Faunal and Vegetation Monitoring in Response to Harbor Dredging

Andre Daniels¹ and Rachael Stevenson²

¹U.S. Geological Survey, Wetland & Aquatic Research Center, Davie, Florida
²Nova Southeastern University, Davie, Florida
High primary productivity

Supports diverse food webs

Maintains water quality

Sustains ecological marine resources

Provides nursery habitats

Sustains ecological marine resources

Short et al. 2007

U.S. Fish and Wildlife Service

SeaSquared Charters

Scuba Diver Life
Port of Miami Deep Dredge Project

Base Contract
- Widen seaward portion of Cut-1 from 500 to 800 feet; deepen Cut-1 and Cut-2 from 44 to 52 feet; reef and seagrass mitigation area construction.

Option A
- Cut 3 station 0 to Cut 3 station 12 and Fisherman’s Channel Station 17 to Lummus Island Turning Basin end; deepen from 42 to 50 feet.

Option B
- Cut 3 station 12 to Fisherman’s Channel station 17; Local sponsor berthing areas F.C. station 8 to 17; deepen from 42 to 50 feet.
Faunal and Vegetation Monitoring in Response to Harbor Dredging (FMHD)

Designed to evaluate the effects of dredging in the Port of Miami by monitoring benthic vegetation, associated faunal communities, and environmental conditions between 2014-2016
Sampling Locations

Port of Miami (POM) served as the affected basin while North Biscayne Bay (NBB) served as the control basin.

Utilized a sampling grid of 30, equal-sized hexagonal cells.

Sites were sampled biannually at the end of the dry and wet seasons, April and September, from 2014-2016.
Environmental Sampling
<table>
<thead>
<tr>
<th>Density</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Absent or no measurable cover</td>
</tr>
<tr>
<td>0.1</td>
<td>Solitary shoot with small cover</td>
</tr>
<tr>
<td>0.5</td>
<td>Few shoots, but with &lt; 5% cover</td>
</tr>
<tr>
<td>1</td>
<td>Numerous shoots, less than 5% cover</td>
</tr>
<tr>
<td>2</td>
<td>Any number of shoots but with 5% to 25% cover</td>
</tr>
<tr>
<td>3</td>
<td>Any number of shoots but with 25% to 50% cover</td>
</tr>
<tr>
<td>4</td>
<td>Any number of shoots but with 50% to 75% cover</td>
</tr>
<tr>
<td>5</td>
<td>Any number of shoots but with &gt; 75% cover</td>
</tr>
</tbody>
</table>
Faunal Sampling
Significant increases in turbidity (NTU) occurred between 2014-2016 and 2015-2016 (p<0.01) at NBB and POM.

Highest peak turbidity in NBB and POM occurred during the 2016 dry season, directly succeeding dredging.
Seagrass density was negatively correlated with turbidity (p<0.01, t=-0.2076391)

Subsequent significant decreases in seagrass density between 2014-2016 (p<0.01) and 2015-2016 (p<0.05) in NBB and POM
NBB had significantly (p<0.001) less animals overall than POM.

NBB and POM showed significant (p<0.05) decreases in caridean shrimp, penaeid shrimp, and fishes.
Seagrass Community Shifts: NBB

In NBB, *Syringodium* accounted for 80% of the density loss by 2016.

Combined, *Syringodium* and *Halodule* accounted for 95% density loss.
In POM, *Syringodium* accounted for 70% of the density loss

Combined with *Halodule*, accounted for 88%
Populations of *Floridichthys* (pupfishes), *Lucania* (ray-finned killifishes), and *Microgobius* (gobies) decreased by 80, 72, and 96% from 2014-2016.
Faunal Community Shifts (fishes): NBB

*Ctenogobius, Gobiosoma* (gobies), and *Hippocampus* (pipefishes and seahorses) increased by 92, 76, and 43% throughout the project.
Faunal Community Shifts (fishes): POM

Floridichthys and Microgobius substantially decreased and were no longer present in the study area by 2016.
Populations of *Gobiosoma* and *Hippocampus* remained relatively stable.

*Lucania* was the only genus with substantial population increases.
Large shift from *Thor* to *Hippolyte* (both members of Hippolytidae family) between 2014-2016

*Thor* populations decreased 46% by 2016
Substantial decreases of 61, 48, 60, 30, and 86% occurred in *Alpheus*, *Hippolyte*, *Latreutes*, *Periclimenes*, and *Processa*
Thor was the only genus with an overall population increase of 74% between 2014-2016.
Aftermath

No collections beyond 2016

NBB experienced a separate seagrass die-off

NBB and POM suffered extensive environment-altering impacts, followed by severe impacts to South Florida by category 4 Hurricane Irma
Conclusions

Was there a return-to-previous state after 2016?

Do some species show resilience to detrimental changes? Do lost species return to their environment after there is a return-to-previous state?

How long does it take for an ecosystem to rebound after anthropogenic impacts?

Integral to address long-term impacts to improve understanding of ecosystem function
Acknowledgements

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