Marbio/ Fish/Ocean 370: Marine Evolutionary Biology Spring 2019

1. Description

Nothing in Biology Makes Sense Except in the Light of Evolution – Dobzhansky 1973

Evolutionary biology is a large discipline, and encompasses investigations in diverse subjects such as morphology, taxonomy, molecular biology, environmental processes and population biology. Evolutionary biologists work in diverse situations, using tools such as genetics and bioinformatics, observational studies of behavior, or fossil and museum collections. In the marine sciences in particular, evolutionary principles have been applied to understanding a wide range of topics. These include global chemical cycles, the origin and progression of life, the impacts of mass extinction events and human-induced change, the conservation and management of marine populations, and medical discovery. Here, we will examine the breadth and current knowledge in the field. We will also provide you with the tools necessary to interpret new developments in this constantly expanding science, and to apply your knowledge to practical situations in marine biology.

2. Objectives

This class aims to develop your skills as a future scientist and provides the basis for an advanced education in the theory and application of evolutionary biology in the marine sciences. The subject matter builds on your previous education in the Introductory Biology series, and is aimed at developing "higher-level" skills and knowledge that will be important to succeed at your senior level classes and beyond.

Specific goals are:

- Develop an advanced understanding relevant to the interpretation of evolutionary processes in marine environments and earth systems as a whole
- Demonstrate the importance and usefulness of evolutionary theory and practice in applications in the marine sciences
- Analyze and interpret different types of data used in evolutionary biology, based on the application of acquired knowledge
- Compile, synthesize and present independent research
- Enhance collaborative skills by group participation in class worksheets, laboratory investigations and a final research project

3. Course Instructors

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4. Meeting times:

Lectures: M, W, F: 9.30 – 10.20 Room 213
Labs: Fridays 1:30 to 4:20 FTR 124

5. Required Textbook

Zimmer C, Emlen DJ (2015) *Evolution: Making Sense of Life* Roberts and Company, Greenwood Village, Colorado. **Second Edition**

This textbook will be used extensively to help you prepare for lectures.

6. Online tools and devices

We have set up a Canvas website that will be used to disseminate resources for the class. To access materials on the website, you will need your UW NetID and password. A class email list has been established for notifications. *Please check your UW email regularly*, because assignment links will be sent to this email address. (There will be no excuses for emails not read!).

Laptops will be required for this class. If you do not have a personal laptop, you can check out one from the Student Technology Loan Program: https://itconnect.uw.edu/service/student-technology-loan-program/

We will use in-class response systems ("clickers") based on "Poll Everywhere". You can respond using any device.

7. Teaching methodology

We are very interested in maximizing your learning and retention of knowledge, and developing your independent research skills. Through several years of research, we have found that you learn best by reviewing the topics prior to the lecture sessions, and applying your knowledge within those sessions. The class is therefore structured as follows:

Pre-lecture preparation: Please complete the assigned readings and online activities before coming to lectures. The readings are outlined in the schedule below – you will be notified of any changes several days ahead the lecture. Occasionally, readings will be substituted by online lecture notes or videos. You will be able to evaluate your understanding of the material with pre-class quizzes.

Summary sheets: To help develop an integrative approach to learning marine evolutionary biology, you will create a summary sheet that synthesizes and integrates your understanding of the week's material in a pictorial format using flowcharts, diagrams and graphs – rather than text. In addition to implementing deep conceptual learning, this approach allows us to keep track of your learning and misconceptions on a weekly basis. Summary sheets are due every Friday at 9.30 am, and submissions will be via canvas. You will also be asked to provide feedback to other students' summary sheets.

Lectures: Sessions will be used to practice the concepts you have read about using discussions, worksheets and hands-on simulations. Your understanding of the exercises will be tested using in-class response systems.

Labs: The lab sessions comprise a mixture of instruction and independent research. We introduce analytical approaches relevant to interpreting key concepts in evolution, and ask you to interpret these data. The knowledge gained in these labs will help you independently apply this information to your research project. Some of the labs have a graded assignment that we ask you to submit online.

Research project: In the lab section, you will research a novel question in marine evolution. This research is central to our goal of developing your skills in independent research and synthesis. Therefore, you will develop a paper and give a presentation that meets the standards at a scientific

conference. Rubrics will be provided, and we will use in-lab discussions, and meetings with instructors to help you craft your research work.

Exams The exams require that you apply your knowledge to novel situations, and so therefore we will use a short-answer format. The final exam places an emphasis on the material in the second part of the quarter, but will draw directly on knowledge gained from the first half.

8. Coursework and Grades

Grades will be based on the following breakdown:

Pre-class quizzes: 7.5%
In-class clicker questions: 7.5%
Weekly summary sheets: 7.5%
Research paper first draft: 7.5%
Research paper final: 25%
Presentation: 5%
Labs: 10%
Exams: 30%

We do not mark on a curve, but set the grade based on equal categories between the top grade and the passing grade. This means that your grade is only affected by the top grade. You do need 50% of the final research paper grade, 50% of the exam grade, and 50% of the marks overall to pass this class.

9. Attendance and participation policies

We have designed this course to maximize your learning of the subject matter and advance your skills through a variety of activities. Therefore, our attendance policy is aimed at supporting our educational goals.

Assignments designed to help you prepare for class (e.g. online quizzes, discussions or homework due in class or section) or *work scheduled to be presented or performed in class* (eg. clickers, presentations, leading discussions) will not be accepted after the due date and time.

Writing and lab assignments that are submitted late will incur a 10% deduction for every day that the work is overdue, starting from the deadline given in class. In other words, if you are given a deadline of 5pm, and you hand in the assignment at 6pm, you will lose 10%.

Exam Attendance. Exams are only offered on the scheduled dates and "make up" exams will not be offered.

Excused absences: Our attendance and participation policies are flexible only under specific circumstances. Excused absences are religious holidays, pre-approved professional activities, injury or illness of student or immediate family member. Verification of these events will be needed. We strongly encourage you to give us notification of anticipated absences as early as possible.

10. Inclusivity and classroom climate

In an ideal world, science would be objective. However, our experiences and backgrounds mean that scientific thought and the interpretation of science can be subjective. We would like to create a learning environment that supports a diversity of thoughts, perspectives and experiences, and honors everyone's backgrounds and identities. To help accomplish this goal, we will attempt to

foster a culture in which each class member is able to respect and hear each other. We ask that everyone be considerate of other's views and mindful of your own.

There are uncomfortable situations that may arise in class, and sometimes these occur despite the intentions of your colleagues or your instructors. There are several steps we can work towards alleviating some of this discomfort. Please come and discuss the situation with us or, if you prefer, we will be happy to direct you to resources within our School or University. We also encourage you seek out alternative avenues to address these situations, if these settings are more comfortable to you.

11. Academic Conduct

At the University level, passing anyone else's scholarly work (which can include written material, exam answers, graphics or other images, and even ideas) as your own, without proper attribution, is considered academic misconduct. Plagiarism, cheating, and other misconduct are serious violations of the University of Washington Student Conduct Code (WAC 478-120). We expect that you will know and follow university policies on cheating and plagiarism. Any suspected cases of academic misconduct will be handled according to university regulations. For more information, see the College of the Environment's Academic Misconduct Policy and the Community Standards and Student Conduct website.

Our specific policy in the class is to encourage reading of primary literature, and collaboration over data analysis and processing. However, we would like you to present your interpretation of the data independently in the lab sessions and research paper. This interpretation includes your own graphics and tables, except where we have asked you to present team-generated work. Instances of plagiarism will result in a zero grade on the relevant assignment or research project.

Instances of cheating during an exam will be awarded a zero on that exam. Entering responses on a clicker other than the one registered to you will result in a zero clicker score up to the day of the event, both for you and for the person whose clicker you use.

12. Disability Accommodations:

It is crucial that all students in this class have access to the full range of learning experiences. At the University of Washington, it is the policy and practice to create inclusive and accessible learning environments consistent with federal and state law. Full participation in this course requires the following types of engagement:

Course component	Requirements
Lectures	The ability to attend tri-weekly lectures of 50 minutes with 50 other students. The ability to collaborate in teams; includes worksheets, short discussions of data, the ability to conduct short computer exercises.
Labs	The ability to manipulate lab equipment; includes repetitive motions, use of microscopes and standing for extended periods of time. The ability to spend 3 hours in computer labs to analyze data. The ability to collaborate in teams; includes 10-15 minute data presentations and discussions
Research project	The ability to collaboratively analyze and interpret data and primary literature; involves computer work, creating text, uploading assignments and presenting a poster.

Exams	The ability to write a set of short-answer questions designed to be completed within 50 or 90 minutes in a room with 20 other students.

If you anticipate or experience barriers to your learning or full participation in this course based on a physical, learning, or mental health disability, please immediately contact the instructor to discuss possible accommodation(s). A more complete description of the disability policy of the College of the Environment can be found here. If you have, or think you have, a temporary or permanent disability that impacts your participation in any course, please also contact Disability Resources for Students (DRS) at: 206-543-8924 V / 206-543-8925 TDD / uwdss@uw.edu e-mail / http://www.uw.edu/students/drs.

Roles & Responsibilities

Student: please inform the instructor no later than the first week of the quarter of any accommodation(s) you will or may potentially require.

Instructor and TA: we will maintain strict confidentiality of any student's disability and accommodation(s) and help all students meet the learning objectives of this course.

13. Schedule

Week		Date	Lecture Topic	Readings	Friday Lab session
Wk01	M	1-Apr	Why is evolution important for Marine Biology?		Lab 1 - Introduction
	W	3-Apr	Tools and Concepts in evolution	Sec 1.1, 3.3	
	F	5-Apr	Micro and Macro mutations	Sec 5.2-3, Box 5.1	
Wk02	M	8-Apr	Hardy-Weinberg principles	Sec 6.1 - 6.3	Lab 2 - Population Genetics
	W	10-Apr	Selection and Adaptation	pp 172 - 182	
	F	12-Apr	Genetic Drift and inbreeding	Sec 6.4, 6.5, 6.7 (not box 6.7)	
Wk03	M	15-Apr	Dispersal and population structure	Sec 6.8	Lab 3 - Species and speciation
	W	17-Apr	Evolution of fitness traits	Sec 7.1-7.2	
	F	19-Apr	Species and Speciation	Sec 13.1-13.2	
Wk04	M	22-Apr	Species and Speciation	Sec 13.3, 13.7	Lab 4 - Bioinformatics & Phylogenetics
	W	24-Apr	Tree Thinking: Fundamentals of phylogeny	Sec 4.1-4.2	
	F	26-Apr	Tree Thinking: molecular phylogenies	Sec 9.1-9.3, 287-288	
Wk05	M	29-Apr	Tree thinking: hypothesis testing	Sec 4.3-4.4	Lab 5 - Research Project
	W	1-May	***Exam I: 9.30-10.20 FSH 213***		
	F	3-May	Geobiology and the history of life I	Sec 3.6-3.9	
Wk06	M	6-May	Geobiology and the history of life II	Online materials	Lab 6 - Research Project
	W	8-May	Evolution and Diversity of Marine Prokaryotes	Online materials	
	F	10-May	Evolution of Eukaryotes: Endosymbiosis	Online materials	
Wk07	M	13-May	Macroevolution: Biogeography	Sec 14.1 - 14.4	Lab 7 - Research Project
	W	15-May	Macroevolution: Adaptive Radiations, Mass Extinctions	Sec 14.5-14.9	
	F	17-May	Sexual selection	Sec 11.2- 11.3	
Wk08	M	20-May	Sexual selection	Sec 11.4- 11.6	Lab 8 - Research Project
	W	22-May	Evolution of life histories	Sec 12.1 -12.3	
	F	24-May	Conflict and Cooperation	Sec 15.1-15.2	
Wk09	M	27-May	**Holiday: Memorial Day**		Lab 9 - Research Project
	W	29-May	Conflict and Cooperation	Sec 15.3-15.4	
	F	31-May	Adaption to Different Marine Environments	Online materials	
Wk10	M	3-Jun	Adaption to Different Marine Environments	Online materials	Lab 10 - Presentations
	W	5-Jun	Applications: Ocean Change	Online materials	
	F	7-Jun	Applications: Conservation and Management	Online materials	
Wk11	W	12-Jun	***Exam 2: 8.30-10.20, FSH 213***		