Benthic Macroinvertebrates of Tampa Bay revisited

David J. Karlen,
Tom Dix, Barbara Goetting & Sara Markham

Environmental Protection Commission of Hillsborough County
Dedication

Dr. Joseph L. Simon
1937 - 2004
BASIS I
Simon & Mahadevan

Findings

- ≈ 1,200 benthic infaunal and epifaunal species
- Seasonal fluctuations in diversity and abundance
- ≈ 5 year cycle of defaunation of benthic communities
- Decreasing faunal diversity due to declining seagrass beds
- “Pollution Indicator” taxa abundant in Hillsborough Bay
- Faunal distribution controlled by sediment type
- Increasing species richness and decreasing abundance towards the lower part of Tampa Bay
Recommendation:

“quantitative, comprehensive and long-term studies of the Bay benthos to better understand (and formulate management plans for) the long-term effects of urban runoff, domestic wastes and industrial discharges to the Bay”.
Bay-wide Benthic Monitoring Program

- TBEP initiated in 1993
- Other monitoring
  - HIMP
  - Special Study Sites
  - Misc. Projects
    - Dredged Hole
    - Tidal Stream
Number of Species

- ≈1,440 species found in over 3,400 samples processed (higher level/multi-species taxonomic groupings were removed from the analysis)
  - 15 Phyla
  - 7 species made up >25% of total abundance
  - 378 species present in a single sample
  - 240 species represented by a single specimen
- Bay-wide + tributaries; wide range of habitat and salinity regimes
- Sampling bias for smaller, infaunal taxa and soft sediment habitats
Species by Phyla

### Pie Chart

- **Arthropods**: 421 (29%)
- **Mollusks**: 385 (27%)
- **Annelids**: 504 (35%)

### Table

<table>
<thead>
<tr>
<th>Phylum</th>
<th>Species</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annelida</td>
<td>504</td>
</tr>
<tr>
<td>Arthropoda</td>
<td>421</td>
</tr>
<tr>
<td>Mollusca</td>
<td>385</td>
</tr>
<tr>
<td>Cnidaria</td>
<td>30</td>
</tr>
<tr>
<td>Echinodermata</td>
<td>29</td>
</tr>
<tr>
<td>Nemertea</td>
<td>22</td>
</tr>
<tr>
<td>Bryozoa</td>
<td>15</td>
</tr>
<tr>
<td>Platyhelminthes</td>
<td>9</td>
</tr>
<tr>
<td>Porifera</td>
<td>8</td>
</tr>
<tr>
<td>Chordata</td>
<td>8</td>
</tr>
<tr>
<td>Sipuncula</td>
<td>6</td>
</tr>
<tr>
<td>Phoronida</td>
<td>2</td>
</tr>
<tr>
<td>Echiura</td>
<td>1</td>
</tr>
<tr>
<td>Brachiopoda</td>
<td>1</td>
</tr>
<tr>
<td>Hemichordata</td>
<td>1</td>
</tr>
</tbody>
</table>
Annelid Species = 504

- Polychaetes: 433 (86%)
- Oligochaetes: 64 (13%)
- Hirudinea: 7 (1%)
Arthropod Species = 421

All Arthropods

- Crustaceans: 308 (73%)
- Insects: 103 (25%)
- Other Arthropods: 8 (2%)

Crustaceans

- Decapods: 111 (36%)
- Amphipods: 121 (39%)
- Isopods: 28 (9%)
- Cumaceans: 15 (5%)
- Mysids Tanaids Cirripedia: 13 (4%)
- Other Crustacea: 2 (1%)
Mollusk species = 385
Dominant Taxa

- Seven taxa accounted for >25% of the overall abundance

- *Branchiostoma floridiae* 3.57%
- *Glottidia pyramidata* 5.77%
- *Monticellina dorsobranchialis* 4.49%
- *Ampelisca holmesi* 3.51%
- *Apocorophium louisianum* 3.38%
- *Mysella planulata* 3.33%
- *Grandidierella bonnieroides* 3.08%
Sediment type influences benthic community structure.
Tampa Bay Benthic Index

Factors:

- proportion of expected number of species adjusted for salinity
- Proportion of total abundance as spionid polychaetes
- Proportion of total abundance as capitellid polychaetes

Cut-off values:

- “degraded” = <73
- “healthy” = ≥87
**Tampa Bay Benthic Index**

- **Bay-wide Median = 81.41**
- **“Healthy” = 26.05%**
  - LTB, MTB and OTB had highest % “Healthy” sites (35-36%)
- **“Degraded” = 29.58%**
  - Empty = 1.48%
  - MR and BCB had highest % degraded sites (42%)
  - HB had the most empty samples (4.83%)
NEP Coastal Condition Report

- EPA National Coastal Assessment (NCA) program
- Based on Gulf Coast Benthic Index
  - 25 samples collected in summer 2000
- Rating Criteria:
  - **Poor** = >20% of area with poor benthic index score
  - **Fair** = 10-20% poor or >50% poor + fair
  - **Good** = <10% “poor” & >50% “good”
- Overall TB rated as “Poor” for benthic condition
## CCR criteria with Tampa Bay Benthic Index

<table>
<thead>
<tr>
<th>Year</th>
<th>HB (n)</th>
<th>OTB (n)</th>
<th>MTB (n)</th>
<th>LTB (n)</th>
<th>BCB (n)</th>
<th>TCB (n)</th>
<th>MR (n)</th>
<th>Bay Wide* (n)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1993</td>
<td>Poor (19)</td>
<td>Fair (16)</td>
<td>Fair (20)</td>
<td>Poor (17)</td>
<td>N/A</td>
<td>Poor (7)</td>
<td>Fair (11)</td>
<td>Poor (90)</td>
</tr>
<tr>
<td>1994</td>
<td>Poor (19)</td>
<td>Poor (17)</td>
<td>Poor (20)</td>
<td>Poor (16)</td>
<td>N/A</td>
<td>Poor (7)</td>
<td>Poor (10)</td>
<td>Poor (89)</td>
</tr>
<tr>
<td>1995</td>
<td>Poor (29)</td>
<td>Fair (23)</td>
<td>Fair (21)</td>
<td>Fair (22)</td>
<td>Poor (7)</td>
<td>Poor (11)</td>
<td>Fair (134)</td>
<td></td>
</tr>
<tr>
<td>1996</td>
<td>Poor (27)</td>
<td>Fair (15)</td>
<td>Poor (24)</td>
<td>Poor (24)</td>
<td>Poor (21)</td>
<td>Fair (8)</td>
<td>Poor (132)</td>
<td></td>
</tr>
<tr>
<td>1997</td>
<td>Poor (22)</td>
<td>Fair (16)</td>
<td>Fair (22)</td>
<td>Fair (21)</td>
<td>Poor (21)</td>
<td>Fair (8)</td>
<td>Poor (123)</td>
<td></td>
</tr>
<tr>
<td>1998</td>
<td>Poor (26)</td>
<td>Fair (16)</td>
<td>Fair (20)</td>
<td>Fair (17)</td>
<td>Poor (21)</td>
<td>Fair (7)</td>
<td>Poor (13)</td>
<td>Fair (120)</td>
</tr>
<tr>
<td>1999</td>
<td>Fair (23)</td>
<td>Fair (19)</td>
<td>Fair (21)</td>
<td>Good (18)</td>
<td>Poor (21)</td>
<td>Poor (8)</td>
<td>Fair (13)</td>
<td>Fair (123)</td>
</tr>
<tr>
<td>2000-2001</td>
<td>Poor (47)</td>
<td>Fair (18)</td>
<td>Fair (49)</td>
<td>Fair (13)</td>
<td>Poor (20)</td>
<td>Poor (8)</td>
<td>Poor (11)</td>
<td>Poor (166)</td>
</tr>
<tr>
<td>2002-2003</td>
<td>Poor (53)</td>
<td>Poor (17)</td>
<td>Poor (30)</td>
<td>Poor (19)</td>
<td>Poor (7)</td>
<td>Poor (14)</td>
<td>Poor (161)</td>
<td></td>
</tr>
<tr>
<td>2004-2005</td>
<td>Poor (34)</td>
<td>Poor (12)</td>
<td>Good (31)</td>
<td>Poor (16)</td>
<td>Poor (19)</td>
<td>Fair (102)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2006-2007</td>
<td>Poor (18)</td>
<td>Good (15)</td>
<td>Good (15)</td>
<td>Poor (18)</td>
<td>Poor (18)</td>
<td>Fair (84)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Where we have come since BASIS I?

Then

- $\approx 1,200$ benthic species
- $\approx 5$ year cycle of defaunation of benthic communities
- “Pollution Indicator” taxa abundant in Hillsborough Bay
- Faunal distribution controlled by sediment type
- Increasing species richness and decreasing abundance towards the lower part of Tampa Bay

Now

- $1,442$ benthic species
- Notable improvements in benthic community overall
  - Hillsborough Bay still more degraded relative to other locations
- Similar influence of sediment type and trends in species richness throughout Tampa Bay