



Appledore Island, Isle of Shoals, Kittery, Maine  
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**Shoals Marine Laboratory**  
**Anatomy and Function of Marine Vertebrates (BIOSM 3210/MEFB 754)**  
**13 June - 27 June 2022**

Course Syllabus and Schedule

**Teaching staff:**

Dr. Nicholas Gidmark ([gidmark@knox.edu](mailto:gidmark@knox.edu))

Emily McParland ([edmcparland@knox.edu](mailto:edmcparland@knox.edu))

**Prerequisites:** One semester of college level biology or equivalent

**Class enrollment limit:** 16

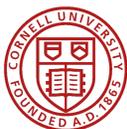
**Credit hours:** 3

**Course Objectives/Goals:**

Welcome to Anatomy and Function of Marine Vertebrates (AFMV), a course on the structure, function, and evolution of vertebrates that live in, on, or near marine habitats. Our study of anatomy will be integrated with analyses of function, ecology, and evolution. Marine vertebrates include hagfishes, lampreys, cartilaginous fishes, ray-finned fishes, coelacanth, sea turtles, crocodilians, marine lizards and snakes, many groups of birds, and marine mammals. Of the 60,000+ living species of vertebrates, roughly 30% are marine or marine-associated. In this course, we will review the diversity of these animals and learn to think in terms of how they function in ocean environments.

Fieldwork includes an offshore trip to collect hagfish, local fishing, tide pooling, a whale watch, trawling, and a tour of a seabird colony. Laboratory exercises will include dissections of marine vertebrates, including hagfishes, sharks, ray-finned fishes, marine birds, and sea turtles. We will also conduct necropsies of marine mammals. Through comparisons of internal and external anatomy, we will explore how these animals are adapted for life in aquatic environments and how they meet basic functions for living in this environment, such as eating, breathing, swimming, and flying. Students will also complete an independent project on a topic of their choosing. Projects generally focus on studies of anatomy, physiology, and biomechanics. Examples of past research projects include examining fin placement in fishes with different swimming modes, comparing tooth shape among species with different diets, and quantifying scaling of ventilation rate with body size in fishes.

**Course Materials:** No textbook is required for this course, although textbooks and other resources on anatomy and function will be available in the Shoals Marine Laboratory library. Here is one book that will be available and is most relevant to the course material:



Cornell University



University of  
New Hampshire

Liem, KF, WE Bemis, WF Walker, L Grande. 2001. **Functional Anatomy of the Vertebrates: An Evolutionary Perspective, 3<sup>rd</sup> Edition**. Thomson/Brooks Cole, Belmont, CA.

### **Assignments & Grading:**

Lecture exam	25
Lab Practical	25
Individual Project Approach	10
Individual Project Execution	10
Individual Project Presentation	10
Individual Project Written Paper	10
In Class/On Site Evaluations	10
TOTAL	100

### *Exam*

We will have one exam based on lecture material. the lecture exam will include essay, short answer and multiple-choice questions.

### *Laboratory Practical*

The lab practical will be an assessment of mastery of laboratory material, including internal and external anatomy of fishes and biodiversity of Gulf of Maine marine vertebrates. The practical will be given in the laboratory and will consist of 25 stations with 50 questions total.

### *Individual Projects*

Each student will complete an independent project pertaining to some aspect of marine vertebrate anatomy and function. More details will be explained in class.

### *In Class/On Site Evaluations*

You are expected to participate fully in lecture, project discussions, and laboratory exercises. This component of the grade is based on our subjective evaluation of your involvement in the course.

### **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 SML Appledore Handbook ([http://www.sml.cornell.edu/sml\\_forms.html](http://www.sml.cornell.edu/sml_forms.html))

1. *Personal Technology*. Do not use cell phones, smart phones, iPads, mp3 players, headphones, or similar devices in the classroom or during course activities. If you take notes with your computer, disable wireless access during lecture
2. The lab has a modest computer facility in 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 Policy for Academic Honesty/Plagiarism and Discrimination

- i. Cornell: <http://cuinfo.cornell.edu/aic.cfm>
  - ii. UNH: <http://www.unh.edu/vpsas/handbook/welcome-university-new-hampshire>
5. *Disabilities & ADA Accommodation*: Students with a disability must contact Cornell's (420 CCC building; 607-254-4545) or UNH's Student Disability Services (<http://www.unh.edu/disabilityservices>) four weeks prior to start of class for confidential discussion of needs and for registration to verify eligibility for academic accommodations. No retroactive accommodations can be made.
  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. Find staff in the office in the Hamilton House between 8am – 7pm or knock on the door of Bartell House after hours

## About the Instructors

Dr. **Nick Gidmark** is an Assistant Professor at Knox College. He is an equal opportunity zoologist, but he typically studies musculo-skeletal biomechanics, focusing on food capture and processing (i.e. teeth, jaws, and their associated muscles). His research has taken him throughout the vertebrates, from sharks to salmon to shiners to swine. His least favorite surgical subject is the turkey, though that may be his favorite culinary subject. Nick's current research program focuses on: I) the biomechanics of chewing & swallowing in monkeys; II) anatomy and muscle physiology in the jaws of sunfishes; and III) the biomechanical importance of mandibular fusion in rats. Nick has conducted NIH- and NSF-funded postdoctoral research fellowships at Brown University, Friday Harbor Marine Laboratories (University of Washington), and the University of Chicago. He finished his PhD in comparative anatomy and biomechanics at Brown University in 2012. His undergraduate degree from the University of Minnesota was in fisheries management and conservation biology. He has spent most summers in the last 15 years at Shoals teaching two courses (This course and one on shark biology) and taught Biology of Fishes at Friday Harbor Marine Laboratories (University of Washington) while in residence there. At Knox, he teaches introductory biology, research methods, Comparative Vertebrate Anatomy, Biology of Fishes, and Animal Physiology. Collaboration with undergraduates in research is the single most rewarding highlight of Nick's career (and why he now is faculty at a small liberal arts college instead of a university), and these endeavors have led to dozens of conference presentations and several peer-reviewed publications.

**Emily McParland** just graduated with a B. S. in Biology from Knox College. She has spent time at Shoals Marine Lab studying form-function relationships of fish anatomy, specifically variation in shark and skate skin structure across species. Emily played on the Knox College women's soccer team when she was not doing research on the jaw joint. She plans to go onto graduate school to study biomechanics of literally any vertebrate. Her favorite anatomical endeavor was the articulation of a nine-foot horse skeleton. The worst smell she has ever experienced was either a mostly rotten seal or a fully rotten hog.

## Lecture, Laboratory, and Field Schedule

Note: This schedule is tentative. The timing and order of activities are likely to change, due to factors such as weather conditions and unexpected opportunities that may arise. We will also be providing plenty of breaks throughout lectures and activities, during which you'll have time to rehydrate and refuel on snacks in the Commons or take SML pictures for your Instagram feed. Appledore Island is a dynamic place, so expect to have fun, work hard, and be flexible!

### Day 1 - Mon June 13

- 05:30 -- 06:00 Introductions and Welcome!
- 06:00 -- 06:45 Dinner
- 07:30 -- 09:30 Perceptions of Anatomy (Commons)

### Day 2 - Tue June 14

- 07:30 -- 08:00 Breakfast
- 08:00 -- 08:30 Syllabus
- 08:30 -- 10:00 Lecture 01: Vertebrates and their characteristics and how to organize them all
- 10:00 -- 12:00 Hagfish Pickup Boat Trip
- 12:30 -- 01:00 Lunch
- 01:00 -- 02:30 Artist in Residence – Bony Fish
- 02:30 -- 04:00 Bony Fish Dissection
- 04:00 -- 05:30 Tide pool :)
- 06:00 -- 06:45 Dinner
- 06:45 -- 08:00 Lecture 02: Tree thinking and worksheet
- 08:00 -- 09:00 Rock Talk

### Day 3 - Wed June 15

- 07:30 -- 08:00 Breakfast
- 08:00 -- 09:30 Lecture 03: Craniate characteristics
- 09:45 -- 12:00 Shark Dissection
- 12:30 -- 01:15 Lunch
- 01:15 -- 02:15 Lecture 05: Skeleton I
- 02:20 -- 03:20 Lecture 06: Skeleton II
- 03:20 -- 04:00 Food Run
- 04:00 -- 05:30 Take a hike – think about the environment we are in!
- 06:00 -- 06:45 Dinner
- 07:00 -- 08:00 Lecture 04: Form Function
- 08:00 -- 10:00 Project Party

### Day 4 - Thu June 16

- 07:30 -- 08:00 Breakfast
- 08:00 -- 09:00 Lecture 07: Vertebrate Phylogeny I
- 09:20 -- 10:30 Lecture 08: Vertebrate Phylogeny II
- 10:30 -- 12:15 Study Time
- 12:30 -- 01:15 Lunch
- 01:15 -- 03:45 Wacked Out Bony Fish Dissection
- 04:00 -- 05:45 Lab Dissection/Review Time
- 06:00 -- 06:45 Dinner
- 07:00 -- 08:00 Methods of Literature Searching
- 08:00 -- 10:00 Study Time

### Day 5 - Fri June 17

- 07:30 -- 08:00 Breakfast
- 08:00 -- 09:30 Lecture 09: Respiration and Circulation
- 10:00 -- 02:00 Whale Watch - Packed Lunches
- 03:00 -- 04:30 Lecture 10: Diving
- 04:30 -- 05:30 Study Time
- 06:00 -- 06:45 Dinner
- 07:00 -- 09:30 Project Party

### Day 6 Sat June 18

- 07:30 -- 08:00 Breakfast

09:00 -- 10:00 Seal Survey Boat Trip  
10:30 -- 12:00 Lecture 11: Muscle Biomechanics  
12:30 -- 01:00 Lunch  
01:30 -- 03:00 Lecture 12: Feeding  
03:00 -- 05:00 Skates and rays dissection  
05:45 -- 06:30 Dinner  
07:00 -- 10:00 Study Time

#### Day 7 Sun June 19

07:00 -- 10:00 Study Time for Lecture Exam  
10:00 -- 11:00 Brunch  
10:45 -- 11:45 **LECTURE EXAM**  
12:00 -- 01:00 Project Work (come talk to Nick and Emily if you want)  
01:00 -- 04:00 Seal Necropsy  
04:00 -- 05:00 Practical Exam Mock-up  
05:00 -- 06:00 Dinner  
08:00 -- 10:00 Project Time

#### Day 8 Mon June 20

07:30 -- 08:00 Breakfast  
08:15 -- 12:15 Dolphin Necropsy  
12:30 -- 01:15 Lunch  
01:30 -- 04:00 Bird Dissection  
04:00 -- 05:45 Project Time  
06:00 -- 06:45 Dinner  
07:00 -- 09:00 Hook and Line Fishing

#### Day 9 Tue June 21

07:15 -- 08:00 Breakfast  
08:00 -- 11:00 Practical Study (lab off limits for set up after 10)  
11:00 -- 12:00 **PRACTICAL EXAM**  
12:15 -- 01:15 Lunch  
01:00 -- 05:00 Project Time **\*\*Get started collecting data!\*\***  
06:00 -- 06:45 Dinner  
07:00 -- 08:00 Lecture with Staff from White Island  
08:00 -- 10:00 Project Time

#### Day 10 Wed June 22

07:30 -- 08:00 Breakfast  
08:30 -- 10:30 White Island Trip  
10:30 -- 12:00 Project Time  
12:30 -- 01:15 Lunch  
01:00 -- 03:20 Project Time  
03:20 -- 04:00 Food Run  
04:00 -- 05:45 Project Time  
05:45 -- 06:30 Dinner  
08:30 -- 10:00 Project Time

#### Day 11 Thu June 23

07:15 -- 08:00 Breakfast  
08:15 -- 12:15 Project Time  
12:30 -- 01:15 Lunch  
01:15 -- 05:45 Project Time  
06:00 -- 06:30 Dinner  
07:00 -- 08:00 Island Tour with Dr. Jenn Seavey  
08:00 -- 10:00 Project Time -- Finish Data Collection

#### Day 12 Fri June 24

07:15 -- 08:00 Breakfast  
08:00 -- 10:00 Work on Figures  
10:00 -- 12:00 Literature Review / Storymaking  
12:00 -- 01:00 Lunch

01:00 -- 05:45 Work on Papers / Presentations  
05:45 -- 06:30 Dinner  
07:00 -- 10:00 Work on Paper / Presentations

**Day 13 Sat June 25**

07:30 -- 08:00 Breakfast  
08:00 -- 12:00 Work on Papers  
12:30 -- 01:15 Lunch  
01:15 -- 04:00 Nick and Emily available to talk about papers  
**04:30 PAPERS DUE**  
04:30 -- 06:00 Work on Presentations  
06:00 -- 06:45 Dinner  
07:15 -- 08:30 Career talk  
08:30 -- 10:00 Work on Presentations

**Day 14 Sun June 26**

10:00 -- 10:45 Brunch  
10:45 -- 03:00 Presentations  
03:00 -- 04:30 Lab / Classroom Cleanup  
04:30 -- 05:00 Class Walk / Whale Reexamination  
05:00 -- 06:00 Dinner  
06:30 -- 10:00 Revel in Your Environment

**Day 15 Mon June 27 Depart**

07:30 -- 08:00 Breakfast  
08:00 -- 09:30 Pack up and leave luggage outside dorm  
10:15 -- 11:30 Voyage to Portsmouth