Economics 145 **THE ECONOMICS OF OCEAN RESOURCES** Winter, 2021

**Course Hours**: MWF 4:00 – 4:50 PM **Classroom**:

**Instructor**: Dale Squires
dsquires@ucsd.edu

**Office**: By appointment
**Office Hours**: Immediately after class or by appointment

**Teaching Assistant:** Chen Lin chl029@ucsd.edu
**Office:**

**Teaching Assistant:** Kevin Winseck kwinseck@ucsd.edu
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**Teaching Assistant**: Jackson Somers jsomers@ucsd.edu

**Reader:** Erica Chuang erchuang@ucsd.edu

**Teaching Assistant Office Hours**: 6:00PM-7:00PM, Tuesday. Zoom recording available.

**Teaching Assistant Section:** 6:00PM-7:00PM, Tuesday. Zoom recording available.

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| **Instruction Dates**: | Monday, January 4 – Friday, March 12 |
| **Assignment 1 Due Date:** | Friday of week 3, January 22 |
| **Midterm Review Session:** | Wednesday, February 10, 6pm-9pm |
| **Midterm Exam:** | Friday of week 6, February 12, 4:00-4:50pm |
| **Assignment 2 Due Date**: | Friday of week 8, February 26 |
| **Final Review Session 1**: | Friday, March 12, 6pm-9pm |
| **Final Review Session 2:** | Sunday, March 14, 1-4pm |
| **Final Exam:** | Friday March 19, 3:00pm-4:30pm |
| **Holidays**: | Martin Luther King, Jr. Monday, January 18<br>President's Day Monday, February 15 |

**Course Objectives**

The Economics of Ocean Resources is designed to provide students with both the economic theory and management concepts of natural resource use as they apply to ocean resources, and the factual and institutional knowledge necessary for well-informed applications.

The course develops several basic themes and applies them to different resources. First, the common thread running throughout the course is the theme of optimal allocation of ocean resources. Second, property rights for ocean resources are often limited or incomplete, and many resource allocation decisions are inter-temporal in nature. As a consequence, competitive markets for ocean resources often fail to form, or when they do form, they fail to optimally allocate ocean resources among the competing uses. The market failure and subsequent suboptimal use of ocean resources therefore calls into play explicit options of management and public regulation. Third, population

dynamics of species forms the basis of bioeconomic models for renewable resources, which combines population dynamics, habitat, biodiversity, and economics. Fourth, the economic concepts of total economic value (use, existence, and option value) and mixed goods (a mixture of private and public goods or common resources) are applied to dolphins, whales, sea turtles, and coral reefs in which management requires attention to both private and public uses and total economic value.

This first section of the course covers issues related to the conservation and management of fisheries. After a review of environmental and resource economics concepts, the course first develops simple population dynamics. The course subsequently integrates the population dynamics with economics to form a bioeconomic model. The basic static bioeconomic model then forms the basis for subsequent discussion of public management of fishing industries. The first section includes one video discussing the current plight of the world's fisheries and discussing various policy measures.

The second section of the course is more applied and broader in nature, covering environmental issues associated with living marine resources. The section first develops an overall economic analytical framework, focusing on management of impure public goods and also called mixed goods (a mixture of private and public goods) and accounting for total economic value. Mixed good management forms one the current "hottest" environmental issue of the oceans, including dolphins, whales, sea turtles, and coral reefs. Specific analytic topics covered include common resources, public and mixed goods, total economic value, biodiversity, habitat, and wildlife management. Ecosystems management and sustainability are also touched upon. Videos and guest lectures will supplement the in-class treatment of several topics. Students are responsible for the readings on their own.

## Course Requirements and Grading

1. Midterm examination on last Friday of week six, February 12 -- 40% of course grade.
    - Covers the concepts but not the mathematics of the bioeconomic model.
    - Review session, Wednesday, February 10, 6pm-9pm

2. Final examination Friday, March 18 -- 40% of course grade.
    - Covers all of the course material between the midterm and the class end, but not explicitly the material covered by midterm. The Final exam is **NOT** cumulative.
    - Review sessions, Friday March 12 6pm-9pm and Sunday March 14, 1pm-4pm

## Midterm and Final Exam Re-grade Requests

- You may request that one or more individual questions be re-graded, but for each question on which you request a regrade that does not result in additional points you may be penalized 0.75 points.
- Requesting a regrade means that we may regrade your entire exam, and your score may increase or decrease.
- If you are requesting a regrade because your score differs from another student with a similar answer, we will email the other student for permission before regrading BOTH exams. This may result in both students getting the lower of the two scores if that is what would be more consistent with the rubric.

- For instructions on how to submit regrade requests through Gradescope, see the following video. https://www.youtube.com/watch?v=6oFVeHvDPYU

3.. Two short assignments for 10% of the grade will be provided during the course and will be graded as good / pass / not pass, with 5 points for Assignment 1 (property rights essay) and 5 points for Assignment 2 (impure public goods and biodiversity conservation).
For each assignment: (1) good = 5 points; (2) pass = 2.5 points; (3) no pass = 0 points). You will have to upload a copy to Canvas (note that Canvas checks for plagiarism, duplicate essays among students, etc.).

- Assignment 1 due date: Friday of week 3, January 22
- Assignment 2 due date: Friday of week 8, February 26

4. Weekly TA session to discuss lectures and readings.

- Dates, times, and location to be determined.

5. Weekly online quizzes, total of 7, for 10% of grade.

- Some questions from online quizzes will be included on the exams.
- Lowest two quizzes dropped
- Questions are directly from lecture notes or conceptual in nature
- These are due 3 p.m. on the relevant Wednesday. Thus, week 1 quiz is due on week 2.
- You will have two attempts. Check the notes to correct any wrong answers.

**Reading Material**

- All of the required reading is available as PDF files on the class website.

Department of Economics
University of California, San Diego
Economics 145

Dale Squires
Winter, 2021

# THE ECONOMICS OF OCEAN RESOURCES
# READING LIST

## I. INTRODUCTION

### 1. Ocean Resources: An Overview

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| Required Reading<br>Skim for general idea | • Willmann, R. and K. Kelleher. 2010. "Economic Trends in Global Marine Fisheries." Chapter 2 in Grafton, Hilborn, Squires, Tait, and Williams, eds., *Handbook of Marine Fisheries Conservation and Management.* Oxford University Press.<br>• Selig, E. 2018. "Mapping Global Human Dependence on Marine Ecosystems." *Conservation Letters*.<br>• Watson, R. and A. Tidd. 2018. "Mapping Nearly a Century and a Half of Global Marine Fishing: 1869-2015." *Marine Policy* 93: 171-177. |
| Optional YouTube Video: Can Conservation Save Our Oceans? The Economist (27:04 minutes) | • https://www.youtube.com/watch?v=BFtrZ0aqqtM |

### 2. Property Rights, Public Goods, Common Resources, Externalities, and Environmental and Resource Problems

| *2.1. Property Rights* | |
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| Required Reading<br>Read thoroughly<br>(Lecture 2) | Arriagada, R. and C. Perrings. 2011. Paying for International Environmental Public Goods. *Ambio* 40:798–806. (Discusses different types of public goods and implications for their provision.) |
| Required Reading<br>Read thoroughly<br>(Lecture 3) | Squires, D. 2010 "Property and Use Rights in Fisheries." In R. Allen, J. Joseph, and D. Squires, editors, *Conservation and Managemnt of Transnational Fisheries*. Blackwell Publishing. |
| PowerPoint Lecture 1 | 1.Environmental Externalities and Market Failure (1 lecture) |
| PowerPoint Lecture 2 | 2.Public Goods and Common Resources (1 lecture) |
| PowerPoint Lecture 3 | 3.Property Rights (2 lectures) |
| Optional: YouTube Video on Coase Theorem | Coase Theorem<br>http://www.youtube.com/watch?v=pdz3rvfbNe4&feature=relad |

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| Optional: YouTube Video on Externalities | https://www.youtube.com/watch?v=pb4bQWM9-M0 |
| Optional: YouTube Video on Externalities | How Markets Fail: Positive and Negative Externalities<br>http://www.youtube.com/watch?v=Jax-ZyL7DkI&feature=related |
| Optional: YouTube Video on Tragedy of the Commons | Tragedy of the Commons<br>http://www.youtube.com/watch?v=MLirNeu-A8I |

| *2.2. Law of the Sea* | |
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| PowerPoint Lecture 4 | 4.Law of the Sea (1 lecture) |
| Optional: YouTube Video Background, history (I don't go into this in class) | https://www.youtube.com/watch?v=3SOqz1Yu8tY |
| Optional: YouTube Videos Law of the Sea Maritime Zones. More detail than class lecture. | https://www.youtube.com/watch?v=kLkvnLjYmg8<br>https://www.youtube.com/watch?v=HlYSyBRsK0c<br>https://www.youtube.com/watch?v=AOB-HsPqf5k<br>https://www.youtube.com/watch?v=R2luKaxeQvo |

## II. THE ECONOMICS AND MANAGEMENT OF RENEWABLE MARINE RESOURCES

### 3. The Theory of Open Access and Bioeconomics

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| Required Reading<br>Skim for general idea | Wilen, J. **"**Life Histories of Organisms,**"** pp. 77-84,89-94, in "Bioeconomics of Renewable Resource Use,**"** Chapter 2 in A.V. Kneese and J.L. Sweeney, eds., *Handbook of Natural Resource and Energy Economics*, Vol. I. New York: Elsevier Science Publishers B.V., 1985. |
| Required Reading<br>Read thoroughly | Flaaten. *Fisheries Economics and Management*. Chapters 2 & 3.1-3.2., Chapter 5 through page 76. |
| Optional Reading<br>(Skim for example for bioeconomic application and Reference) | Ahmed, M. et al. 2007. "Overfishing in the Gulf of Thailand: Policy Challenges and Bioeconomic Analysis." *Environment and Development Economics* 12(1): 145-172. (Example of bioeconomic application)<br>Squires, D. 2005. "Introductory Lecture on Bioeconomics, Parts I, II, III." (Reference)<br>• Word and pdf files available on class website. |
| Optional: YouTube Video: Introduction to Fisheries Management | https://www.youtube.com/watch?v=Z4AXnZOsrK8 |
| PowerPoint Lecture | None available. |
| Assignment 1 | Required. See below. |
| Highly Recommended: | https://www.youtube.com/watch?v=7DNhqtYf47E |

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| YouTube Video of Population Dynamics & Bioeconomics (15:40 minutes) | https://www.youtube.com/watch?v=gDfufBUwcgg |
| Highly Recommended: YouTube Video of Population Dynamics & Bioeconomics (44:30 minutes) This is really excellent. | https://www.youtube.com/watch?v=v4O3jmE3LdA |
| Highly Recommended: YouTube Video of Population Dynamics & Bioeconomics (13:22 minutes) Good for population dynamics and average revenue – average cost Gordon model. | https://www.youtube.com/watch?v=DqK5l-9Ufjk |
| Optional: YouTube Videos | Various types of fishing methods<br>**Trawlers:**<br>http://www.youtube.com/watch?v=aAuqBghv1Ck<br>http://www.youtube.com/watch?v=7sqv9Xf8YlA&feature=rela<br>d<br>**Longline:**<br>http://www.youtube.com/watch?v=err9JXTzymg<br>Purse Seine:<br>http://www.youtube.com/watch?v=348apH3pe3k<br>**Albacore Jig Fishing:**<br>http://www.youtube.com/watch?v=TUXum0Lnexg&feature=re<br>ted<br>**Pole-and-Line:**<br>http://www.youtube.com/watch?v=lp_Rs75-<br>5vI&feature=related<br>http://www.youtube.com/watch?v=KlvsDYM0ABI&feature=rel<br>ed<br>**Crab Pots:**<br>http://www.youtube.com/watch?v=SsfDNNTNdFU&feature=r<br>elated |

| **Required Assignment 1** | |
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| Due Date | Friday of Week 3, January 22 |
| Conceptual Background | Read Hardin and *either* (1) Wade *or* (2) Seabright (more theoretical than Wade; Seabright uses theory of repeating cooperative and noncooperative games). |
| Application.<br>Either one is required of all students. | Read either (1) Acheson or (2) Cinner |
| Conceptual Assignment Reading.<br>Required of all students. | Hardin, G. 1968. "Tragedy of the Commons." *Science*, 162: 1243-1248. |
| Conceptual Assignment Reading.<br>Read this or Seabright. | Wade, R. 1987. "The Management of Common Property Resources: Finding a Cooperative Solution." *World Bank Research Observer* 2(2): 219-234.<br>• pdf file is available on class website. |
| Conceptual Assignment Reading.<br>Read this or Wade. | Seabright, P. "Managing Local Commons: Theoretical Issues in Incentive Design*." Journal of Economic Perspectives* 7(4): 113-134. |
| Application Assignment Reading.<br>Read this or Cinner. | Acheson J. 1975. "The Lobster Fiefs: Economic and Ecological Effects of Territoriality in the Marine Lobster Industry." *Human Ecology* 3:183-207. |
| Application Assignment Reading.<br>Read this or Acheson. | Cinner, J. 2005. "Socio-Economic Factors Influencing Customary Marine Tenure in the Indo-Pacific. *Ecology and Society* 10(1):1-36. |
| **Assignment** | 4-page paper (typed, double spaced, 12 Arial font, 1" margins) discussing the possible use of common property to address the commons problem.<br><br>Please develop your discussion within the context of either (1) Acheson and the lobster fiefs or (2) Cinner and customary marine tenure in the Indo-Pacific. Note: you don't have to read Acheson if you read Cinner and vice versa, but in either case, you should show evidence of having read Hardin and either Wade or Seabright. |

**4. Regulation and Public Policy within a Bioeconomics and Property Rights Framework**

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| Required Reading<br>Read thoroughly | Flaaten. *Fisheries Economics and Management*. Chapter 3.3-3.4, Chapter 5. |
| Required Reading<br>Skim for general idea | Grafton *et al.* 2006. "Incentive-Based Approaches to Sustainable Fisheries," *Canadian Journal of Fisheries and Aquatic Sciences* 63: 699-710. |
| Required Reading<br>Skim for general idea<br>Lecture 5 | Birkenbach, A. 2017. "Catch Shares Slow the Race to Fish." *Nature* 544: 223–226 |
| PowerPoint Lecture | 5.ITQs<br>• Available on class website. |
| Highly Recommended: YouTube video on ITQs (10:22 minutes)<br>Lecture 5 | https://www.youtube.com/watch?v=pyQk786TCoQ |
| Optional: YouTube video on ITQs (8:19 minutes) Lecture 5 | https://www.youtube.com/watch?v=iLe-Zz5SvC4 |
| Video | *Empty Oceans Empty Nets* |
| Highly Recommended: YouTube video on Taxes and Subsidies (7:10 minutes) | https://www.youtube.com/watch?v=YsDvxir7YsI |
| Highly Recommended: YouTube video on Territorial Use Rights in Fisheries (5:17 minutes) | https://www.youtube.com/watch?v=mPkEIVRgmkc |
| Highly Recommended: YouTube video on ITQs (10:22 minutes)<br>Lecture 5 | https://www.youtube.com/watch?v=pyQk786TCoQ |
| Computer Simulation | *Abasim* |
| Optional: YouTube video on Marine Protected Areas | https://www.youtube.com/watch?v=n6_JLZnQe6Y |
| Optional: YouTube video on Territorial Use Rights in Fisheries | https://www.youtube.com/watch?v=mPkEIVRgmkc |
| Optional: Troubled Waters Video on Overfishing (Environmentalist Perspective) (47:23 minutes) | https://www.youtube.com/watch?v=YACTNvuijQY |
| Optional: YouTube video: The Future of Seafood (Aquaculture) (27:17 minutes) | https://www.youtube.com/watch?v=eff-Z0NdwzY |

**5. Global Fisheries Issues (Optional: If Sufficient Time, is after Midterm)**

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| Required Reading<br>Skim Worm and Watson for general | • Worm, B. et al. 2009. Rebuilding Global Fisheries. *Science* 325: 578-585.<br>• Watson, R. and D. Pauly. 2013. "The Changing Face of |

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| idea<br>You have already read Willmann and Watson and Tidd Lecture 6 | Global Fisheries: The 1950s to the 2000s. *Marine Policy* 42:1-4.<br>• Willmann, R. and K. Kelleher. 2010. "Economic Trends in Global Marine Fisheries." Chapter 2 in Grafton, Hilborn, Squires, Tait, and Williams, eds., *Handbook of Marine Fisheries Conservation and Management.* Oxford University Press.<br>• Watson, R. and A. Tidd. 2018. "Mapping Nearly a Century and a Half of Global Marine Fishing: 1869-2015." *Marine Policy* 93: 171-177. |
| PowerPoint Lecture | 6.Global Fisheries Issues (1 lecture) |
| Optional: Video Global Fishing Watch | https://www.youtube.com/watch?v=fn2JXmCUo30 |
| Optional: YouTube Video | State of World Fisheries Parts 1,2,3 – Ray Hilborn<br>http://www.youtube.com/watch?v=frfOi2P0wIo<br>http://www.youtube.com/watch?v=etSjm0zZs9U&feature=related<br>http://www.youtube.com/watch?v=J49rCgFo1Ko&feature=related |
| Optional: Video | Ray Hilborn<br>http://www.uwtv.org/video/player.aspx?dwrid=2515 |

**MIDTERM EXAMINATION**
Friday of Week 6, Friday February 12

## III. THE MANAGEMENT OF IMPURE PUBLIC GOODS IN AN ECOSYSTEMS FRAMEWORK: DOLPHINS, WHALES, SEA TURTLES, AND CORAL REEFS

### 6. Common Resources, Impure Public Goods, Total Economic Value, Biodiversity, Ecosystems

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| Required Reading<br>Read thoroughly<br>Lecture 7 | "Total Economic Value," pp. 129-137 in D. W. Pearce and R.K. Turner, 1990.*Economics of Natural Resources and the Environment*. London: Harvester Wheatsheaf. |
| Required Reading<br>Read thoroughly<br>Lecture 8 | Arriagada, R. and C. Perrings. 2011. Paying for International Environmental Public Goods. *Ambio* 40:798–806. (Discusses different types of public goods and implications for their provision.) |
| Required Reading<br>Read for basic ideas of voluntary (private), direct regulation, incentive-based, and hybrid approaches to marine conservation<br>Lecture 9 | Squires, D, L.T. Ballance, L. Dagorn, P.H. Dutton, R. Lent 2021 in press. "Mitigating Bycatch: Novel Insights to Multidisciplinary Approaches**."** *Frontiers in Marine Scienc*e**.** |

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| PowerPoint Lecture | 7.Conservation and Markets<br>(Reconciling Biodiversity Conservation with Markets and Resource Use) (1.5 lectures) |
| Optional Reading Questions conservation's biology biodiversity mitigation hierarchy | Squires, D. and S.M. Garcia. 2018. "Economic Efficiency and the Biodiversity Mitigation Hierarchy with a Focus on Marine and Fishery Issues." *Conservation Biology* 32(5): 989-997. |
| PowerPoint Lecture | 8.Impure Public (Mixed) Goods and Public Bads (2 lectures) |
| PowerPoint Lecture | 9.Policies for Externalities (2 lectures) |
| Optional: Biodiversity, Ecosystems, & Ecosystem Services (Lecture 7) | https://environment.yale.edu/teeb/foundations/barker/ |
| Optional: YouTube Economics of Protected Areas (Lecture 9) | http://environment.yale.edu/teeb/policymakers/bruner/ |
| Optional: YouTube Payments for Ecosystem Services) (Lecture 9) | http://environment.yale.edu/teeb/policymakers/rosenberg/ |
| Optional: Connecting Biodiversity to Ecosystem Services in Ocean Ecosystems and Fisheries (Lectures 7 & 9( | https://environment.yale.edu/teeb/policymakers/rosenberg/ |

| **Required Assignment 2** | |
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| Due Date | Friday of Week 8, February 26 |
| Conceptual Background | Read Arriagada and Perrings. 2011. Paying for International Environmental Public Goods. *Ambio* 40:798–806<br>Bulte, E., G. van Kooten, and T. Swanson. 2003. Economic Incentives and Wildlife Conservation. Working paper. |
| **Assignment** | 4-page paper (typed, double spaced, 12 Arial font, 1" margins) discussing incentives to conserve marine biodiversity conservation within the framework of impure public goods. The intent of the assignment to ensure that you understand the conceptual framework for the rest of the class. Discuss what an impure public good is, the types of externalities associated with impure public goods, the technology of public good supply (best shot, weakest link, etc.), and the types of economic incentives (positive and negative) that are created for impure public goods with different technologies of public good supply. |

**7. Sea Turtles**

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| Required Reading Read thoroughly Lectures 14A & 14B | Dutton, P. and D. Squires. 2008. "Reconciling Fishing with Biodiversity: A Holistic Recovery Strategy for Pacific Sea Turtles," *Ocean Development and International Law* 39:200–222. |
| Optional Reading Lectures 14A & 14B | Squires, D., V. Restrepo, S.M. Garcia. 2018 "Fisheries Bycatch Reduction within the Least-Cost Biodiversity Mitigation Hierarchy: Conservatory Offsets with an Application to Sea Turtles." *Marine Policy* 93: 55-61. |
| Guest Lecture | Peter Dutton unless scheduling conflict |
| PowerPoint Lecture | 14A.Sea Turtles Econ 145 (3 lectures total) |
| PowerPoint Lecture | 14B.Sea Turtles Econ 145 |
| Video | https://www.dropbox.com/s/lmtgv22vlwr2uu4/saving%20sea%20turtles.mov |

**8. Whales**

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| Required Reading: Read thoroughly (Important for Final Exam) Lecture 12 | Schneider, V. and D. Pearce. 2004. "What Saved the Whales? An Economic Analysis of the 20th Century Whaling." *Biodiversity and Conservation* 13(3): 543-562. |
| Required Reading: Skim for general idea Lecture 12 | Costello, C., L. Gerber, and S. Gaines. 2011. "A Market Approach to Saving the Great Whales." *Nature* 481: 139-140. |
| Required Reading: Skim for general idea Lecture 12 | Butler-Stroud, C. 2016. "What Drives Japanese Whaling Policy?" *Frontiers in Marine Science* 22 June 2016 \| http://dx.doi.org/10.3389/fmars.2016.00102 |
| PowerPoint Lecture | 12.Whales (1-2 lectures) |
| Optional Video on Scientific Whaling by Marc Mangel | http://panopto.uw.edu/Panopto/Pages/Viewer.aspx?id=0512ca7b-0a3a-4929-8397-a9d1f03963f6 |

**9. Coral Reefs**

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| PowerPoint Lecture | 13A.Coral Reefs (1 lecture both 13A & 13B)<br>13B.Coral Reefs |
| Required Reading Read for general idea Lectures 13A & 13B | McClanahan, T.R., M.J. Marnane, J.E. Cinner, and W.E. Kiene. 2006. A comparison of marine protected areas and alternative approaches to coral reef management. *Current Biology* 16(14): 1408-1413.<br>Cinner, J. et al. Bright spots among the world's coral reefs. *Nature* 535 (7612). pp. 416-419. |

**10. Marine Mammals: Dolphins (Could be skipped if insufficient time)**

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| Required Reading<br>Skim for general idea | Hall, Martin. 1998. "An Ecological View of the Tuna-Dolphin Problem: Impacts and Trade-Offs," *Reviews in Fish Biology and Fisheries*, 8: 1-34. |
| PowerPoint Lecture | 10.Dolphin-Tunas (1 lecture)<br>Could be alternative guest lecture on marine mammals |
| Optional: YouTube Video for Lecture 10 | Tuna Fishing, Parts I & II<br>http://www.youtube.com/watch?v=qEuioCqTjjo&feature=fvsr |
| PowerPoint Lecture | 11.Ecological Trade-Offs in the ETP (1 lecture) |
| Required: YouTube Video for Lecture 11 | Ray Hilborn on sea- and land-based food<br>http://www.youtube.com/watch?v=hjiZA4pDiPg |