MARINE, ESTUARINE AND FRESHWATER BIOLOGY MAJOR (B.S.)

https://colsa.unh.edu/biological-sciences/program/bs/marine-estuarine-and-freshwater-biology

Description

The Major in Marine, Estuarine, and Freshwater Biology is intended to give students interested in the fields of marine and freshwater biology the background and direct hands-on experience needed to pursue productive careers, including potential advanced study. This strategically cross-disciplinary major builds on a broad set of science courses in high-impact areas of study for today's world, represented by a core curriculum in math, chemistry, physics, and biology. The core background is strengthened by a series of required and elective courses in a diverse range of aquatic sciences spanning watersheds to oceans, providing opportunities for study from organismal to ecosystem scales. Designed to provide a solid foundation of knowledge in freshwater, estuarine, and marine biology, the MEFB Major allows flexibility and encourages students to focus on particular areas of interest from molecular biology to ecosystem and policy studies. Students will have the opportunity to specialize in areas of their own interest, such as aquaculture and fisheries, animal behavior, ecological restoration, or management. While MEFB students must complete rigorous course requirements, our students are encouraged to tailor their elective courses within and across departments and colleges as needed to build their own, unique cross-disciplinary path.

The University of New Hampshire is uniquely located for the study of aquatic organisms and their habitats. We are centered between the Great Bay Estuary and the Gulf of Maine, with easy access to diverse marine environments as well as the freshwater habitats of New Hampshire's Lakes Region and the White Mountain National Forest. We boast three Marine Laboratories that provide exceptional opportunities for our student's research and educational needs, including Jackson Estuarine Laboratory (JEL), the Coastal Marine Lab (CML; part of the larger Judd Gregg Marine Research Center), and the Shoals Marine Laboratory (SML), as well as strong affiliations with the Great Bay National Estuarine Research Reserve. While JEL is located on Great Bay in Durham, CML is in nearby New Castle at the Seacoast, and SML is located seven miles off the coast. SML provides summer undergraduate programing with field-based marine courses that fulfill major electives, as well as internships and research opportunities for advanced study. In addition, UNH's campus maintains two fish aquaculture facilities, a world-class genomics laboratory, and the State Veterinary Diagnostic Laboratory, which provide hands-on opportunities for undergraduates. There is also an active diving program with courses at both beginner and advanced levels. A major strength of the MEFB program is the hands-on approach to learning combined with an emphasis on involving undergraduate students in mentored research opportunities.

Off Campus Coursework and Study Abroad Opportunities

It is strongly recommended that students consider participating in a summer, semester, or year-long study abroad program. UNH's Shoals Marine Laboratory (https://www.shoalsmarinelaboratory.org/), in conjunction with Cornell University, offers a host of marine biology-related college level courses that meet many degree requirements of the MEFB major over the summer on our island campus in the Isles of Shoals. SML offers both Merit and Need-based Scholarships, multi-course discounts, as well as competitive Research Internships offering summer stipends. UNH Global is the definitive resource for Study Abroad opportunities for undergraduates (https://www.unh.edu/global/education-abroad). UNH Global can provide information on programs of study, while students' academic advisors can assist in course selection options that provide equivalencies to requirements in MEFB so progress toward degree is not compromised. In addition, Ecoquest, run by the Department of Natural Resources, offers summer and semester programs of environmentally oriented courses in New Zealand (https://ecoquest.unh.edu/). These are just some of the many opportunities available for MEFB students and we encourage you to explore more.

Pre-health Professional Program

MEFB majors who wish to pursue postgraduate degrees in the health care professions should visit the premed advising website (http://www.unh.edu/premed-advising).

Requirements

Degree Requirements

Minimum Credit Requirement: 128 credits

Minimum Residency Requirement: 32 credits must be taken at UNH

Minimum GPA: 2.0 required for conferral*

Core Curriculum Required: Discovery & Writing Program Requirements

Foreign Language Requirement: No

All Major, Option and Elective Requirements as indicated.
**Major GPA requirements as indicated.*

Major Requirements

A minimum grade of C- is required in all biological science courses that are counted toward the requirements for a degree in MEFB. Students who expect to compete successfully for post-baccalaureate programs should attain a cumulative GPA of 3.0 or higher by the end of the sophomore year and maintain it at that level.

Code	Title	Credits
MEFB Core		
BIOL 412	Introductory Biology: Evolution, Biodiversity and Ecology	4
BIOL 411	Introductory Biology: Molecular and Cellular	4
MEFB 401	Marine Estuarine and Freshwater Biology: Freshmen Seminar	1
MEFB 503	Introduction to Marine Biology	3
MEFB 725	Marine Ecology	3
ZOOL 690	Evolution	4
GEN 604	Principles of Genetics	4
CHEM 403	General Chemistry I	4
CHEM 404	General Chemistry II	4
CHEM 545 & CHEM 546	Organic Chemistry and Organic Chemistry Laboratory	5
BMCB 658A	General Biochemistry	3
MATH 424B	Calculus for Life Sciences	4
or BIOL 428	Quantitative Biosciences	
or BIOL 633	Data Analysis for Life Science	
or BIOL 706	Data Science with R for the Life Sciences	

or BIOL 711	Experimental Design & Analysis	
BIOL 528	Applied Biostatistics I	4
PHYS 401	Introduction to Physics I	4
PHYS 402	Introduction to Physics II	4
Choose one Plant Survey course:		
MEFB 625	Introduction to Marine Botany	
MEFB 747	Aquatic Plants in Restoration/Management	
Choose one Systems course:		3-4
MEFB 717	Lake Ecology	
MEFB 755	Biological Oceanography (C)	
ZOOL 708	Stream Ecology (C)	
Choose one Physiology/Function course:		4-5
ZOOL 625 & ZOOL 626W	Principles of Animal Physiology and Animal Physiology Laboratory	
MEFB 773	Physiology of Fishes	
Choose one Animal Survey course:		3-4
MEFB 628	Marine Invertebrate Evolution and Ecology	
MEFB 675	Marine Mammal Biology and Conservation	
ZOOL 542	Ornithology	
ZOOL 710	Sharks and Bony Fishes	
Capstone:		
BIOL 780	Capstone Companion Course	
MEFB Electives [1]		
Select three courses from the following:		
ANSC 701	Physiology of Reproduction	
BIOL 566	Systematic Botany	
BIOL 706	Data Science with R for the Life Sciences	
BIOL 720	Plant-Animal Interactions	
BMCB 605	Principles of Cell Biology	
BMS 503 & BMS 504	General Microbiology and General Microbiology Laboratory	
ESCI 501	Introduction to Oceanography	
GEN 713	Microbial Ecology and Evolution	
MARI 705	Introduction to Marine Policy: Understanding US Ocean, Coastal and Great Lakes Policy	
MEFB 505	Introduction to Applied Science Communication (SML)	
MEFB 506	Marine Parasitology and Disease (SML)	
MEFB 508	Marine Ecosystem Research and Management (SML)	
MEFB 510	Field Ornithology (SML)	
MEFB 530	Evolution and Marine Diversity (SML)	
MEFB 535	Marine Mammal Biology (SML)	
MEFB 590	Coastlines in Crisis	
MEFB 625	Introduction to Marine Botany	
MEFB 628	Marine Invertebrate Evolution and Ecology	
MEFB 674	Ecology and Marine Environment (SML)	
MEFB 675	Marine Mammal Biology and Conservation	
MEFB 702	Sustainable Marine Fisheries (SML)	
MEFB 714	Field Animal Behavior (SML)	
MEFB 717	Lake Ecology	
MEFB 741	Sharks: Biology and Conservation (SML)	
MEFB 747	Aquatic Plants in Restoration/Management (C)	
MEFB 751	Research in Biology at the Shoals Marine Lab (SML)	
MEFB 754	Anatomy and Function of Marine Vertebrates (SML)	
MEFB 755	Biological Oceanography (C)	
MEFB 772	Fisheries Biology: Conservation and Management	
MEFB 773	Physiology of Fishes	
NR 504	Freshwater Resources	
NR 703	Watershed Water Quality Management	
NR 712	Mammalogy	
NR 744	Biogeochemistry	
ZOOL 518	Comparative Morphology and Biology of Vertebrates	
ZOOL 542	Ornithology	
ZOOL 610	Principles of Aquaculture	
ZOOL 625 & ZOOL 626W	Principles of Animal Physiology and Animal Physiology Laboratory	
ZOOL 690	Evolution	
ZOOL 710	Sharks and Bony Fishes	
ZOOL 708	Stream Ecology (C)	
ZOOL 733W	Behavioral Ecology (C)	
ZOOL 736	Genes and Behavior (C)	
ZOOL 740	Acoustic Ecology (C)	
ZOOL 777W	Neuroethology (C)	
Research and Special Projects [2]		
Select from the following Courses:		
BIOL 795	Independent Investigations in Biology	
BMS 795	Investigations in Biomedical Science	
BIOL 799H	Honors Senior Thesis (C)	
MEFB 403	Investigative Marine Biology Laboratory (SML)	
MEFB 730	Underwater Research (SML)	
MEFB 751	Research in Biology at the Shoals Marine Lab (SML)	
MEFB 795	Independent Investigations in Marine, Estuarine, and Freshwater Biology	
TECH 797	Undergraduate Ocean Research Project (C) [3]	
MEFB 799H	Honors Senior Thesis in Marine, Estuarine, and Freshwater Biology (C)	

1 A single course cannot be used for both a core requirement and an elective (e.g., ZOOL 542 cannot be used to fulfill the animal survey requirement and as an elective).

2 Primary focus of the project must be Marine, Estuarine and/or Freshwater. A 600, 695, 795, or 799 experience may substitute for one elective with academic advisor approval, but only if taken for at least four credits. These four credits may be spread over multiple semesters if they are consecutive and with the same faculty mentor.

3 This class requires enrollment in both fall and spring sections, 2 credits/semester for a total of 4 credits.

Capstone Experience

As part of the University of New Hampshire's Discovery Program requirements, all students must complete a capstone experience during their senior year (after earning at least 90 credits). The capstone experience for students majoring in MEFB consists of BOTH (1) an approved individual experience AND (2) the successful completion of the BIOL 780 Capstone Companion Course. Students will not be approved for graduation until capstone certification has been granted.

1) The individual experience

The individual experience may be satisfied through various forms of experiential learning (e.g., Honors thesis, mentored research project, internship) or a course denoted with a "(C)" in the courses listed above. The individual experience must fulfill at least one of the University's capstone criteria:

- synthesizes and applies disciplinary knowledge and skills
- fosters reflection on undergraduate learning and experience
- demonstrates emerging professional competencies
- applies, analyzes, and/or interprets research, data, or artistic expression
- explores areas of interest based on the integration of the prior learning

Before beginning *any* capstone individual experience, students must submit a completed capstone approval form to their Program Coordinator.

Students can obtain this form on the Department's Capstone page or from their Program Coordinator. Here they will describe their proposed individual experience and how it fulfills at least one of the University's capstone criteria listed above. If the student is selecting a "C" course for their individual experience, they should obtain the course syllabus from the instructor for information about the course's content and learning objectives.

2) Enrollment in BIOL 780 Capstone Companion Course

Students will also be required to enroll in BIOL 780 (1 cr.) during the semester of their individual experience. BIOL 780 is offered every Fall and Spring semester.

- If the individual experience is a two-semester thesis, BIOL 780 should be taken during the second semester.
- If the individual experience occurs during the summer (e.g., internship), BIOL 780 should be taken during the Fall semester that immediately follows.
- Note: Because BIOL 780 is not offered during the summer, students cannot complete their individual experience during the summer *and graduate during that same September*. Summer experiences could only be used as individual capstone experiences if completed the summer before the student's senior year.

Degree Plan

Sample Degree Plan

This sample degree plan serves as a general guide; students collaborate with their academic advisor to develop a personalized degree plan to meet their academic goals and program requirements.

First Year		
Fall		**Credits**
MEFB 401	Marine Estuarine and Freshwater Biology: Freshmen Seminar	1
BIOL 412	Introductory Biology: Evolution, Biodiversity and Ecology	4
CHEM 403	General Chemistry I	4
ENGL 401	First-Year Writing	4
Discovery Course		4
	Credits	**17**
Spring		
BIOL 411	Introductory Biology: Molecular and Cellular	4
CHEM 404	General Chemistry II	4
BIOL 528	Applied Biostatistics I	4
Discovery Course		4
	Credits	**16**
Second Year		
Fall		
MEFB 503	Introduction to Marine Biology	3
CHEM 545 & CHEM 546	Organic Chemistry and Organic Chemistry Laboratory	5
BIOL 541W	Ecology	4
Discovery Course		4
	Credits	**16**
Spring		
BIOL 633	Data Analysis for Life Science	4
BMCB 658	General Biochemistry	3
GEN 604	Principles of Genetics	4
Discovery Course		4
	Credits	**15**
Third Year		
Fall		
MEFB 625	Introduction to Marine Botany	5
MEFB 747	Aquatic Plants in Restoration/Management	4
MEFB 717	Lake Ecology	4
PHYS 401	Introduction to Physics I	4
Discovery Course		4
	Credits	**21**
Spring		
GEN 604	Principles of Genetics	4
ZOOL 625 & ZOOL 626	Principles of Animal Physiology and	5
PHYS 402	Introduction to Physics II	4
Animal Survey Course		4
	Credits	**17**
Fourth Year		
Fall		
MEFB 755	Biological Oceanography	3
Major Elective		4
Major Elective		4
Capstone		4
	Credits	**15**
Spring		
Major Elective		4
Discovery Course		4
Elective		4
Elective		4
	Credits	**16**
	Total Credits	**133**

Student Learning Outcomes

Program Learning Outcomes
Students will be able to:

- Show the ability to synthesize diverse sources of information and communicate it effectively.
- Demonstrate a broad understanding of the unique characteristics, as well as the similarities, governing freshwater, estuarine and marine systems.
- Have a broad understanding of biology from the molecular to the ecosystem with a particular appreciation for the abiotic and biotic factors relating to diverse aquatic ecosystems.
- Demonstrate the ability to describe basic principles of scientific inquiry and the importance of scientific study for understanding the natural world.
- Demonstrate the ability to design and experiment, collect data, analyze and graph it appropriately, and summarize the significant findings.
- Demonstrate an ability to critically and objectively evaluate data, develop hypotheses, plus interpret biological experiments and studies.
- Demonstrate an ability to communicate clearly and explicitly, both orally and in writing, following conventional scientific formats.

- Demonstrate a broad understanding of major groups of prokaryotic and eukaryotic aquatic life.