Anna Maria Island Mitigative Artificial Reefs – An Evaluation of Reef Material and Age

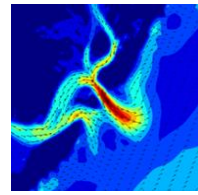
Lauren Floyd and Katy Brown, CB&I

Overview

- Types of Artificial Reefs
- Anna Maria Island Beach Nourishment Projects and Mitigation
- Current Conditions of 1993, 2005 and 2011 Artificial Reefs
- Conclusion

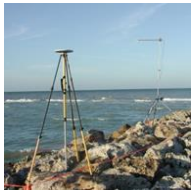




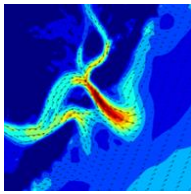



"An artificial reef may be described as one or more objects of natural or human origin deployed purposefully on the seafloor to influence physical, biological or socioeconomic processes related to living marine organisms."

Seaman and Jensen (2000)





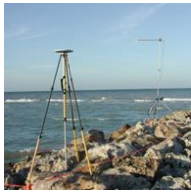
Types of Artificial Reefs

Reasons for artificial reefs

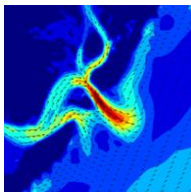
- Recreation (diving, fishing)
- Habitat enhancement (coral, oyster, fish)
- Coastal protection (breakwaters)
- Artistic expression
- Mitigation

Types of artificial reefs

- Materials of opportunity
- Engineered/designed

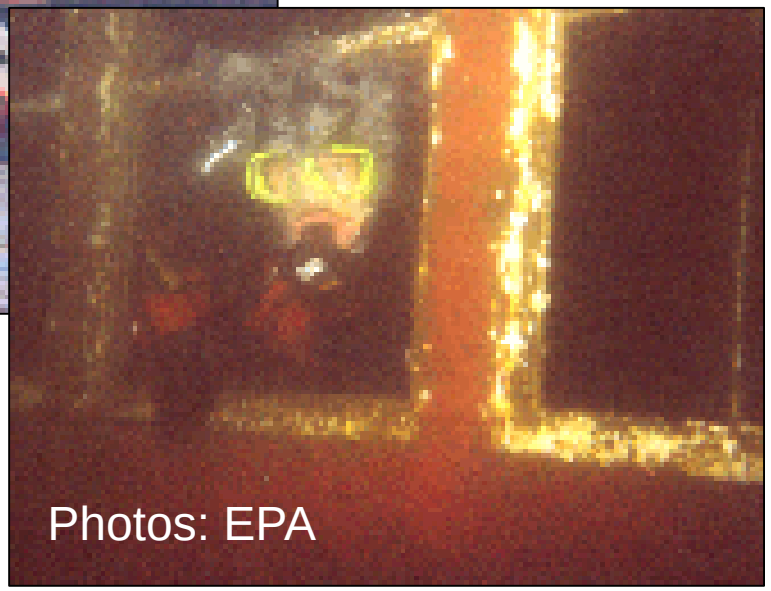




Types of Artificial Reefs

Osborne Tire Reef
Broward County, FL

Types of Artificial Reefs



NYC Subway Cars
Ocean City, MD

Photos: EPA

Types of Artificial Reefs

USS Spiegel Grove
Key Largo, FL

Types of Artificial Reefs

"secondary use concrete"

Types of Artificial Reefs

Deerfield Beach - Rapa Nui Statues

Types of Artificial Reefs

Photo: Reef Ball Foundation

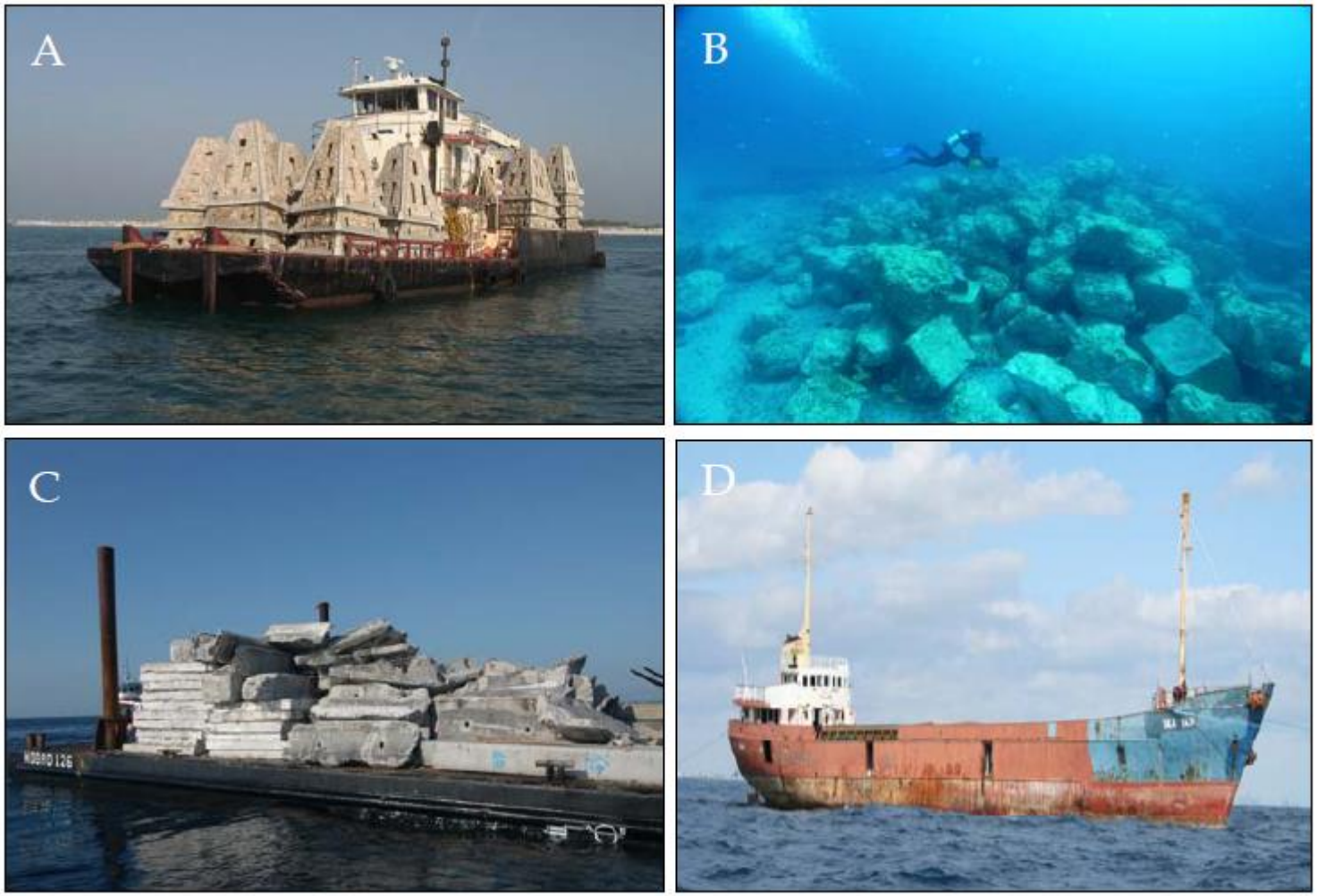
Biorock

Types of Artificial Reefs

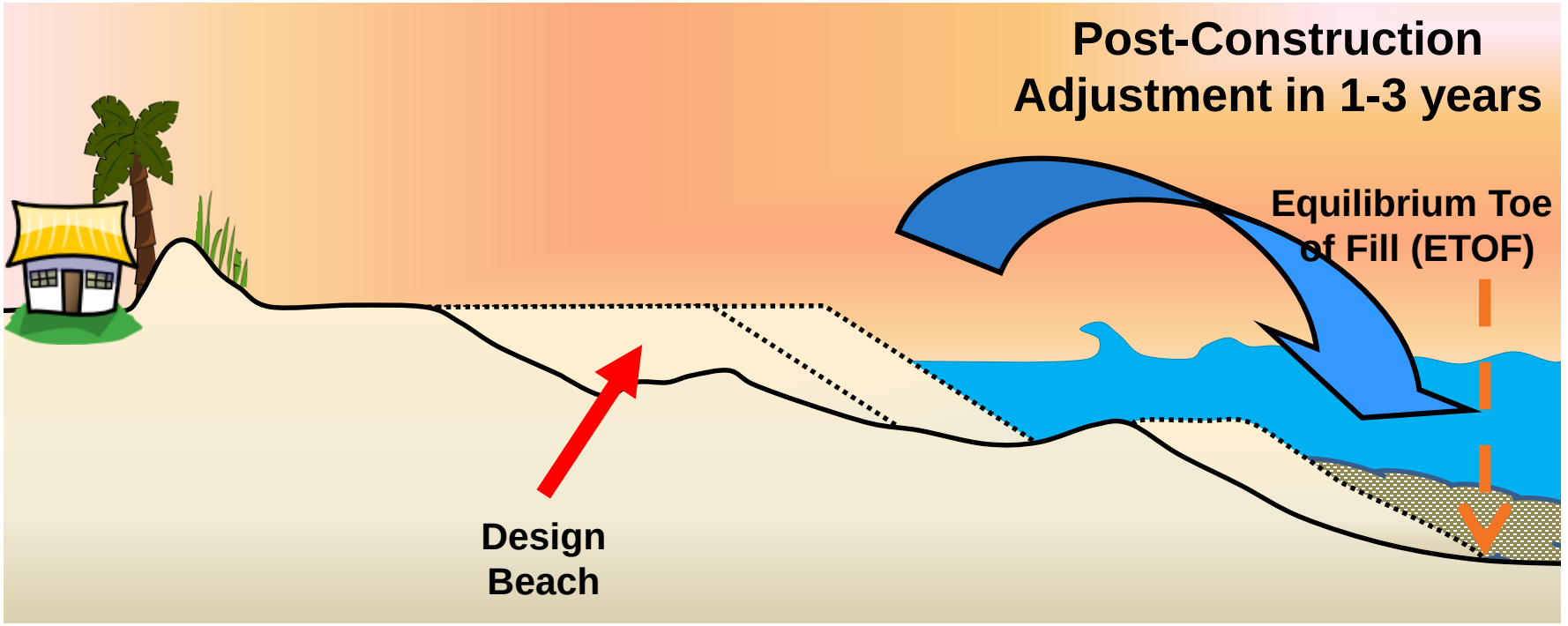
Photos : Miami Dade County DERM

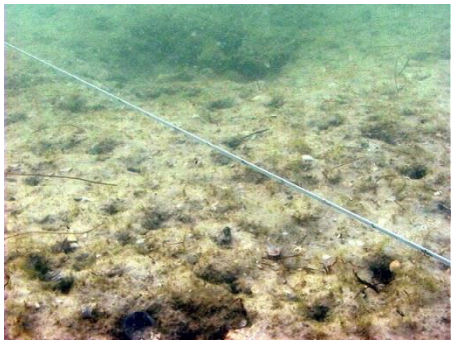
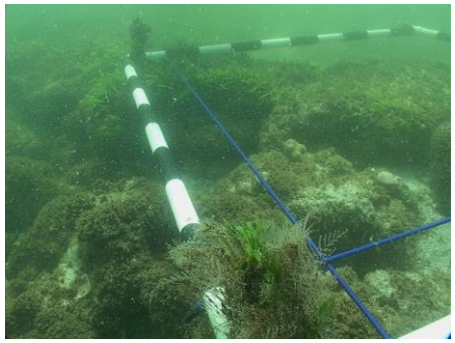
Types of Artificial Reefs

Guidelines and Management Practices for Artificial Reef Siting, Use, Construction, and Anchoring in Southeast Florida (SEFCRI, 2011)



PROFILE EVOLUTION OF BEACH NOURISHMENT



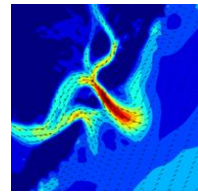
ERP Applicant's Handbook

- "In general, mitigation is best accomplished through creation, restoration, enhancement, or preservation of ecological communities similar to those being impacted." (10.3.1.1)

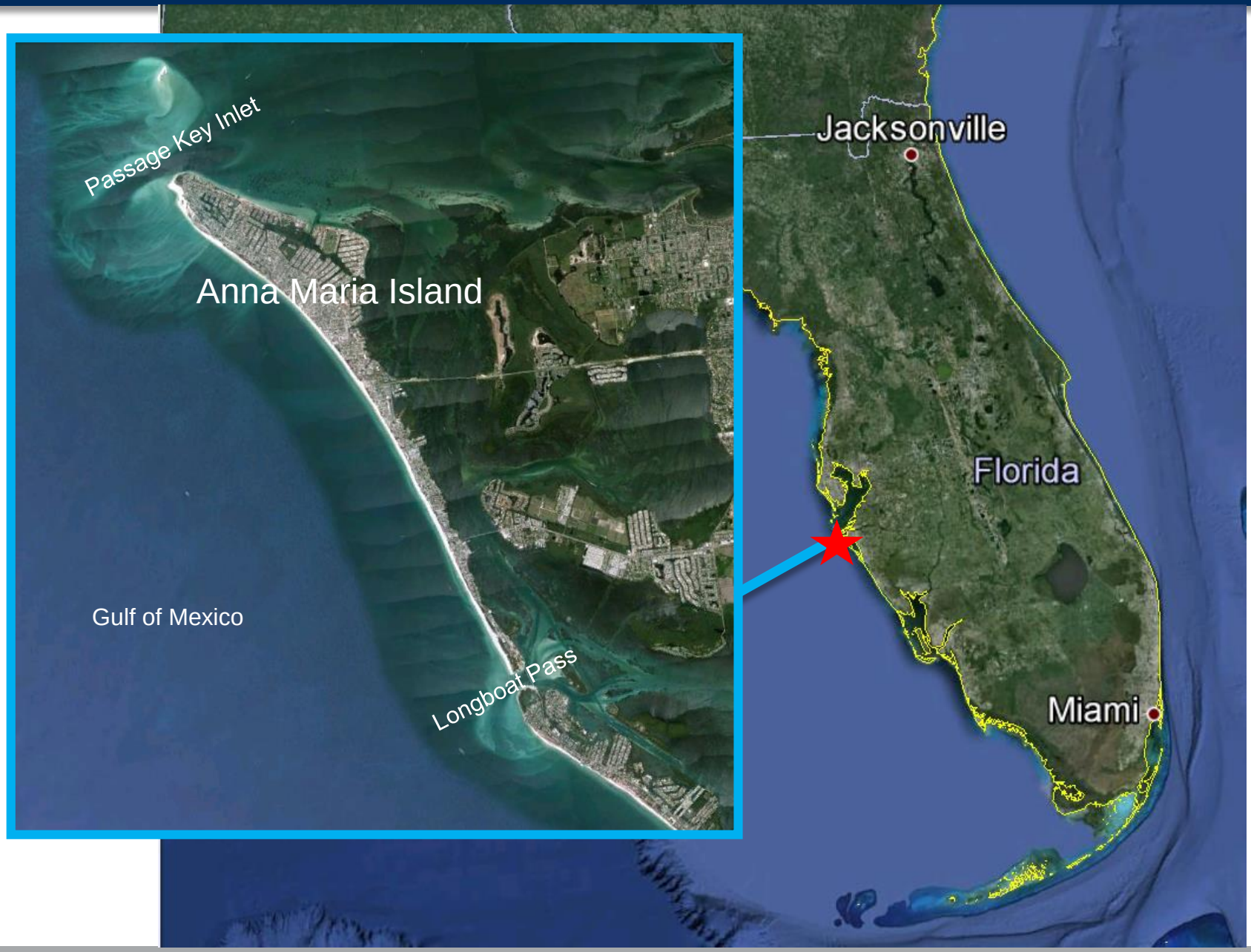
- "Applicants shall provide reasonable assurance that proposed mitigation will:
  - (a) Offset adverse impacts due to regulated activities; and
  - (b) Achieve mitigation success by providing viable and sustainable ecological and hydrological functions." (10.3.3.1)





Anna Maria Island



Anna Maria Island Beach Nourishment Projects

City of Anna Maria
2002, 2011

Central Beach
1992/93*, 2002*, 2005/06, 2014

Coquina Beach
2011*, 2014

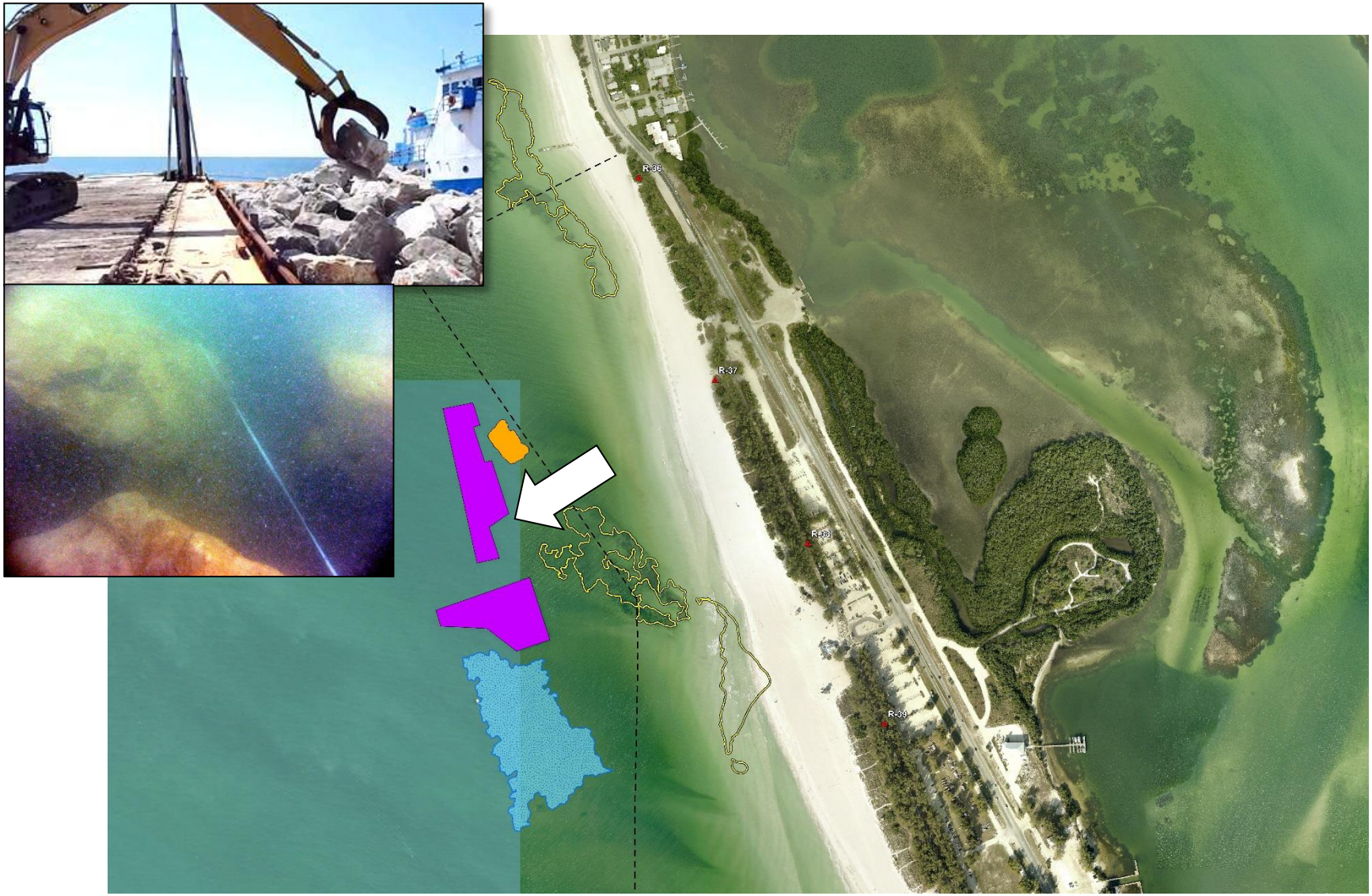
**mitigation required*

1993 Artificial Reef

2005 Artificial Reef

2011 Coquina Beach Project

2011 Artificial Reef

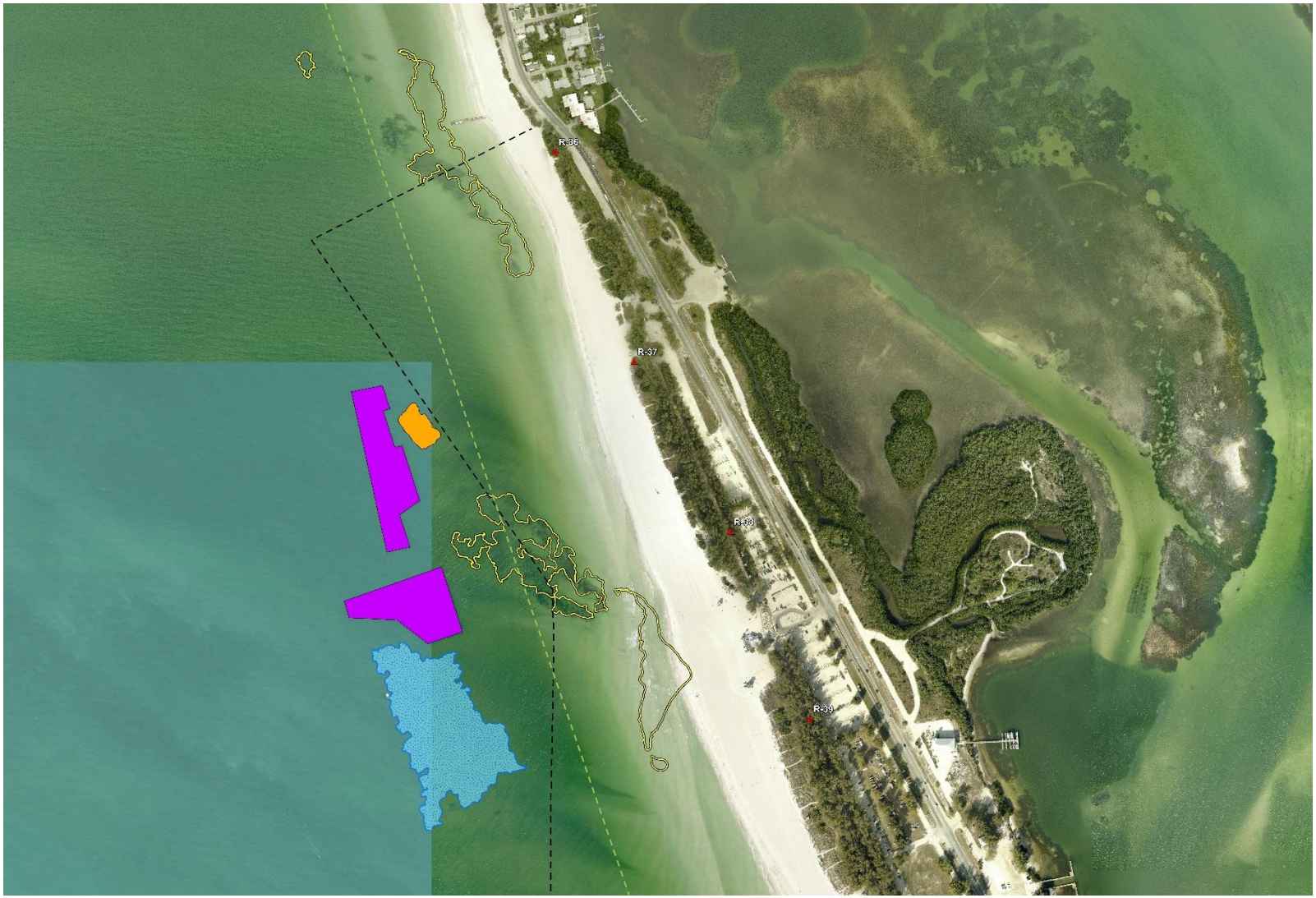


Mitigation Summary

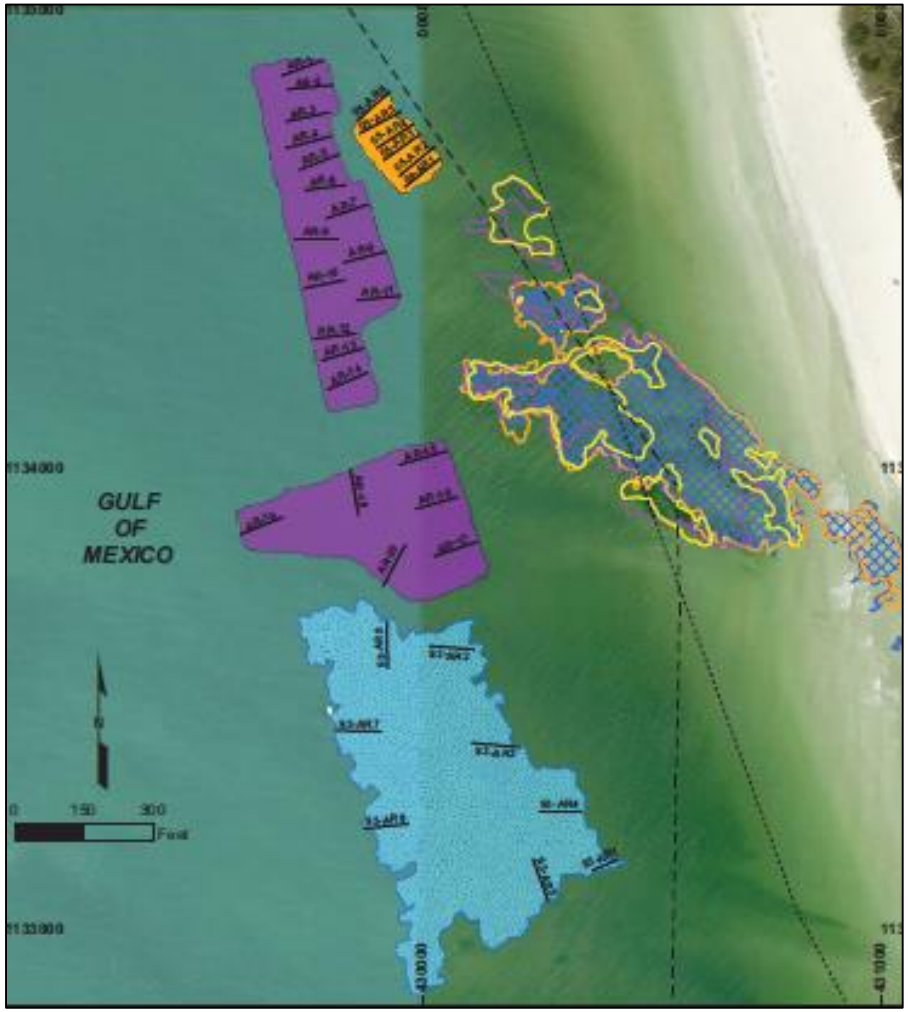
Artificial Reef	Mitigation Required	Material (Acres)
1993 One Mile AR	Initial Federal project: A total of 7.3 ac required	Clean concrete (6.8 ac)
1993 Nearshore AR	by both AR for impacts from R-12 to R-33A	Clean concrete (6.4 ac)
2005 Artificial Reef	2002 Federal renourishment: 0.44 ac, for impacts from R-35 to R-36	Limestone boulders (0.44 ac)
2011 Coquina AR	2011 Coquina Project: 4.87 ac, for impacts from R-35+790 to R-41+365	Limestone boulders (5.16 ac); excess of 0.82 ac ("up-front mitigation")

**All mitigation reefs deemed successful*

2014 Coquina Beach Project



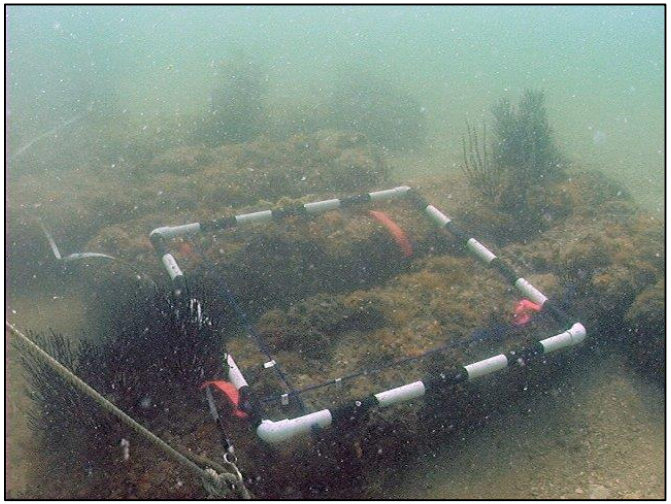
Artificial Reef Monitoring

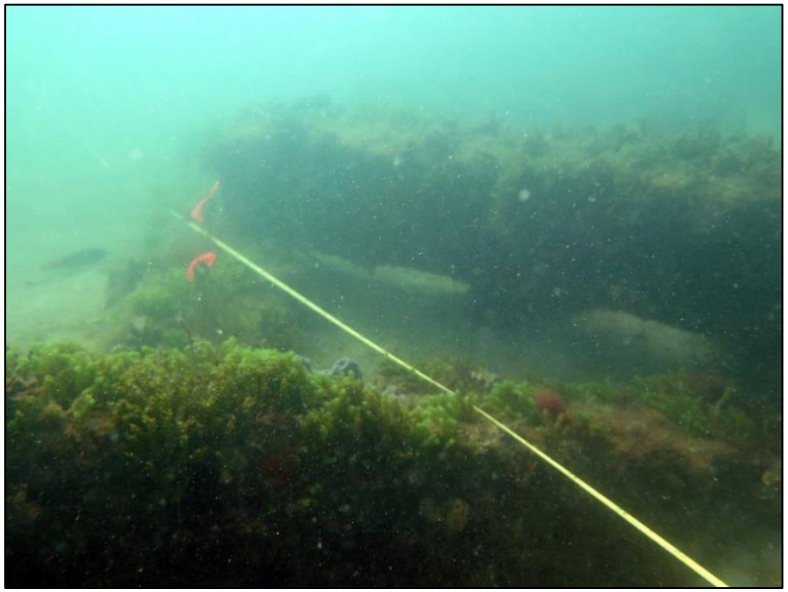


Artificial Reef Transects
1993 Artificial Reef
8 Permanent Transects*
42 Temporary Transects
2005 Artificial Reef
6 Permanent Transects*
2011 Artificial Reef
20 Permanent Transects*
30 Temporary Transects

Completed Surveys	
2013	Pre-Construction
2015	1 Year Post-Construction

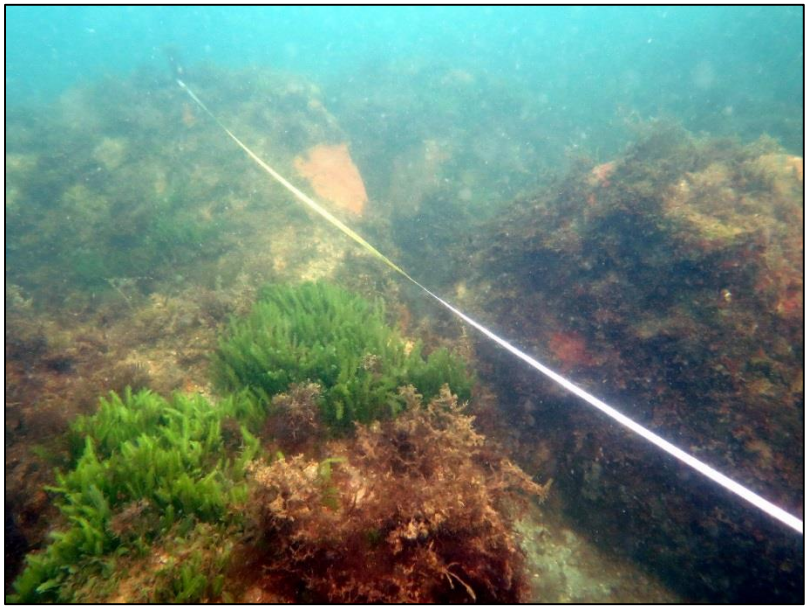
1993 AR Photos



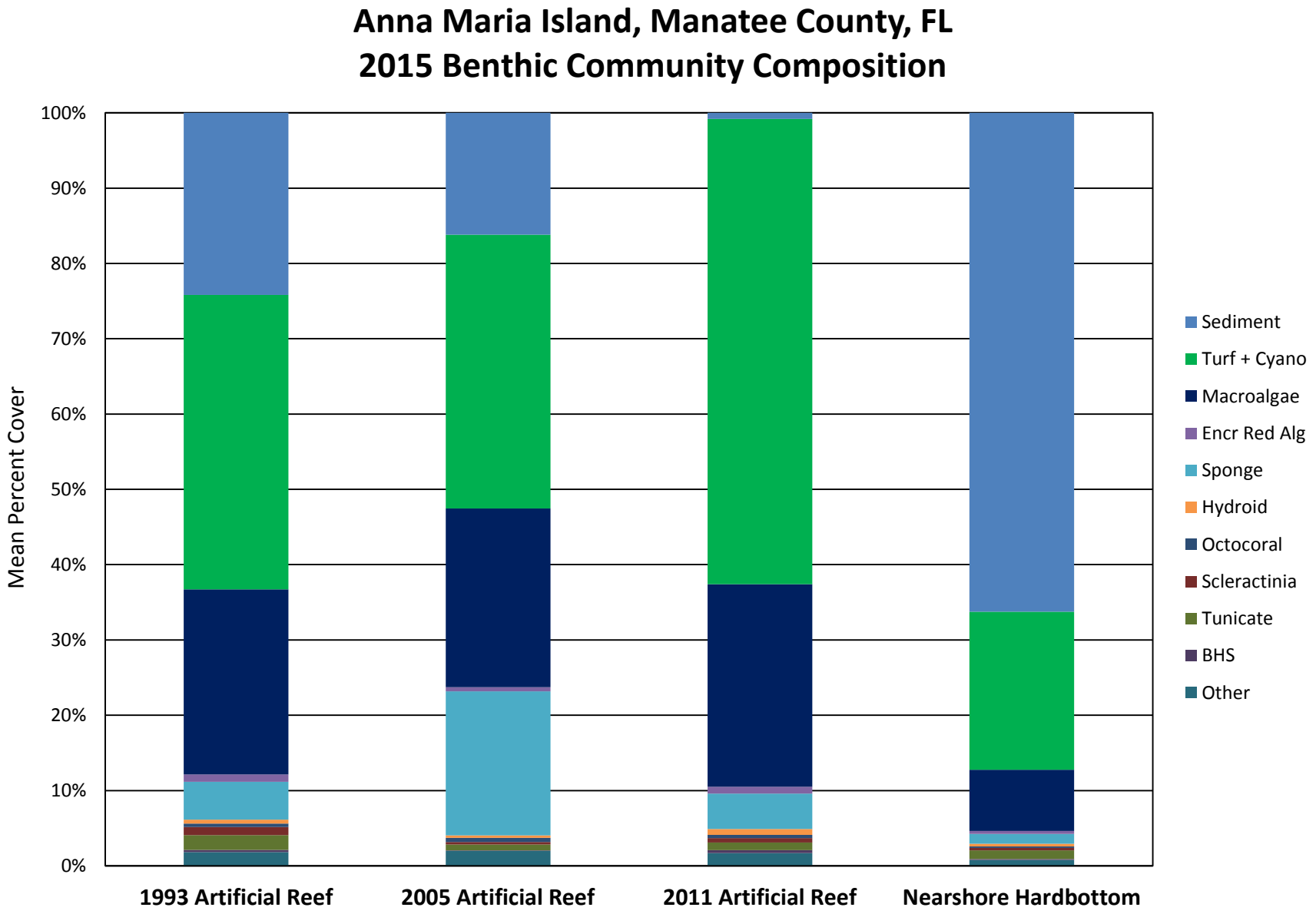


2005 AR Photos

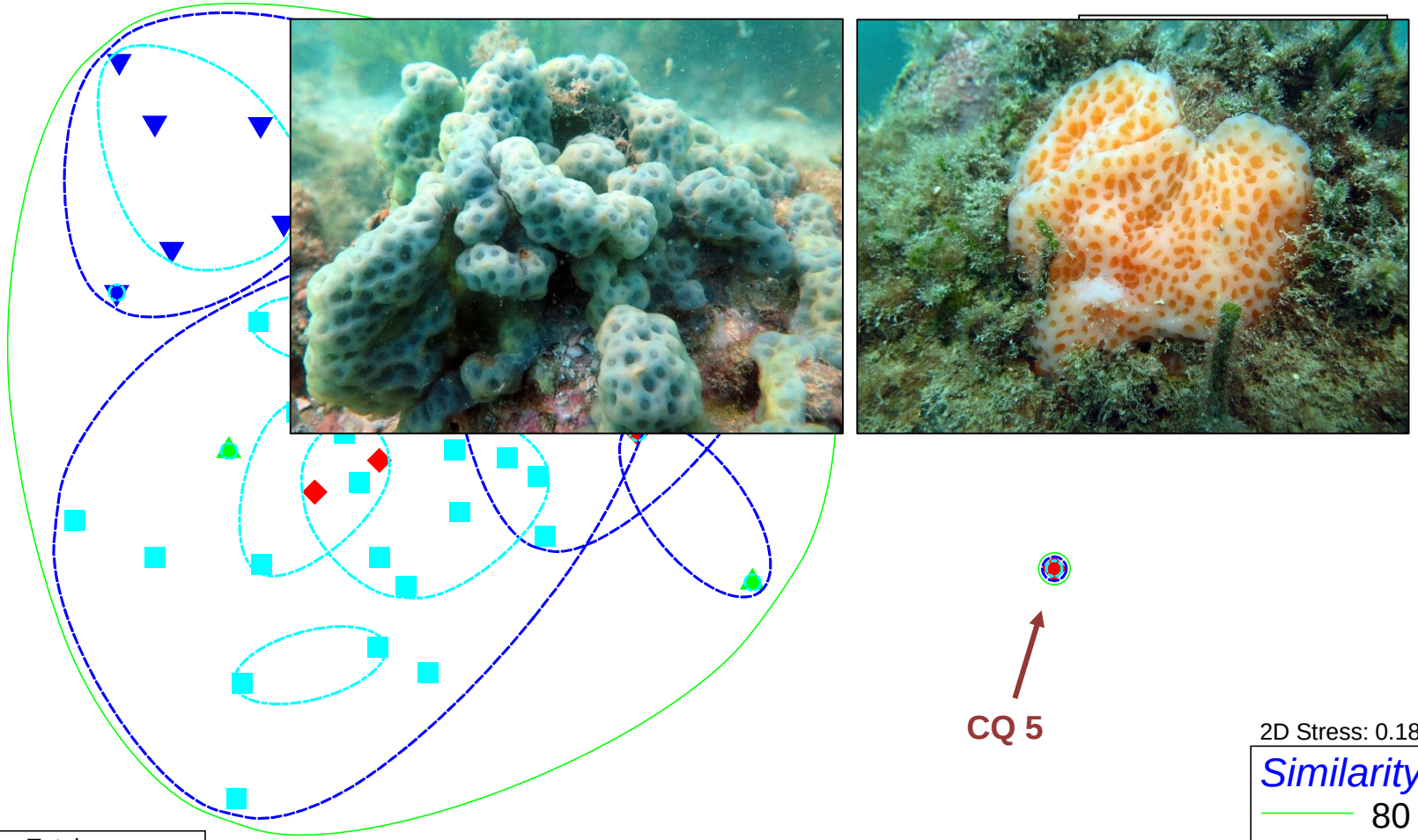
2011 AR Photos



Natural Hardbottom

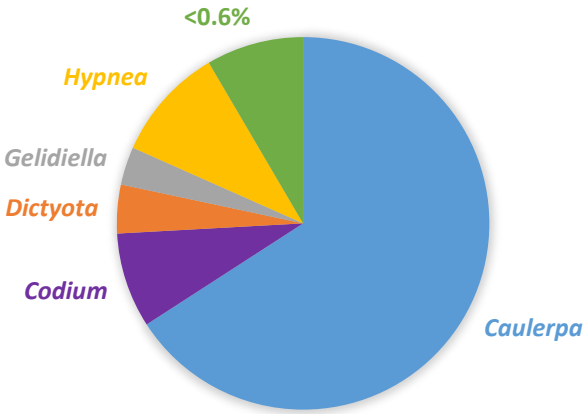

Anna Maria Island, Manatee County, FL
2015 Benthic Community Composition
Mean Percent Cover
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
1993 Artificial Reef
2005 Artificial Reef
2011 Artificial Reef
Nearshore Hardbottom
Sediment
Turf + Cyano
Macroalgae
Encr Red Alg
Sponge
Hydroid
Octocoral
Scleractinia
Tunicate
BHS
Other

Multi-dimensional Scaling (MDS) Ordination

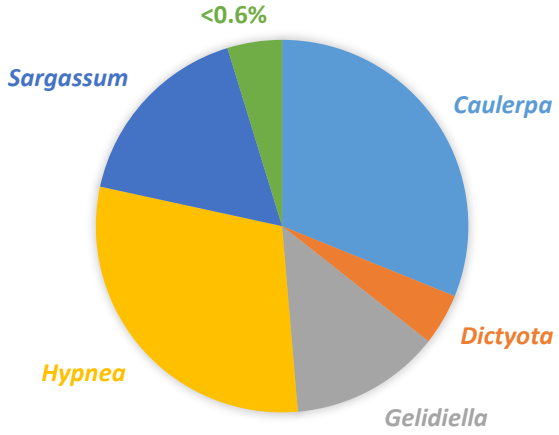


Standardise Samples by Total
Transform: Log(X+1)
Resemblance: S17 Bray Curtis similarity

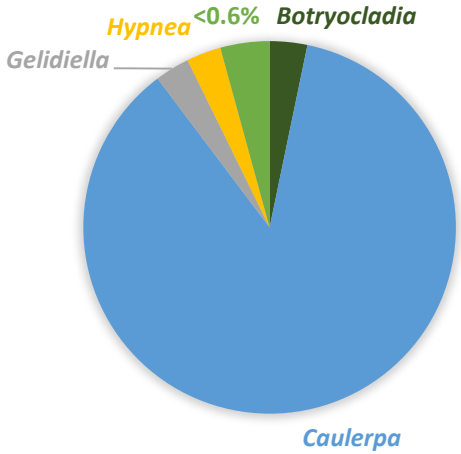
1993 ARTIFICIAL REEF
24.6 ± 9.3%



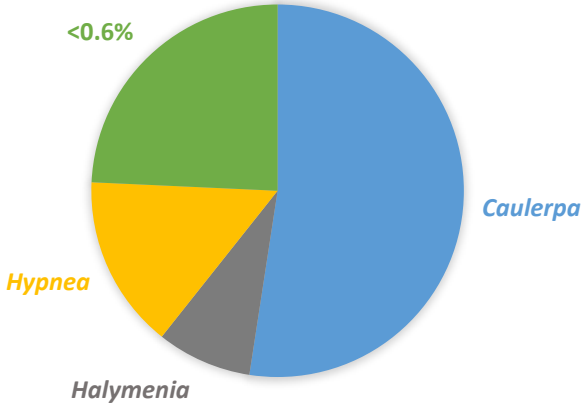
2011 ARTIFICIAL REEF
26.9 ± 6.9%

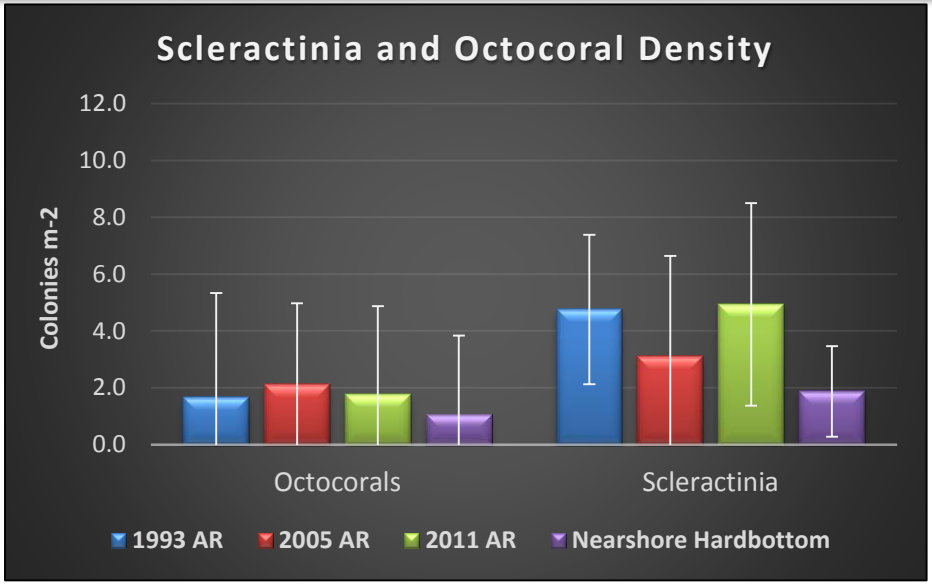


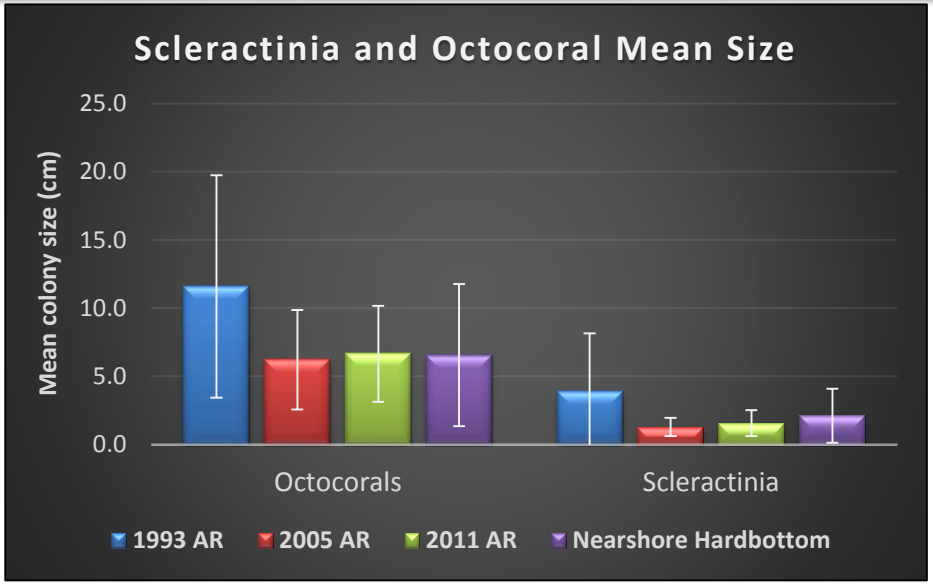
2005 ARTIFICIAL REEF
23.7 ± 7.1%



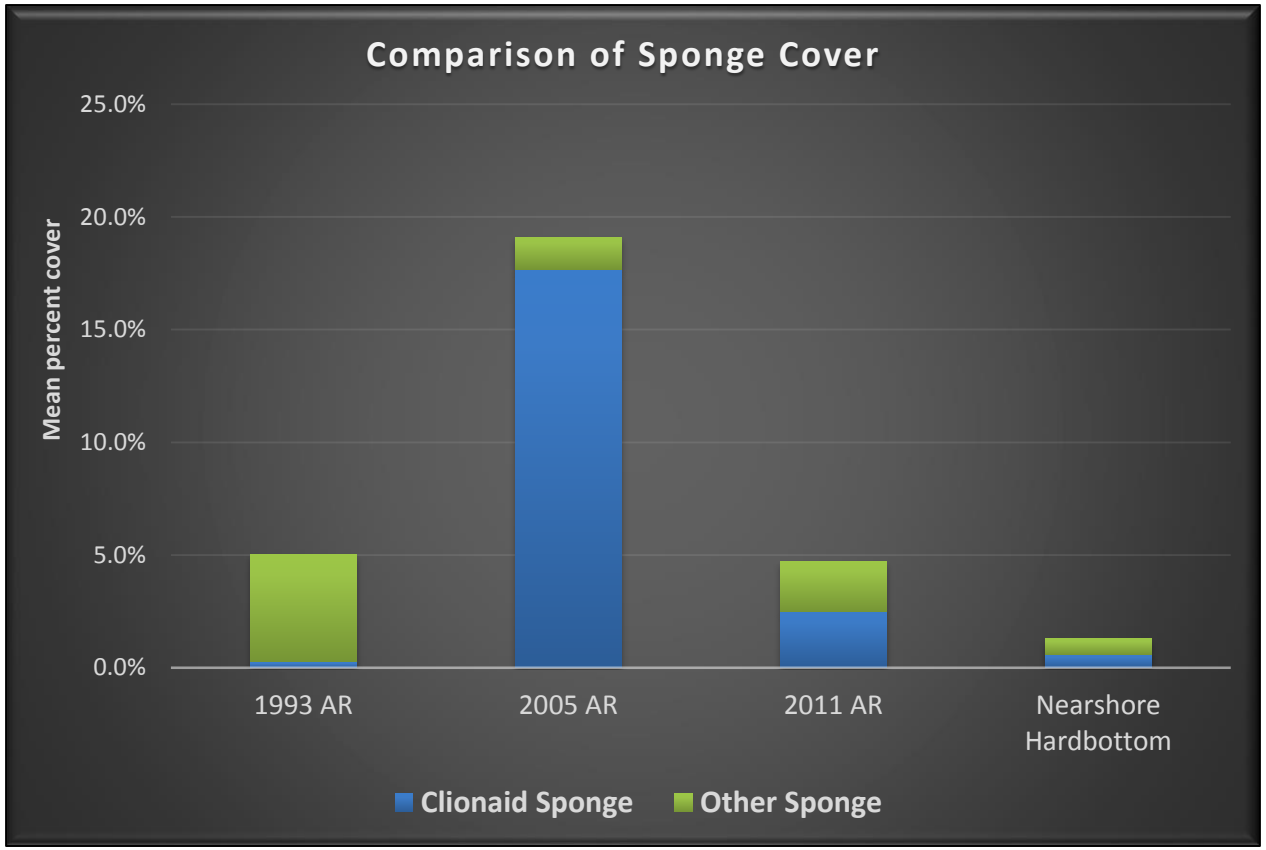
NEARSHORE HARDBOTTOM
8.1 ± 7.4%

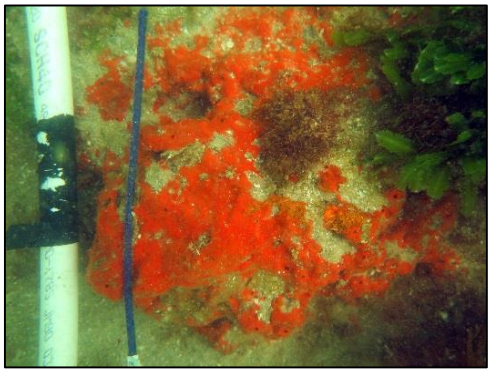



Scleractinia and Octocoral Density
Colonies m-2
12.0
10.0
8.0
6.0
4.0
2.0
0.0
Octocorals
Scleractinia
1993 AR
2005 AR
2011 AR
Nearshore Hardbottom


Scleractinia and Octocoral Mean Size
Mean colony size (cm)
25.0
20.0
15.0
10.0
5.0
0.0
Octocorals
Scleractinia
1993 AR
2005 AR
2011 AR
Nearshore Hardbottom

Sponge

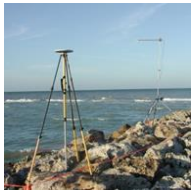

Comparison of Sponge Cover
25.0%
20.0%
15.0%
10.0%
5.0%
0.0%
Mean percent cover
1993 AR
2005 AR
2011 AR
Nearshore Hardbottom
Clionaid Sponge
Other Sponge



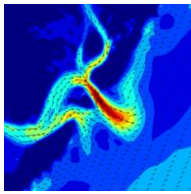
Video

Conclusions

- Results do not show distinction between communities on concrete vs limestone boulder reefs
- Results do not show distinction among communities based on age of artificial reef
- None of the reefs perfectly mimics the natural hardbottom but all develop overlapping communities
- Might be worth investigating One-Mile Artificial Reef – possible excess mitigation?
- Coordinate with agencies on mitigation options
- Artificial reef siting – continue to seek similar habitat to impact site but ideally reef can be far enough away to avoid future impacts and requirement for monitoring for impacts





Lauren Floyd
CB&I
2481 Boca Raton Blvd.
Boca Raton, FL 33431
Lauren.floyd@cbi.com

Thank You