Top 25 Water Ports by Containerized Cargo: 2008
Ocean Economy

Offshore wind

Tourism

Shipping

Fishing
Marine Ecosystem Health
CMSP identifies areas most suitable for various types or classes of activities in order to reduce conflicts among uses, reduce environmental impacts, facilitate compatible uses, and preserve ecosystem services.
Ocean Policy Task Force
THE WHITE HOUSE COUNCIL ON ENVIRONMENTAL QUALITY

June 12, 2009 – July 19, 2010
Nine National Priority Objectives

*How we do business*

1. Ecosystem-based management
2. **Coastal and marine spatial planning**
3. Inform decisions and improve understanding
4. Coordinate and support

*Areas of special emphasis*

1. **Resiliency and adaptation to climate change and ocean acidification**
2. Regional ecosystem protection and restoration
3. Water quality and sustainable practices on land
4. Changing conditions in the Arctic
5. Ocean, coastal and Great Lakes observations, mapping and infrastructure
Goals

CMSP is intended to:

- Facilitate sustainable economic growth
- Improve ecosystem health and services
CMSP
Marine Transportation and Climate Change
Vessel Tracks

September 2007 – July 2008
Navigation, Military and Infrastructure Areas Designated as Areas of Particular Concern
Rhode Island Ocean SAMP: Climate Change impacts on marine transportation, navigation and infrastructure

<table>
<thead>
<tr>
<th>Climate Change Variable</th>
<th>Potential Impact</th>
<th>Marine Transportation</th>
<th>Navigation</th>
<th>Infrastructure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increasing air temperatures</td>
<td>Extended shipping season and use of infrastructure (Neumann 2009)</td>
<td>+</td>
<td>n/a</td>
<td>+</td>
</tr>
<tr>
<td></td>
<td>Degradation and shortened lifespan of ships and infrastructure</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td>Reduced icing in waterways and on vessels and infrastructure (PIANC 2008)</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Increasing sea level</td>
<td>Increased exposure to infrastructure (corrosion)</td>
<td>–</td>
<td>n/a</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td>Increased likelihood of flooding/inundation of coastal infrastructure (Neumann 2009)</td>
<td>–</td>
<td>n/a</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td>Need for higher passing height for bridges (PIANC 2008)</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td>May increase navigability of waterways (TRB 2008)</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Increase in storm intensity</td>
<td>Changing movements of sediment (erosion/accretion) (EPA 2008b)</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td>Increased degradation and vulnerability of infrastructure (coastal and offshore) (PIANC 2008)</td>
<td>–</td>
<td>n/a</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td>Loss/retreat of land (for associated infrastructure) (PIANC 2008)</td>
<td>–</td>
<td>n/a</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td>Increase in unsafe condition and poor visibility for navigation/transferring cargo (TRB 2008)</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td>More need for emergency planning and rescue (Neumann 2009)</td>
<td>–</td>
<td>n/a</td>
<td>–</td>
</tr>
</tbody>
</table>
Massachusetts Ocean Plan

OPA - Infrastructure, Navigation, and Transportation Uses on 250 Meter Grid (DRAFT)

Priority Rankings
- No Priority
- Medium Priority
- High Priority
# Massachusetts Ocean Plan

<table>
<thead>
<tr>
<th>Resource</th>
<th>Low Priority</th>
<th>Medium Priority</th>
<th>High Priority</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anchorage areas</td>
<td></td>
<td>*</td>
<td></td>
</tr>
<tr>
<td>Anchorage berths</td>
<td></td>
<td></td>
<td>*</td>
</tr>
<tr>
<td>Pilot boarding area</td>
<td>*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ship channels</td>
<td></td>
<td></td>
<td>*</td>
</tr>
<tr>
<td>Ferry routes</td>
<td></td>
<td></td>
<td>*</td>
</tr>
<tr>
<td>Dredged material disposal areas</td>
<td></td>
<td></td>
<td>*</td>
</tr>
</tbody>
</table>
## Economic benefits: Rhode Island

### Port of Providence
- Number of direct Jobs: 953
- Wages paid: $42.1 million
- Tax revenue generated: $16.9 million

### Port of Quonset
- Number of direct Jobs: 1,100
- Wages paid: $42 million
- Tax revenue generated: $9 million
Rhode Island
Economic benefit of Marine Transportation and Navigational Uses within SAMP Area

Navigation-dependent marine transportation industries as well as recreational and fishing-related industries
Data: Region Long-Term Dredged Material Disposal Site Evaluation Project
12,265 direct jobs
$425 million in wages
$586 million gross state product

Marine transportation-related industries
Data: The National Ocean Economics Program
1,968 direct jobs
$134 million in wages
$97 million in gross state product
The Ocean Rules Climate... Climate Rules the Ocean
Ocean Acidification

Diagram showing the process of ocean acidification with chemical reactions: 

\[ Ca^{2+} + 2HCO_3^- \rightarrow \text{CaCO}_3 + \text{CO}_2 + \text{H}_2\text{O} \]

Carbonate saturation horizon, Clay, Carbonate ooze.
Ocean Acidification
Planktonic Pteropods
Ocean Acidification
US Commercial Fisheries
2007: $4 billion

Uninfluenced 1%
Other calcifiers 1%
  (limpets, sea urchins, andwhelks)
Oysters & Mussels 3%
Clams 5%
Scallops 10%
Lobsters 9%
Shrimp 10%
Crabs 11%
Top predators 26%
  Includes: barracuda, marlin, salmon, shark, squid, swordfish, tuna
Calcifiers' predators 24%
  Includes: cod, haddock, halibut, mackerel, octopus, snapper, sole, striped bass, flounder
Sea Level Rise
(Global: IPCC)
Sea Level Rise
(Newport, RI)

Rate of Rise
25.8 cm +/- 1.9 cm / 100 yr
Gulf: Freight handling port facilities at risk from relative sea level rise of 61 and 122 cm (2 and 4 ft)
Gulf: **Highways** at risk from a relative **sea level rise** of 122 cm (4 ft).
Gulf: **Rail lines** at risk due to relative **sea level rise** of 61 and 122 cm (2 and 4 ft).
Storm Intensification

Annual Frequency of North Atlantic Tropical Storms
(ten-year running average)

Average Number of Named Storms


1948-1957

1992-2001

1998-2007
Storm Damage

Katrina Damage
31 Aug 2005
Port Sulpher, LA

15489-30 at fotosearch.com
Insurance Information Institute
Catastrophe Losses 1987-2006 (in 2006 $s)

- Hurricanes and tropical storms: 46.3% $138 billion
- Total: $297 billion

- Tornadoes: 26.0% ($77.3 billion)
- Winter storms: 7.8% ($23.1 billion)
- Terrorism: 7.5% ($22.3 billion)
- Earthquakes: 6.4% ($19.1 billion)
- Wind/hail/flood: 3.1% ($9.3 billion)
- Fire: 2.2% ($6.6 billion)
- Civil disorders: 0.4% ($1.1 billion)
- Utility service disruption: 0.1% ($0.2 billion)
- Water damage: 0.1% ($0.4 billion)
Gulf: Freight handling port facilities at risk from storm surge of 5.5 and 7.0 m (18 and 23 ft)
Gulf: **Highways** at risk from **storm surge** at elevations currently below 5.5 m (18 ft)
Gulf: **Rail lines** at risk due to **storm surge** of 5.5 and 7.0 m (18 and 23 ft)
Airports in Surge Zones

<table>
<thead>
<tr>
<th>Airports</th>
<th>Surge Zone Elevation (ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CS</td>
<td>&lt; 0</td>
</tr>
<tr>
<td>GA</td>
<td>0 - 5</td>
</tr>
<tr>
<td>IND</td>
<td>5 - 18</td>
</tr>
<tr>
<td>MIL</td>
<td>18 - 24</td>
</tr>
<tr>
<td>Study Area</td>
<td>&gt; 24</td>
</tr>
<tr>
<td>States</td>
<td></td>
</tr>
</tbody>
</table>

Legend:
- CS: Civilian
- GA: General Aviation
- IND: Ind. Civilian
- MIL: Military
- Study Area
- States

Map showing surge zones with different color codes for elevation ranges.
Ensuring a sustainable coast requires immediate & aggressive wetland creation & barrier island restoration. This can only be achieved using river resources & effective use of dredged material. A sustainable coast provides storm protection for urban & rural communities & infrastructure, maintains normal oxygen conditions in offshore waters, reduces inshore salt water intrusion, & supports habitat for abundant fish & wildlife, as well as the thriving Cajun & Creole cultures. With aggressive restoration, accretion can keep up with subsidence & sea level rise, so that there is a net land gain. Only with aggressive restoration does coastal Louisiana stand a fighting chance to survive the effects of future climate change.
Shrinking Sea Ice Extent in Arctic Ocean: September

2007
Shrinking Sea Ice

Sea Ice Thickness (10-year average)

1950's

2050's

100% of 1955 volume

54% of 1955 volume

(cm)
Northern Sea Shipping Route
Habitat Restoration
Non-Native (Invasive) Species

“Killer algae”

Non-native zebra mussels clogging pipes in the Great Lakes
National Ocean Council
Regional Planning
(Areas Defined in Executive Order)
Challenge: Resources
Public/Private Partnerships
Public/Private Partnerships