Coastal and Marine Spatial Planning (CMSP) in the context of Ecosystem-based Management (EBM)

Porter Hoagland & Di Jin

Marine Policy Center
Woods Hole Oceanographic Institution
Woods Hole, MA 02543

Tracey Dalton & Joe Dwyer

Department of Marine Affairs
University of Rhode Island
Kingston, RI 02881

IIFET 2014, June 11, 2014
Coupled Nature-Human (CNH) Systems

- CNH concept arose from theoretical ecology
- **Spatial** and temporal dimensions
- Application of CNH thinking to natural resource management comprises ecosystem-based management (EBM)
- Initial steps comprise an ecosystem approach to management (EAM)
CMSP for EBM

• The coastal ocean is becoming more crowded

• Seems sensible to plan for ways to mitigate any conflicts

• When one type of human use (or non-use) could displace or exclude another, how can we assess such tradeoffs?

• What are the effects on the ecosystem?…on humans?

• Can planning help to realize an “ecosystem-based approach to management”?

Massachusetts Ocean Plan

http://www.env.state.ma.us/eea/mop/final-v1/figs/2-21.htm
Ecologists build models of marine food webs. These models may recognize humans as a component. Typically do not model the complexity of the human system explicitly.

Natural Sciences and Engineering Research Council of Canada

NSERC (2008)
Regional Economy

- Economists build models of flows among industry sectors in an economy.
- Typically do not model the complexity of the natural system explicitly.

http://www.ugcnetmanagement.com/tag/business/
Linked Economic and Ecological Models

- CNH thinking suggests that distinct models might be linked

- Advantage is that we can examine the effects of changes occurring in one part of the system on another

- Linked models may enable an ecosystem approach and could facilitate planning within the context of EAM

CINAR (2011)
Distribution of Effects across Households

• There is now increased policy-level attention to issues of *wealth and income inequality*

• Pres. Obama: “…increasing inequality is most pronounced in our country, and it challenges the very essence of who we are as a people…”

• Effects on final consumers (households) in an economy also are important
Proposed Wind Farm Sites off Rhode Island and Massachusetts

- Deepwater Wind’s Block Island Wind Farm (BIWF) [25 MW]
- Cape Wind’s lease area in Nantucket Sound (grandfathered) [468 MW]
- RI and MA “Area of Mutual Interest” (AMI) in Rhode Island Sound (North and South) [1,000 MW]
- Bureau of Offshore Energy Management (BOEM) Massachusetts Wind Energy Area [2,000-13,000 MW]

Boston Globe (2013)
Potential Effects of Displacement of Commercial Fisheries from the RI/MA Area of Mutual Interest (AMI)

- NMFS compiles catch data at the level of 10’ squares (numbered boxes)
- During 1998-2008, average annual commercial fishing revenues were $12m
- We assumed that commercial fishing would be excluded from the AMI
- Thus $5m in gross revenues would be lost to the coastal RI/MA economy
- **Caveats**! (assumptions regarding exclusion; fishermen’s behavior; renewable energy impacts)

Dwyer et al. (2013)
Baseline Regional Economy for Coastal RI and MA

<table>
<thead>
<tr>
<th>Baseline Economy ($m 2013)</th>
<th>Output</th>
<th>Regional Supply</th>
<th>Imports</th>
<th>Exports</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agriculture</td>
<td>965</td>
<td>4,479</td>
<td>4,207</td>
<td>693</td>
</tr>
<tr>
<td>Fishing</td>
<td>515</td>
<td>432</td>
<td>71</td>
<td>153</td>
</tr>
<tr>
<td>Fish Processing</td>
<td>800</td>
<td>343</td>
<td>81</td>
<td>538</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>110,851</td>
<td>149,809</td>
<td>60,737</td>
<td>21,779</td>
</tr>
<tr>
<td>Other</td>
<td>469,400</td>
<td>412,617</td>
<td>84,306</td>
<td>141,089</td>
</tr>
</tbody>
</table>

- **“Economy”** encompasses coastal counties in Rhode Island and Massachusetts
- **Fisheries and Fish Processing** are distinguished from the rest of the economy
- Changes from the baseline involve changing quantities and prices as the economy re-equilibrates
Basic Components of a CGE Model

- Capital
- Labor
- Composite Factor
- Intermediate Input
- Output
- Imports
- Domestic Sales
- Exports
- Fish Stock
- Armington Composite Commodity
- Household
- Government
- Investment
- Intermediate Input
- Non-market values
- Welfare measures
- Production
- Trade
- Consumption

Food Web

Management measures
Excluded Fishery Impacts “Multiply” through the Economy

### Table 2: Indirect and Induced Output Impacts of Lost Fishing on Other Industry Sectors (2013)

<table>
<thead>
<tr>
<th>IMPLAN Sector</th>
<th>Industry</th>
<th>Indirect</th>
<th>Induced</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>43</td>
<td>Maintenance and repair of nonresidential buildings</td>
<td>515,887</td>
<td>12,366</td>
<td>528,252</td>
</tr>
<tr>
<td>390</td>
<td>Wholesale trade</td>
<td>320,506</td>
<td>189,060</td>
<td>509,566</td>
</tr>
<tr>
<td>509</td>
<td>Owner-occupied dwellings</td>
<td>0</td>
<td>416,440</td>
<td>416,440</td>
</tr>
<tr>
<td>467</td>
<td>Hospitals</td>
<td>0</td>
<td>208,745</td>
<td>208,745</td>
</tr>
<tr>
<td>431</td>
<td>Real estate</td>
<td>33,146</td>
<td>148,711</td>
<td>181,857</td>
</tr>
<tr>
<td>397</td>
<td>Scenic and sightseeing transportation and support</td>
<td>176,105</td>
<td>4,198</td>
<td>180,303</td>
</tr>
<tr>
<td>465</td>
<td>Offices of physicians- dentists- and other health</td>
<td>0</td>
<td>173,039</td>
<td>173,039</td>
</tr>
<tr>
<td>481</td>
<td>Food services and drinking places</td>
<td>4,728</td>
<td>154,069</td>
<td>158,797</td>
</tr>
<tr>
<td>427</td>
<td>Insurance carriers</td>
<td>53,858</td>
<td>91,471</td>
<td>145,329</td>
</tr>
<tr>
<td>478</td>
<td>Other amusement- gambling- and recreation industries</td>
<td>109,263</td>
<td>24,693</td>
<td>133,956</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>AMI Alt. A Welfare Changes ($m 2013; Jobs)</th>
<th>Direct</th>
<th>Indirect</th>
<th>Induced</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output</td>
<td>- 5.2</td>
<td>- 2.0</td>
<td>- 3.3</td>
<td>- 10.5</td>
</tr>
<tr>
<td>Value Added</td>
<td>- 2.5</td>
<td>- 1.1</td>
<td>- 2.0</td>
<td>- 5.6</td>
</tr>
<tr>
<td>Tax Receipts</td>
<td></td>
<td></td>
<td></td>
<td>- 1.7</td>
</tr>
<tr>
<td>Employment</td>
<td>- 113</td>
<td>- 14</td>
<td>- 25</td>
<td>- 152</td>
</tr>
</tbody>
</table>
Potential Welfare Effects

- **Welfare losses** are lost EV (consumer surplus) from excluded fisheries and linked sectors (~$14m)

- [Welfare changes from wind energy (if they exist) were not estimated]

- **Impacts** are progressive, showing how middle-class and wealthy households consume more seafood and are tied more closely to the regional economy

- **Impacts** comprise a larger proportion of household income for the less wealthy (not shown)
Inequality Aversion

• Societal concerns about wealth or income inequality

• Reflective of an “inequality” aversion (much like risk aversion)

• Weight impacts to low income groups more heavily (and v.v.)

• Losses to income categories are assigned to census tracts based upon median income

• Losses per household are estimated
Comments

• EBM involves understanding how changes to a coupled nature-human system play out across space and over time

• Using this knowledge, society may be able to plan better for the consequences of new ocean uses or the reallocation of existing ocean uses

• Many issues require further work, including:
  • the political economy of decision-making
  • exogenous influences on the coupled system (climate change)
  • the dynamic aspects of CNH