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Observations of marine diversity during a coral spawning event in the Flower Gardens Bank National Marine Sanctuary

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Researchers from the College of Marine Science at the University of South Florida joined an expedition coordinated by the Flower Garden Banks National Marine Sanctuary (FGBNMS) to the East and West Flower Garden Banks during August 24-26 to study the diversity of marine life during a massive coral spawning event. The team sailed on the Sanctuary vessel, the *R/V Manta*, and collected samples while diving to measure the diversity of genetic material swirling in the water above the coral using a technique called “environmental DNA” (eDNA).

eDNA is a cutting-edge tool that detects which organisms are in the area by measuring trace DNA shed and left behind by them. The methods are being tested by the Marine Biodiversity Observation Network (MBON; <http://mbon.ioos.us/>) as a practical means for evaluating changes in species, including or the presence of new species in a number of different ecosystems. By visiting the FGBNMS, we sought to determine whether eDNA can detect the diversity of spawning corals, sponges, and brittle stars as they released their sperm and eggs into the water during this annual massive reproduction event.



From left to right: *R/V Manta* at the Texas A&M dock; FGBNMS Research Ecologist Michelle Johnston ready to dive to collect eDNA samples; sunset setting the stage for the night-time coral spawning event.

Mass coral spawning events are one of nature’s most spectacular phenomena. They happen every year in the FGBNMS like clockwork, one week after the last full moon just before the end of summer. We were therefore ready for the reef to start spawning on the night of August 24, one hour after sunset. The team was uncertain whether this year’s spawning event was going to happen on time due to an unprecedented die-off of corals, sponges, brittle stars, sea urchins,

fish, and many other organisms in the eastern FGBNMS in July 2016. The causes of this die-off are still under investigation but we suspect this was the result of a massive and very quick offshore movement of coastal brackish water in late June and early July after weeks of heavy rainfall in Texas. “We are studying this episode using NASA and NOAA satellites and looking at imagery, ship data, and numerical models going back to 1979 to see how often these events happen” said Frank Muller-Karger, director of USF’s Institute for Marine Remote Sensing.

Fortunately, the coral reef organisms began their spawning ritual as scheduled by nature!

The FGBNMS diving team was led by Michelle Johnston, John Embesi, Ryan Eckert, Kelly Drinnen, and Dustin Picard. They went overboard right after the sunset to collect seawater bathing the corals before, during, and after the spawning event. They collected the samples in 1-liter sterile bags.



USF graduate student Megan Hepner (left) and Michelle Johnston (right) collecting eDNA samples above a *Montastraea spp.* colony. Picture courtesy of the FGBNMS Research Staff.



Diver collecting eDNA samples above a *Montastraea spp.* colony using 1-liter sterile bag. Picture courtesy of the FGBNMS Research Staff



Pseudodiploria strigosa during spawning on August 24, 2016. Picture courtesy of the FGBNMS Research Staff

Samples were processed on the deck of the *R/V Manta*. The water was filtered through sterile filters, which were then stored frozen in liquid nitrogen to be transported to the University of South Florida in ST. Petersburg for DNA analyses. Anni Djurhuus, a postdoctoral researcher at USF, is currently extracting and sequencing the DNA in November and December 2016.

If proven successful, this technique could be applied by NOAA operationally in a wide range of marine ecosystems, from pole to pole to track how life in the ocean is changing. New technology, such as automated Environmental Sample Processors being developed by the Monterey Bay Aquarium Research Institute (MBARI), would allow unattended collection in remote areas, process the samples, and communicating eDNA data via satellites back to scientists around the world.