Shoreline Epifauna Community of South Biscayne Bay in Relation to Salinity

Presentation at the Greater Everglades Ecosystem Restoration Meeting
July 13-16, 2010

Joan A. Browder, Michael B. Robblee, Gladys A. Liehr, Darlene R. Johnson, Eric Buck, Tom Jackson, Ana Griefen, Laura Petteway
A CERP Objective for Nearshore Biscayne Bay

- To restore the diversity and abundance of the faunal component associated primarily with salinities ranging from near zero to 20 (RECOVER 2005).
- Historical descriptions of the fisheries of the bay suggest a greater diversity and abundance of estuarine species than has been recorded recently.
Alongshore Epifauna Monitoring and Assessment

• Project purpose
  – To develop a dynamic characterization of the epifaunal community along the shoreline of south Biscayne Bay from Shoal Point to Manatee Bay
  – To determine salinity affinities (i.e., preferred habitat) of epifaunal species
  – To develop performance measures and restoration targets to assess the effectiveness of restoration efforts
Sampling area:
2005-2006  Shoal Point to Turkey Point
2007-2009  Shoal Point to Manatee Bay

2005 – 2006, Sites 1-47

2007 and ongoing, with additional Sites 48-72

Dry (Jan. – Feb.) and Wet Season (July – Aug.)
Environmental Data:
  a) Water and Sediment Depth
  b) Salinity, DO, pH
  c) Algae Seagrass Coverage
  d) bottom type (Braun Blanquet) and canopy height

Faunal data: 3 Throw Traps samples at each site, and 4 Sweeps of each throw trap

Samples kept on ice in the field and frozen for storage
In the laboratory, samples are sorted and bulk weights taken. Then samples are identified, counted, measured, weighed, and preserved in alcohol or formalin for future use.

Special examinations are made to determine sex and other information on selected taxa.

Data entry, quality control, master files, and multi-year database

Metadatabase, statistics, reports
Sampling sites of the alongshore epifauna project

The 72 sampling sites along the shoreline are numbered from north to south.

Designated sub-segments of the coastline and site numbers are delineated.

Note that major canals are concentrated between sites 18-40.
Some members of the alongshore epifauna

- L. parva
- F. carpio
- A. stipes
- M. gulosus
- S. scovelli
- O. beta
- C. sapidus
- Caridea
- Ophiuriodea
- F. duorarum
Site salinity at sampling time

Dry season collection

Years 2007, 2008, and 2009
Site salinity at sampling time

Wet season collection

Years 2007, 2008, and 2009
Salinity (psu) - Temperature (cm) - Canopy height (cm)
### Initial classification of species by halohabitat

<table>
<thead>
<tr>
<th>Halohabitat</th>
<th>Salinity</th>
<th>Number of species</th>
<th>2005</th>
<th>2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>Estuarine</td>
<td>&lt; 35</td>
<td></td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>Estuarine-polyhaline</td>
<td>~18-35</td>
<td></td>
<td>1</td>
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<td>??</td>
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<td>48</td>
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</tr>
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</table>

www.fishbase.com
Gilmore 1995
Lorenz&Serafy 2006
**VENICE System:**

A system for the classification of brackish water based on the percentage of chloride in the water.

<table>
<thead>
<tr>
<th>Zone</th>
<th>Salinity (ppt)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hyperhaline</td>
<td>&gt;40</td>
</tr>
<tr>
<td>Euhaline</td>
<td>40 - 30</td>
</tr>
<tr>
<td>Mixohaline</td>
<td>~35 - 0.5</td>
</tr>
<tr>
<td>Mixoeuhaline</td>
<td>&gt; 30 but &lt; adjacent euhaline sea</td>
</tr>
<tr>
<td>(Mixo-) polyhaline</td>
<td>30 - 18</td>
</tr>
<tr>
<td>(Mixo-) mesohaline</td>
<td>18 - 5</td>
</tr>
<tr>
<td>(Mixo-) oligohaline</td>
<td>5 - 0.5</td>
</tr>
<tr>
<td>Limnic (freshwater)</td>
<td>&lt; 0.5</td>
</tr>
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</table>
Box plots of salinity, temperature, and canopy height of sites at sampling time

Salinity (ppt)

Collection

Dry' 07
Wet' 07
Dry' 08
Wet' 08
Dry' 09
Wet' 09

Mesohaline
Polyhaline
Euhaline
Hyperhaline

Temperature (C)

Collection

Dry' 07
Wet' 07
Dry' 08
Wet' 08
Dry' 09
Wet' 09

Canopy Height (cm)

Collection

Dry' 07
Wet' 07
Dry' 08
Wet' 08
Dry' 09
Wet' 09
Individual occupancy in relation to salinity - Fish

Salinity (ppt)

Mesohaline 5-18
Polysaline 18-30
Euhaline 30-40
Hyperhaline >40

Red line indicates RECOVER salinity target

L. cyprinoides
E. melanopterus
S. punctilla
S. spengleri
Bolidae
S. scovelli
T. maculatus
P. latipinna
Tetraodontidae
Gobiidae
L. parva
A. lineatus
Syngnathidae
E. gula
S. testudineus
B. sorator
Kyphosidae
L. griseus
F. carpio
H. hemerids
Haemulidae
M. guilousus
A. stipes
H. bimaculatus
E. havana
Gerreidae
C. variegatus
G. beta
H. reidi
E. jonesi
L. rhomboides
Carangidae
G. robustum
H. sciurus
H. erectus
S. marina
B. dunckeri
H. geminatus
H. aurolinatum
H. histrio
Unidentified
L. nolcholsi
S. pelagicus
Cyprinodontiformes
M. punctatus
A. mitchilli
S. floridana
H. zosterae
D. pauciradiatus
C. macrops
R. marmoratus
G. cinereus
M. cephalus
S. fuscus
C. arctifrons
A. criniger
H. parra
H. plumieri
Syngnathidae
Mugilidae
Ch. saburrae
Sparidae
Atherinidae
C. macrocerus
Ch. ocellata

Cyprinodontiformes
S. fuscus
M. cephalus
Atherinidae
C. macrocerus
Ch. ocellata

Red line indicates RECOVER salinity target
Individual Occupancy in Relation to Salinity – Crab, Shrimp, and Echinoderms

Red line indicates RECOVER salinity target
Faunal-density-weighted salinity, of dominant species.

Ordinate is mean salinity at sites 1-47 at time of sampling.
Dry faunal-density-weighted salinity difference from the mean, by species and year.
Mean faunal-density-weighted salinity, and average salinity across all sites (1-47), for collections in which species was present, 2005-2009

Salinity units below and above average across sites
Mean faunal-density-weighted salinity, and average salinity across all sites (48-72), for collections in which species was present, 2005-2009

Salinity units below and above average across sites
Multiple-regression results for nine dry season and nine wet season species, 2005-2009: Number of models in which each variable was significant.
Salinity relationships in multiple regression models, by species

Predicted species density change with salinity increase: decrease (negative) or increase (positive)

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<th>Season</th>
<th>Negative</th>
<th>Positive</th>
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<td>Goldspotted killifish</td>
<td>Pink shrimp</td>
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<td>Caridean shrimp</td>
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<td>Blue crab</td>
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<td>Gulf pipefish</td>
<td>Gulf toadfish</td>
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<td></td>
<td>Species richness</td>
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Percent of captured species, coded to halohabitat, by faunal group
Percent of captured individuals, coded to halohabitat, by faunal group
Percent of species, coded by halohabitat -- separate bars indicate degree of rarity

Species that did not occur in season
Species that only occurred one time
Species that occurred at least 10 times
Another look at halohabitat in relation to rarity – separate bars for percent of species of increasing degree of dominance.
Summary/Conclusions

- Dominant species -- polyhaline habitat; rarer species -- non-estuarine (marine) habitat.
- Dominant species, sites 1-47 -- polyhaline habitat, consistent with prevailing conditions.
- Dominant species, sites 48-72 -- non-estuarine (marine) habitat, consistent with prevailing conditions.
- CERP success in implementing of 0-20 (~mesohaline) conditions may radically alter nearshore species composition.
- Possible mechanisms for colonization of new mesohaline habitat
  - Adaptation of species already present (e.g., pink shrimp in mesohaline mangrove zone of southwest Florida)
  - Immigration of new species (e.g., hogchoker and mangrove rivulus).
ACKNOWLEDGMENTS

This is a RECOVER CERP Monitoring and Assessment Project funded by the U.S. Army Corps of Engineers and supported by NOAA Fisheries Service. We thank a myriad of volunteers for helping us with our labor intensive sampling.