The Role of Economics in Ecosystem-based Management:

Applications to Massachusetts Marine and Coastal Environments

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Science. Education. Community.

Goals of the Workshop

- Provide information regarding the economic methods that are available to provide policy insight for ecosystem-based management and marine spatial planning and how these methods can be used
- Learn (from each other) how economic analysis can help you with management decisions and regulatory analyses
- Discuss where economic data may be found to help inform management and limitations of existing data
- Highlight some of the common pitfalls, red flags and challenges of using economics for policy guidance
- Establish an ongoing dialog between social scientists and ecosystem service managers and stakeholders

Some General Comments

- A workshop - not a short course
- We hope to capitalize on the experience and knowledge in this room to collectively determine how economics can contribute to management of the coastal ecosystem
- There is a diversity of participants in terms of economics background and specific expertise– we'll try to strike a balance– let us know when we are being too technical or too simplistic

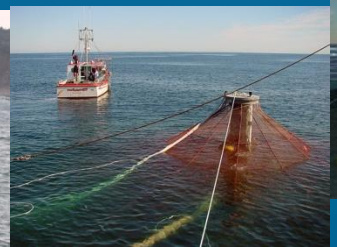
A Growing Need for Management of Marine Environments

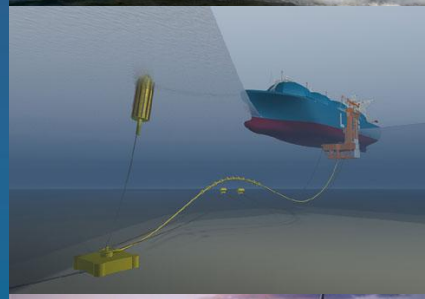




- Ocean and coastal management regimes have focused primarily on the independent management of fishing, recreation, and shipping
- On top of traditional conflicts over access to resources, managers now face proposals for:
  - sand and gravel mining,
  - gas pipelines,
  - harbor/port development,
  - offshore wind and tidal energy facilities,
  - offshore LNG terminals,
  - aquaculture,
  - marine parks and biodiversity conservation
- The intensity of ocean and coastal uses has increased the need for coordinated management
  - to take advantage of synergies
  - to avoid or minimize conflicts
  - to understand indirect as well as direct linkages of coupled natural-human systems
  - to maintain integrity of marine ecosystems

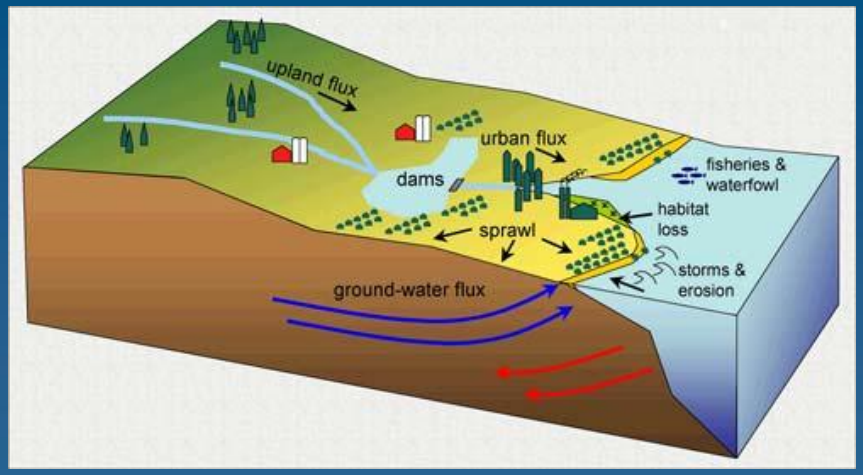




EBM as defined in consensus statement (McLeod et al. 2005)

"EBM is an integrated approach to management that considers the entire ecosystem, including humans. The goal of EBM is to maintain an ecosystem in a healthy, productive and resilient condition so that it can provide the services humans want and need. EBM differs from current approaches that usually focus on a single species, sector, activity or concern; it considers the cumulative impacts of different sectors."



- emphasizes the *protection of ecosystem structure*, functioning, and key processes;
- *place-based* in focusing on a specific ecosystem and the range of activities affecting it;
- *accounts for the interconnectedness within systems*, recognizing the importance of interactions between many target species or key services and other non-target species;
- *acknowledges interconnectedness among systems*, such as between air, land and sea;
- *integrates ecological, social, economic, and institutional perspectives*, recognizing their strong interdependences."

McLeod, K. L., J. Lubchenco, S. R. Palumbi, and A. A. Rosenberg. 2005. Scientific Consensus Statement on Marine Ecosystem-Based Management. Signed by 221 academic scientists and policy experts with relevant expertise and published by the Communication Partnership for Science and the Sea at http://compassonline.org/?q=EBM.

Implementing EBM in Practice

- At a minimum, managers of particular activities and resources should consider effects of and impacts on other activities and resources (that often may be managed by someone else).
- We need to move beyond considering trade-offs in use of a single resource (e.g. how to divvy up the allowable catch of herring between big boats and small boats) to considering trade-offs at the ecosystem level (e.g. how does the herring fishery impact the larger ecosystem and related ecosystem services).
- When considering spatial management measures and exclusive use areas we need to consider how they affect areas and users indirectly as well as directly

Who has a stake in herring?

- In the absence of good scientific and economic information on the role of herring in the ecosystem and its value to different direct and indirect users, management decisions are unlikely to make the best use of the herring resource and ensure its role in the ecosystem is maintained.

Where does economics fit in and what does it have to offer?

- Economics seeks to understand how human behavior and welfare is changed by policies, markets and exogenous factors and how expected changes in behavior influence outcomes (economic and ecological) both in the short run and in the long run as changes in the ecosystem feed back to change incentives and future behavior.
- Economics is only one social science tool and is best used in concert with other social sciences and natural sciences that together provide a more holistic and accurate understanding of how human policies and decisions affect and are affected by the ecosystem.

Three broad and overlapping areas to apply economics

- Economic evaluation of projects and policies – assessing trade-offs and best uses of scarce resources

- Modeling human behavior: predicting outcomes and understanding distributional effects

- Designing policies and governance systems to be more efficient and effective and provide the right incentives for desired behavior

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Primary Frameworks for Economic Evaluation

- Cost Benefit Analysis (CBA): comparing the total long-run costs and benefits of a policy to determine whether it provides greater net economic benefits to society than alternatives
- Cost Effectiveness Analysis (CEA): Comparing the costs of alternative ways of achieving a particular objective – costs may include reductions in ecosystem services as well as monetary costs
- Economic Impact Analysis (EIA): Quantifying how a project, policy or event will effect economic activity (e.g., sales revenues, employment)

Measuring Benefits and Costs

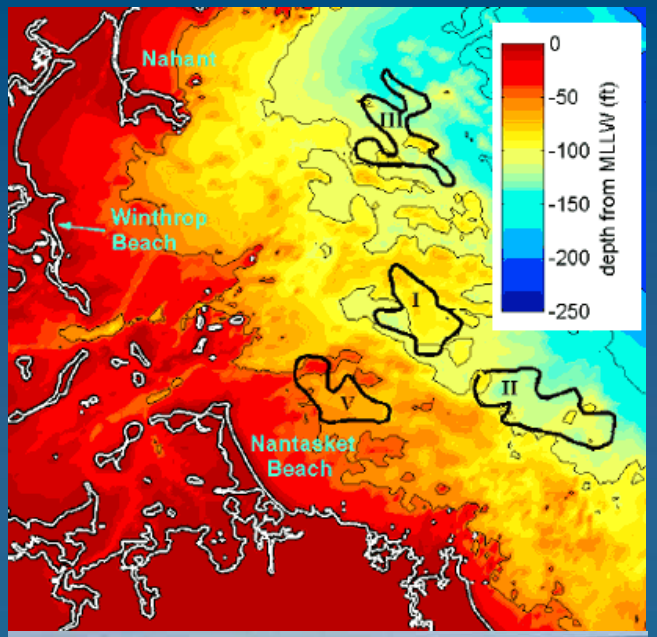
- Market Values
  - Can be estimated with aggregate or individual data on market transactions (e.g. purchase decisions, sales)
- Non-market Values
  - Use Value (e.g., recreation) – can be estimated with models that use observations of behavior
  - Non-use Values (e.g. existence value, bequest value) – can only be measured with survey techniques
  - Benefit Transfer techniques can be used to estimate use value and non-use value based on prior studies done on similar resources

Example: Costs and Benefits of Wind Farms

- Cost-benefit analysis can tell us if there are net benefits to society that justify allowing this private-exclusive use of public waters
- Private financial analysis will generally not consider potential external impacts
- CBA should compare a wide range of measurable benefits & costs
  - Market benefits related to electricity production (producer/consumer).
  - Market cost related to building and maintaining wind farm and related infrastructure
  - Market benefits or costs related to fishery impacts.
  - Non-market benefits related to reduced reliance on alternative, more polluting energy sources.
  - Non-market benefits or costs related to impacts on coastal aesthetics and property values.
  - Market and/or Non-Market benefits or costs related to other impacts on ecosystem services, short and long term (e.g., recreation).
- Economic benefits/costs depend not only on project existence, but also on scale and attributes and timing.

Example: Cost Effectiveness of beach nourishment from upland sand sources vs. offshore sand mining

- Assume a decision has already been made to nourish the beach but the alternative sources of sand are being considered
- Monetary cost of acquiring sand from offshore borrow sights is lower
- But how do costs compare if we include the costs of environmental impacts of sand mining?
- Cost effectiveness analysis may improve efficiency but does not tell us whether beach nourishment will provide net benefits to society
- What about the long term – what are the consequences of creating an expectation that this beach will be maintained indefinitely?



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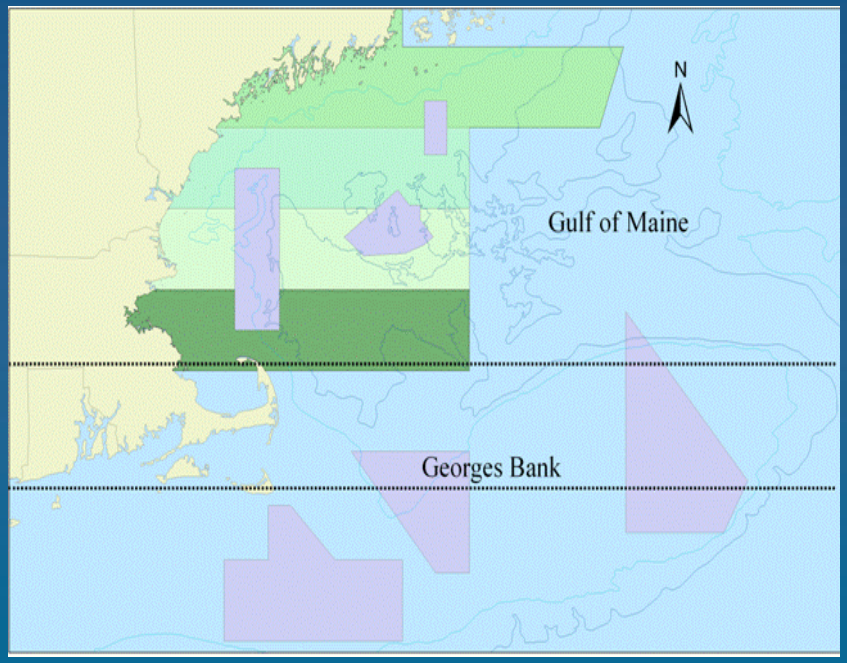
Understanding and Modeling Human Behavior

- Modeling techniques that use data on real or hypothetical choices people make can be used to determine peoples' preferences for various ecosystem services and the attributes of those services
- The model can be used to understand and predict how people will react to changes in availability, quality and prices of ecosystem services
- This is often necessary to predict and evaluate the consequences of different policy choices since they depend on how people react

Understanding impacts of year-round and rolling closures for groundfish fishery

- The impacts and the benefits and costs of permanent and rolling closures depend on where excluded fishermen go instead
- If closures were designed in part to protect habitat or reduce interference with spawning are we sure displaced effort is not doing more harm elsewhere?
- Closures to commercial groundfishermen may attract and benefit lobstermen and recreational fishers not excluded from the closed area



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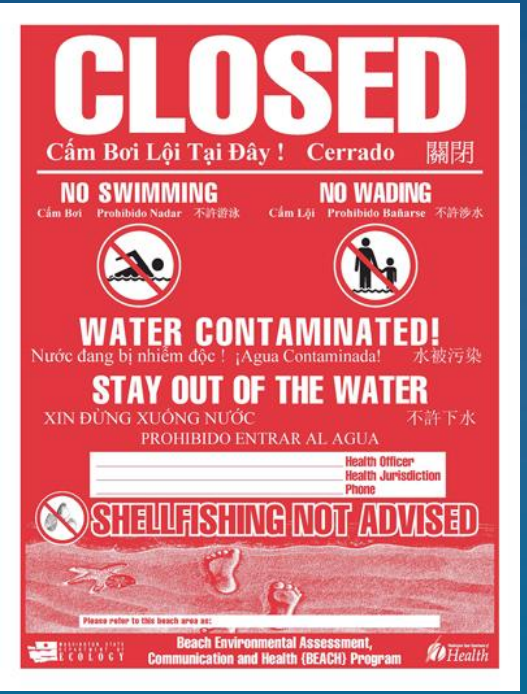
Understanding behavior to determine value

- The value society derives from the marine ecosystem results from people's preferences and people's decisions that determines how ecosystem services are used and how they respond changes in the attributes of those ecosystem services
- The same models economists use to predict behavior can sometimes also be used to estimate the change in benefits (value) that people derive from use of ecosystem services

Valuing reductions in pollution related beach closures

- Recreational demand models can estimate how use of a beach may change with changes in water quality or other attributes and also how benefits to prospective users are affected
- What is the lost value to would be users of the beach while it is closed to swimming? – what are the gains when it is closed less?
- The answer depends on how people react and what substitutes are available to them
- Indirect losses to businesses (e.g. hotels and restaurants) are generally excluded from valuation since these losses may be offset by gains elsewhere



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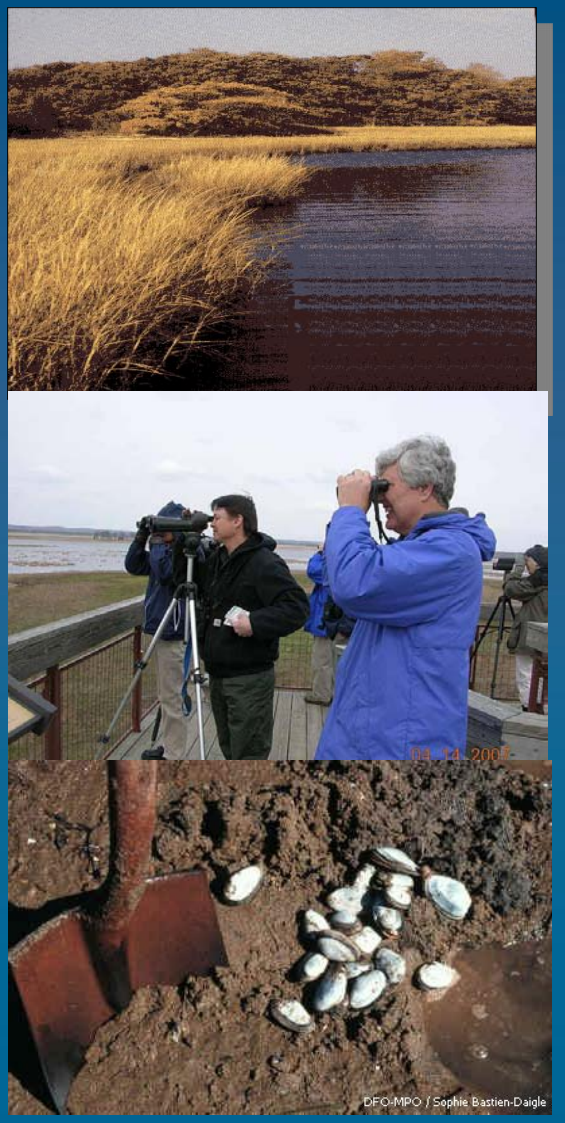
Modeling Coupled Natural and Human Systems

- Understanding initial human response to a policy or something that changes incentives is only the first step in many if not most cases
- Human actions that modify the ecosystem feed back to affect the value of ecosystem services and future human behavior
- Models of natural systems coupled with models of human behavior are sometimes necessary to predict the effects of policies and design them to accomplish the desired objectives

Evaluating Salt Marsh Restoration

- Insufficient resources to restore all sites, so how do you prioritize? Ecology is only part of the solution.
- Need to coordinates economic and ecological information to prioritize salt marsh restoration projects.
- Link restoration impacts on salt marsh features to functions to non-market values (e.g., waste processing, erosion control, bird viewing and recreational fishing, biodiversity, etc.) and market values (e.g. benefits from commercial fish harvests).
- The valuation may require ecological or physical models coupled with human behavioral models to predict and value changes in production of ecosystem services that are expected to occur



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Using Economic Incentives to Achieve Management Outcomes

- Traditional “command and control” approaches to regulating use of and impacts on ecosystem resources often fail to distribute resources to their highest value use or balance benefits to users with negative impacts
- There is increasing use of economic incentives and cap-and-trade systems to influence behavior and allocate resources
- Markets (or redistribution with fair compensation) may succeed in reallocating resources to higher value use where political allocation has failed
- Understanding incentives created by policy and anticipating behavior – can avoid unexpected and undesirable outcomes

Politics vs. Benefits

- What are the implications of ignoring economics and social science in evaluating decisions or designing policies?
  - Reduced benefits from ecosystem services
  - Excessive resources spent on lobbying (i.e., rent seeking)
  - Unintended consequences of regulation

What does economics have to offer EBM

- Economic evaluation of projects and policies – assessing trade-offs and best uses of scarce resources
- Modeling human behavior: predicting outcomes, distributional effects and impacts on the ecosystem
- Designing policies and governance system to be more efficient and effective