

Shoals Marine Laboratory
Integrated Ecosystem Research and Management
MEFB 6XX/ BIOSM 3750
Proposed July 15-29, 2019

Course Syllabus and Schedule

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Prerequisites: One semester of college biology. One semester of ecology or conservation required, or via permission from instructor

Course Description:

The Gulf of Maine is experiencing rapid ecological change as a result of multiple stressors including climate change, ocean acidification, introduced species, and changing fisheries dynamics. This course will challenge students with these real-world problems to engage in solutions that integrate the best available science into conservation and management goals. Students will learn integrated ecosystem research tools used to conduct field and laboratory research and how to apply these tools in the Gulf of Maine and around the Isles of Shoals. Students will learn about ecosystem-based management and integrated ecosystem assessments. Students will be organized into small groups when conducting research and then collaborate to integrate their research and to make recommendations to a panel of experts on their answers for management.

Class enrollment limit: 14

Credit hours: 3 (Cornell) and 4 (UNH)

Learning Goals and Objectives:

- To understand the fundamentals of ecosystem-based management and integrated ecosystem assessment by:
 - Reading and orally critiquing several papers in current ecosystem-based research
 - Developing skills for analyzing time-series data (and their limitations).
 - Analyzing environmental and biological data from an integrated ecosystem research project

- Conducting design-based sampling of demersal fish and invertebrate species, environmental conditions and seabirds associated with the Isles of Shoals
- Addressing a real-world conservation management question (environmental and prey patterns affecting tern population trends)
- To understand the importance of collaboration and integrated ecosystem research to add value to research products and strengthen management recommendations.
 - Students will be taught all research techniques and then work in small groups to collect data within a discipline in order to understand a range of field and laboratory techniques.
 - Once data are collected, student groups will collaborate to describe an integrated picture of their research results in order to understand the value of collaboration among marine science disciplines.
 - Students will present their results before a panel of management experts, both in small groups and collaboratively, in order to learn how to formulate and present research results and make management recommendations.

Course Materials:

- Papers in current ecosystem research.
- Laboratory notebook (each student must provide their own).
- Personal laptops (recommended each student bring their own).

Assignments & Grading:

Grades:

- a. Project and panel presentation: 40%
- b. Final Exam: 40%
- c. Paper Discussions: 20%

Project: Students will as a team conduct an integrated environmental and biological research project exploring the management of the Isles of Shoals tern colony. The project will focus on seabird management and will incorporate seabird (terns), fisheries (bait fish), and plankton as the suite of biological focus. Students will work in small groups to sample a variety of ecosystem aspects (oceanography, plankton, fish, birds) (we will focus on the birds and fish if student enrollment is less than 6). Students will work closely with the instructors to formulate research questions and the appropriate analytical approaches to answer the questions. Small groups will present a specific ecosystem biological component and the class will synthesize across the biological aspects to create an integrated ecosystem assessment. The project offers students an opportunity to detect patterns, test specific hypotheses, and relate pieces of the

ecosystem into a whole. Each student will work through all aspects of a research project including hypothesis formulation, data collection, analysis and interpretation, synthesis of disciplinary knowledge, and communicating conclusions. The project will culminate in a presentation to a panel of experts involved in managing seabirds and fisheries. Students will present the results of their small group work (5 min each) and integrated team work (15min) that includes providing recommendations for management of the Isles of Shoals tern colony. All students will participate in the presentation and will speak for 5 minutes each. Presentation software will be utilized and all work will be merged into one presentation. Points for this work will be award based on the following rubric:

Table. Rubric for evaluating the project presentation (to be filled out for each student)

Category	Criteria	Points given/total possible	Comments
Organization	Information is presented in logical sequence	/2	
	Presentation cites at least 2 references	/2	
	Information is appropriate for audience	/2	
Content	Presentation contains scientifically accurate material	/2	
	Data is presented in an easy to understand format	/2	
	Data analysis and interpretation is appropriate	/2	
	Data is presented in at least 1 visual format	/2	
	Recommendations are appropriate for audience	/2	
Presentation Skills	Draws on material from the course	/2	
	Speaker uses a clear voice and can be heard by audience	/2	
	Presenter shows preparation and practice	/2	
	Uses assigned length of time	/2	
	Presenters address questions and comments from the panel appropriately	/2	

Final Exam: The final exam will consist of three multiple choice, 5 short answer, and 2 essay questions covering the lectures and readings. Questions will emphasize broad concepts. One essay question will present new information and will require synthesis of lectures and reading to answer. For example, use a different ecosystem as an example to test student's ability to integrate course skills and knowledge more broadly. The

second essay question will focus on interdisciplinary thinking to emphasize a main take away of this entire course. We will allow students to create and have with them one page of carefully constructed notes to reduce rote memorization as this course is about synthesis across disciplines.

Paper Discussions: Pairs of students will read and critically evaluate current papers assigned from the primary literature. Results of their analysis will be presented to the class in the form of an organized discussion. Additionally, all students are expected to have read and comprehend the papers in preparation for the group discussions. Grades will be assigned to both the discussion leaders and for student participation based on the following rubric.

Table: Rubric for Paper Discussion Evaluation (to be filled out for each student at each discussion)

Criteria	Weight	Points 6	Points 4	Points 2	Points 0
Level of engagement	50%	<ul style="list-style-type: none"> _ Effectively identifies & summarizes main points _ Asks multiple questions _ Engages on answering multiple questions 	<ul style="list-style-type: none"> _ Identifies & summarizes main points _ Asks a few questions _ Engages on answering a few questions 	<ul style="list-style-type: none"> _ Identifies & summarizes some main points _ Asks one questions _ Engages on answering one questions 	<ul style="list-style-type: none"> _ Identifies & summarizes no points _ no questions _ no answers
Preparedness	25%	<ul style="list-style-type: none"> _ Accurately expresses foundational knowledge pertaining to issues raised during the discussion _ Notes and power pt (if leading) fleshed out 	<ul style="list-style-type: none"> _ Expresses basic foundational knowledge pertaining to class discussions _ some notes 	<ul style="list-style-type: none"> _ Expresses limited foundational knowledge pertaining to class discussions _ no notes but evidence that they read 	<ul style="list-style-type: none"> _ Expresses no relevant foundational knowledge _ did not read paper
Attitude	25%	<ul style="list-style-type: none"> _ Very positive, cooperative attitude _ Very supportive of other students' ideas 	<ul style="list-style-type: none"> _ Intermediate positive, cooperative attitude _ Intermediate support of other students' ideas 	<ul style="list-style-type: none"> _ Limited participation _ Sometimes supportive of other students' ideas 	<ul style="list-style-type: none"> _ Does not participate _ Disruptive or unsupportive of other students

Summary of points as presenter:

Summary of points as participant:

Total points for assignment:

Expectations and Conduct:

Students are responsible for fully understanding all of the information presented in this syllabus. If there are any questions regarding this information, it is the student's responsibility to bring it to the instructor's attention. In addition, students are responsible for attending all activities associated with this course and completing all assignments. Students are responsible for asking questions anytime they need clarification (remember, there is no such thing as a bad question).

Every student is responsible for their own behavior – specifically in being respectful and collegial to other students and with instructors. Students are responsible for fully understanding and adhering all of the information presented in the *Appledore Island Handbook* (<https://www.shoalsmarinelaboratory.org/about-appledore>).

1. *Personal Technology*. Do not use cell phones or similar devices in the classroom or during course activities. If you take notes with your computer or tablet, disable wireless access during lecture.
2. *Computer Facilities*. The lab has a few desktop computers in the Loughton Library; please treat this shared facility with respect. Printers are available, but please limit printing to your FINAL document (if required).
3. *Transmission of Course Materials*. Students are not authorized to replicate, reproduce, copy or transmit lectures and course materials presented, or derivative materials including class notes, for sale or free distribution to others without written consent of the instructors who are the original source of the materials.
4. *Academic Integrity*. Any work submitted must be your own. Uncredited use of another person's words, data or images is considered plagiarism, a serious violation of the Code, whether the material comes from another student, a web site, or a published paper. Students must adhere to Cornell's and UNH's Policies for Academic Integrity, Honesty, and Plagiarism:
 - a. Cornell's policy: <http://cuinfo.cornell.edu/aic.cfm>
 - b. UNH's policy: <https://www.unh.edu/student-life/academic-honesty-policy>
5. *Disabilities & ADA Accommodation*: As Appledore Island is a remote location and any special arrangements need time and planning in order to be enacted, Shoals Marine Laboratory appreciates early notification for accommodation requests. Students with disabilities requesting accommodations must contact the appropriate disabilities services office:
 - a. Cornell and high school students: <https://sds.cornell.edu/forms>
 - b. UNH and all other college students:
<https://www.unh.edu/studentaccessibility/students-0>
6. *Mental Health*: Shoals Marine Laboratory cares about you and your well-being. If you experience unusual personal or academic stress during the course or need to talk with someone about a personal problem, seek support from your

instructors as soon as possible. In addition, any SML staff is available for consultation 24/7 and are committed to making students feel safe, comfortable, welcome, and included at all times on Appledore Island. Find staff in the office on the second floor of Hamilton Hall between 8am-7pm or knock on the door of Bartels House after hours.

Daily Schedule:

Note: Daily Schedule is subject to change based on weather, boat availability, tides, instructor's discretion, etc.

DAY	MORNING	AFTERNOON	EVENING
Mon, Jul 15		Arrive	Course Introduction
Tue, Jul 16	Ecosystem Based Management (EBM) 101 (Seavey); Steller sea lion foraging (Sigler)	Tern Biology & Conservation (Seavey) Lab 1: Seabird and prey sampling at colony (Seavey/Craig)	Rock Talk - NH tern manager Michael Marchand
Wed, Jul 17	Integrated ecosystem studies: Bering Sea Project (from oceanography to people) (Sigler); Data collection: Design-based sampling (C. Siddon); Prep for Lab 2	Lab 2: Statistics (C. Siddon)	Discuss papers
Thu, Jul 18	Social Science in EBM: (Min-Yang Lee, NOAA); Prep for Lab 3	Lab 3: Beach seine sampling to enumerate available prey (Graham Sherwood, Gulf of Maine Research Institute) Hi: 116 pm, 8.3 ft; Lo: 7 pm, 1 ft	Ecosystem survey example (Sherwood)
Fri, Jul 19	Search for patterns: Exploratory data analysis (E. Siddon); Ecosystem Status Reports (E. Siddon)	Lab 4: CTD and plankton sampling (Sigler)	Pollock overwinter survival (recruitment success provides more prey for seabirds and marine mammals) (E. Siddon)

Sat, Jul 20	Sea lion study design (Sigler); Recruitment processes study design (E. Siddon); Prep for Lab 6	Lab 5: Seabird diet data DNA vs Observation (Adrienne Kovach, tentative)	Discuss papers
Sun, Jul 21	Lab 6: Prey energy content (E. Siddon)		Discuss student projects
Mon, Jul 22	Student project field sampling (CTD and plankton, fish seining, and analyzing (not collecting) tern data (colony size, productivity, prey items)	Student project field sampling	Locate and analyze historic data sets
Tue, Jul 23	Student project field sampling	Lab 7: Run Gulf of Maine ecosystem model to address student questions (Gaichas)	Rock Talk - Sarah Gaichas, NOAA: Gulf of Maine ecosystem model
Wed, Jul 24	Student project field sampling	Student project field sampling	Exam Q& A with faculty
Thu, Jul 25	FINAL EXAM	Student project field sampling	Citizen Science and Outreach (Seavey, E. Siddon, Sigler)
Fri, Jul 26	Study analysis	Study analysis	Discuss studies
Sat, Jul 27	Prepare presentations	Prepare presentations	Discuss presentations
Sun, Jul 28	Open	PRESENTATIONS to panel	Open
Mon, July 29	Student clean rooms and labs, return all equipment	Depart	

Tides for Gosport Harbor (best approximation for Appledore Island) can be found here: <http://nh.us harbors.com/monthly-tides/New%20Hampshire/Gosport%20Harbor>

Reminder about meal times:

Monday-Saturday: Breakfast = 7:30am, Lunch = 12:30pm, Dinner = 6:00pm
Sunday: Brunch = 10:00am, Dinner = 5:00pm

First day of the course schedule:

Check-in at the SML dock in Portsmouth, NH= 1pm

Depart Portsmouth = 2:45pm

Arrive on Appledore Island = ~4pm

Welcome & Orientation, "Fire & Water" talk with SML Staff = ~4:30-5pm

Weekly events:

Every Tuesday is a "Rock Talk" (island-wide guest speaker's seminar): ~8-9pm

Every Wednesday is "Food Run" (all courses are asked to participate): ~4:00-4:30pm

Sunday mornings before brunch, students are expected to work together to tidy their dorm rooms and shared dorm spaces. Adding this to your syllabus (say, ~9-10am) is a big help to SML staff!

Course evaluations:

Sunday evening / Monday morning before departure: SML students will be asked to fill out course evaluations. Adding ~1hr to your syllabus helps to ensure that students take the time to provide valuable feedback to SML!

Last day of the course schedule:

Students are asked to be packed up and have their luggage ready on their dorm porch immediately following breakfast (ready for pick-up by 8:30am by SML staff).

Departing courses should gather at the SML dock between 9:15-9:30am prior to departure. Departure from Appledore Island for Portsmouth = 9:45am

Expected arrival back in Portsmouth = ~10:30-11am