



Appledore Island, Isle of Shoals, Kittery, Maine
t: 603.964.9011 • shoals.lab@unh.edu • shoalsmarinelaboratory.org

Shoals Marine Laboratory
Shark Biology and Conservation (BIOSM 4650/MEFB 741)
July 16-30, 2018

Course Syllabus and Schedule

Faculty: Dr. Heather Marshall (heather@atlanticwhiteshark.org)

Teaching Assistant:

Prerequisites: Two semesters of undergraduate science, or permission of the instructor

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

Course Objectives/Goals:

The last 30 years have produced an explosion of new information on the biology of the approximately 1,000 living species of sharks, skates, rays, and chimaeras, which collectively make up the group Chondrichthyes. This course will cover advanced topics in the evolution, diversity, anatomy, functional morphology, physiology, sensory systems, behavior, reproduction, development, and conservation of cartilaginous fishes.

Learning outcomes for *Shark Biology and Conservation* include:

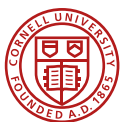
- Understanding of elasmobranch phylogeny and evolution.
- Knowledge of how evolution has resulted in a wide variety of elasmobranch anatomical, physiological and morphological specializations.
- Develop a working knowledge of the research methods used to advance understanding of shark biology, ecology and conservation.
- Understanding of shark research, objectives and study species in the Gulf of Maine.

Course Materials:

1. Background readings and research literature will be provided for students electronically.
2. Laboratory notebook (each student must provide their own).
3. Personal laptops (recommended each student bring their own).

Assignments & Grading:

Quizzes & Exams: Nine quizzes and one cumulative exam will be given. Quizzes are based on previous-day lectures, and all material presented in the course will be included on the exam.



Cornell University



University of
New Hampshire

Field/Laboratory Work & Research Project: Field and laboratory sessions will be based on topics covered in lecture, will explore some topics in depth, and hone your skills in reading and critically evaluating scientific literature. Students will record observations and findings in a laboratory notebook, which will be graded at the end of the course. You also will conduct a research project, which will culminate in a final presentation; we will explain more about this in class.

Participation: Success at Shoals requires a positive attitude and a willingness to accept changes in the schedule with grace. Island living demands respect for your fellow classmates, and residents on Appledore. Students are expected to actively participate in all facets of this course, and to display good citizenship while at Shoals. 10% of your grade will be based on the faculty's subjective evaluation of your personal involvement in course activities. If you have any questions or comments about the course, please contact the instructors directly.

Grading:

Quizzes	30%
Final Exam	20%
Field & Lab Projects, Lab Notebook	20%
Final Presentation	20%
Participation	10%

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:
 - i. Cornell and high school students: <http://cuinfo.cornell.edu/aic.cfm>
 - ii. UNH: <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:

- i. Cornell and high school students: <https://sds.cornell.edu/forms>
 - ii. UNH and all other college students: <https://www.unh.edu/studentaccessibility>
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.

Monday July 16th

1:00pm – Check-in at the SML dock in Portsmouth, NH
2:45pm – Depart Portsmouth
4:00pm – Arrive at SML on Appledore Island
4:30-5:00pm – Welcome & Orientation, “Fire & Water” talk with SML Staff
5:00-6:00pm – Unpack and settle into dorm rooms
6:00-6:30pm – Dinner
7:00-7:30 – Lecture 1. Introductions, background, intro to shark research
7:30-8:00 – Lecture 2. Classification of sharks, skates, rays, chimaeras

Tuesday July 17th

7:30-8:00am – Breakfast
8:00-9:00am – Article introduction and reading in class
9:05-9:55am – Lecture 3. Phylogeny
10:10-11:00am – Lecture 4. Form and function – sharks general
11:15-12:05am – Lecture 5. Comparative form and function – shark diversity
12:05-12:30am – Free time
12:30-1:00pm – Lunch
1:00-4:00pm – Lab 1. External anatomy, key out sharks
4:00-6:00pm – Read article, Project planning time
6:00-6:30pm – Dinner
6:30-7:00pm – Study, prepare for discussion
7:00-8:00pm – Article Discussion
8:00-9:00pm – Rock Talk!

Wednesday July 18th

7:30-8:00am – Breakfast
8:00-8:30am – Study/review
8:30-9:00am – Quiz 1
9:05-9:55am – Lecture 6. Research methods: evolution and phylogeny
10:10-11:00am – Lecture 7. Anatomy
11:15-12:05am – Lecture 8. Internal organs
12:05-12:30am – Free time
12:30-1:00pm – Lunch
1:00-4:00pm – Lab 2. Dissection 1 – Internal Anatomy
4:00-6:00pm – Project time
4:00-4:30pm – Food Run! All courses participate
4:30-6:00 – Artist in Residence
6:00-6:30pm – Dinner
6:30-7:00pm – Study, prepare for discussion
7:00-8:00pm – Lecture 9. Research Methods: Anatomy and Internal Organs

Thursday July 19th

7:30-8:00am – Breakfast
8:00-8:30am – Study/review
8:30-9:00am – Quiz 2
9:05-9:55am – Lecture 10. Reproduction 1
10:10-11:00am – Lecture 11. Digestive system
11:15-12:05am – Lecture 12. Research methods: Reproduction & digestive system
12:05-12:30am – Free time
12:30-1:00pm – Lunch
1:00-4:00pm – Lab 3. Dissection 2 – Reproduction & digestive system
4:00-6:00pm – Project time, read article
6:00-6:30pm – Dinner
6:30-7:00pm – Study, prepare for discussion
7:00-8:00 – Article discussion

Friday July 20th

7:30-8:00am – Breakfast
8:00-8:30am – Study/review
8:30-9:00am – Quiz 3
9:05-9:55am – Lecture 13. Feeding morphology
10:10-11:00am – Lecture 14. Predatory behavior
11:15-12:05am – Lecture 15. Food-web dynamics
12:05-12:30am – Free time
12:30-1:00pm – Lunch
1:00-4:00pm – Lab. Field Afternoon – local species
4:00-6:00pm – Project time, read article
6:00-6:30pm – Dinner
6:30-7:00pm – Study, prepare for discussion
7:00-8:00pm – Lecture 16. Research methods: trophic ecology

Saturday July 21th

7:30-8:00am – Breakfast
8:00-8:30am – Study/review
8:30-9:00am – Quiz 4
9:05-9:55am – Lecture 17. Muscle morphology
10:10-11:00am – Lecture 18. Physiology
11:15-12:05am – Lecture 19. High-performance sharks
12:05-12:30am – Free time
12:30-1:00pm – Lunch
1:00-4:00pm – Lab. Physiology data/movement data
4:00-6:00pm – Project time, read article
6:00-6:30pm – Dinner
6:30-7:00pm – Study, prepare for discussion
7:00-8:00 – Lecture 20. Case study: shark hearts

Sunday July 22nd

7:00-8:30 – Work on projects, study

8:30-9:00 - Quiz 5

9:00-10:00am – Help to tidy up your dorm room and shared dorm spaces! ☺

10:00-10:30am – Brunch

10:30-11:00 – Lecture 21. Osmoregulation

11:10-12:00 – Lecture 22. Ecology

12:00-12:30 – Lecture 23. Movements

12:30-1:00 – Free time

1:00-4:00 – Lab. Fieldwork prep (make chum?)

4:00-5:00 – Work on projects and reading, study

5:00-5:30pm – Dinner

5:30-6:00 – Study time

6:00-7:00 – Lecture 24. James Research lecture

Monday July 23rd: FIELD WORK DAY (weather dependent, schedule may be swapped with another day)

7:30-8:00am – Breakfast

8:00-9:00 – Prepare for fieldwork

9:00 – Head out for fishing!

5:00-5:30pm – Dinner

5:30-6:00 – Study time

6:00-8:00 – Fieldwork de-brief

Tuesday July 24th

7:30-8:00am – Breakfast

8:00-8:30am – Study/review

8:30-9:00am – Quiz 6

9:05-9:55am – Lecture 25. Migrations

10:10-11:00am – Lecture 26. Introduction to local species

11:15-12:05am – Lecture 27. Introduction to local research

12:05-12:30am – Free time

12:30-1:00pm – Lunch

1:00-4:00pm – Lab. Blood work, Processing samples, Post-field work methods

4:00-6:00pm – Project time

6:00-6:30pm – Dinner

6:30-8:00pm – Study, read, project

8:00-9:00pm – Rock Talk!

Wednesday July 25th

7:30-8:00am – Breakfast

8:00-8:30am – Study/review

8:30-9:00am – Quiz 7

9:05-9:55am – Lecture 28. Research methods: Migrations and local work

10:10-11:00am – Lecture 29. What can we learn from sharks?

11:15-12:05am – Lecture 30. Biomedical research

12:05-12:30am – Free time

12:30-1:00pm – Lunch
1:00-4:00pm – Lab. Biomedical/bioengineering literature research
4:00-6:00pm – Project time, read article
4:00-4:30pm – Food Run! All courses participate
4:30-6:00 – Artist in Residence
6:00-6:30pm – Dinner
6:30-7:00pm – Study
7:00-8:00pm – Lecture 31. Bioengineering

Thursday July 26th

7:30-8:00am – Breakfast
8:00-8:30am – Study/review
8:30-9:00am – Quiz 8
9:05-9:55am – Lecture 32. Conservation status
10:10-11:00am – Lecture 33. Shark fisheries
11:15-12:05am – Lecture 34. Research methods: fishing-induced mortality
12:05-12:30am – Free time
12:30-1:00pm – Lunch
1:00-4:00pm – Lab. Conservation online review/Film Viewing
4:00-6:00pm – Project time
6:00-6:30pm – Dinner
6:30-7:00pm – Study, prepare for discussion
7:00-8:00pm – Article Discussion

Friday July 27th

7:30-8:00am – Breakfast
8:00-8:30am – Study/review
8:30-9:00am – Quiz 9
9:05-9:55am – Lecture 35. Essential habitat and degradation
10:10-11:00am – Lecture 36. Research for conservation
11:15-12:05am – Lecture 37. Human-shark interactions
12:05-12:30am – Free time
12:30-1:00pm – Lunch
1:00-4:00pm – Lab. Work on projects
4:00-6:00pm – Project time
6:00-6:30pm – Dinner
6:30-7:00pm – Study, work on presentation
7:00-8:00 – Lecture 38. Research of avoidance mechanisms

Saturday July 28th

7:30-8:00am – Breakfast
8:00-10:00am – Study/review
10:10-11:00am – Lecture 39. Shark research as a career
11:15-12:05am – Lecture 40. Future of sharks and shark research
12:05-12:30am – Free time
12:30-1:00pm – Lunch
1:00-4:00pm – Cumulative exam – lecture and lab

4:00-6:00pm – Project time
6:00-6:30pm – Dinner
6:30-8:00pm – Free time to work on final presentations

Sunday July 29th

7:00-9:00 – Prepare for presentations
9:00-10:00am – Help to tidy up your dorm room and shared dorm spaces! ☺
10:00-10:30am – Brunch
10:30-12:30 – Presentations
12:30-1:00 – Free time
1:00-2:00 – Course Evaluation
2:00-5:00 – Clean up and wrap up
5:00-5:30pm – Dinner
5:30-7:00 – Art Show!
7:00-8:00 – Free time and packing

Monday July 30th

7:30-8:00am - Breakfast
8:00-8:30am – Have luggage packed and waiting on dorm porch for pick-up by 8:30
9:15-9:30 – Gather at SML dock for departure
9:45am – Depart Appledore Island for Portsmouth, NH
10:30-11:00am – Arrive back in Portsmouth