

ECON 639 - Marine Resource Economics

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Course Description

Economics is the study of the use of scarce resources to satisfy human wants. Nowhere is this more apparent than in society's interaction with the ocean. This class will focus on the economic effects of specific policies in areas such as ocean recreation, shipping, offshore oil and gas production, aquaculture, and coral reef protection.

This course will introduce the methodologies used by economists to understand and assess different marine management policies: for example, economic impact assessment, equilibrium analysis, benefit-cost analysis, empirical program evaluation, dynamic programming and non-market valuation.

Student Learning Objectives

The course is designed to enhance the student's ability to understand economic concepts and models and to assess their relevance to marine issues. For non-economists, the course will develop understanding of economic issues and methods. For students of economics, the course provides a deepening of experience and understanding of the role of economics in marine policy. All students will learn how the different methodologies in the "Economist's Toolkit" can be applied to a variety of important marine resource issues.

In addition to studying the topics covered in class lectures and readings, each student will choose an area of special interest for a **research paper**. This paper requires application of a mix of theory, empirical evidence, and experience to a specific marine policy. The research paper promotes skill in recognizing and describing economic components of a policy issue and in identifying appropriate approaches to analyzing economic aspects of marine policy problems. Students from different disciplinary backgrounds are strongly encouraged to collaborate on a research paper together.

After completion of the course, students should be able to:

- (1) rigorously evaluate the economic impacts of marine management policies;
- (2) explain the linkages between economics, law and environmental science in the marine sector;
- (3) communicate with economists working at the frontier of research in marine economics.

Assessment

Short Assignments

There will be several short assignments during the semester. The assignments will be linked to the case studies associated with each topic. Each assignment involves solving a problem or considering policy options and writing a short report. Detailed requirements for each report will be established in class the week before they are due. On the due dates students will hand in their reports at the beginning of the seminar. The class will collectively discuss and evaluate the assignment.

Research Paper

Each student will write a research paper of about 15 pages in length (double-spaced) on a selected topic. Extensions or critiques of existing published papers are excellent starting points. Students from different disciplinary backgrounds are strongly encouraged to collaborate on a research paper together. Students are also encouraged to interview expert(s) in the area you are studying (for example, if you are interested in recreational fishing, you could interview a representative from the Pacific Islands Fisheries Group).

The paper should have the following parts:

- (1) An introduction identifying the specific marine or coastal policy, issue, or regulation;
- (2) A statement of the problem that prompted the issue, policy, or regulation, including explanation of economic efficiency or equity issues and identification of stakeholders and competing interests;
- (3) An analysis that explains current theory and approaches to the problem, logical selection of an analytical approach to the problem, and selection and display of information crucial to understanding the problem, consequences, policy options, or evaluation methods.
- (4) A conclusion that assesses the economic information, reviews policy approaches from an economic standpoint, and provides economic insight or recommendations.

Grades

The course grade will be based upon classroom participation and short assignments (40 percent) and the research paper (60 percent).

Topics and Readings

1. Principles of Microeconomics

This part of the course will introduce students to the fundamental principles underlying most economic analysis. We will start with the simple model of a competitive market and explore how to calculate consumer and producer surplus. We will then extend our analysis to the realm of “market failures”, in particular the role of externalities, public goods and common property resources. This part of the course will conclude with a broad discussion of the policy instruments used to address market failures such as taxes/subsidies, cap-and-trade regulation and enclosure of the commons. The case studies used to highlight these principles will include the 1973-74 Oil Crisis, the establishment of SO₂ Permit Markets and the current carbon tax vs. cap-and-trade debate.

Readings:

Chapters 2, 4 and, 15 of Tietenberg, *Environmental and Natural Resource Economics*

2. Harvesting and Management of Commercial Fisheries

This topic is the core of the course. Students will learn how to couple market systems with natural systems in a unified modeling framework. We will focus on deriving bio-economic equilibria and on optimizing yield from fisheries. The methodology of Dynamic Programming will be introduced. This part of the course will conclude with an overview of the empirical techniques used to test whether fisheries management policies are achieving their desired goals. We will draw heavily from the empirical program evaluation literature. A key case study will be the Alaskan halibut fishery and its transition through various forms of fisheries management.

Readings:

- (1) Chapter 13 of Tietenberg, *Environmental and Natural Resource Economics*
- (2) Costello, Gaines and Lynham. (2008) “Can Catch Shares Prevent Fisheries Collapse?”, *Science*, 321(5896): 1678 – 1681.
- (3) Pearse. 1992. “Fishing Rights and Fishing Policy: The Development of Property Rights as Instruments of Fisheries Management”.
- (4) Casey, et al. “The effects of Individual Vessel Quotas in the British Columbia Halibut Fishery”. *Marine Resource Economics*
- (5) G.R. Morgan 1995. “Optimal fisheries quota allocation under a transferable quota (TQ) management system.”

3. Bycatch and Regulation of Commercial Fishing

Economist’s Toolkit:

Bycatch is a major problem in many commercial fisheries. We will study the causes of bycatch in the fishery sector and evaluate various innovative market mechanisms designed to reduce bycatch levels. This will draw on the methodologies studied in the first part of the course in relation to cap-and-trade sulphur dioxide markets. The case study used in class will be turtle bycatch in the Hawaiian longline fishery. Students will be introduced to Discrete-Choice Logit Modeling and learn how it can be used to analyze the efficacy of bycatch regulation.

Reading:

- (1) Alverson. 1997. Global Assessment of Fisheries Bycatch and Discards: A Summary Overview. Pp 115- 125. In Pikitch, Huppert, and Sissenwine.
- (2) Marasco and Terry. 1982. Controlling incidental catch. An economic analysis of six management options. *Marine Policy* (April 1982):131-139.
- (3) Rebecca L. Lewison, Sloan A. Freeman, Larry B. Crowder. (2004) "Quantifying the effects of fisheries on threatened species: the impact of pelagic longlines on loggerhead and leatherback sea turtles", *Ecology Letters*, 7(3): 221-231.
- (4) Gilman et. al. (2006) "Reducing sea turtle by-catch in pelagic longline fisheries", *Fish and Fisheries*, 7(1): 2-23.
- (5) Ning, F.T. and Zhang, C. and Fujita, R. (2008) "Quantitative evaluation of the performance of a permit auction system in reducing bycatch of sea turtles in the Hawaii Swordfish longline fishery", *Marine Policy*.
- (6) Curtis, R. and Hicks, R.L. (2000) "The Cost of Sea Turtle Preservation: The Case of Hawaii's Pelagic Longliners", *American Journal of Agricultural Economics*, 82(5): 1191—1197.
- (7) N.C. Pradhan and P.S. Leung. "Sea turtle interactions with Hawaii 's longline fishery: An extended multiobjective programming model incorporating spatial and seasonal dimensions," *Applied Economics*, in press.
- (8) N.C. Pradhan and P.S. Leung. 2006. "Incorporating sea turtle interactions in a multi-objective programming model for Hawaii 's longline fishery," *Ecological Economics*, 60(1):216-227.

4. Economics of Marine Reserves and Ecosystem-Based Management

The design of marine reserves is one of the most important and contentious issues in modern marine conservation and fisheries management. This part of the course will use many of the methodologies already introduced (such as Discrete-Choice Logit Modeling, Bio-economic Modeling and Dynamic Programming) to evaluate existing and potential marine reserves. Case studies will include the Channel Islands, the Northwest Hawaiian Islands and the main Hawaiian Islands. This topic will conclude with analyzing how economics can be incorporated into the movement towards ecosystem-based management of marine resources.

Readings:

- (1) Hastings and Botsford (1999) "Equivalence in Yield from Marine Reserves and

- Traditional Fisheries Management”, *Science*.
- (2) Sanchirico and Wilen. (2001) “A Bioeconomic Model of Marine Reserve Creation”, *Journal of Environmental Economics and Management*.
 - (3) Roberts et al. (2001) “Effects of Marine Reserves on Adjacent Fisheries”, *Science*.
 - (4) Smith et al. (2006) “Effectiveness of Marine Reserves for Large-Scale Fisheries Management”, *Canadian Journal of Fisheries and Aquatic Sciences*.
 - (5) Costello and Polasky. (2008) “Optimal Harvesting of Stochastic Spatial Resources”, *Journal of Environmental Economics and Management*.
 - (6) Smith and Wilen. (2003) “Economic impacts of marine reserves: the importance of spatial behavior”, *Journal of Environmental Economics and Management*.
 - (7) Friedlander, AM and Brown, EK and Monaco, ME. (2007) “Coupling ecology and GIS to evaluate efficacy of marine protected areas in Hawaii”, *Ecological Applications*, 17(3): 715-30.
 - (8) Friedlander, A.M. and Brown, E. and Monaco, M.E. (2007) “Defining reef fish habitat utilization patterns in Hawaii: comparisons between marine protected areas and areas open to fishing”, *Marine Ecology Progress Series*, 351.
 - (9) Sanchirico, J.N. and M.D. Smith, and D.W. Lipton. (2008) “An empirical approach to ecosystem-based fishery management”, *Ecological Economics*.

5. Aquaculture

Economist’s Toolkit:

Aquaculture is both a rising global industry and of important historical significance in Hawai‘i. This part of the course will focus on emerging trends in the aquaculture industry, potential interactions with wild harvest, mitigation of negative impacts and the potential for demand-side management. Case studies will include Kona Blue Water Farms and the restoration of Hawaiian fishponds.

Reading:

- (1) P.S. Leung and Carole Engle, Editors. *Shrimp Culture: Economics, Market and Trade*, Blackwell Publishers, 2006, 335 pp.
- (2) Jim Anderson. 1997. The Growth of Salmon Aquaculture and the Emerging New World Order of the Salmon Industry. In Pikitch, Huppert, and Sissenwine.
- (3) C. Tisdell. 2003. “Aquaculture’s potential impacts on conservation of wild stocks and biodiversity.” *Aquaculture Economics and Management* 7(1/2): p. 155-165
- (4) Neiland, et al. 2001. “Shrimp aquaculture: economic perspectives for policy development.” *Marine Policy* 25: 265-279.
- (5) Barbier, E. B. 2003. “Habitat-Fishery Linkages and Mangrove Loss in Thailand.” *Contemporary Economics Policy* 21(1): 59-77.
- (6) Huitric, et al. 2002. “Development and government policies of the shrimp farming industry in Thailand in relation to mangrove ecosystems.” *Ecological Economics* 40:441-455
- (7) Costa, Ecio De Farias and Yony Sampaio. 2004. “Direct and indirect job generation in the farmed shrimp production chain.” *Aquaculture Economics and Management*

8(3/4):143-155.

6. Economic Impact Assessment and Benefit-Cost Analysis

This part of the course will focus on what most people assume economists do: assessing the economic impacts of different policies. In particular, we will focus on two methodologies: Economic Impact Assessment and Benefit-Cost Analysis. As a case study, we will focus on efforts to estimate the economic benefits of coral reefs for the Hawaiian economy.

Readings:

- (1) Cropper, Maureen L., 2000. Has Economic Research Answered the Needs of Environmental Policy?, *Journal of Environmental Economics and Management*, vol. 39(3), pages 328-350.
- (2) Dave Swenson (2002). *An Introduction to Economic Impact Assessment*.
- (3) Lipton, Wellman, Sheifer and Weiher (1995). *Economic Valuation of Natural Resources: A Guidebook for Coastal Resources Policymakers*. Chapters 1-3. <http://www.mdsg.umd.edu/programs/extension/valuation/handbook.htm>
- (4) van Beukering and Cesar (2004) "Ecological Economic Modeling of Coral Reefs: Evaluating Tourist Overuse at Hanauma Bay and Algae Blooms at the Kīhei Coast, Hawai'i", *Pacific Science*, 58(2): 243-260.
- (5) Cesar and van Beukering (2004) "Economic valuation of the coral reefs of Hawaii", *Pacific Science*, 58(2): 231-242.
- (6) Mak and Moncur. (1998) "Political economy of protecting unique recreational resources: Hanauma Bay, Hawaii," *Ambio*, 27(3): 217-223.
- (7) Leeworthy and Vanesse (1999) *Economic Contribution of Recreating Visitors to the Florida Keys/Key West*
- (8) Padma Lal. 2003. "Economic Valuation of mangroves and decisionmaking in the Pacific". *Ocean and Coastal Management* 46:823-944.

7. Methods for Measuring Non-Market Values

Economist's Toolkit:

This part of the course will introduce the commonly used methodologies of Contingent Valuation, Hedonic Pricing and Travel Cost Valuation. These are different methods for estimating non-market values, such as how much do people value the waves on the North Shore or mammals in the ocean. The case study of the Exxon Valdez Oil Spill will be used to illustrate how these methodologies are used in practice.

Reading:

- (1) Lipton, Wellman, Sheifer and Weiher (1995). *Economic Valuation of Natural Resources: A Guidebook for Coastal Resources Policymakers*. Chap. 4 & 5. <http://www.mdsg.umd.edu/programs/extension/valuation/handbook.htm>

- (2) Bishop and Heberlein. *The Contingent Valuation Method*. Chap 12 in Ward and Duffield, *Natural Resource Damages: Law and Economics*.
- (3) Arrow et al., 1993
- (4) Carson, Richard; Hanemann, W. Michael (1992-12-18). "A Preliminary Economic Analysis of Recreational Fishing Losses Related to the Exxon Valdez Oil Spill". Exxon Valdez Oil Spill Trustee Council.
- (5) "An Assessment of the Impact of the Exxon Valdez Oil Spill on the Alaska Tourism Industry" (PDF). Exxon Valdez Oil Spill Trustee Council (August 1990).
- (6) "Economic Impacts of the Spill". Exxon Valdez Oil Spill Trustee Council. <http://www.evostc.state.ak.us/facts/economic.cfm>

8. The Economics of Ports and Shipping

We will return to our analysis of Pigouvian taxes and also introduce basic Bayesian Decision-Making to study the subsidization of seaports, the control of carbon emissions from sea trade and the massive risk proposed by trade-related invasive species introductions. Case studies will include Honolulu Harbor and the control of invasive species in Hawai'i.

Readings:

- (1) Goss. 1990. *Economic policies and seaports: 1. The economic functions of seaports*
- (2) Goss. 1986. *Seaports should not be subsidized*.
- (3) German Advisory Council on Global Change (2002), *Charging the Use of Global Commons*
- (4) Burnett, K., Kaiser, B., Pitafi, B.A. and Roumasset, J. (2006) "Prevention, Eradication, and Containment of Invasive Species: Illustrations from Hawaii", *Agricultural and Resource Economics Review*, 35(1).
- (5) Whitehurst. 1985. *American Domestic Shipping in American Ships; Jones Act costs, Benefits, and Options*. American Enterprise Institute for Public Policy Research. Washington, D.C.
- (6) Francois and Wooton. 2000. *Trade in International Transport Services: The Role of Competition*.
- (7) McAusland C. and C. Costello, "Avoiding Invasives: Trade-related policies for controlling unintentional exotic species introductions", *Journal of Environmental Economics and Management* 48(2) 2004: 954-977.
- (8) Carol McAusland Chris Costello, Mike Springborn and Andy Solow. "Unintended biological invasions: Does risk vary by trading partner?" *Journal of Environmental Economics and Management* 54(3) 2007: 262-276

9. Economics of Offshore Oil Development

Economist's Toolkit:

The course will conclude with a discussion of the optimal extraction of non-renewable resources, in particular Hotelling's Rule. We will combine this with our earlier study of

Benefit-Cost Analysis to evaluate the pros and cons of extending offshore oil drilling in the United States.

Readings:

(1) Energy Information Administration. (2007) "Impacts of Increased Access to Oil and Natural Gas Resources in the Lower 48 Federal Outer Continental Shelf"

(2) H. Hotelling, (1931). "The Economics of Exhaustible Resources." *J. Polit. Econ.*, Vol. 39:137-175.

(3) S. Devarajan and A. C. Fisher, (1981). Hotelling's "Economics of Exhaustible Resources": Fifty Years Later. *Journal of Economic Literature*, Vol. 19(1):65-73.

(4) Kotchen, M.J. and Burger, N.E. (2007) "Should we drill in the Arctic National Wildlife Refuge? An economic perspective", *Energy Policy*, 35(9): 4720-4729.

(5) Farrow, et al. 1990. Managing the Outer Continental Shelf Lands: Oceans of Controversy. Chap. 1 (Pp 3 – 23)

(6) Mead, et al. 1985. *Offshore Lands: Oil and Gas Leasing and Conservation on the Outer Continental Shelf*. Chapter 3. (pp. 45-84)