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

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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)
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

Photos: Project Baseline
Types of Artificial Reefs

NYC Subway Cars
Ocean City, MD

Photos: EPA
Types of Artificial Reefs

USS Spiegel Grove
Key Largo, FL

Photo: L. D. Gohl
Types of Artificial Reefs

“secondary use concrete”
Types of Artificial Reefs

Key Largo

Cancun

Grenada
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
PROFILE EVOLUTION OF BEACH NOURISHMENT

Post-Construction Adjustment in 1-3 years

Equilibrium Toe of Fill (ETOF)

Design Beach
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 Beach Nourishment Projects

- City of Anna Maria
  - 2002, 2011

- Central Beach

- Coquina Beach
  - 2011*, 2014

*mitigation required
<table>
<thead>
<tr>
<th>Artificial Reef</th>
<th>Mitigation Required</th>
<th>Material (Acres)</th>
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<tbody>
<tr>
<td>1993 One Mile AR</td>
<td>Initial Federal project: A total of 7.3 ac required</td>
<td>Clean concrete (6.8 ac)</td>
</tr>
<tr>
<td>1993 Nearshore AR</td>
<td>by both AR for impacts from R-12 to R-33A</td>
<td>Clean concrete (6.4 ac)</td>
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<tr>
<td>2005 Artificial Reef</td>
<td>2002 Federal renourishment: 0.44 ac, for impacts from R-35 to R-36</td>
<td>Limestone boulders (0.44 ac)</td>
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<tr>
<td>2011 Coquina AR</td>
<td>2011 Coquina Project: 4.87 ac, for impacts from R-35+790 to R-41+365</td>
<td>Limestone boulders (5.16 ac); excess of 0.82 ac (“up-front mitigation”)</td>
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*All mitigation reefs deemed successful*
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
2011 AR Photos
Natural Hardbottom
Anna Maria Island, Manatee County, FL
2015 Benthic Community Composition

- 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

Reef Location
1993 AR
2005 AR
2011 AR

Nearshore Hardbottom

2D Stress: 0.18

Similarity
- 80
- 85
- 90

CQ 5
Macroalgae

1993 ARTIFICIAL REEF
24.6 ± 9.3%

- Hypnea
- Gelidiella
- Dictyota
- Codium
- Caulerpa

2005 ARTIFICIAL REEF
23.7 ± 7.1%

- Hypnea
- Botryocladia
- Gelidiella
- Caulerpa

2011 ARTIFICIAL REEF
26.9 ± 6.9%

- Sargassum
- Hypnea
- Dictyota
- Gelidiella
- Caulerpa

NEARSHORE HARDBOTTOM
8.1 ± 7.4%

- Hypnea
- Halymenia
- Caulerpa

<0.6%
Comparison of Sponge Cover

Mean percent cover

- 1993 AR
- 2005 AR
- 2011 AR
- Nearshore Hardbottom

Clionaid Sponge
Other Sponge
• 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
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