Environmental Studies Program: Ongoing Study

Field	Study Information
Title	Long-Term Coral Reef Monitoring at Flower Garden Banks (FGB), Gulf of Mexico: 2023–2026 (GM-22-03)
Administered by	Gulf of Mexico Regional Office
BOEM Contact(s)	Alicia Caporaso (Alicia.Caporaso@boem.gov)
Procurement Type(s)	Interagency Agreement
Conducting Organization(s)	Flower Garden Banks National Marine Sanctuary (NOAA)
Total BOEM Cost	$800,000
Performance Period	FY 2022–2027
Final Report Due	Reports submitted annually
Date Revised	October 25, 2023
Problem	BOEM requires annual community characterization and condition baseline information on the hermatypic coral communities and associated community assemblages at Flower Garden Banks National Marine Sanctuary for the purpose of monitoring the health of these communities and enabling detection of short and long-term responses to environmental and anthropogenic disturbances. These data inform BOEM NEPA analyses of potentially affected environment, impact mitigation development, and various consultations.
Intervention	Observations will be made to continue evaluating coral reef diversity, long term changes in individual coral colonies, fish assemblages, water quality parameters, and general coral reef community health during years 2023–2026.
Comparison	BOEM and NOAA will collaborate to analyze observations within the context of short-term environmental disturbances and anthropogenic factors (e.g., BOEM-permitted activities). This level of monitoring enables informed decision making amid threats such as climate change, invasive species, water quality degradation, and natural disturbances such as storms (Johnston et al., 2021).
Outcome	The objectives for this continued long-term monitoring effort are to collect data that will enable BOEM and NOAA to assess the long-term health of the coral reefs and, in the event of disturbance, detect any response, evaluate contributing factors, and assess impacts and significance.
Context	The hermatypic coral reefs of East and West Flower Garden Banks are well documented to be among the healthiest in the western Atlantic and Caribbean region. Such reefs are marine biodiversity hot spots, providing habitat for a variety of fish and invertebrate species, including threatened and endangered species and species of commercial and recreational importance.

BOEM Information Need(s): The need for ongoing monitoring at Flower Garden Banks National Marine Sanctuary (FGB) is critical to ensure adequate baseline information continues to be available. Such a baseline enables federal resource managers to discern among natural and anthropogenic drivers of variation within the ecosystem of the northern Gulf of Mexico, especially among the topographic

features of the Outer Continental Shelf (OCS) edge. This information is used by BOEM and NOAA to conduct environmental assessments for NEPA analyses and design management policies that minimize any negative impacts to hermatypic coral reefs from permitted energy activities.

The continued high coral cover documented at East and West FGBs makes these banks unique among the northern Gulf of Mexico's coral reefs and justifies the need for continued monitoring and protection. Sustained monitoring allows researchers to document changes in reef community condition, link changes to oceanographic events, and compare to historical baselines. This level of monitoring enables resource managers to make informed decisions regarding management and research amid threats such as climate change, water quality degradation, and natural disturbances such as storms (Johnston et al., 2021).

Background: Thanks in part to long-term DOI monitoring funding, the hermatypic coral reefs of East and West FGB have been documented as among some of the healthiest in the western Atlantic and Caribbean region. Evaluation of coral reef health includes several measurable parameters including coral growth, mortality, and condition, bleaching, and pressure from predation and competition (AGRRA 2021). Many comparable coral reefs throughout the region have experienced significant declines in coral cover in recent decades, East and West FGB have suffered minimally from hurricanes, recovered from coral bleaching events, and shown no signs of disease, with the exception of a localized mortality event at EFGB in 2016 (Johnston et al., 2021). The health of coral reefs may be threatened by a variety of potential sources including direct and indirect impacts from anthropogenic activities. Due to concern about potential impacts resulting from offshore oil and gas development, DOI (through the Minerals Management Service – now BOEM) started systematic monitoring at East and West FGB in 1988 to assess the health of the coral reefs and to establish baseline data to better detect any impacts from nearby OCS exploration and production activities. For example, long-term monitoring data collected before, during, and after the 2016 coral bleaching event allowed the sanctuary to examine levels of and variability in bleaching at monitoring stations and subsequent recovery (Johnston et al., 2019). Overall, some of the most important trends documented in the program's 30 years of monitoring include stable coral cover at EFGB and significantly increasing coral cover at WFGB, significantly increasing macroalgae cover at both banks, and significantly increasing seawater temperatures at reef depth.

Objectives: The primary objective of this study is to assess the health of the hermatypic coral reefs, evaluate water quality parameters, potentially expand baseline understanding of the adjacent mesophotic zone (< 100 ft. depth), and provide an analysis of the status of the coral reefs in comparison with historical data, within the context of OCS oil and gas exploration, development, and production.

Methods: The monitoring protocols will be detailed in a joint BOEM-NOAA document and shall be generally consistent with the most recent agreement IA M19PG00001 for monitoring the coral reefs of East and West FGB, with additional updated methods for randomized reef-wide benthic surveys to meet current monitoring needs and to evolve the program. BOEM and NOAA shall review protocols annually to ensure methods achieve program objectives, incorporating changes as appropriate to adapt to dynamic and evolving conditions and information needs. The physical health of the coral reef community shall be monitored to detect any significant effects from natural and/or anthropogenic disturbances that could potentially endanger coral community integrity. Surveys of random sites and established repetitive stations at East and West FGB shall be performed over a four-year period. Annual data collection cruises (both diver and ROV) on each bank shall be conducted during summer or early fall each year of the study, and water quality shall be monitored quarterly. NOAA shall continue to publish an annual report in the Marine Sanctuaries Conservation Series, detailing observations, analyses,

and results following the completion of each field season. As appropriate, historic long-term monitoring data may be reanalyzed to develop statistically comparable long-term data series that try to address any detectable trends related to impacts and changes over time. Collected data shall be submitted to and archived by the National Centers for Environmental Information (NCEI).

Specific Research Question(s):

1. What is the current baseline condition of hermatypic corals, their habitat, and associated benthic reef community?
2. How are benthic percent cover, fish community dynamics, water quality parameters, and coral community demographics changing over time?
3. How have acute events impacted the reefs?
4. What might current ecological trends tell BOEM and NOAA about potential short- and long-term impacts of OCS oil and gas activities and cumulative natural and anthropogenic impacts?

Current Status: Ongoing

Publications Completed: N/A

Affiliated WWW Sites: Previous FGB Long-term monitoring reports are located at the below websites.
https://flowergarden.noaa.gov/science/sciencereports.html
https://sanctuaries.noaa.gov/science/conservation/conservation_reports.html

References:

[AGRRA] Atlantic and Gulf Rapid Reef Assessment. 2021. Coral indicators to assess reef health; [accessed 2021 April 2]. https://www.agrra.org/coral-reef-monitoring/coral-indicator/

Johnston MA, Hickerson EL, Nuttall MF, Blakeway RD, Sterne TK, Eckert RJ, Schmahl GP. 2019. Coral bleaching and recovery from 2016 to 2017 at East and West Flower Garden Banks, Gulf of Mexico. Coral Reefs. 38:787–799. https://doi.org/10.1007/s00338-019-01788-7

Johnston, MA, O'Connell K, Blakeway RD, Hannum R, Nuttall MF, Hickerson EL, Schmahl GP. 2021. Long-term monitoring at East and West Flower Garden Banks: 2019 annual report. Galveston (TX): U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Flower Garden Banks National Marine Sanctuary. 88 p. Report No.: National Marine Sanctuaries Conservation Series ONMS-21- 02.