

Coastal and Marine Species (and Ecosystem)
Protection and Management:
What Does Economics Bring to the Table?

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Coastal and Marine Resources

- Beaches
- Dunes
- Estuaries
- Mangroves
- Marshes
- Reefs
- Seagrass beds

Associated Ecosystem Services

- Provisioning services
 - production of **food, medicine** and materials
- Cultural services
 - **opportunities for recreation, leisure and tourism**
- Regulating services
 - pollution filtration, **shoreline protection**, climate regulation
- Supporting services
 - waste removal, habitat provision
- Marine systems are also the primary means for regional trade; hence coastal zones also serve as centers of commerce.

Coastal and Marine Issues & Tradeoffs

- Coastal zones are densely inhabited
 - 23-39% of the world's population lives within 100 km of the coast
 - 21 of the world's 33 megacities are located within 100 km of the coast

Coastal and Marine Issues & Tradeoffs

- Anthropogenic stressors on coastal ecosystems
 - direct habitat alteration
 - over-harvest of marine species
 - NPS pollution / runoff
 - nutrient loading
 - sedimentation
 - the introduction of non-native species

Coastal and Marine Issues & Tradeoffs

- Allocation issues
 - Coastal land allocation (public/private)
 - Marine space allocation (take/no-take)
 - Harvest allocation (commercial/recreational)
- Hazard mitigation
 - Beach renourishment
 - Dredging
 - Armoring
 - Retreat
- Nature-based tourism

The Economic Perspective on these Issues

- Most of these issues involve tradeoffs:
 - Market vs. non-market goods
 - Public goods vs. private goods
 - Commercial uses vs. recreational uses
 - Current uses vs. future uses

What does Economics Bring to the Table?

- Modeling the behavior of people
- Measures and indicators of well-being
- Policy design
- Valuation

Modeling individual and market behaviors

- People respond to *incentives*
- Numerous economic models are available to estimate the determinants of human behaviors and how behaviors may change following natural or policy-induced changes in coastal and marine ecosystems.
 - Game theory
 - Portfolio theory
 - Discrete choice modeling
 - Bio-economic modeling

Building an operational and useful system of indicators for *economic* sustainability

- ROI
- Profit
- Net present value

Designing policies that are consistent with economic incentives

Incentive-based policies

- Taxes
- Entry fees
- Subsidies
- PES/Buyouts
- Cap & trade
- ITQs
- Deposit-refund

Understanding the range of economic values associated with coastal and marine resources

Valuation and Cost-Benefit Analysis

- Understanding the baseline
- Understanding economic value, impacts and tradeoffs
 - BAU
 - Policy-induced change
 - Opportunity costs!
- Building awareness

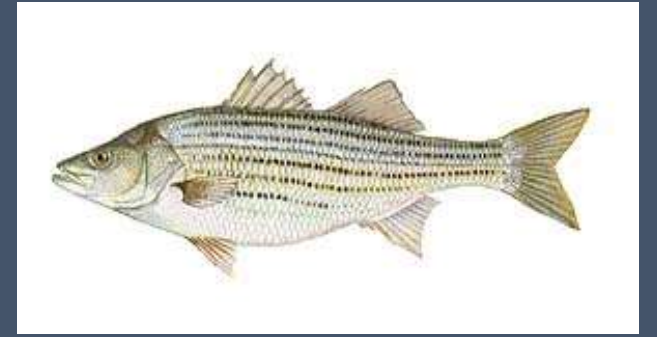
Economic valuation of coastal/marine resources

- Valuation can add transparency to the decision making process
- Improved understanding of:
 - How scarce resources, including both financial and natural capital, are being appropriated,
 - The efficiency, distribution, and economic consequences of alternative resource management decisions, including that of the no-decision option.
- When combined with modeling, the economic consequences of potential policy changes can be examined *ex ante*, and can therefore inform policy formation.

Something interesting to consider ...

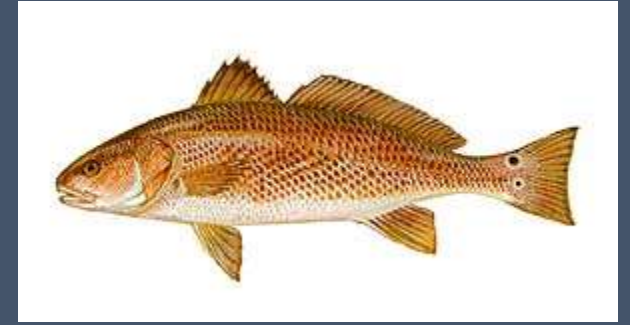
- In a RUM application, we model choice among mutually exclusive alternatives (e.g. recreation sites)
 - Multinomial logistic regression, because Y is discrete with multiple levels
 - E.g. respondent chooses site 4 of 10: $Y = 0, 0, 0, 1, 0, 0, 0, 0, 0, 0$
- We observe site choice *after* it has been made, but the site choice decision is made prior to the trip
- What type of quality variables influence site choice?

Examples of research questions



- How much recreational angler welfare and local business revenues could be gained or lost from changes in water quality following development at a river site (which happens to be the spawning grounds of an important recreational species)?
 - RUM application
 - Heterogeneity between catch/keep anglers and catch/release anglers

Examples of research questions



- Would a partial or complete reallocation of the NC commercial red drum stock to the recreational sector result in a net economic gain? Would the stock grow as a result?
 - Bioeconomic model of fish stock and angler behavior used to predict how policy-induced changes in commercial harvest would result in changes in stock size and recreational catch rates, utility and trip frequency.
 - Stock = $f(\text{dual-sector harvest})$
 - Recreational effort = $g(\text{catch})$
 - Recreational catch = $h(\text{stock})$
 - Simulated changes in recreational catch rates were fed into a RUM to value recreational gains
 - Demand model of commercial catch was used to derive value losses to commercial sector

Examples of research questions

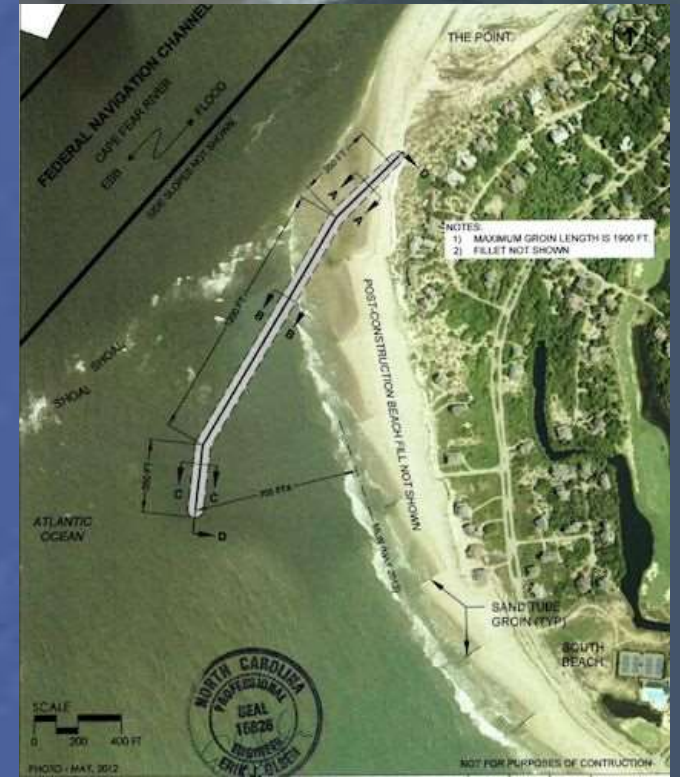
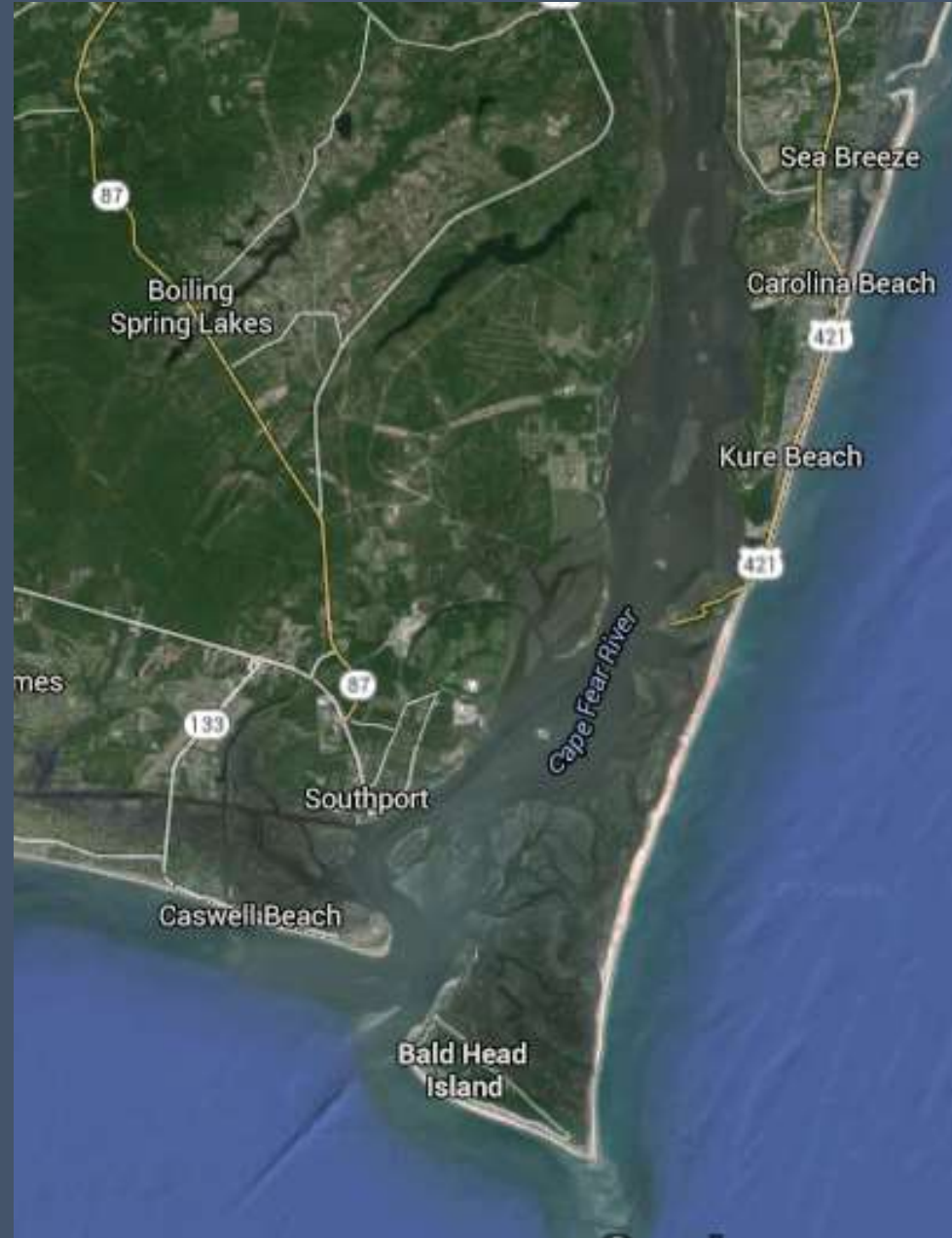


- What are the potential economic losses to commercial and recreational fishing from an increase the possibility of oil spills associated with exploratory drilling in the Atlantic northeast of Cape Hatteras NC?
 - RUM and market valuation

Examples ..

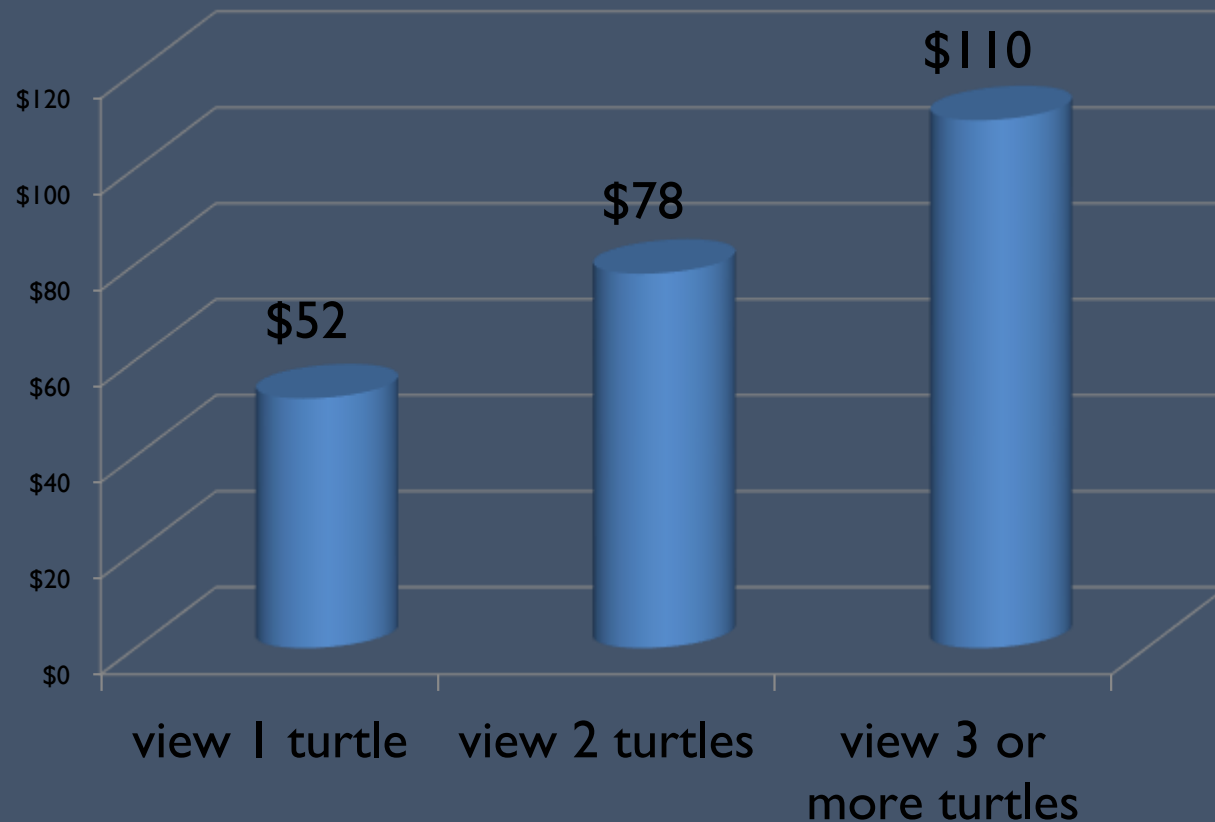
What are the costs and benefits of alternative options for stabilizing the shoreline on Bald Head Island NC?

- Approach: market price, MCDA using results from literature



Examples of research questions

- How much are divers willing to pay to encounter marine turtles?
 - Choice model



Examples of research questions

- What is the potential pharmaceutical value of marine biodiversity for anti-cancer drug discovery?
 - Market price method, probability
- Are divers willing to pay (WTP) to avoid encounters with other divers at dive sites in Barbados and Tobago?
 - CVM

Work to be done / Gaps and unknowns

- Despite a plethora of market data and *evidence of overfishing*, the economic *impacts of overfishing* remain largely unexplored.
 - Revenues and employment
 - Food security & protection against exogenous economic/natural shocks
 - Tourism
 - Historic fishing heritage/culture
- What role do fisheries *subsidies* play in overfishing?
 - Are subsidies doing more harm than good?

Work to be done / Gaps and unknowns

- While important aspects of provisioning and cultural (recreational) service values have garnered considerable attention by economists, values associated with *supporting and regulating services* provided by marine ecosystems have *not* received much attention.
 - E.g. the economic contribution of reefs and other coastal ecosystems to fisheries production, *climate regulation* and habitat provision.

Work to be done / Gaps and unknowns

- The economic value of *pelagic and continental shelf ecosystems* is largely unmeasured.
 - What are the values associated with the provisioning, regulating and cultural services provided by these ecosystems?

Work to be done / Gaps and unknowns

- How will tourism change with environmental degradation?
 - Will tourist demand shift toward destinations where effects are less apparent?
 - Can environmental protection serve to mitigate degradation?
 - What is the nature and scope of the economic tradeoff between mass tourism and *green* tourism?

Work to be done / Gaps and unknowns

- What is the economic impact (value loss) associated with invasive species?