

Environmental Studies Program: Ongoing Study

Study Area(s): Western Gulf of Mexico

Administered By: Gulf of Mexico OCS Region

Title: Coral Reef Ocean Acidification Sentinel Site in the Flower Garden Banks National Marine Sanctuary: Data Collection and Analysis (NSL #GM-14-05a)

BOEM Information Need(s) to be Addressed: BOEM scientists require an understanding of multiple stressors on an ecosystem to conduct environmental assessments required by NEPA. Coral reef communities are expected to be uniquely impacted by climate change stressors and ocean acidification (OA). This study will assess OA variability in the Flower Garden Banks National Marine Sanctuary and will eventually help understand the implication of regional OA changes.

Total BOEM Cost: \$500,000

Period of Performance: FY 2014–2019

Conducting Organization(s): Texas A&M University – College Station

Principal Investigator(s): Dr. Niall Slowey (slowey@geos.tamu.edu)

BOEM Contact(s): Dr. Rebecca Green (rebecca.green@boem.gov)

Description:

Background: Ocean acidification, or the ongoing increase in acidity of the Earth's oceans, is one possible outcome of climate change which has the potential to seriously threaten ocean health. Anthropogenic releases of carbon dioxide into the atmosphere since the mid-18th century have resulted in an increase of atmospheric CO₂ concentrations, with the ocean absorbing a significant fraction of this CO₂. However, when CO₂ is absorbed by seawater, chemical reactions occur that reduce both seawater pH and the concentration of carbonate ions in a process known as “ocean acidification” (OA) (NOAA, 2010). Coral reef ecosystems are of unique concern because their ability to precipitate calcium carbonate and net accretion rates may be impacted by OA. Experimental observations beginning in the 1990s have suggested that declining levels of calcification will occur with increasing ocean acidification. BOEM and its predecessors have studied the Flower Garden Banks for several decades (since the 1970's), making this coral reef ecosystem a sensible choice for establishment of an OA sentinel site in GOM offshore waters. It also compliments NOAA's current OA plans for the region. The historic physical, chemical, and biological measurements at this location will aid in determining an optimal location for a sentinel site in Flower Garden Banks National Marine Sanctuary (FGBNMS) and will contribute background for future observed changes in this ecosystem.

Objectives: The primary objective of this project is to establish a sentinel site at FGBNMS to assess variability in ocean acidification (OA)-related parameters through collection of an initial multi-year baseline of measurements. By definition, sentinel sites

are “areas in coastal and marine environments that have the operational capacity for intensive study and sustained observations to detect and understand physical and biological changes in the ecosystems they represent.” This study will aid BOEM’s role in understanding the multiple impacting factors to the FGB ecosystem, which the agency has been dedicated to protecting for a long period of time. Questions to be answered by the study include:

- What are the present temporal (diurnal to interannual) and spatial trends in ocean acidification-related parameters, as measured through saturation state dynamics, in FGB reef waters?
- What are the primary driving controls of observed variability in the carbonate chemical dynamics?
- Have significant changes occurred in these dynamics since the inception of the FGB Long-Term Monitoring Program?

Methods: The first four years of the study will be used for field work, including establishing mooring location, instrumenting and deploying the mooring, and data collection, and the fifth year will be dedicated to data analysis and report writing. Historical physical and biological datasets from the banks will be used to determine the best choice of sites for the OA mooring. The minimum core measurements at OA monitoring sites include pCO₂, pH, O₂, chlorophyll, turbidity, temperature, and salinity. All of these measurements will be monitored from the mooring at two or more depths, including near-bottom. Consideration will be given to whether redundant measurements (such as of temperature and salinity) are required, if these parameters are being measured nearby, depending on for example equipment expense and the importance of ensuring these measurements are accurately collected. The autonomous observations will be validated and supplemented on a bimonthly basis through a discrete sampling campaign conducted aboard the FGBNMS vessel, the R/V Manta, or other available vessels. The time series of data will be analyzed to establish diel and monthly variability in OA parameters at the banks, in connection with other time series data collected in the region, such as physical measurements from the Texas Automated Buoy System (TABS). As well, an approach for modeling aragonite saturation values at this site as a function of more commonly collected hydrographic and chemical data will be explored, and potentially applied to reconstructing historical carbon chemistry conditions in this region. Coordination will continue to be explored with various partners to establish this sentinel site as a long-term monitoring location and a node of the proposed Coral Reef Ocean Acidification Network in the Gulf of Mexico.

Current Status: Bottom-mounted and surface instrumentation packages have been designed. The bottom package was deployed during May – July 2017 at East Flower Garden Banks for testing, with the surface buoy next in line for deployment. Ongoing coordination is occurring with project partners. The project PI presented at the BOEM Information Transfer Meeting (ITM) in August, 2018 in New Orleans.

Final Report Due: September 30, 2019

Publications Completed: -

Affiliated WWW Sites:

<https://marinecadastre.gov/epis/#/search/study/27205>

<https://www.boem.gov/Applied-Physical-Sciences-Presentations-Slowey/>

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