf and Caribbean Fisheries Institute. Corpus Christi, TX. November 2013.
- Embesi, J.A., Eckert, R.J., Hickerson, E.L., Johnston, M.A., Nuttall, M.F., Schmahl, G.P. Benthic Community Composition Associated with Gas Platform, High Island, A389-A, Located within the Flower Garden Banks National Marine Sanctuary (2014). Poster. Gulf and Caribbean Fisheries Institute. Corpus Christi, TX November 2013.
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- Johnston, Michelle A., M.F. Nuttall, R.J. Eckert, J.A. Embesi, N.C. Slowey, E.L. Hickerson, and G.P. Schmahl. 2013. Long-term monitoring at the East and West Flower Garden Banks National Marine Sanctuary, 2009-2010: Volume I: Technical report. U.S. Dept. of Interior, Bureau of Ocean Energy Management, Gulf of Mexico OCS Region, New Orleans, Louisiana. OCS Study BOEM 2013-0214. 202 pp.
- Johnston, Michelle A., M.F. Nuttall, R.J. Eckert, J.A. Embesi, N.C. Slowey, E.L. Hickerson, and G.P. Schmahl. 2013. Long-term monitoring at the East and West Flower Garden Banks National Marine Sanctuary, 2009-2010: Volume II: Appendices. U.S. Dept. of Interior, Bureau of Ocean Energy Management, Gulf of Mexico OCS Region, New Orleans, Louisiana. OCS Study BOEM 2013-0215.
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- Nuttall, M.F., Johnston, M.A., Eckert, R.J., Embesi, J.A., Hickerson, E.L., and Schmahl, G.P. (2014) Lionfish (*Pterois volitans/miles*) Records Within Mesophotic Depth Ranges on Natural Banks in the Northwestern Gulf of Mexico. *BioInvasions Records*. 3(2):111-115
- Nuttall, M.F., Hickerson, E.L., Eckert, R.J., Embesi, J.A., Johnston, M.A., Schmahl, G.P. (2014). Fish Communities Associated with Benthic Biological Zones at the Flower Garden Banks National Marine Sanctuary and other Banks in the Northwestern Gulf of Mexico. Poster. Gulf and Caribbean Fisheries Institute. Corpus Christi, TX. November 2013.

- Precht, W.F., Hickerson, E.L., Schmahl, G.P., and Aronson, R.B. (In Press) The Invasive Coral *Tubastraea coccinea* (Lesson, 1829): Implications for Natural Habitats in the Gulf of Mexico and the Florida Keys. *Gulf of Mexico Science*. 2014
- Precht, W.F., Deslarzes, K.J.P., Hickerson, E.L., Schmahl, G.P., Nuttall, M.F., and Aronson, R.B. Back to the future: The history of acroporid corals at the Flower Garden Banks, Gulf of Mexico, USA. *Marine Geology* 349 (2014) 152-161.
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Sandbar shark (*Carcharhinus plumbeus*) cruises through Stetson Bank. Image credit: FGBNMS/G.P. Schmahl

## FUNDING

- Secured funding for BOEM/FGBNMS Ocean Acidification project to support shiptime and diver support \$100K
- Secured funding from Texas State Aquarium to support lionfish removal activities \$20K
- Secured funding from HQ to support John Embesi to attend Divemaster class in Key West FL
- Secured donation of technical dive gear from NASA via ONMS and NDC – 6 sets of doubles, regulator setups, backplates, stage bottles
- Secured donation of up to 12 VEMCO VR2 receivers through James Lindholm – California Academy of Sciences
- Secured donation of \$1,500 from Kempner Foundation to support replacement of camera gear.
- Received Hollings grant to support lionfish removal activities \$25K
- Secured funding for LTM camera equipment from DOC PAC funds \$12K
- Funding received from Kempner Fund for replacement camera gear \$1500
- Secured funding with partners for OA project from Shell \$150K
- NCCOS lionfish ciguatera \$5K/LAD proposal funded \$100K
- NOS funds - Maintenance of tech regs and guardian masks \$3300
- Proposal to Busch/SeaWorld funded to support acoustic network array \$15K

## NEW SANCTUARY BIOLOGICAL RECORDS



Black Throated Blue Warbler (*Setophaga caerulescens*) photographed by TAMUG Reciprocity Diver, Travis Sterne

## RESEARCH AND SCIENCE PARTNERSHIPS

- Bureau of Ocean Energy Management (BOEM)
- Bureau of Safety and Environmental Enforcement (BSEE)
- Cooperative Institute of Ocean Exploration, Research and Technology (CIOERT)
- Food and Drug Administration (FDA)
- GotMercury.org
- Harbor Branch Oceanographic Institute (HBOI)
- National Centers for Coastal Ocean Science (NCCOS)
- National Coastal Data Development Center (NCDDC)
- Oregon State University (OSU)
- Reef Environmental Education Foundation (REEF)
- Texas A&M University (TAMU)
- Texas A&M University – Galveston (TAMUG)
- Texas A&M University - Corpus Christi (TAMU-CC)
- The Nature Conservancy - TNC
- University of North Carolina – Wilmington (UNCW)
- University of Texas
- University of Texas – Brownsville (UT)

## HONORS

Emma Hickerson was inducted into the Women Divers Hall of Fame during the Beneath the Sea Dive Show. March 31, 2014

## RESEARCH STAFFING

1. Ryan Eckert, Research Assistant
2. John Embesi, Research Assistant
3. Emma Hickerson, Research Coordinator
4. Michelle Johnston, FGBLTM Project Manager
5. Alyson Kuba, Hollings Scholar and Research Intern – PSBF project
6. Marissa Nuttall, Research Assistant
7. G.P. Schmahl, Sanctuary Superintendent

R/V MANTA core crew –services provided by BlueStar Marine, Inc., owned and operated by Captain Darrell Walker, and Shetler Marine, Inc., owned and operated by Captain Michael Shetler

1. Captain Michael Shetler
2. First Mate Mike Petry
3. Deck Brett Mayberry
4. Galley Tina Thompson

FGBNMS NOAA Divers:

1. Kelly Drinnen
2. Ryan Eckert
3. John Embesi
4. Emma Hickerson (Unit Diving Supervisor)
5. Michelle Johnston
6. Marissa Nuttall
7. Jamie Park
8. G.P. Schmahl
9. Michael Shetler

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