The Dawn of the Age of Mass Oceanography

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University of Southern Maine
Categories of Economic Benefits

- **Business**
  - Transportation cost savings
    - Freight
    - Passenger
    - Commercial Fishing
    - Electricity
    - Construction & Engineering

- **Public**
  - Recreation
    - Fishing
    - Boating
    - Beach going
  - Property protection
  - Safety
The Economic Benefits of Regional Ocean Observing Systems: The Gulf of Maine as an Example
# Maritime Transport in GoM: Transits

<table>
<thead>
<tr>
<th>Port Calls, 1999</th>
<th>Penobscot River ME</th>
<th>Searsport Harbor ME</th>
<th>Portland ME</th>
<th>Portsmouth NH</th>
<th>Salem MA</th>
<th>Boston MA</th>
<th>Total GoM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Foreign Dry Cargo and Passenger</td>
<td>2</td>
<td>97</td>
<td>152</td>
<td>77</td>
<td>26</td>
<td>481</td>
<td>835</td>
</tr>
<tr>
<td>Foreign Tanker</td>
<td>17</td>
<td>31</td>
<td>309</td>
<td>92</td>
<td>5</td>
<td>363</td>
<td>817</td>
</tr>
<tr>
<td>Foreign Barge</td>
<td>2</td>
<td>6</td>
<td>16</td>
<td>11</td>
<td>0</td>
<td>19</td>
<td>54</td>
</tr>
<tr>
<td>Domestic Tanker</td>
<td>4</td>
<td>3</td>
<td>22</td>
<td>6</td>
<td>0</td>
<td>24</td>
<td>59</td>
</tr>
<tr>
<td>Domestic Dry Cargo Barge</td>
<td>0</td>
<td>4</td>
<td>15</td>
<td>11</td>
<td>0</td>
<td>173</td>
<td>203</td>
</tr>
<tr>
<td>Domestic Tank Barge</td>
<td>70</td>
<td>28</td>
<td>105</td>
<td>62</td>
<td>38</td>
<td>896</td>
<td>1,199</td>
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</tbody>
</table>
Maritime Transport in GoM: Cost Savings from Transit Optimization

<table>
<thead>
<tr>
<th></th>
<th>time charter rate, $/day</th>
<th>operating cost, $/day</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>dry bulk</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Handysize (27k dwt)</td>
<td>6,500</td>
<td>3,500</td>
</tr>
<tr>
<td>Handymax (43k dwt)</td>
<td>8,000</td>
<td>4,000</td>
</tr>
<tr>
<td>Panamax (59k dwt)</td>
<td>9,500</td>
<td>4,500</td>
</tr>
<tr>
<td>Cape (150k dwt)</td>
<td>14,000</td>
<td>6,000</td>
</tr>
<tr>
<td><strong>tanker</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>product (45k dwt)</td>
<td>12,000</td>
<td>5,000</td>
</tr>
<tr>
<td>Aframax (90k dwt)</td>
<td>13,000</td>
<td>6,000</td>
</tr>
<tr>
<td>Suezmax (140k dwt)</td>
<td>16,500</td>
<td>7,000</td>
</tr>
<tr>
<td>VLCC (280k dwt)</td>
<td>22,000</td>
<td>9,000</td>
</tr>
<tr>
<td><strong>container</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>400 TEU geared</td>
<td>5,000</td>
<td>2,000</td>
</tr>
<tr>
<td>1000 TEU geared</td>
<td>9,000</td>
<td>3,500</td>
</tr>
<tr>
<td>1500 TEU geared</td>
<td>13,500</td>
<td>4,000</td>
</tr>
<tr>
<td>2000 TEU gearless</td>
<td>18,000</td>
<td>4,500</td>
</tr>
<tr>
<td>3000 TEU gearless</td>
<td></td>
<td>5,200</td>
</tr>
<tr>
<td>4000 TEU gearless</td>
<td></td>
<td>5,500</td>
</tr>
</tbody>
</table>
A Model of Oceanographic Information and Fisheries

Environment → Biology → Management

Biology → Fishery

Fishery → Fishing Economy
Linking Ocean Data to Fishing Activity

2003 Total Northern Shrimp Landings by SST

2003 Northern Shrimp Catch Per Unit Effort by SST
1% Increase in Fisheries Value Added

<table>
<thead>
<tr>
<th>State</th>
<th>FINFISH</th>
<th>SHELLFISH</th>
</tr>
</thead>
<tbody>
<tr>
<td>ME</td>
<td>$0.3</td>
<td>$0.3</td>
</tr>
<tr>
<td>NH</td>
<td>$0.1</td>
<td>$0.0</td>
</tr>
<tr>
<td>MA</td>
<td>$1.2</td>
<td>$0.8</td>
</tr>
<tr>
<td>RI</td>
<td>$0.3</td>
<td>$0.3</td>
</tr>
<tr>
<td>NEW ENG</td>
<td>$1.8</td>
<td>$2.3</td>
</tr>
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</table>
An increase in Marine Recreational Fishing

<table>
<thead>
<tr>
<th>State</th>
<th>% Caught from Commercial Vehicles</th>
<th>% Caught from Private Boats</th>
<th>Number of Marine Recreational Anglers</th>
<th>Trips per person</th>
<th>Estimated Value @100/day</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maine</td>
<td>72</td>
<td>384</td>
<td>216,007</td>
<td>2.9</td>
<td>$45,611,032</td>
</tr>
<tr>
<td>New Hampshire</td>
<td>32</td>
<td>174</td>
<td>122,901</td>
<td>2.3</td>
<td>$20,666,366</td>
</tr>
<tr>
<td>Massachusetts</td>
<td>340</td>
<td>1,823</td>
<td>470,570</td>
<td>6.3</td>
<td>$216,307,961</td>
</tr>
<tr>
<td>Rhode Island</td>
<td>144</td>
<td>771</td>
<td>321,201</td>
<td>3.9</td>
<td>$91,512,117</td>
</tr>
<tr>
<td>GULF OF MAINE TOTAL</td>
<td>588</td>
<td>3,153</td>
<td>1,130,679</td>
<td>4.6</td>
<td>$374,097,475</td>
</tr>
</tbody>
</table>
1% Increase in Marine Recreational Fishing

- ME: $6.3
- NH: $2.9
- MA: $29.8
- RI: $12.6
- GOM: $51.6
Search and Rescue in GoM: Scale

• Gulf of Maine SAR Activities
  – 6,000 Missions
  – 500 Lives At Risk
  – Lives Lost: 28

• US SAR Activities
  – 40,000 missions
  – Lives at Risk: 4,800/year
  – Loose about 360/year in failed SAR efforts
Search and Rescue in GoM: Application of GoMOOS Information

- improved wind, wave, and current info -> better search patterns and more rapid location of persons in distress
- successful rescue is more likely (90%) if person is reached within 2 hours – success rate only 4% after 2 hours
Search and Rescue: GoMOOS Benefits

• nationally: 1% improvement in search success -> 44 additional lives saved = $176 million
Pollution Control

Oil Spill Clean Up and Remediation

Fate and Effect of Land-originating pollutants
Oil Spill Cost Categories

- **Direct Expenses**
  - Cost of personnel and their expenses during cleanup
  - Cost of contractors and other direct cleanup
  - Reimbursed cost for USCG and USCG fines.
  - Fees and fines from state agencies.
  - Cost of litigation and litigation defense
  - Costs associated with residual damages
- **Economic Losses**
- **Environmental damages**
- **Mitigation Expense**

- **Indirect Expenses**
  - Increased attention by regulators
  - Permit for new activities cost more and take longer
  - More drills and exercises
  - Increased cost of new equipment and other preparation cost
  - New local, state and federal laws
  - New local, state and federal taxes and fees
  - Business cost by diverting key personnel to spill control
  - Stock price and stockholder pressure
  - Higher insurance costs
  - Loss of sale of products
Volume of oil spilled by size

- 0
- 5,000,000
- 10,000,000
- 15,000,000
- 20,000,000
- 25,000,000
- > 1000 Gals
- <1000 Gals

Graph showing the volume of oil spilled by size from 1973 to 1997.
U.S. Gulf of Maine Oil Ports account for 5% of U.S. waterborne oil (961M/1961M bbls)
Canadian Oil Movement in the Gulf of Maine is also very large
Oil Spill Cost Estimates

• $10,000 per barrel of oil spilled (British Petroleum)
  – Total costs 1990-1999
    • US: $3.67 billion
    • New England (CG District 1) $746 million

• Cost has risen 700% since Exxon Valdez

• Oil spill cleanup is 5-15% effective
Wave Forecasts  07:00 & 13:00 2/26-2/29 2004
SIG. WAVE HEIGHTS (CONTOURS), WAVE DIRECTIONS (DIR. OF VECTORS), WAVE PERIODS (LENGTH OF VECTORS) AT 2004022912
SIG. WAVE HEIGHTS (CONTOURS), WAVE DIRECTIONS (DIR. OF VECTORS), WAVE PERIODS (LENGTH OF VECTORS) AT 2004022718
SIG. WAVE HEIGHTS (CONTOURS), WAVE DIRECTIONS (DIR. OF VECTORS), WAVE PERIODS (LENGTH OF VECTORS) AT 2004022800
SIG. WAVE HEIGHTS (CONTOURS), WAVE DIRECTIONS (DIR. OF VECTORS), WAVE PERIODS (LENGTH OF VECTORS) AT 2004022806
SIG. WAVE HEIGHTS (CONTOURS), WAVE DIRECTIONS (DIR. OF VECTORS), WAVE PERIODS (LENGTH OF VECTORS) AT 2004022812
SIG. WAVE HEIGHTS (CONTOURS), WAVE DIRECTIONS (DIR. OF VECTORS), WAVE PERIODS (LENGTH OF VECTORS) AT 2004022818
SIG. WAVE HEIGHTS (CONTOURS), WAVE DIRECTIONS (DIR. OF VECTORS), WAVE PERIODS (LENGTH OF VECTORS) AT 2004022906

Period scale:
- 5 sec
- 10 sec
- 15 sec

Vector lengths in meters:
- 0
- 1.0
- 2.0
- 3.0
- 4.0
- 5.0
- 6.0
- 7.0
- 8.0
- 9.0
- 10.0
- 11.0
- 12.0

Legend:
- LAND
If oil spill costs could be reduced by 1% in New England...
If oil spill costs could be reduced by 1% in the US…
Accounting for Benefits

- Changes in Economic Activity
  - Economic Impact
    - Direct
      - Fishing
      - Recreational Fishing
    - Indirect, Induced
  - Value Added (National Income) Basis

- Change in Social Surplus
  - Profits
    - Transportation
    - Pollution Control
  - Consumer value
    - Boating, Beach going
    - Pollution Control
## Summary of Potential GOMOOS Benefits

<table>
<thead>
<tr>
<th>application</th>
<th>nature of benefit</th>
<th>annual potential benefits ($million)</th>
</tr>
</thead>
<tbody>
<tr>
<td>search and rescue</td>
<td>lives saved*</td>
<td>24</td>
</tr>
<tr>
<td></td>
<td>reduced operating costs</td>
<td>?</td>
</tr>
<tr>
<td>pollution mitigation</td>
<td>oil spills**</td>
<td>0.75</td>
</tr>
<tr>
<td></td>
<td>other</td>
<td>?</td>
</tr>
<tr>
<td>commercial fisheries</td>
<td>improved weather information</td>
<td>?</td>
</tr>
<tr>
<td></td>
<td>improved management/fishing operations</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>aquaculture</td>
<td>?</td>
</tr>
<tr>
<td>recreation</td>
<td>additional recreational fishing days</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>improved weather information</td>
<td>?</td>
</tr>
<tr>
<td>maritime transportation</td>
<td>lower vessel operating costs</td>
<td>0.5</td>
</tr>
<tr>
<td><strong>total</strong></td>
<td></td>
<td>33+</td>
</tr>
</tbody>
</table>