

**Shoals Marine Laboratory**  
**Integrated Ecosystem Research and Management**  
**MEFB 508/ BIOSM 3750**  
**June 15 - 29, 2021**

Course Syllabus and Schedule

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**Prerequisites:** One semester of college biology or equivalent. One semester of ecology or conservation-related field preferred, but not required.

**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:**

- Understand the fundamentals of integrated ecosystem research through combined classroom and field-based learning opportunities.
  - Read and orally critique papers in current ecosystem-based research
  - Develop skills for analyzing time-series data (and their limitations).
  - Analyze environmental and biological data from an integrated ecosystem research project
  - Conduct design-based sampling of demersal fish and invertebrate

- species, environmental conditions and seabirds associated with the Isles of Shoals
  - Address a real-world conservation management question (environmental and prey patterns affecting tern population trends)
- Learn the importance of collaboration and integrated ecosystem research to add value to research products and to strengthen management recommendations.
  - Students will be taught all research techniques and then will 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.
- Learn how to formulate and present research results to a diverse audience of end-users.
  - 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).
- Download <https://www.jamovi.org> version “solid” to your laptop

### **Assignments & Grading:**

#### *Grades:*

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

*Project:* Students work as a team to 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 (15 min) that includes providing recommendations for the 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). The top rating within a subfactor (indicated by ■) is not always the points 6 category.

Criteria	Points 6	Points 4	Points 2	Points 0
Content (weight 50%)	_Presentation contains scientifically accurate material _Data is presented in an easy to understand format <span style="background-color: #90EE90;">■</span> Data analysis and interpretation are clearly stated and appropriate _Data is presented in at least 2 visual formats <span style="background-color: #90EE90;">■</span> Recommendations are clearly stated and appropriate for audience <span style="background-color: #90EE90;">■</span> Draws on material from course (at least 3 mentions)	<span style="background-color: #90EE90;">■</span> Presentation contains scientifically accurate material <span style="background-color: #90EE90;">■</span> Data is presented in an easy to understand format _Data analysis and interpretation are appropriate <span style="background-color: #90EE90;">■</span> Data is presented in at least 2 visual formats _Recommendations are appropriate for audience _At least 2 mentions of course material	_Presentation contains a few minor errors _Data presentation is somewhat difficult to understand _Data analysis and interpretation are somewhat inappropriate _Data is presented in at least 1 visual format _Recommendations are somewhat inappropriate _One mention of course material	_Presentation contains inaccurate material _Data is presented in a difficult to understand format _Data analysis and interpretation are inappropriate _No visual formats are used to present data _Recommendations are inappropriate for audience _No mention of course material

Organization (weight 25%)	<input checked="" type="checkbox"/> Information presented in a logical sequence _at least 3 references cited _Information is appropriate for audience	_Identifies & summarizes main points <input checked="" type="checkbox"/> at least 3 references cited <input checked="" type="checkbox"/> Information is appropriate for audience	_Identifies & summarizes some main points _1 reference cited _Information is somewhat suited for audience	_ Information presented haphazardly _No references cited _Information is unsuited for audience
Presentation skills (weight 25%)	<input checked="" type="checkbox"/> Speaker uses a clear voice and can be heard by the audience <input checked="" type="checkbox"/> Presenter shows preparation and practice _Uses assigned length of time _Presenter addresses questions and comments from the panel appropriately	_Speaker's voice is clearly heard most of the time _Presenter mostly shows preparation and practice <input checked="" type="checkbox"/> Uses assigned length of time <input checked="" type="checkbox"/> Presenter addresses questions and comments from the panel appropriately	_Speaker's voice cannot be clearly heard some of the time _Presenter little shows preparation and practice _Speaker goes somewhat over time _Presenter answers to questions and comments are somewhat suited for the audience	_Speaker is difficult to hear _Presenter shows no preparation and practice _Goes substantially over time _Presenter answers to questions and comments are unsuited for the audience

*Exam:* The exam will consist of three multiple choice, five short answer, and two 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 takeaway of the 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). For this evaluation, the top rating within a subfactor is always the points 6 category.

Criteria	Weight	Points 6	Points 4	Points 2	Points 0
Level of engagement	50%	<ul style="list-style-type: none"> <li>_Effectively identifies &amp; summarizes main points</li> <li>_Asks multiple questions</li> <li>_Engages on answering multiple questions</li> </ul>	<ul style="list-style-type: none"> <li>_Identifies &amp; summarizes main points</li> <li>_Asks a few questions</li> <li>_Engages on answering a few questions</li> </ul>	<ul style="list-style-type: none"> <li>_Identifies &amp; summarizes some main points</li> <li>_Asks one questions</li> <li>_Engages on answering one question</li> </ul>	<ul style="list-style-type: none"> <li>_ Identifies &amp; summarizes no points</li> <li>_no questions</li> <li>_no answers</li> </ul>
Preparedness	25%	<ul style="list-style-type: none"> <li>_ Accurately expresses foundational knowledge pertaining to issues raised during the discussion</li> <li>_Notes and power pt (if leading) fleshed out</li> </ul>	<ul style="list-style-type: none"> <li>_Expresses basic foundational knowledge pertaining to class discussions</li> <li>_some notes</li> </ul>	<ul style="list-style-type: none"> <li>_Expresses limited foundational knowledge pertaining to class discussions</li> <li>_no notes but evidence that they read</li> </ul>	<ul style="list-style-type: none"> <li>_Expresses no relevant foundational knowledge</li> <li>_did not read paper</li> </ul>
Attitude	25%	<ul style="list-style-type: none"> <li>_Very positive, cooperative attitude</li> <li>_Very supportive of other students' ideas</li> </ul>	<ul style="list-style-type: none"> <li>_Intermediate positive, cooperative attitude</li> <li>_Intermediate support of other students' ideas</li> </ul>	<ul style="list-style-type: none"> <li>_Limited participation</li> <li>_Sometimes supportive of other students' ideas</li> </ul>	<ul style="list-style-type: none"> <li>__Does not participate</li> <li>_Disruptive or unsupportive of other students</li> </ul>

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 to 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.*

**COVID-related adjustments:** Guest lecturers will appear online rather than in person. The two guest labs will occur in person (Liz Craig, Nathan Furey) following COVID guidelines (outdoors, masks, social distancing).

DAY	MORNING	AFTERNOON	EVENING
Sun, Jun 13			1815 - Virtual faculty meeting
Mon, Jun 14			
Tues, Jun 15		<b>STUDENTS Arrive 4 pm</b>	<a href="#">Course Introduction</a>
Wed, Jun 16	IER examples: <a href="#">Steller sea lion foraging</a> (Sigler); <a href="#">Prey species availability</a> (Alaska pollock) (E. Siddon); <a href="#">Gulf of Maine overview</a> (Sigler)	<a href="#">Tern Biology &amp; Conservation</a> (Craig) Lab: Seabird and prey sampling at colony (Craig) 1622 high tide, 8.1 ft	<a href="#">Ecosystem Status Reports</a> (E. Siddon)
Thu, Jun 17	<a href="#">Seasonality and location matters</a> (Sigler); <a href="#">Landscape ecology</a> (Seavey); 1100 - Geret De Piper, NOAA: Social Science in EBM	1330 - Sarah Gaichas, NOAA: Gulf of Maine ecosystem model, Lecture and Lab	Rock Talk - Pribilof Island Sentinel (Lauren Divine, TBN)
Fri, Jun 18	What is an ecosystem? (E. Siddon); Lab: <a href="#">Ecosystems</a>	<a href="#">Biology and availability of tern prey species</a> (Sigler); UNH graduate student talks	Discuss paper <a href="#">Cury et al. Discussion paper questions.</a>

		(Caldwell, Hermann) Lab: Fish sampling (Nathan Furey, UNH) (request JBH, 1330-1730)	
Sat, Jun 19	<a href="#">Introduce data analysis</a> (Sigler); Data analysis ( <a href="#">C. Siddon/Sigler</a> )	Lab: Data analysis ( <a href="#">C. Siddon/Sigler</a> ); <a href="#">Download analysis software</a>	Lab: <a href="#">CTD and plankton sampling</a> 1900 - 2100 (JMK)
Sun, Jun 20	0900 - Tidy living spaces; 1000 - brunch; 1100 - Seal biology and conservation (Bogomolni); Veo student talk. Lab: 1215-1415 View seal colony from boat (request vessel); 1326 low tide 0.2 ft; Lab cont. ID plankton; Data management (C. Siddon)		1700 - Dinner; 1815 - Virtual Faculty meeting; 1900 - Discuss paper <a href="#">Sigler et al.</a>
Mon, Jun 21	<a href="#">Climate Change and Alaska Marine Ecosystems</a> (Sigler); <a href="#">Ecosystem Based Management (EBM) 101</a> (Seavey);	Lab: Revisit tern colony, 1423 low tide, 0.1 ft	<a href="#">Building integrated student projects</a> ; Discuss student projects; Review and sign data sharing agreement
Tue, Jun 22	Artist in Residence; <a href="#">IER study design</a> : Discuss student projects	Discuss student projects	Open (or in the morning, student choice)
Wed, Jun 23	Study analysis  1130 Discuss project progress	Lab: <a href="#">Foraging and energy density</a> ; 1615 low tide, -0.1 ft	Adv. lab methods: Isotopes (Liz Craig); DNA (Gemma Clucas, Cornell); <a href="#">Energy density</a> (Sigler)
Thu, Jun 24	Study analysis  1130 Discuss project progress	Optional: CTD/plankton or fish sampling (JMK) OR study analysis (student choice)	Rock Talk - Kathy Mills, Gulf of Maine Research Institute, Forecasting the future state of the Gulf of Maine ecosystem
Fri, Jun 25	The M part: Citizen science and Outreach (Seavey, <a href="#">Sigler</a> , E. Siddon); Lab: <a href="#">Communication</a>	Open	<b>EXAM</b>

Sat, Jun 26	<a href="#">How to prepare a presentation</a> (Seavey); Finish analysis and prepare individual presentations	Prepare individual presentations	Present draft individual presentations
Sun, Jun 27	0900 - Tidy living spaces; 1000 - brunch; Prepare integrated presentation		Present draft integrated presentation
Mon, Jun 28	Open	<b>1100- PRESENTATIONS</b> to management panel	Course evaluations
Tue, Jun 29	Students <b>clean</b> rooms and labs and return all equipment	<b>Depart @945am</b>	

\*Student project field sampling consists of temperature, salinity (CTD) and plankton (including simplified identification), fish sampling, and analyzing (not collecting) tern data (colony size, productivity, prey items).

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 Thursday 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:

Monday evening /Tuesday 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