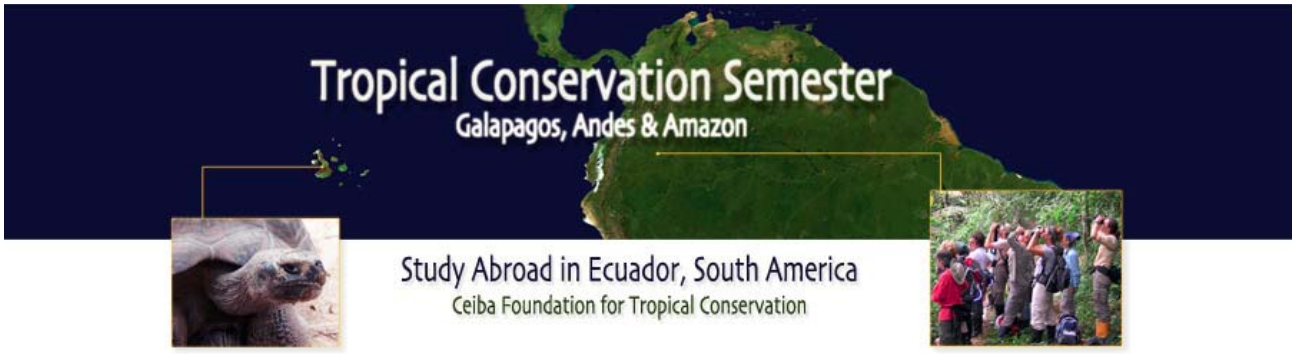

TCS 2016 Marine Biology & Conservation Biology (part 2) Materials

Schedule Syllabi Marine & Conservation Assignments Study Aids & Guidelines

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Schedule: Marine Biology & Conservation Biology (Part 2)

The following schedule contains: textbook chapters (in Osborne and Primack) and other papers, please read these **before** coming to class; learning objectives as a study guide; and due dates for all assignments. Additional study aids are included; see also Study Aids and Guidelines below.

Readings below are **required,** unless marked with two stars. The entire schedule can be downloaded as a pdf (here); however, you must visit this page to download readings and slides. Readings are updated regularly, so check this page frequently.

Lecture slides (as a pdf), when available, are linked to Lecture Topics.

*** = conservation biology readings**
**** = recommended/supplemental readings**

Date	Topic	Readings / Assignments / Handouts	Learning Objectives	What's Due?
3/7	Introduction to Oceans	• **Nybakken Ch 1**	• Use appropriate terminology to describe the various areas of the ocean • Describe the physical environment of the ocean and how it changes vertically and horizontally • Describe the ocean carbon cycle and explain how oceans regulate global climate • Compare and contrast marine and terrestrial environments, abiotically and biotically • Explain the drivers of water movement, including waves, tides, currents, gyres, and upwelling and how this movement impacts ocean ecosystems	
3/8	Ocean Productivity & Food Webs	• **Nybakken Ch 2**	• Identify areas of high and low productivity in the ocean, and outline the main factors that influence productivity • Compare and contrast productivity in tropical and temperate oceans • Compare marine food webs to terrestrial food webs • Explain the microbial loop and its contribution to marine productivity • Describe the major groups of primary producers in marine ecosystems • Define and give examples of phytoplankton, holozooplankton and merozooplankton • Outline the characteristics and adaptations of the major groups of plankton	
3/9	Ecology of Fishes	• **Nybakken Ch 3 (pp. 103-104, 119-128, 132-143)** • WWF 2015. Living Blue Planet Report (excerpt), pp. 1-8. • Goldman 2015. The fish are swimming north, leaving fishermen behind. *Conservation (U. Washington).* pp. 1-2.	• Connect different fish morphologies to ocean zone • Link environmental pressures of the ocean to fish adaptations, diversity, behavior • Connect fish adaptations, in terms of morphology, behavior, and physiology, to feeding guild • Describe principle modes of predation, and defenses against predation • Evaluate evolutionary balance between different forms of reproduction: egg size and number, parity, larval form	

3/12-20	**SPRING BREAK**			
3/21	Marine Invertebrates	• **Nybakken 7 (pp. 351-359)** • **Nybakken Ch 10** • Witman 2010. Barnacles prefer upwelling currents, enriching food chains in the Galapagos. *ScienceDaily.* pp. 1-2. • Table of Marine Invertebrate Phyla	• Identify the major taxa of marine invertebrates • Rank major invertebrate groups by increasing complexity (cephalization, digestion, etc.) • Discuss how evolutionary advances (sensory, reproductive, defensive, etc.) enhanced fitness • Link environmental pressures to key adaptations in invertebrate groups • Explain key ecological roles played by inverts • Identify human uses of invertebrate groups, and negative impacts that usage may inflict • Identify organisms and processes that provide structure in the ocean, and its value to fish and invertebrates • Discuss the tension on reefs between reef-building organisms and bio-eroding organisms (w/ examples)	
3/22	Intertidal Zones	• **Nybakken 5 (pp. 196-221)** • **Nybakken Ch 6** • **Nybakken Ch 9 (pp. 453-466)** • **Listen:** Galapagos on RadioLab podcast or stream	• Compare and contrast abiotic conditions in sandy and rocky intertidal zones, and the organisms that inhabit them • Outline adaptations organism have to the variable salinity, exposure, and immersion-emersion cycles with examples representative of different phyla. • Describe the factors that result in zonation of intertidal zones • Outline the adaptations of mangrove plants and the roles of animals that live among them. • Discuss the importance of mangroves • Describe the linkages between coral reefs, mangroves, and sea grass beds	
3/23	Fishes of the Pacific	• **Nybakken Ch 3** (pages not read for *Ecology of Fishes* lecture) • COML 2010. First Census of Marine Life: Highlights of a Decade of Discovery. pp. 1-7. • **Cruz 2003. Marine Biodiversity in Ecuador.	• Explain how primitive & advanced fishes differ in speed, buoyancy control, diversity of forms • Explain the differences in fish morphology and biology related to life in water (vs. air) • Identify major causes of fish diversification • Describe diverse forms and uses for types of fins • Recognize "shape groups", relate them to location in ocean, feeding guild, and behavior • Identify ecological interactions & symbioses • Describe uses of swim bladder, gills, pharynx, and other major organs • Understand key evolutionary adaptations that permitted fish diversification • Identify primary feeding guild for each fish group	
3/24-26	**Expedition to Southern Coast**			
3/24	*Marine Conservation - Fisheries 1	• **Nybakken Ch 11 (pp. 501-518)** • *Ellis 2003. Decline of the Fisheries. Chapter 2 *from* The Empty Ocean. pp. 11-92. • *Pauly et al. 2002. Towards sustainability in world fisheries. *Nature.* pp. 689-695. • *The Economist, Sept. 2008. Fishing and Conservation: A Rising Tide. *The Economist.* pp. 1-2 • *Sumaila 2010. ITQs: A Cautionary Note.	• Describe ocean governance frameworks at global, national, and regional scales, including UNCLOS, the Magnuson-Stevens Fisheries Management Act, and Regional Fisheries Management Councils. • List the world's important neritic and oceanic fisheries • Describe the main methods by which fish are caught, including methods to reduce bycatch • Outline the biological evidence that overfishing is occurring. • Explain why deep sea fisheries are unsustainable • Discuss the socioeconomic, technological, and policy factors that have caused the current overfishing crisis. • Describe how ITQs work and their potential ecological, economic and social benefits • Discuss the potential drawbacks of ITQs for managing fisheries and how to overcome them	
3/25	*Marine Conservation - Fisheries 2			**DUE: Assignment 1**
3/26	Introduction to Galapagos	• **Jackson Ch 1-3** • *Watkins & Cruz 2007. Galapagos at Risk: A Socioeconomic Analysis. *Charles Darwin Foundation*. pp. 1-21. • *Edgar et al. 2004. Galapagos Marine Reserve baseline bias. • **Darwin 1959. The Voyage of the Beagle, Ch 17.	• Describe the geologic origins of Galapagos and how the islands were formed • Outline the 3 barriers species must overcome to be able to successfully colonize the islands • Explain patterns of endemism for different taxonomic groups in Galapagos • Discuss, using specific examples, how introduced species, fishing, and tourism pose threats to Galapagos today	
3/27	**Travel to Galapagos -- San Cristobal Island**			
Date	**Topic**	**Readings / Assignments / Handouts**	**Learning Objectives**	**What's Due?**

3/28	Sea Birds	• **Nybakken Ch 3 (pp. 128-132)** • Jones 2010. Seabird islands take mere decades to recover following rat eradication. *Ecological Applications.* pp. 2075-2080. • *McCauley et al. 2012. From wing to wing: the persistence of long ecological interaction chains in less-disturbed ecosystems. *Scientific Reports.* pp. 1-5.	• Describe adaptations to foraging in oceans • Identify key cause of colonial reproduction • Identify primary threats to seabirds, and conservation approaches that address them • Recognize major groups of seabirds	
3/29	Coral Reefs	• **Nybakken 9 (pp. 407-453)** • **Nybakken 5 (pp. 233-241)**	• • Describe coral reef geographical distribution & diversity • Describe the symbiosis responsible for reef-building • Discuss corals as keystone members of reef community • Describe abiotic conditions necessary for coral reefs • Discuss the diversity of seagrass communities, and name organisms that contribute to biodiversity • Identify ecological services of seagrasses, including connections to pelagic & near shore systems	
3/30	*Marine Threats & Conservation Approaches 1: Climate Change & Eutrophication	• *Ocean Conservancy 2015. Stemming the Tide (executive summary). • Munday et al. 2010. Replenishment of fish populations is threatened by ocean acidification. *PNAS.* pp. 12930-934. • *Worm 2015. Silent Spring for Oceans.	• List some of the threats to coral reefs, and identify those that originate on land • Explain ocean acidification and describe its likely impacts on marine ecosystems • Identify key threats to marine ecosystems, their origin, how they specifically impact marine systems • Describe the strengths & weaknesses of approaches to addressing marine threats • Provide examples of the connections between land management and the marine environment • Analyze key national and international policies aimed at protecting marine resources, including scope, strengths and limitations of each	**DUE: Literature Review**
3/31	*Marine Threats & Conservation Approaches 2: Invasive Species, Marine Diseases, Mining			
4/1	The Deep Sea	• **Nybakken Ch 4 (pp. 144-187)** • **Nybakken Ch 5 (pp. 233-241)**	• Summarize the challenges and adaptations to life at extreme depths • Distinguish major deep sea communities • Explain the primary source of energy in deep sea vents, and how they differ from terrestrial systems • Identify key organisms in vent communities	**DUE: Marine Project Topic**
4/2	**Day Off**			
4/3-10	**Galapagos Natural History Cruise -- Yate Eden & Yate Aida Maria** finish reading *all* of Jackson, *Galapagos, A Natural History Guide* (1994)			
4/10	*Return to San Cristobal*			**DUE: Galapagos Natural History Assignment**
4/11	*Marine Conservation: Marine Protected Areas	• **Nybakken Ch 11 (pp. 518-520)** • *Hughes et al. 2006. No-take areas, herbivory and coral reef resilience. *TRENDS in Ecology & Evolution.* pp. 1-3. • **Urbina 2016. Palau vs. the Poachers. *New York Times.*	• Outline the evidence that marine reserves work, with specific examples • Discuss the factors that distinguish successful from unsuccessful marine reserves • Discuss the principles of marine reserve design, including IUCN zones • Outline the socioeconomic benefits and challenges of marine reserves, and how to address the challenges	
4/12	*Solutions for Saving Our Seas	• **Nybakken Ch 11 (pp. 520-537)** • *Duarte et al. 2009. Will the Oceans Feed Humanity?. *BioScience.* pp. 967-976. • Palumbi et al. 2008. Ecosystems in Action: Lessons from Marine Ecology about Recovery, Resistance, and Reversibility. *BioScience.* pp. 33-42.	• Outline the pros and cons of fish farming • Make recommendations for enhancing the sustainability of aquaculture practices • Outline key steps that must be undertaken before, during, and after restoration programs • Give examples of how key threats have been mitigated before restoration programs have begun • Describe the factors that determine whether restoration efforts are successful	
4/13	MPA Activity		• Represent accurately the concerns of major stakeholders in protected area establishment • Identify key areas of conflict in management plans • Perform professionally in a public forum, substantiating opinions with succinct evidence • Find common ground with opponents	In Class: MPA Activity **DUE: Rough Drafts**
4/14	**Marine Field Final Exam**			**Marine Field Final Exam**
4/15	**FUN DAY -- Snorkeling Leon Dormido Rock**			

4/16	**Travel from Galapagos to Cumbaya**			
4/17	**Day Off**			
Date	**Topic**	**Readings / Assignments / Handouts**	**Learning Objectives**	**What's Due?**
4/18	*Optional advising*			
4/19	*Marine Review Session*			
4/20	**Marine Written Final Exam**			**Marine Written Final Exam**
4/21	*Optional Advising*			
4/22	Marine Presentations			**DUE: Final Drafts (midnight)** **DUE: Slates & Field Notebooks**
4/23	**Day Off**			
4/24	**Travel to Internships**			
4/25	**Start Conservation Internship** (see Schedule page)			

Handouts: Marine Ecology & Conservation Biology (Part 2)

Table of Marine Invertebrate Phyla

Galapagos Common Fish ID Card *(we'll provide laminated cards for you)*

Syllabi: Marine Biology & Conservation Biology

Each syllabus contains the course purpose, learning objectives, grading breakdown, and a list of lecture topics. Please refer to the course-specific pages (here on tcsdocs) for day-to-day lecture schedules, readings, and assignment due dates.

Syllabus - Marine Biology

Syllabus - Conservation Biology

Assignments: Marine Biology & Conservation Biology (Part 2)

Assignment 1: Fisheries Management Discussion Questions - DUE March 25

Watch the following two short videos, and answer the questions for each one. Be prepared to turn in your answers and discuss in class on **3/25.**

1) NOAAs "ABCs of fish stock assessment": http://www.fisheries.noaa.gov/stories/2013/06/science_stock_assessments.html
Questions:

1. What are the three components of fish stock assessment?
2. What factors must come together to generate the "world class science" upon which good fisheries management depends?
3. In the Hake stock assessment example, what are the causes of uncertainty in stock assessments?
4. What specific methods and technologies are used to assess fish stocks?

2) Rebuilding Global Fisheries: https://www.youtube.com/watch?v=ZIsl-AkrPmo
Watch video to answer the following questions. You may supplement your answers using the original article (Worm et al. 2009).

1. What are the management strategies that lead to rebuilding fish stocks?
2. What sources of data were used to determine stocks that were rebuilding?
3. What are three geographic areas showing good signs of stock recovery?
4. Dig deeper: Why are catch data not a good indication of fish populations?

Assignment 2: Galapagos Natural History Questions & Field Activities - DUE April 10

In order to assure that everyone benefits as much as possible from our Galapagos cruise, we have prepared a list of questions on the natural history of each site we will

visit. Each student should prepare detailed written answers to these questions throughout the cruise. Some questions may be covered in group discussions while on board. Turn in your answers separately, not in field notebooks. At several islands we also will conduct marine mini research projects; each student should turn in their data and answers to follow-up questions about the activities.

- *Galapagos Questions and Field Activities* (printed assignment will be handed out on prior to boarding)

Assignment 3: Design of a Marine Protected Area - DUE April 13

You will be provided, in the Galapagos, with a detailed description of a (hypothetical) coastal location in need of a Marine Protected Area (MPA). You and your fellow classmates will participate in a role-playing activity to discuss the potential benefits and problems of MPAs, and come to a consensus opinion on a design for the protected area and a strategy for implementing the design. Each student should:

1. Review materials on MPAs from lecture, textbook and assigned articles
2. Interview host families, tourism operators, scientists, fish market vendors, boat personnel or any other Galapagos resident to determine their opinions on MPAs, and the arguments each might make for or against establishment of such a reserve.
3. Select a "role" that you will play in the debate; these roles may be assigned.
4. Come to class prepared to engage in a vigorous, detailed but civil and productive debate over whether the proposed MPA should be established, how it should be designed, and how it should be managed.

Study Aids & Guidelines

Marine List of Required Species for 2016 Final Exam: List of marine and coastal birds, plants, invertebrates, mammals, fish and reptiles required for the marine final exam (**to be posted once field portion is completed**).

Marine Research Proposal Guidelines (RFP): Guidelines for the grant application (final paper) in which you give results of the pilot field study, and apply them to a larger pieced of proposed research or action. *Note that group (powerpoint) presentations given in Quito should follow the same format as the grant application.

Marine Pilot Study Pre-Proposal Guidelines: Guidelines for the pre-preposal describing the preliminary, or pilot, study you will conduct in Galapagos.