



Long-Term Monitoring at East and West Flower Garden Banks National Marine Sanctuary, 1989-2016



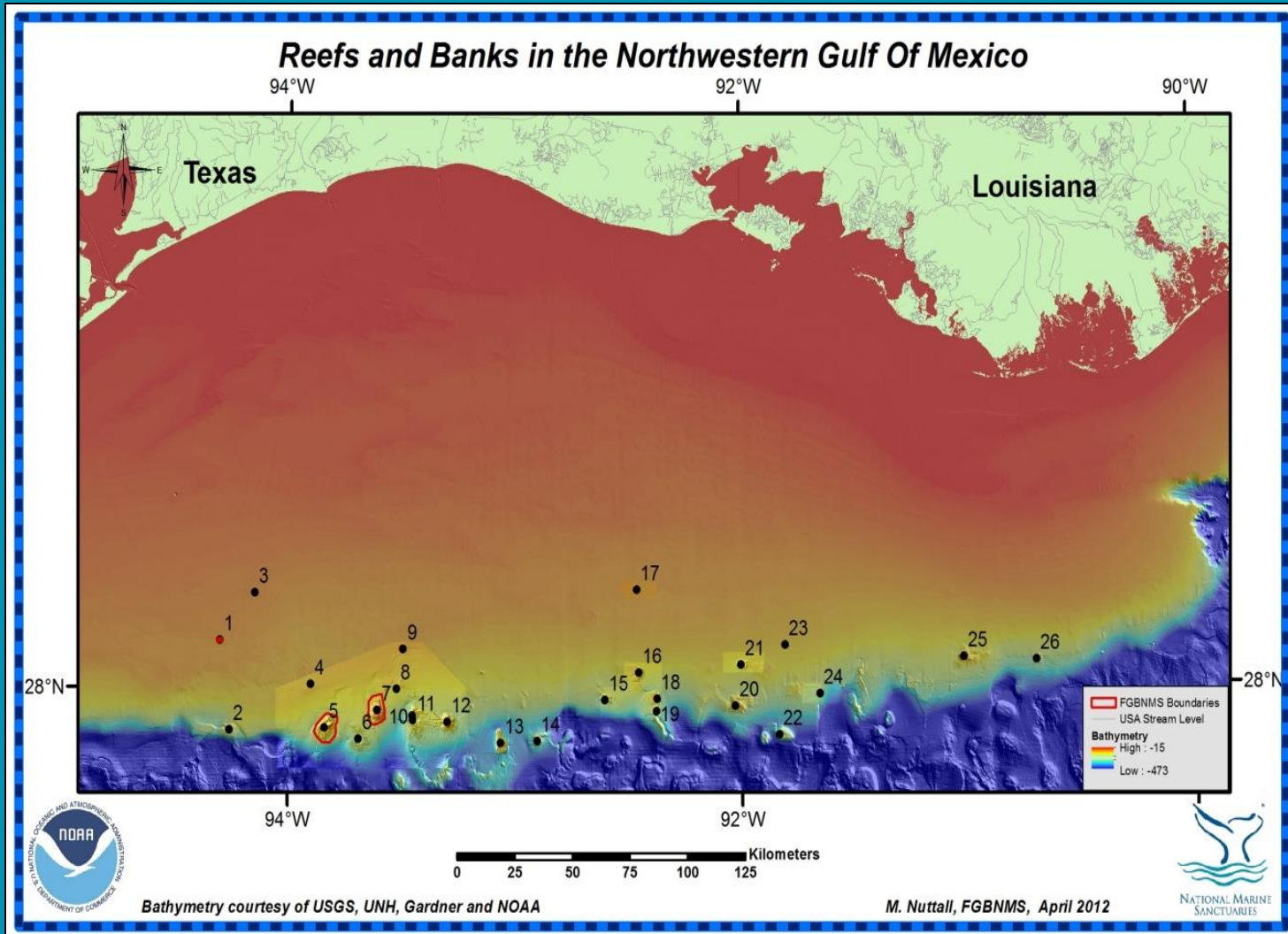
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National Marine Sanctuaries

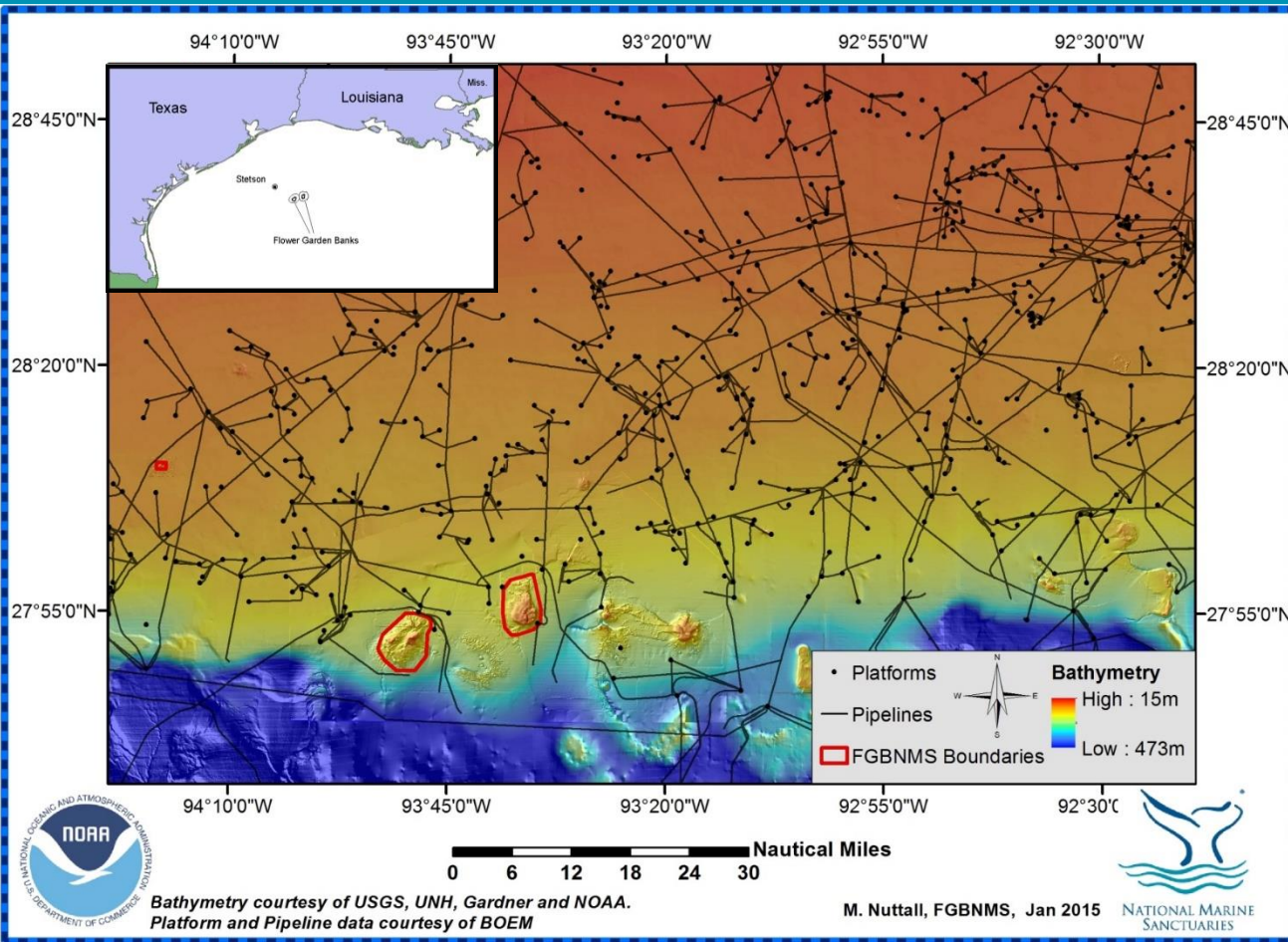


Flower Garden Banks NMS



Monitoring at the Flower Garden Banks NMS

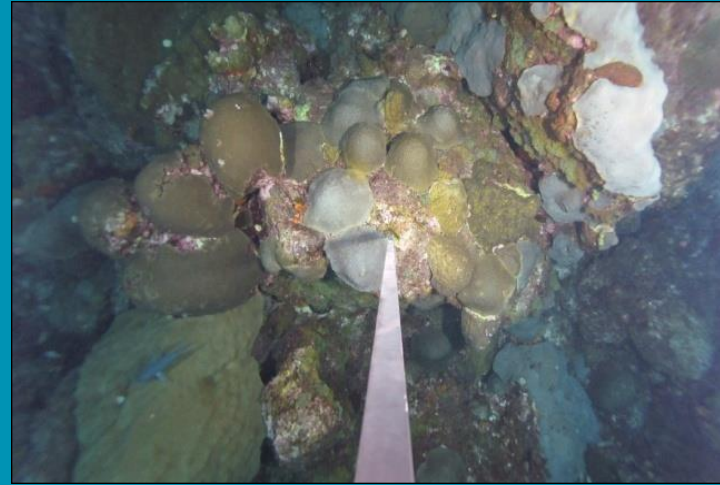
- Monitoring since 1975
- BOEM instituted long-term monitoring program beginning in 1989
- Designated as a marine sanctuary in 1992
 - Joint monitoring effort began in 1995
 - 27 year dataset



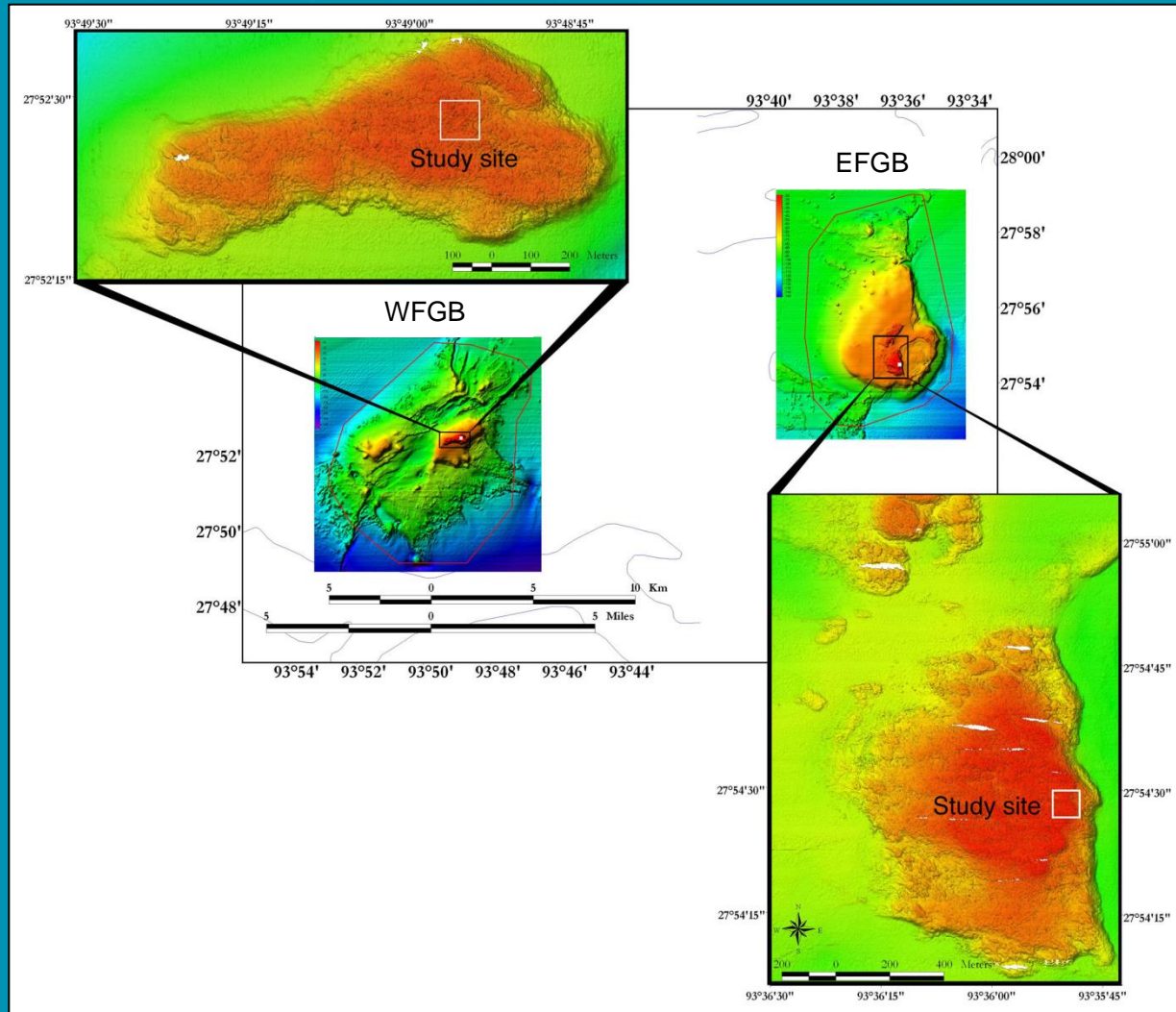
Major Reefs Living Coral Cover

Location	Percent Coral Cover	Source
Flower Garden Banks	50-60	Johnston et al. 2017
Bonaire	10-38	Steneck et al. 2011
Bermuda	35	Jackson et al. 2014
Puerto Rico	7-36	Waddell and Clark 2008
Navassa Island	10-25	Waddell and Clark 2008
Florida Keys NMS	3-20	ONMS 2011
Jardin de la Reina, Cuba	7-19	Pina Amargós et al. 2008
Pedro Bank, Jamaica	5-19	Bruckner 2013
Cay Sal Bank, Bahamas	7-9	Bruckner 2011

Long-Term Monitoring Objectives



Flower Garden Banks Study Sites

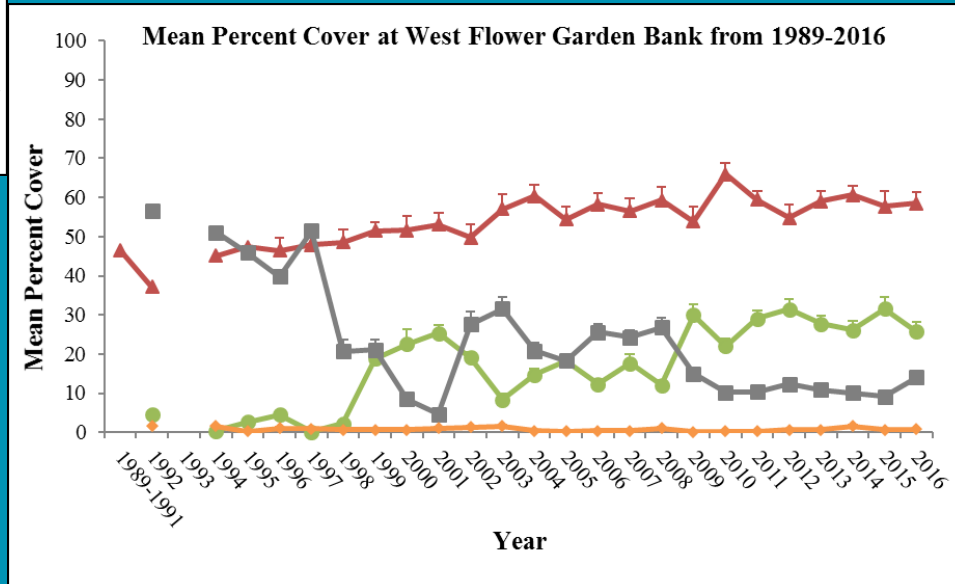
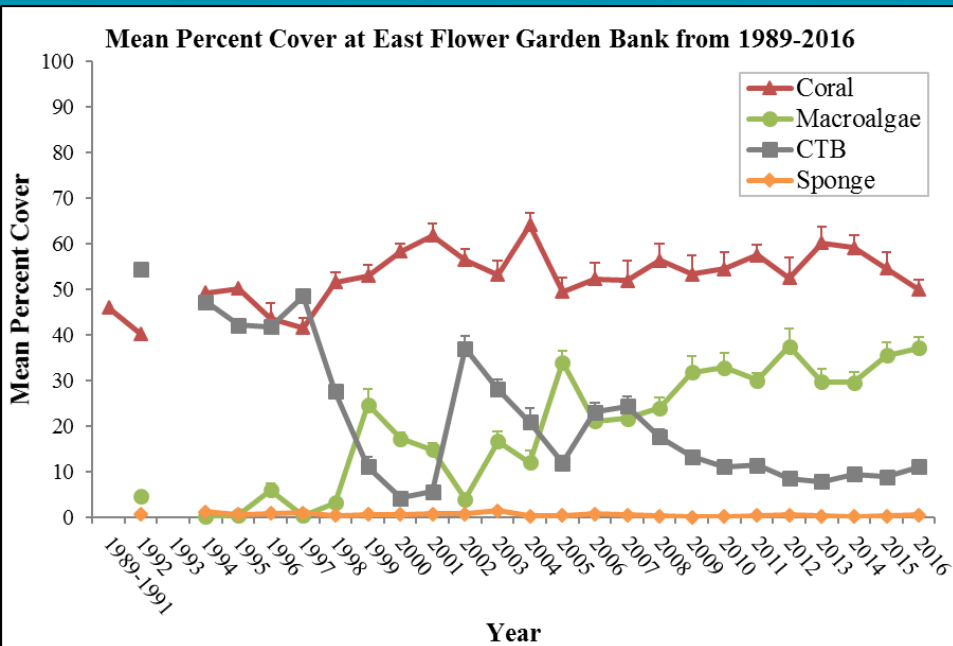


Long-Term Monitoring Methods

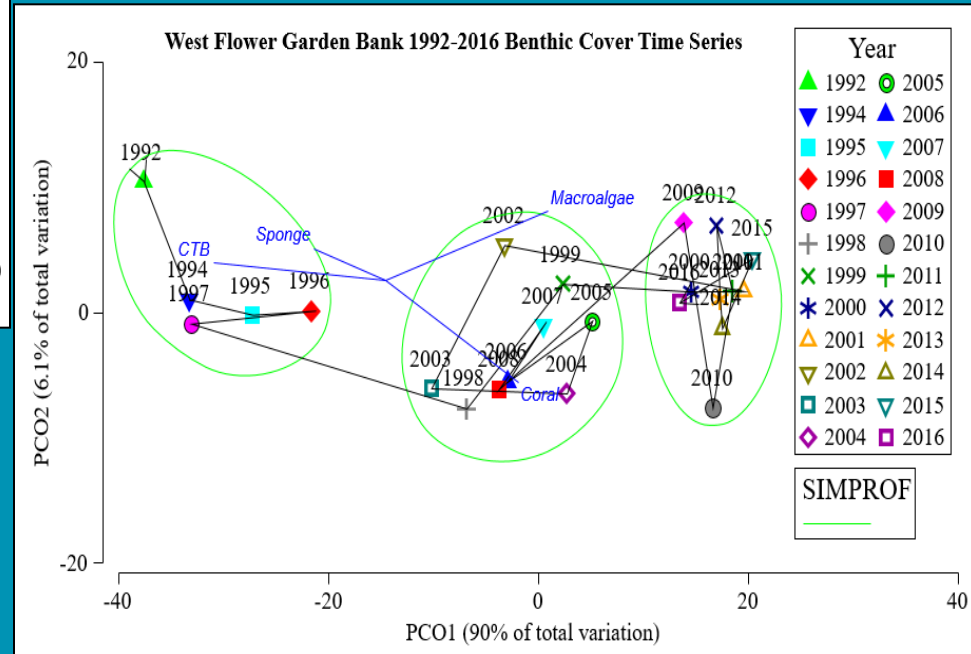
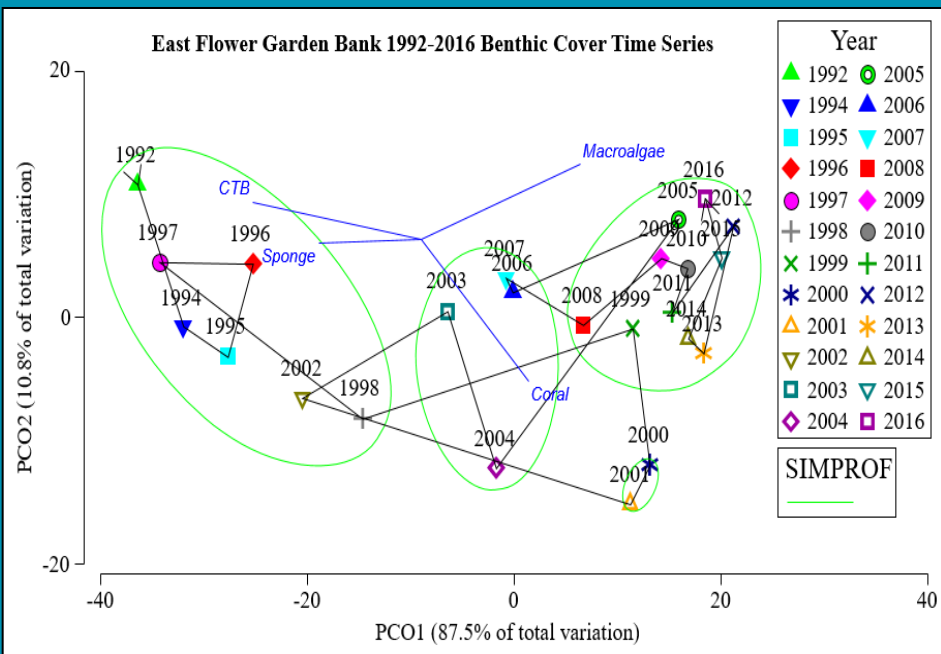
- Random Photographic Benthic Transects
- Coral Demographic Surveys
- Repetitive Quadrat Photostations
- Lateral Growth Photostations (*P. strigosa*)
- Perimeter Video
- Fish Surveys (Bohnsack-Bannerot 1986)
- Lobster and Sea Urchin Surveys (100m)
- Water Quality (temperature, salinity, nutrients, etc.)



Random Transect Data



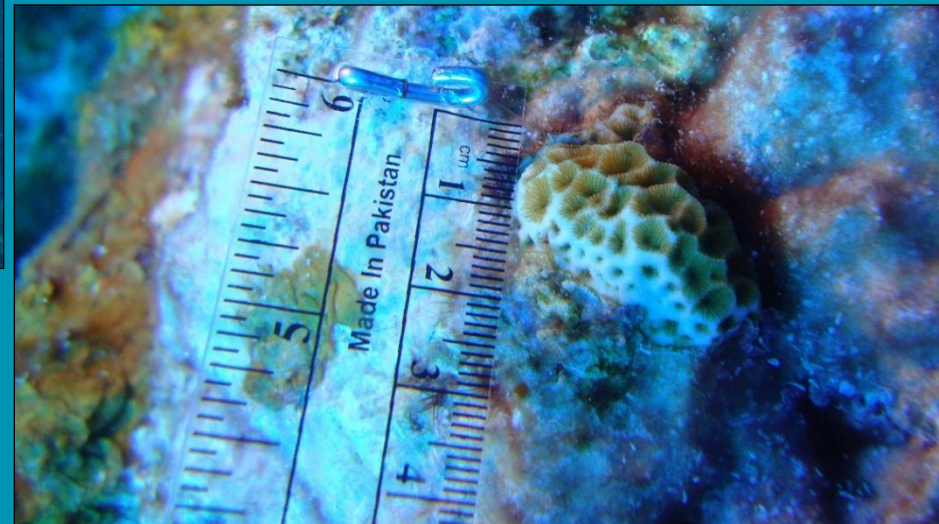
Random Transect Data



Coral Demographic Surveys

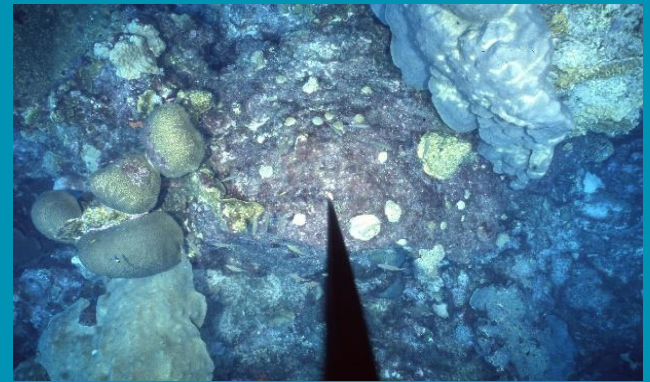


- Dominant coral species:
 - *Orbicella franksi*
 - *Pseudodiploria strigosa*



Repetitive Photostations

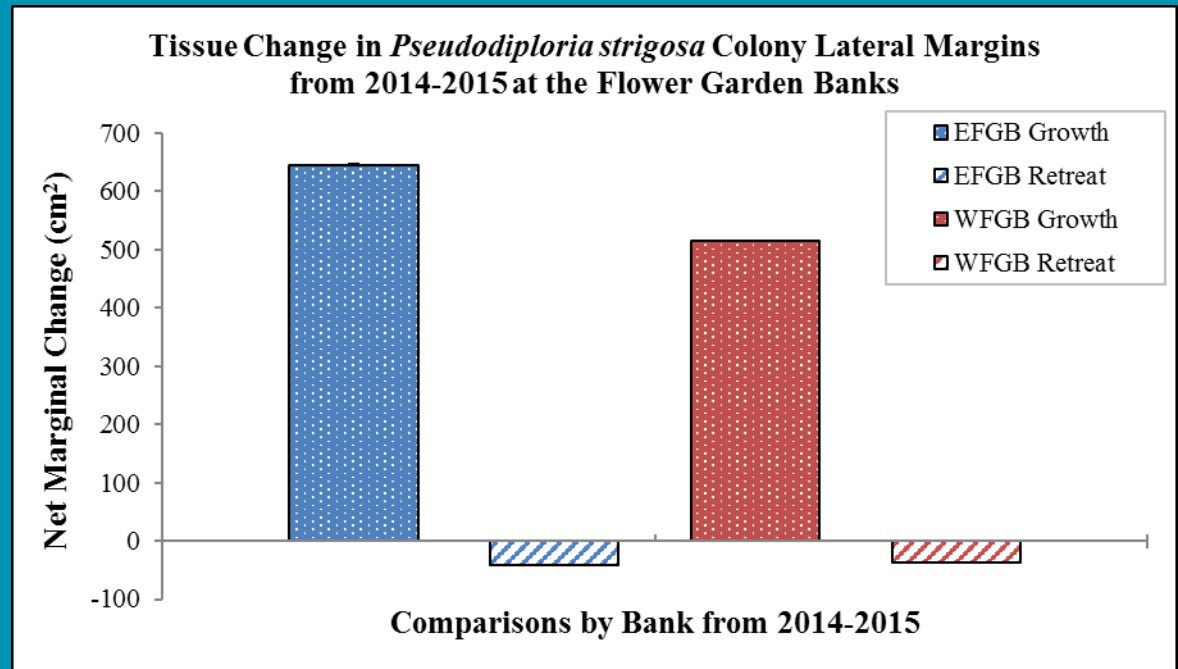
1989



2016



Lateral Growth Stations



Perimeter Video



Perimeter Video



Cable



Cable

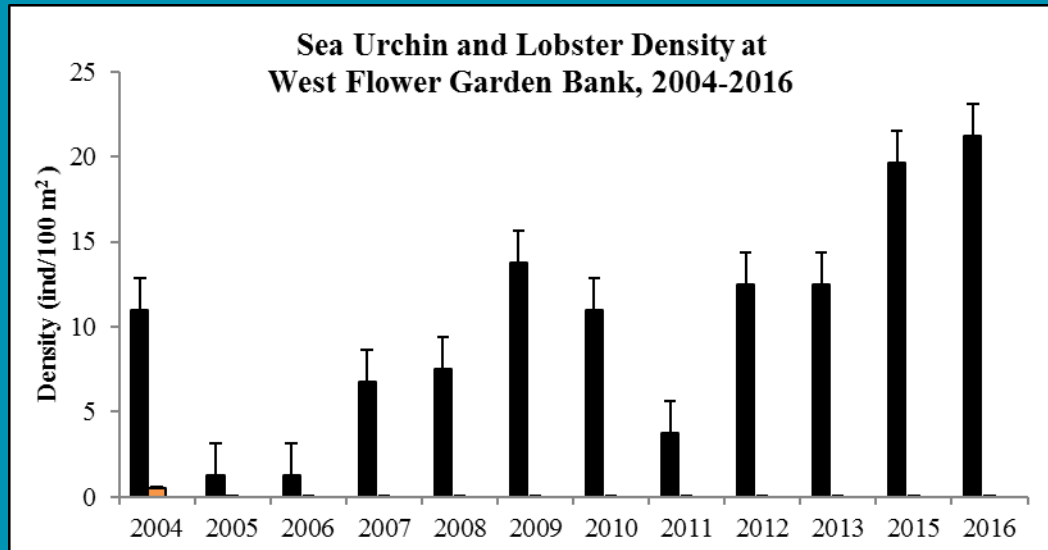
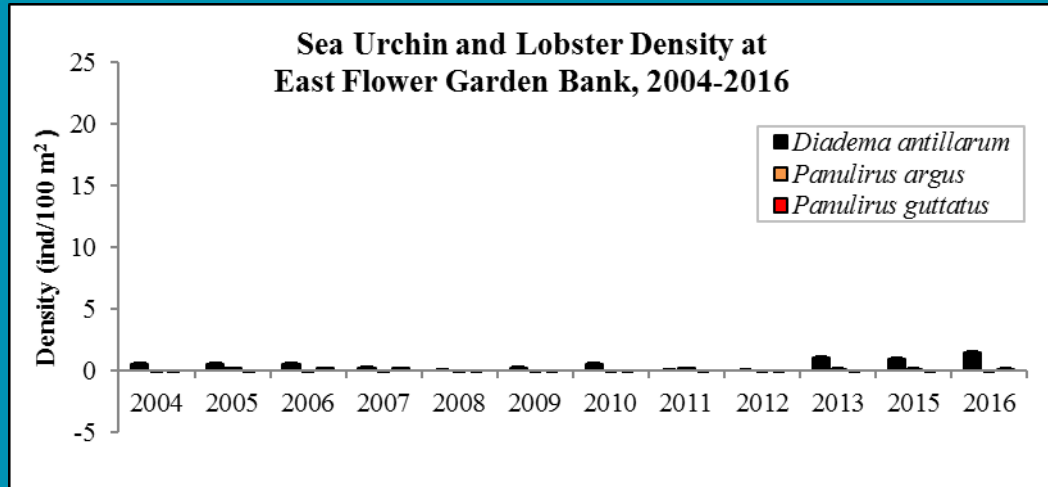
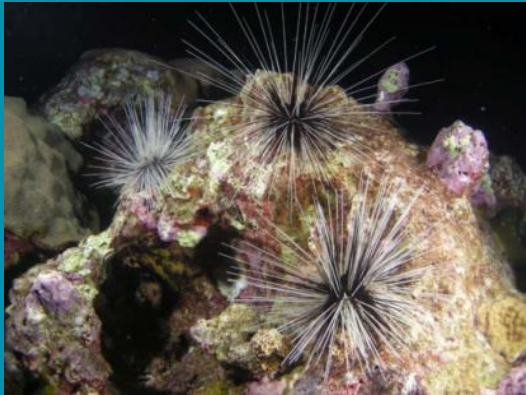
Scar



Recovered
Coral

Cable

Urchin and Lobster Transects

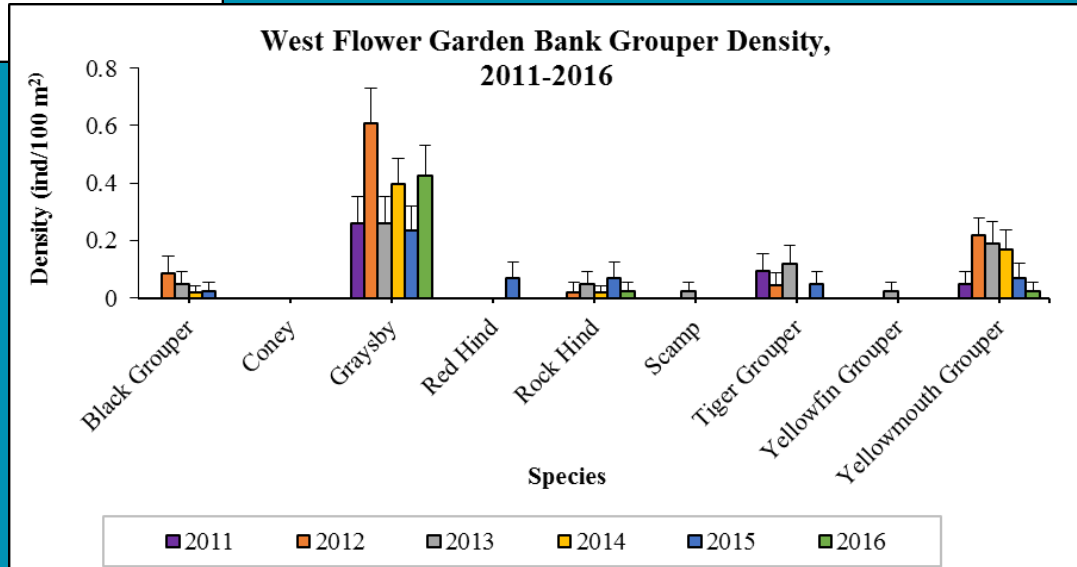
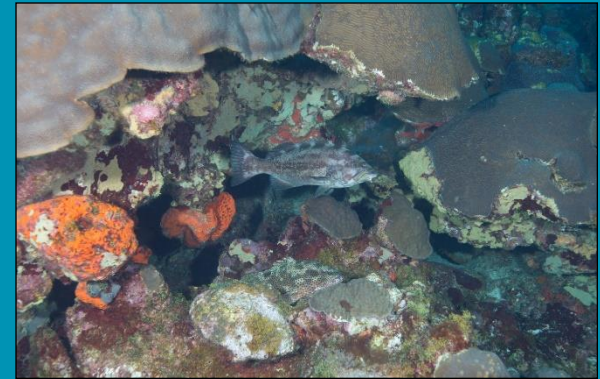
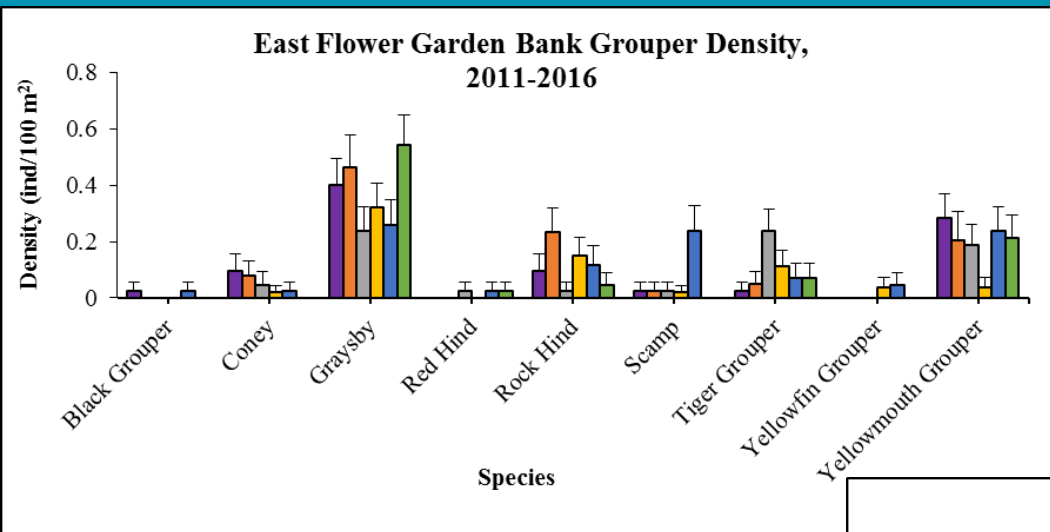




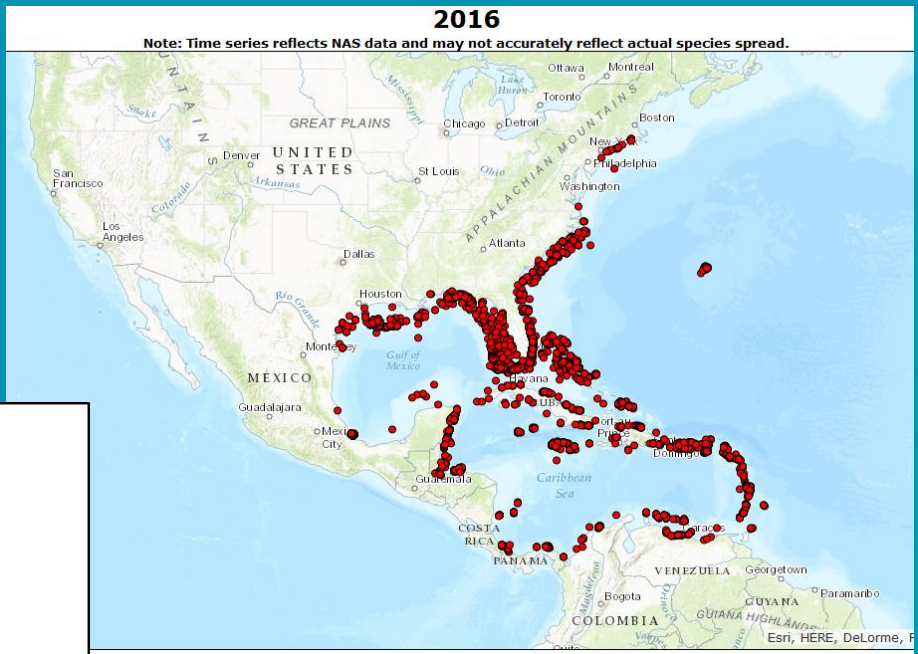
Fish Survey Data



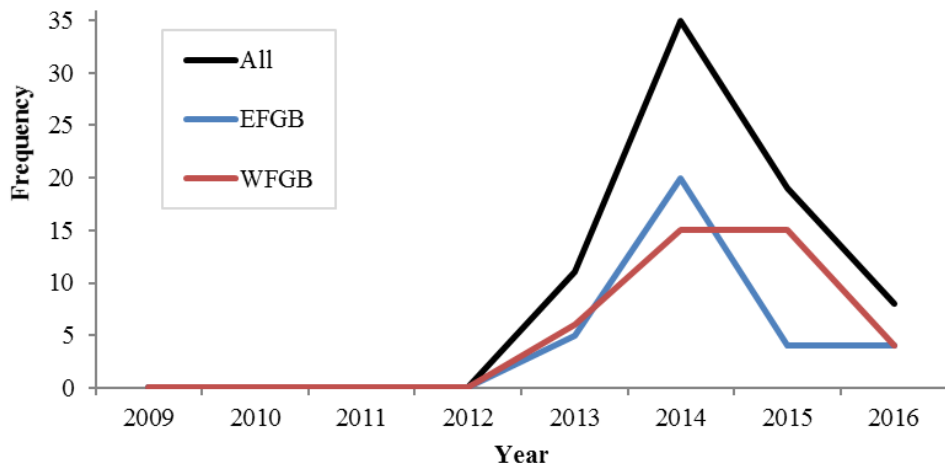
Fish Survey Data



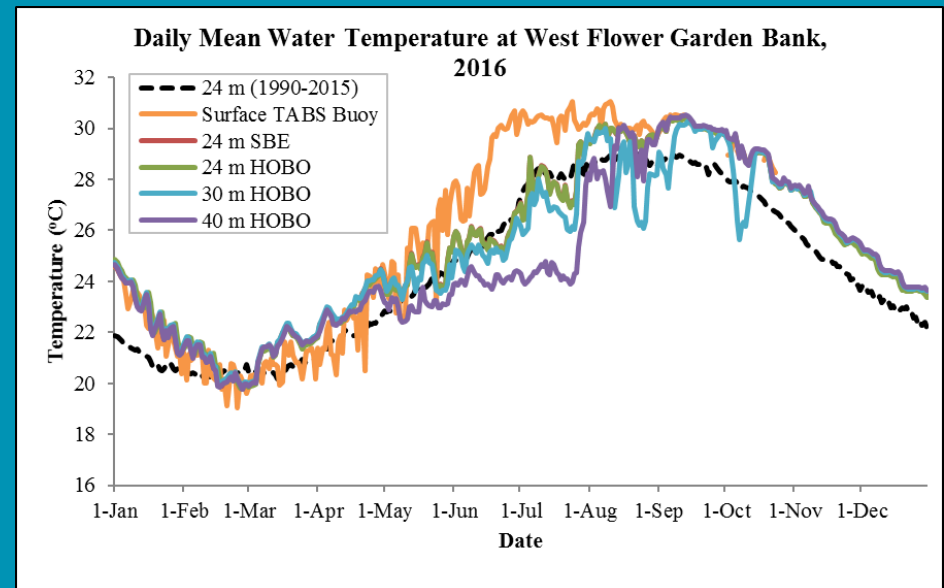
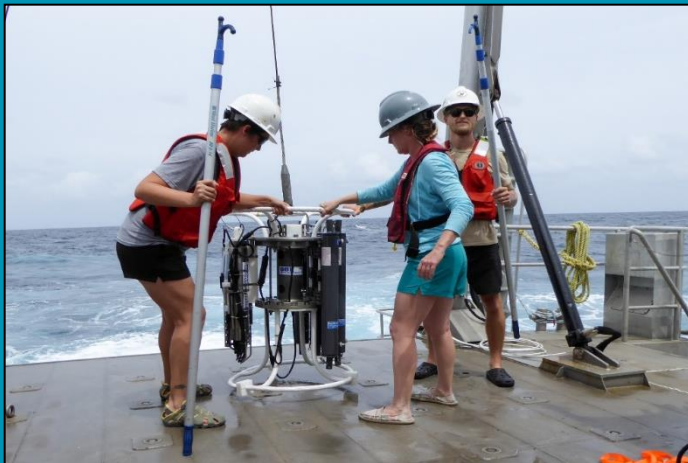
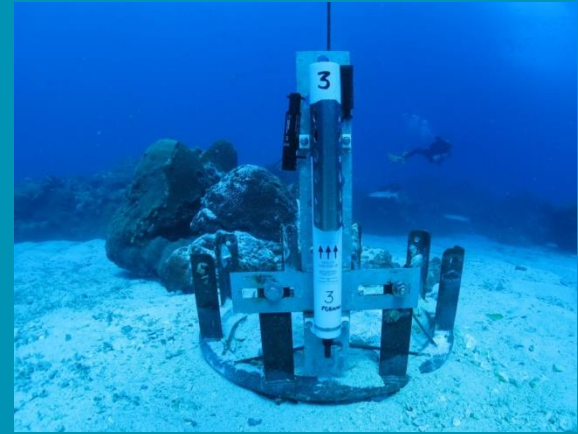
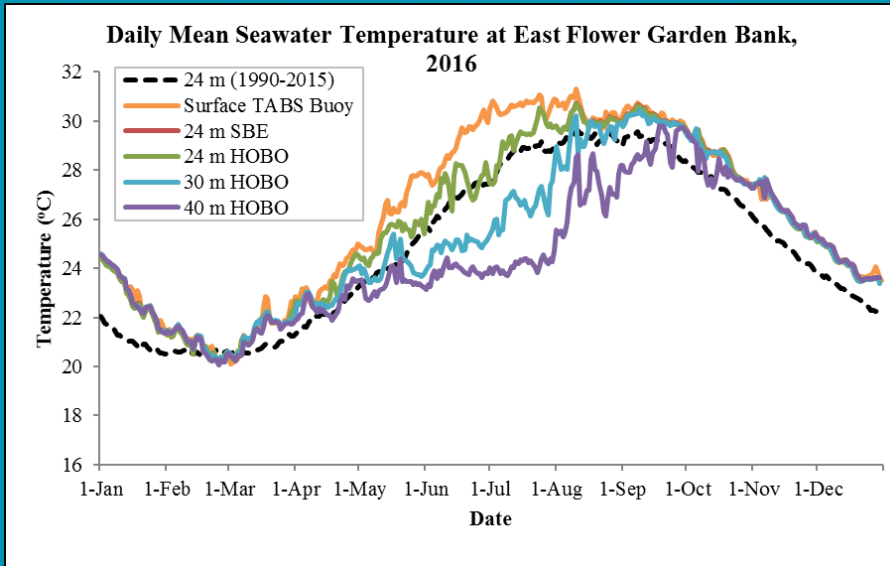
Fish Survey Data



Lionfish Abundance

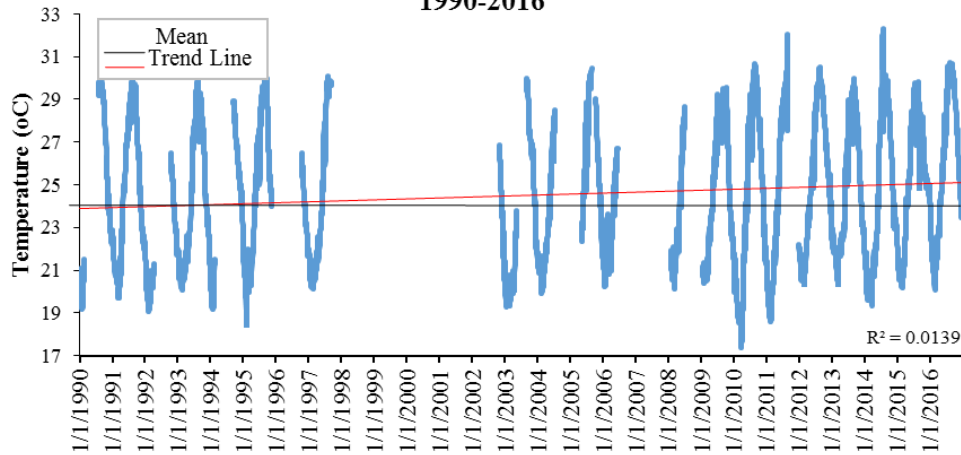


Water Quality Analysis

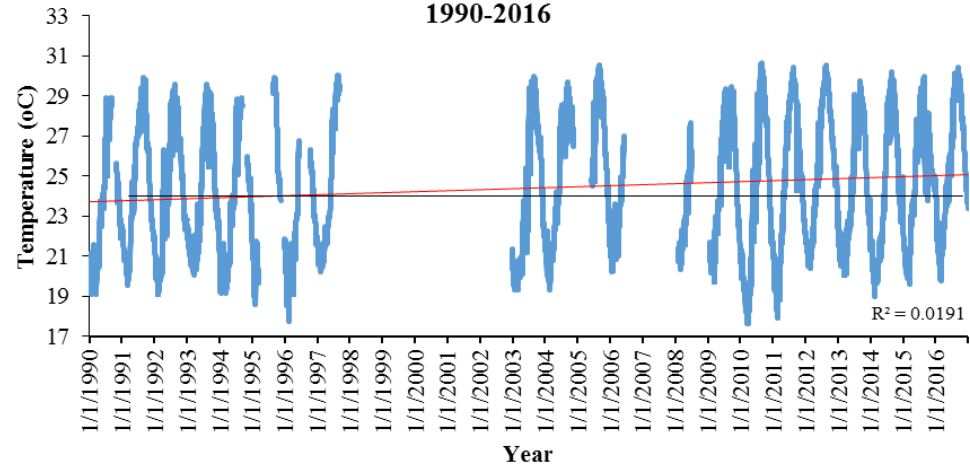


Water Quality Analysis

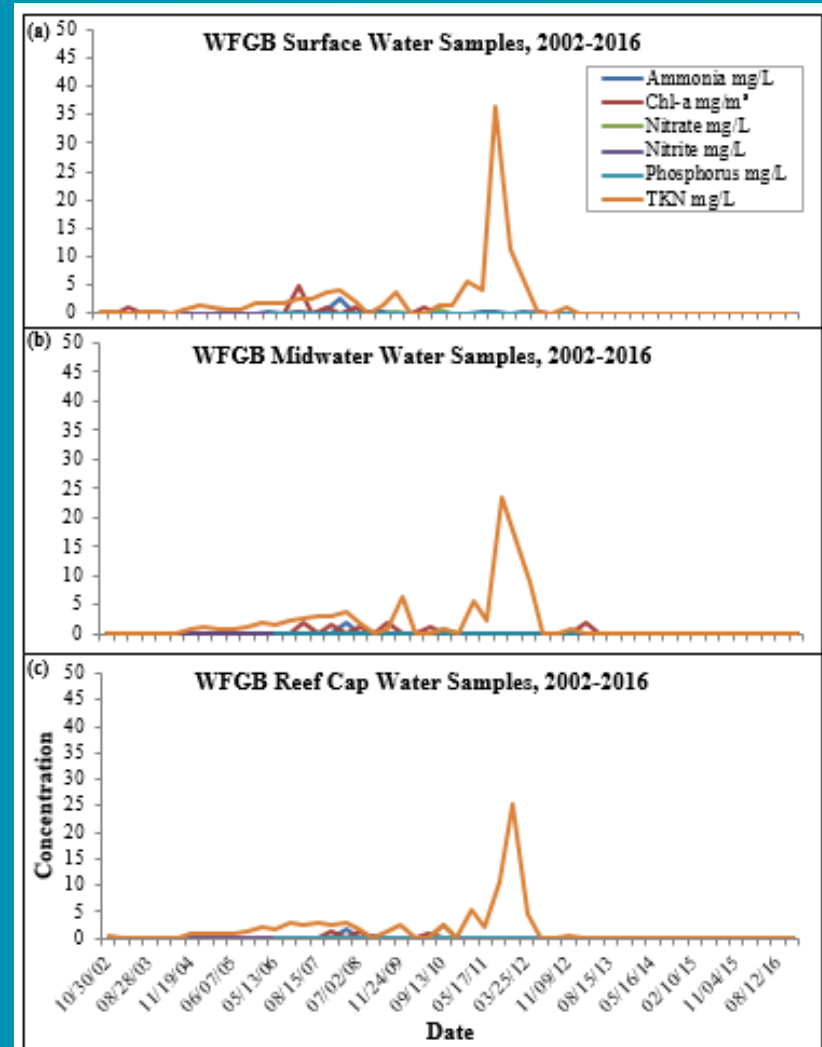
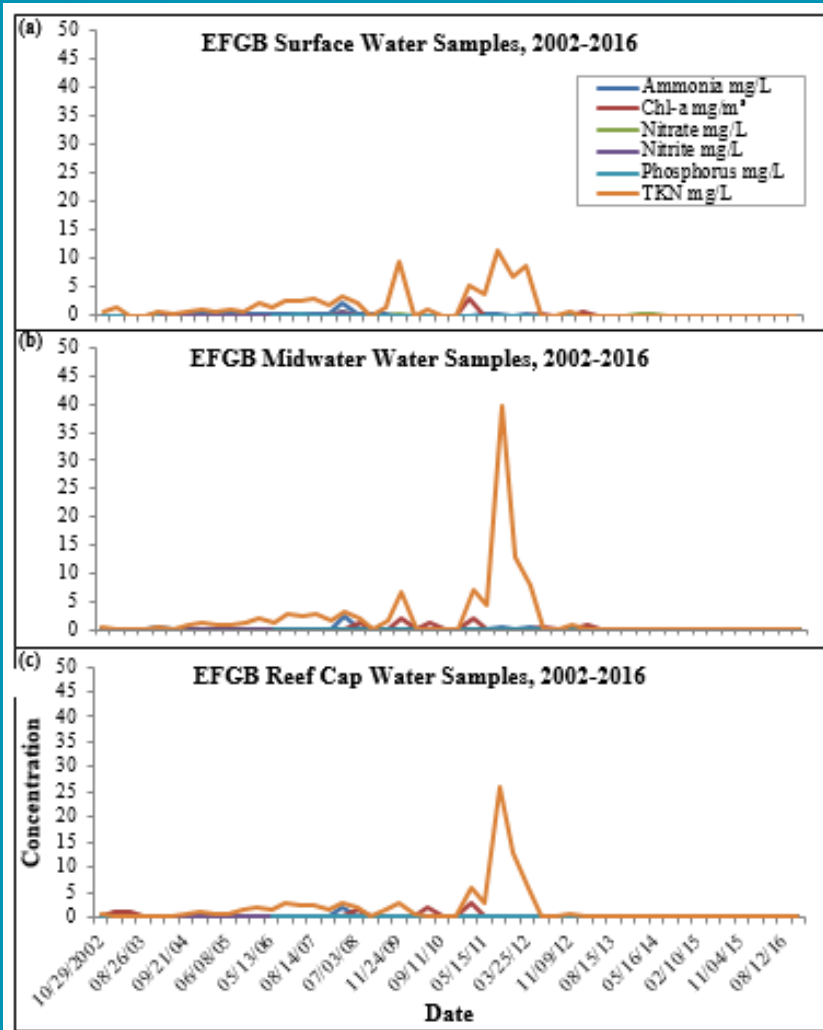
Daily Mean Seawater Temperature at East Flower Garden Bank, 1990-2016



Daily Mean Seawater Temperature at West Flower Garden Bank, 1990-2016



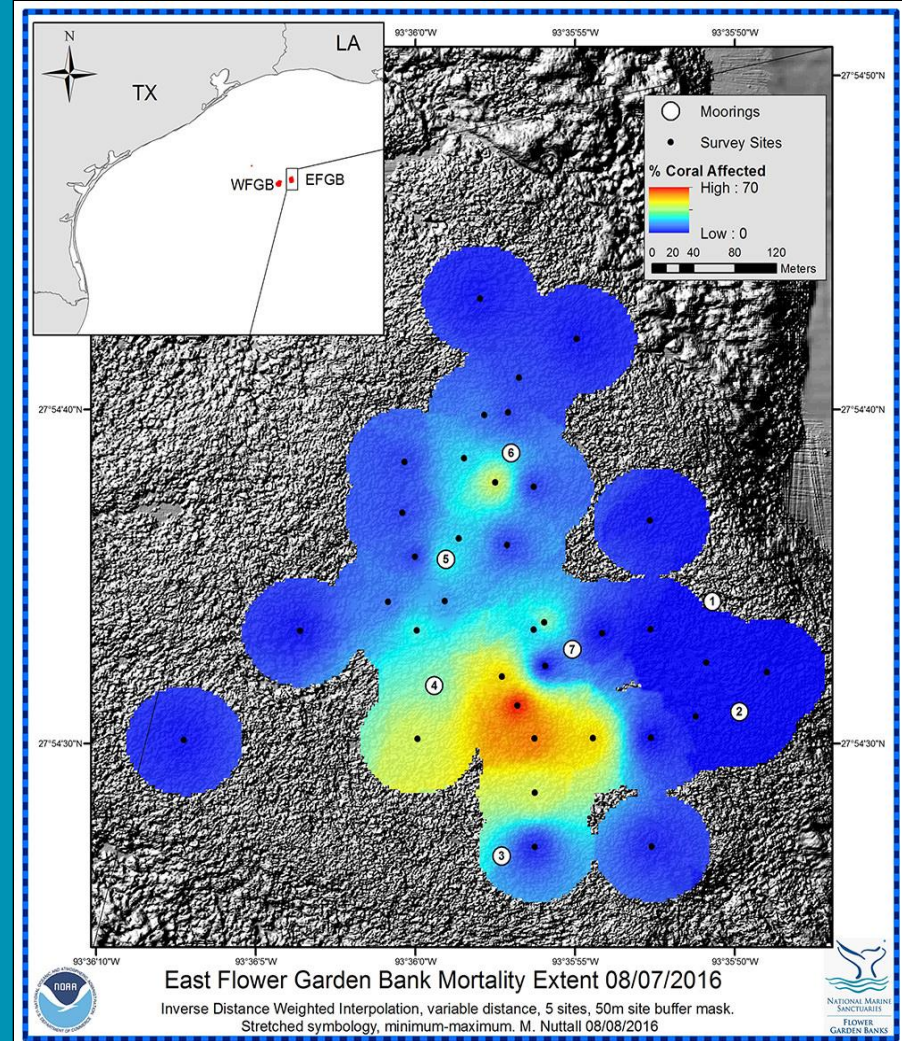
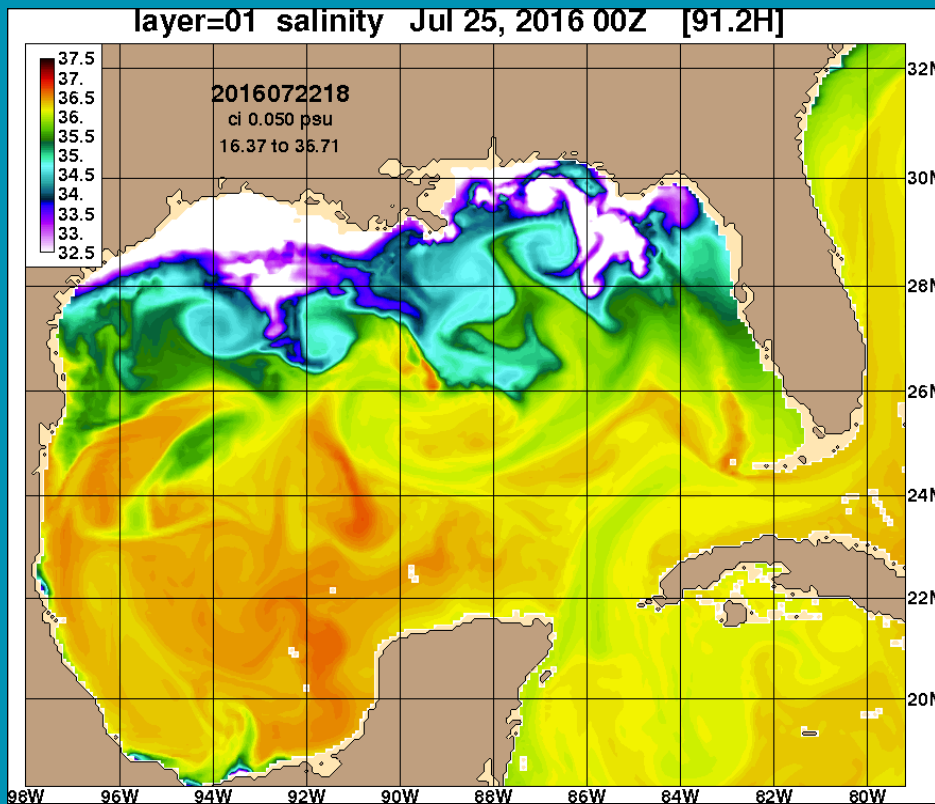
Water Quality Analysis



2016 EFGB Mortality Event



2016 EFGB Mortality Event

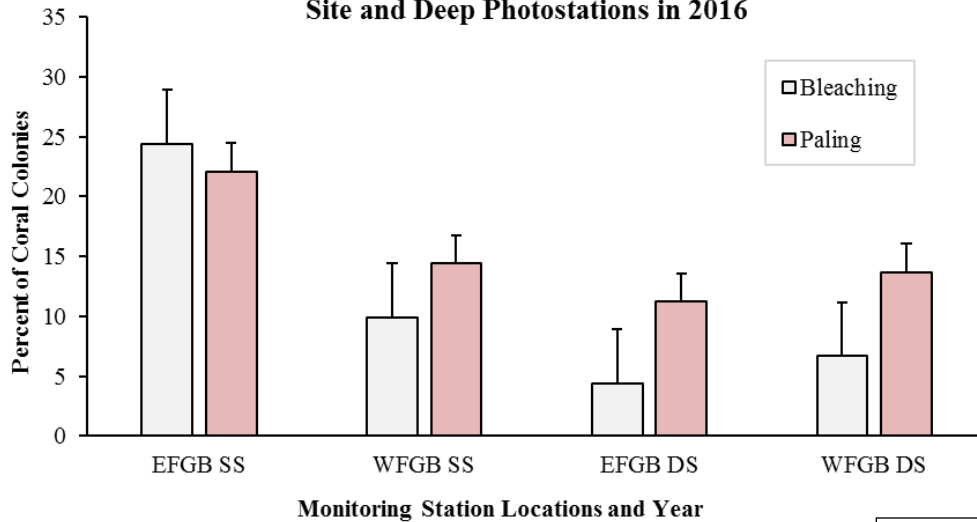


2016 Bleaching Event

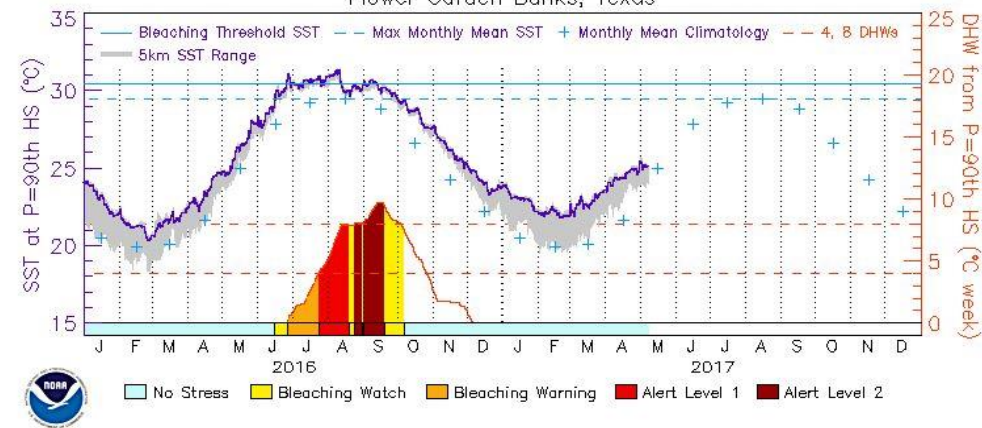


2016 Bleaching Event

Coral Colonies Impacted by Bleaching Stress at Repetitive Study Site and Deep Photostations in 2016

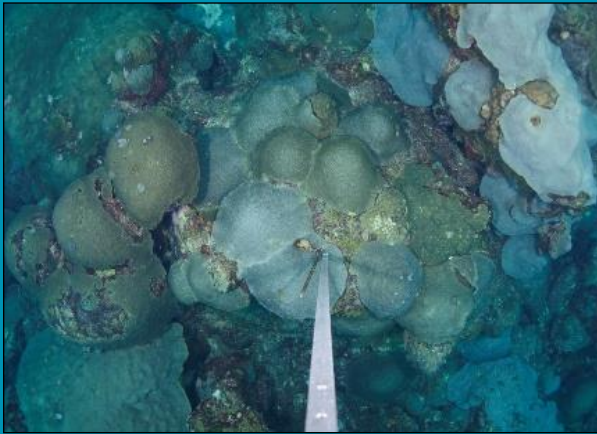


Flower Garden Banks, Texas



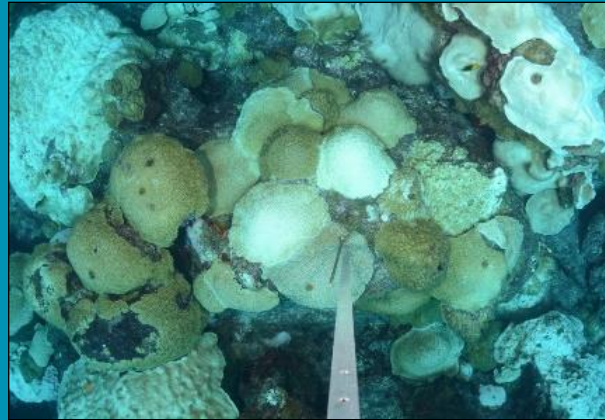
2016 Bleaching Event

July 2016

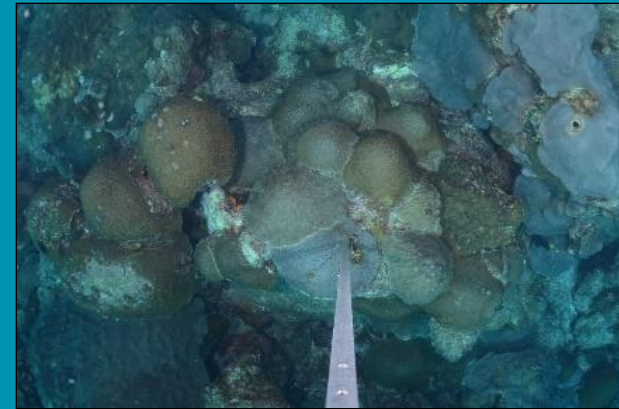


EFGB Photostation #102

October 2016



January 2017



Program Updates



- Extend fish and random transect surveys outside the study sites (stratified random sampling design across the reef cap)
- Compare random transect survey results to results produced by line-point intercept methodology (scheduled October 2017)
- Discontinued use of sclerochronology (coral cores) as a regular monitoring tool, and take coral core samples only for permitted special projects
- Discontinue lateral growth monitoring stations after 2017
- Install additional repetitive deep photostations at EFGB and WFGB (completed July 2017)

Program Summary

- FGBNMS represents a relatively stable coral reef environment
 - Consistent High Coral Cover ~50%
 - Consistent Fish Species and Family Abundance
- Lengthy Historical Dataset
- Continued monitoring is needed to identify environmental conditions that may threaten the health of the reef



Thanks to...



FGBNMS Research Team

BOEM

Project Divers

R/V Manta Crew



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