



Appledore Island, Isle of Shoals, Kittery, Maine
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Shoals Marine Laboratory
Marine Environmental Science (BIOSM 1620.801)
August 1-15, 2022

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Course Syllabus and Schedule

Credits: 3 credits via Cornell

Prerequisites: Two year-long high school courses in science; completion of grades 10, 11, or 12

Course goals:

Environmental studies have become an integral component of high school programs all around the country, however, opportunities to gain hands-on experience while observing, measuring, and characterizing ecosystem health and diversity are limited.

Marine Environmental Science at Shoals Marine Lab will explore the diversity of coastal marine habitats and ecosystems as well as the tools scientists use to study them. An emphasis will be placed on topics related to human impacts and environmental health.

Fieldwork will include explorations along Appledore's rocky intertidal zone, excursions to neighboring islands to observe seal and seabird colonies, and offshore trips to practice oceanographic sampling techniques and observe whale foraging grounds. Laboratory exercises will include observation and identification of plankton under the microscope, and familiarization with invertebrate and vertebrate adaptations through observation and dissection. Lectures and discussions will expose students to topics in marine ecology, oceanography, and climate science. Finally, we will study how humans have impacted the ocean and discuss how we can be stewards of marine ecosystems.

A major component of this course is a group project in which students are expected to apply the scientific methods they have practiced in the field and lab to answer a question centered around a key component of the course. Students will be responsible for creating a paper and presentation to effectively communicate results and conclusions to peers and instructors.

Course Materials:

Students should bring a laptop computer for writing papers, completing lab exercises, creating presentations, and working with data. Canvas will be used as a learning management system and as a way to distribute instructional materials to reduce excessive printing. We require sturdy, close-toed shoes (or muck boots) for work in the intertidal zone and recommend rain gear as we will head into the field, rain or shine, to complete activities.

Assignments & Grading:

- a. Assignments: Grades for this course will be based upon student mastery of learning objectives within each topic plus the research project. All assignments will be turned in via canvas, where rubrics and descriptions will also be available. Overall performance will be weighted across these units as follows:

Lab Notebook: 10%

Field Guide: 15%

Classwork: 25%

Participation: 10%

Research Project (paper, presentation, and data files): 40%

**Full and active participation, including the reading of assigned scientific articles and preparation for in-class exercises, are required. Failure to prepare for activities will result in a loss of classwork points and a low participation score.*

Additional 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. Every student is responsible for their behavior- specifically maintaining a safe experience for themselves and others, and 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 SML Appledore Handbook as well.

- a. Personal Technology During the Workday.

Do not use cell phones, iPads, headphones, laptops, or similar devices in the classroom or during course activities unless instructed to do so. Please do not plan on taking notes on a laptop as there is ample research showing it inhibits learning compared to taking notes by hand (even compared to not taking notes at all, e.g. Muler and Oppenheimer 2014).

Allowances are made for any student with learning a plan specifying an accommodation for typing class notes, in which case it will be expected that wireless access during lecture.

- b. Computing.

Shoals Marine Lab has a modest computer facility in Leighton Library. Please treat this shared facility with respect. Printers are available, but please limit printing and be sure to upload your completed assignments to canvas. See also, Course Materials and Personal Technology sections above.

- c. Transmission of Course Materials.

Students are not authorized to copy, record, replicate, reproduce, or transmit any course materials presented, or derivative materials including class notes, for sale or free distribution to others without the written consent of the instructor who is either the source of the materials or is using them with permission of their original authors.

d. 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 website, or a published paper. Students must adhere to the policies of Cornell and UNH for Academic honesty, plagiarism, and discrimination.

Cornell: <http://theuniversityfaculty.cornell.edu/academicintegrity/>

UNH: <https://www.unh.edu/student-life/09-academic-honesty>

e. Disabilities & ADA Accommodation:

Students with a disability must contact Cornell's (420 CCC building; 607-254-4545) or UNH's Student Disability Services <https://www.unh.edu/studentaccessibility> before the start of class for a confidential discussion of needs and for registration to verify eligibility for academic accommodations. No retroactive accommodations can be made.

f. 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. Find staff in the office in the Hamilton House between 8 am – 7 pm or knock on the door of Bartels House after hours.

Schedule:

Daily schedules at Shoals Marine Laboratory are flexible to accommodate predictable events (e.g. tides), and unpredictable events (e.g. weather) to take advantage of unforeseen opportunities to experience the marine environment and to participate in campus-wide marine science lectures and field opportunities. As a result, MES's daily routine may include early morning field or lab work.

Three meals are served on the island each day, except Sunday, when schedules are more relaxed and begin after a mid-morning brunch. Between meals, students should expect to be fully engaged in lectures, fieldwork, and laboratory exercises each day. After dinner and outside of formal class hours, students may be expected to work on research projects or attend guest lectures and films.

Island Life:

Days on Appledore are filled with academic endeavors, but students do have free time around meals when they can use the island's volleyball court, swimming area, or library. SML encourages MES participants to interact with the entire island community. Additionally, one morning or afternoon each week, students join in general cleaning of the island and its facilities.

Schedule of Events:

*Note: This schedule is subject to change to accommodate predictable events, unpredictable events, or to take advantage of unforeseen opportunities.

Day/Topic	Overview
Mon, 8/1	<p>2:45 pm: Depart Portsmouth</p> <p>~4 pm: Arrive on Appledore Island</p> <p>~4:30-5:30 Welcome & Orientation, "Fire and Water" talk with SML Staff</p> <p>6:00 pm Dinner</p> <p>7 pm: Course, Instructor, and TA Introduction</p> <p>8 pm: Appledore sunset orientation hike + icebreakers (flashlights needed)</p>
<p>Tues, 8/2</p> <p>HIGH TIDE 2:35</p> <p>LOW TIDE 8:47</p> <p>HIGH TIDE 3:07</p> <p>LOW TIDE 9:04</p>	<p>7:30 Breakfast</p> <p>8:30 am - 9:15 Lecture: Intro to the Gulf of Maine</p> <p>9:15-9:25 Break</p> <p>9:25-10: How deep is the ocean mini lab</p> <p>10-10:30: Ocean zonation lecture + fill in of info on board in groups, share info after</p> <p>10:30-10:45: Discuss how to read a scientific paper</p> <p>10:45-11:30: The five deeps: The location and depth of the deepest place in each of the world's oceans</p> <p>11:30-12:30: Mini lab on creating your own ocean zones</p> <p>12:30-1:30 Lunch</p> <p>1:45-2:30: Intro to intertidal zonation (biotic and abiotic factors)</p> <p>2:30-3:30 Artist in residence</p> <p>3:45-5: Intertidal exploration and mini-transect (Seek app/Intertidal Key) and intro to field sketching activity with transect</p> <p>6:00 pm Dinner</p> <p>7:30 -7:45 Intro to speaker</p> <p>8-9 PM Rock Talk</p>
<p>Wed 8/3</p> <p>HIGH TIDE 3:17</p> <p>LOW TIDE 9:27</p> <p>HIGH TIDE 3:46</p> <p>LOW TIDE 9:51</p>	<p>7:30 Breakfast</p> <p>8:00 - 8:30 Discussion of Rock Talk</p> <p>8:30 - 9:15: How do we ask scientific questions? Experimental vs observational research studies/scientific method</p> <p>9:30-10:15: Transect Exploration: document change at low tide</p> <p>10:30-11:15: Discussion on changes</p> <p>11:15-Lunch: Seabirds and the scientific method activity (online)</p> <p>12:30-1:30 Lunch</p> <p>1:45-2:15: Discussion of seabirds and scientific method activity. Why do you think we are talking about seabirds?</p>

	<p>2:30-3:15: <i>Why start with seabirds?</i></p> <p>3:15-3:45: <i>Animal behavior and ethogram introduction</i></p> <p><i>4-4:30 Help with Food Run</i></p> <p>4:45-5:00: <i>Gull ethograms</i></p> <p>5:00-5:45: <i>Time budget, ethogram, pie chart</i></p> <p>6:00-7 pm: <i>Dinner</i></p> <p>7:30-8:15: <i>Discussion of ethogram</i></p> <p>8:30 on: <i>independent reading of Dr. Craig paper</i></p>
<p>Thurs, 8/4</p> <p>HIGH TIDE 4:03</p> <p>LOW TIDE 10:10</p> <p>HIGH TIDE 4:30</p> <p>LOW TIDE 10:42</p>	<p>7:30 <i>Breakfast</i></p> <p>8:30-9:15: <i>Overview of research projects</i></p> <p>9:15-9:45 <i>Threats to seabird</i></p> <p>10-10:30: <i>Paper discussion</i></p> <p>10:30- <i>Lunch: Plastic Search</i></p> <p>12:30 <i>Lunch</i></p> <p><i>Potential Tern Colony Trip</i></p> <p>6:00 pm <i>Dinner</i></p>
<p>Fri, 8/5</p> <p>HIGH TIDE 4:54</p> <p>LOW TIDE 10:57</p> <p>HIGH TIDE 5:19</p> <p>LOW TIDE 11:37</p>	<p>7:30: <i>Breakfast</i></p> <p>8:30 - 9:30 <i>Copepods and Whales (trophic connections/top-down vs bottom-up control of marine food webs, biomagnification of microplastics) + Boat safety</i></p> <p><i>Whale watch 10-2</i></p> <p>2:30-3:30: <i>Brainstorm projects</i></p> <p>3:30-5: <i>Group work on projects</i></p> <p>5-6: <i>Intro to plankton</i></p> <p>6:00 pm: <i>Dinner</i></p> <p>7:00- 8:30: <i>TBD</i></p>
<p>Sat, 8/6</p> <p>HIGH TIDE 5:50</p> <p>LOW TIDE 11:50</p> <p>HIGH TIDE 6:13</p> <p>LOW TIDE: N/A</p>	<p>7:30: <i>Breakfast</i></p> <p>8:30-9: <i>Boat sampling safety</i></p> <p><i>Physical, chemical, and biological (plankton) water sampling R/V Kingsbury. Depart at 9:00 – returning approx. 12:00</i></p> <p>12:30 - 1:30: <i>Lunch</i></p> <p>1:45-2:30: <i>TA Guest Lecture Data Entry and Excel</i></p> <p>2:30 - 4:30: <i>Analysis of phys/chem water quality data</i></p> <p>4:30 - <i>Dinner: Group data review and introduction to data analysis</i></p> <p>6:00 pm: <i>Dinner</i></p> <p>7 pm: <i>TBD</i></p>
Sun, 8/7	<p>9-10 am: <i>Tidy Dorms and Common Spaces</i></p> <p>10:00: <i>Brunch</i></p>

<p>HIGH TIDE 6:52</p> <p>LOW TIDE 12:37</p> <p>HIGH TIDE 7:13</p> <p>LOW TIDE 12:48</p>	<p><i>10-10:30 Species Interactions Intro</i></p> <p><i>10:30-11:00: Vertebrate growth plasticity in response to a mutualistic interaction</i></p> <p><i>11-12: Intro to fish, sharks, skates, and rays</i></p> <p><i>12:15-12:45 Tracking sharks (tagging, mapping, eDNA)</i></p> <p><i>1-2: group project work</i></p> <p><i>2-2:30 Intro to DVM, and phosphorescence</i></p> <p><i>5:30- 6:00: Nighttime boat safety</i></p> <p><i>4:00 -5:00: Challenges in fisheries + introduction to stakeholder meeting</i></p> <p><i>5:00 pm: Dinner</i></p> <p><i>Faculty meeting after dinner to 7</i></p> <p><i>7:00 - 9:30 Nighttime Phytoplankton Sampling</i></p>
<p>Mon, 8/8</p> <p>HIGH TIDE 7:59</p> <p>LOW TIDE 1:42</p> <p>HIGH TIDE 8:16</p> <p>LOW TIDE 1:51</p>	<p><i>7:30 Breakfast</i></p> <p><i>8:30-10:00: Daytime/nighttime plankton data comparison/analysis</i></p> <p><i>10-12:30: Last man fishing</i></p> <p><i>12:30-1:30: Lunch</i></p> <p><i>2-3:15: Introduction to Cetaceans</i></p> <p><i>3:30-4: North Atlantic Right Whale Identification</i></p> <p><i>4-5:30 Lab: Marine Mammal Identification</i></p> <p><i>6:00 pm: Dinner</i></p> <p><i>7:30: Screening of entangled</i></p>
<p>Tues, 8/9</p> <p>HIGH TIDE 9:05</p> <p>LOW TIDE 2:47</p> <p>HIGH TIDE 9:19</p> <p>LOW TIDE 2:55</p>	<p><i>7:30: Breakfast</i></p> <p><i>8:30 - 9:00: Discussion of film</i></p> <p><i>9:00 - 10:00: Stakeholder meeting sessions</i></p> <p><i>10:00 - 11:00: Group work stakeholder meeting</i></p> <p><i>11:00-12:15: Sustainable fisheries/aquaculture</i></p> <p><i>12:30-1:30: Lunch</i></p> <p><i>1:30- 4:00: Fishing excursion: methods, gear impacts (Rod and Reel, and trawl)</i></p> <p><i>4:00-6:00: Group project time (groups meet with instructors to discuss project proposal)</i></p> <p><i>6:00 pm: Dinner</i></p> <p><i>7:30 - 8:00: Dynamic ecologic systems (Dr. Cheng's work)</i></p> <p><i>8-9 PM: Rock Talk w/ Dr. Helen Cheng</i></p>
<p>Wed, 8/10</p> <p>HIGH TIDE 10:06</p> <p>LOW TIDE 3:49</p>	<p><i>7:30 Breakfast</i></p> <p><i>8:30-9:30: Changing Oceans and Invasive Species</i></p> <p><i>9:45-12:15: Group project time</i></p> <p><i>12:30-1:30 Lunch</i></p>

<p>HIGH TIDE 10:19 LOW TIDE 3:56</p>	<p><i>1:45-3:45: Lab: Invasive species detection and survey</i></p> <p><i>4-4:30: Help with Food Run</i></p> <p><i>4:45-5:45 PM: Green Crab dissection</i></p> <p><i>6:00 pm: Dinner</i></p>
<p>Thurs, 8/11</p> <p>HIGH TIDE 11:04 LOW TIDE 4:46 HIGH TIDE 11:17 LOW TIDE 4:54</p>	<p><i>7:30-8:30 Breakfast</i></p> <p><i>8:45-9:15: TA Georgia Ocean Acidification Lecture</i></p> <p><i>9:15-10:45: TA Brian Shell Strength Lecture</i></p> <p><i>11-12:15: Ocean acidification lab led by TA's</i></p> <p><i>12:30 Lunch</i></p> <p><i>1:30- 6:00: Group Project work</i></p> <p><i>6:00 pm: Dinner</i></p> <p><i>7:00: Project time</i></p>
<p>Fri, 8/12</p> <p>HIGH TIDE 11:59 LOW TIDE 5:40 HIGH TIDE: NA LOW TIDE 5:50</p>	<p><i>7:30-8:30 Breakfast</i></p> <p><i>8:30-12:30: Group Project Presentations</i></p> <p><i>12:30-1:30 Lunch</i></p> <p><i>1:30 -2:30 Lecture: Erosion and rising sea levels</i></p> <p><i>2:30 - 4:00 Lab: Mapping erosion on Appledore</i></p> <p><i>4:15-5:00: Discussion</i></p> <p><i>6:00-7 pm: Dinner</i></p>
<p>Sat, 8/13</p> <p>HIGH TIDE 12:12 LOW TIDE 6:32 HIGH TIDE 12:51 LOW TIDE 6:45</p>	<p><i>7:30-8:30: Breakfast</i></p> <p><i>8:30 - 9:30: Read "ECOSYSTEM MONITORING: ARE SEALS A POTENTIAL TOOL FOR MONITORING CHANGE IN MARINE SYSTEMS?"</i></p> <p><i>9:30-10:00: Paper Discussion</i></p> <p><i>10:15- 10:45: Pinniped ecology</i></p> <p><i>10:50-12:00: Seal monitoring at Duck Island</i></p> <p><i>12:30-1:30: Lunch</i></p> <p><i>1:30-4: TBD.</i></p> <p><i>4-6pm: Island Exploration</i></p> <p><i>6:00-7 pm: Dinner</i></p>
<p>Sun, 8/14</p> <p>HIGH TIDE 1:06 LOW TIDE 7:22 HIGH TIDE 1:41 LOW TIDE 7:38</p>	<p><i>9-10 am: Tidy Dorms and Common Spaces</i></p> <p><i>10:00-11:00: Brunch</i></p> <p><i>11:00 - 12:00: Presentation workshop</i></p> <p><i>12:00-3:00: Presentations (25 Min: 15 + 10 Q&A)</i></p> <p><i>3:00: T-Shirt Design</i></p> <p><i>4:00: Course Evaluations and Packing</i></p> <p><i>5:00 pm: Dinner</i></p> <p><i>Jaws Screening!!</i></p>

Mon, 8/15	<p>7:30: <i>Breakfast</i></p> <p>8:30 am: <i>Have luggage ready on your dorm porch for pick-up</i></p> <p>9:15 am: <i>Gather on the dock for departure :(</i></p> <p>9:45 am: <i>Departure from Appledore Island</i></p> <p>~10:30-11 am: <i>Expected Arrival Back in Portsmouth</i></p>



Cornell University



University of
New Hampshire

Shoals Marine Laboratory on Appledore Island, Isles of Shoals, Maine: Dedicated to undergraduate education and research in marine science since 1966