Estimating the Condition of Gulf of Mexico Estuaries: National Coastal Assessment and National Estuary Program

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EMAP Symposium 2004
Program Goals

- National Coastal Assessment
  - Assess condition of U.S. coastal resources
  - Create an integrated, comprehensive coastal monitoring program among the coastal states.

- National Estuary Program
  - Improve quality of estuaries of national importance
  - Attain or maintain water quality in estuaries by developing Comprehensive Conservation and Management Plans.
National Estuary Program

Coastal Bend Bays
Galveston Bay
Barataria-Terrebonne Estuarine Complex
Mobile Bay
Tampa Bay
Sarasota Bay
Charlotte Harbor

Coastal Bend Bays
Galveston Bay
Barataria-Terrebonne Estuarine Complex
Mobile Bay
Tampa Bay
Sarasota Bay
Charlotte Harbor
Estuarine Assessments

How well does the condition of NEP estuaries represent the condition of Gulf of Mexico estuaries?
Surface Area of Gulf of Mexico Estuaries

Other Gulf Estuaries 68%

NEP Estuaries 32%
Methods

• Probability-based survey designs
• Data collected by states using standardized field, lab, & QA protocols
• Data analysis
  ▪ Cumulative distribution functions (CDFs) with confidence intervals
  ▪ Maps and pie charts showing distribution of good, fair, poor conditions
### Number of Stations

<table>
<thead>
<tr>
<th>NCA</th>
<th>2000</th>
</tr>
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<tbody>
<tr>
<td>Florida</td>
<td>23</td>
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<tr>
<td>Alabama</td>
<td>50</td>
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<tr>
<td>Mississippi</td>
<td>35</td>
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<tr>
<td>Louisiana</td>
<td>38</td>
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<td>Texas</td>
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<table>
<thead>
<tr>
<th>NEP</th>
<th>2000</th>
<th>2001</th>
<th>2002</th>
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<tbody>
<tr>
<td>Charlotte Harbor</td>
<td></td>
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<td>30</td>
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<tr>
<td>Sarasota Bay</td>
<td></td>
<td>20</td>
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<tr>
<td>Tampa Bay</td>
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<td>25</td>
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<tr>
<td>Mobile Bay</td>
<td></td>
<td>33</td>
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<tr>
<td>Barataria-Terrebonne</td>
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<td>Galveston Bay</td>
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<td>Coastal Bend Bays</td>
<td>13</td>
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</tbody>
</table>
# Indicators

## Water Quality
- DIN
- DIP
- Chlorophyll *a*
- Water Clarity
- DO

## Sediment Quality
- Metals
- Organics
- TOC
- Toxicity

## Biological Quality
- Benthic Index
- Fish Tissue Contaminants
# NCA Water Quality Assessment Criteria

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Region</th>
<th>Good</th>
<th>Fair</th>
<th>Poor</th>
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</thead>
<tbody>
<tr>
<td>DIN (mg/L)</td>
<td>Gulf FL Bay</td>
<td>&lt; 0.1</td>
<td>0.1 – 0.5</td>
<td>&gt; 0.5</td>
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<td></td>
<td></td>
<td>&lt; 0.05</td>
<td>0.05 – 0.1</td>
<td>&gt; 0.1</td>
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<tr>
<td>DIP (mg/L)</td>
<td>Gulf FL Bay</td>
<td>&lt; 0.01</td>
<td>0.01 – 0.05</td>
<td>&gt; 0.05</td>
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<td>&lt; 0.005</td>
<td>0.005 – 0.01</td>
<td>&gt; 0.01</td>
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<tr>
<td>Chl a (μg/L)</td>
<td>Gulf FL Bay</td>
<td>&lt; 5</td>
<td>5 – 20</td>
<td>&gt; 20</td>
</tr>
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<td>&lt; 0.5</td>
<td>0.5 – 1</td>
<td>&gt; 1</td>
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<tr>
<td>WCI</td>
<td>Gulf</td>
<td>&gt; 2</td>
<td>1 – 2</td>
<td>&lt; 1</td>
</tr>
<tr>
<td>DO (mg/L)</td>
<td>Gulf</td>
<td>&gt; 5</td>
<td>2 – 5</td>
<td>&lt; 2</td>
</tr>
</tbody>
</table>
Dissolved Inorganic Phosphorus

NCA 2000
Gulf Estuaries

- Poor: 11 ± 5%
- Fair: 31 ± 8%
- Good: 58 ± 8%

NEP
Gulf Estuaries

- Poor: 22 ± 1%
- Fair: 35 ± 5%
- Missing: 1%
- Good: 42 ± 7%
Dissolved Inorganic Phosphorus

NEP 2000-2002

NCA 2000
Chlorophyll a

**NCA 2000**
Gulf Estuaries

- Missing: 3%
- Poor: 8 ± 5%
- Fair: 38 ± 9%
- Good: 51 ± 3%

**NEP**
Gulf Estuaries

- Missing: 3%
- Poor: 6 ± 2%
- Fair: 60 ± 4%
- Good: 31 ± 8%
Water Clarity

NCA 2000
Gulf Estuaries

- Missing: 3%
- Poor: 23 ± 7%
- Fair: 22 ± 7%
- Good: 52 ± 8%

NEP
Gulf Estuaries

- Missing: 3%
- Poor: 31 ± 2%
- Fair: 36 ± 8%
- Good: 30 ± 7%
Water Clarity

NEP 2000-2002

NCA 2000
Dissolved Oxygen

NCA 2000
Gulf Estuaries

- Fair: 18 ± 7%
- Poor: 1 ± 7%
- Good: 81 ± 7%

NEP
Gulf Estuaries

- Fair: 23 ± 1%
- Poor: 2 ± 1%
- Good: 75 ± 7%
Water Quality Index

NCA 2000

- Good: 45%
- Fair: 46%
- Poor: 9%

NEP 2000-2002

- Good: 21%
- Fair: 65%
- Poor: 13%
- Missing: 1%
Benthic Index

NCA 2000
Gulf Estuaries

- Missing: 9%
- Poor: 17 ± 7%
- Fair: 26 ± 9%
- Good: 47 ± 5%

NEP
Gulf Estuaries

- Missing: 7 ± 5%
- Poor: 11 ± 5%
- Fair: 36 ± 7%
- Good: 46 ± 9%
Benthic Index

NEP 2000-2002

NCA 2000
## NCA Sediment Quality Assessment Criteria

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Good</th>
<th>Fair</th>
<th>Poor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ampelisca Survival (%)</td>
<td>= 80</td>
<td></td>
<td>&lt; 80</td>
</tr>
<tr>
<td>Number of Contaminants</td>
<td>0 &gt; ERM</td>
<td>= 5 &gt; ERL</td>
<td>= 1 &gt; ERM</td>
</tr>
<tr>
<td></td>
<td>&lt; 5 &gt; ERL</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOC (%)</td>
<td>&lt; 2</td>
<td>2 – 5</td>
<td>&gt; 5</td>
</tr>
</tbody>
</table>
Sediment Toxicity

NCA 2000 Gulf Estuaries
- Missing: 38%
- Poor: 1 ± 1%
- Good: 61 ± 7%

NEP Gulf Estuaries
- Missing: 38%
- Poor: 1 ± 6%
- Good: 61 ± 6%
Sediment Toxicity

NEP 2000-2002

NCA 2000
Sediment Contaminants

NCA 2000 Gulf Estuaries
- Poor: 10%
- Fair: 1%
- Good: 89%

NEP Gulf Estuaries
- Missing: 22%
- Poor: 11 ± 0%
- Fair: 3 ± 6%
- Good: 64 ± 6%
Total Organic Carbon

NCA 2000 Gulf Estuaries
- Good: 78 ± 8%
- Fair: 14 ± 5%
- Poor: 2 ± 5%
- Missing: 6%

NEP Gulf Estuaries
- Good: 89 ± 6%
- Fair: 7 ± 4%
- Poor: 4 ± 4%
Sediment Quality Index

NEP 2000-2002

NCA 2000
### NCA Regional Scoring Criteria

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Good</th>
<th>Fair</th>
<th>Poor</th>
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<tr>
<td>DIN, DIP, Water Clarity</td>
<td>&lt; 10% Poor and &gt; 50% Good</td>
<td>10-25% Poor or &gt; 50% Fair + Poor</td>
<td>&gt; 25% Poor</td>
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<tr>
<td>CHL, WQI, Benthic Index</td>
<td>&lt; 10% Poor and &gt; 50% Good</td>
<td>10-20% Poor or &gt; 50% Fair + Poor</td>
<td>&gt; 20% Poor</td>
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<tr>
<td>Contaminants, DO, SQI</td>
<td>&lt; 5% Poor and &gt; 50% Good</td>
<td>5-15% Poor or &gt; 50% Fair + Poor</td>
<td>&gt; 15% Poor</td>
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<tr>
<td>Toxicity</td>
<td>&lt; 5% Poor</td>
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<tr>
<td>TOC</td>
<td>&lt; 20% Poor</td>
<td>20-30% Poor</td>
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## Condition of Gulf of Mexico Estuaries

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<tr>
<th>Water Quality</th>
<th>NCA</th>
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<tr>
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<tr>
<td>CHL</td>
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<tr>
<td>Clarity</td>
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<tr>
<td>DO</td>
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<table>
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### Table: Water Quality and Sediment Quality

<table>
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### Table: Contam and TOC

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</table>

### Table: Toxicity

*Note: The charts indicate the condition of Gulf of Mexico Estuaries with green indicating good condition, yellow indicating moderate condition, and red indicating poor condition.*