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: 2.0 required for conferral*

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.

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
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<tbody>
<tr>
<td>BIOL 412</td>
<td>Introductory Biology: Evolution, Biodiversity and Ecology</td>
<td>4</td>
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<tr>
<td>BIOL 411</td>
<td>Introductory Biology Molecular and Cellular</td>
<td>4</td>
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<tr>
<td>BIOL 541W</td>
<td>Ecology</td>
<td>0 or 4</td>
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<tr>
<td>&amp; BMS 504</td>
<td>General Microbiology</td>
<td>5</td>
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<tr>
<td>&amp; BMS 504</td>
<td>and General Microbiology Laboratory</td>
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<tr>
<td>GEN 604</td>
<td>Principles of Genetics</td>
<td>4</td>
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<tr>
<td>CHEM 403</td>
<td>General Chemistry I</td>
<td>4</td>
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<tr>
<td>CHEM 404</td>
<td>General Chemistry II</td>
<td>4</td>
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<tr>
<td>CHEM 545</td>
<td>Organic Chemistry</td>
<td>5</td>
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<tr>
<td>&amp; CHEM 546</td>
<td>and Organic Chemistry Laboratory</td>
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<tr>
<td>BMCB 680A</td>
<td>General Biochemistry</td>
<td>3</td>
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<tr>
<td>MATH 424B</td>
<td>Calculus for Life Sciences</td>
<td>4</td>
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<tr>
<td>or BIOL 633</td>
<td>Data Analysis for Life Science</td>
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<td>or BIOL 711</td>
<td>Experimental Design &amp; Analysis</td>
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<tr>
<td>BIOL 528</td>
<td>Applied Biostatistics I</td>
<td>4</td>
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</table>
MEFB 401  Introduction to Marine Biology  4
MEFB 402  Introduction to Marine Biology  4

MEFB Required Courses

MEFB 401  Marine Estuarine and Freshwater Biology Freshmen Seminar  1
MEFB 503  Introduction to Marine Biology  4

Choose one Plant Survey course:  4.5
MEFB 625  Introduction to Marine Botany  5
or MEFB 747  Aquatic Plants in Restoration/Management

Choose one Freshwater course:  4
MEFB 717  Lake Ecology  4
ZDOL 708  Stream Ecology  4

Choose one Physiology/Function course:  4.5
ZDOL 625 & ZDOL 626W  Principles of Animal Physiology
& Animal Physiology Laboratory
or MEFB 733  Physiology of Fishes

Choose one Marine or Estuarine course:  4
MEFB 735  Marine Ecology  4
or MEFB 755  Biological Oceanography

Choose one Animal survey course:  4
ZDOL 542  Ornithology  4
or MEFB 628  Marine Invertebrate Evolution and Ecology
or ZDOL 710  Sharks and Bony Fishes

Capstone:

BIOL 780  Capstone Companion Course  1

MEFB Electives: Choose 3

Evolution, Systematics and Biodiversity

BIOL 566  Systematic Botany  4
BIOL 706  Data Science with R for the Life Sciences  4
GEN 713  Microbial Ecology and Evolution  4
MEFB 500  Coastal Habitat Field Research Methods (SML)  4
MEFB 510  Field Ornithology (SML)  4
MEFB 530  Evolution and Marine Diversity (SML)  4
MEFB 535  Marine Mammal Biology (SML)  4
MEFB 625  Introduction to Marine Botany  5
or MEFB 747  Aquatic Plants in Restoration/Management
MEFB 628  Marine Invertebrate Evolution and Ecology  5
MEFB 4360  Biodiversity and Biology of Marine Invertebrates (SML)  4
MEFB 741  Sharks: Biology and Conservation (SML)  4
MEFB 754  Anatomy and Function of Marine Vertebrates (SML)  4
MEFB 747  Aquatic Plants in Restoration/Management (C)  4
NR 504  Freshwater Resources  4
NR 712  Mammalogy  4
ZDOL 518  Comparative Morphology and Biology of Vertebrates  4
ZDOL 542  Ornithology  4
ZDOL 690  Evolution  4
ZDOL 710  Sharks and Bony Fishes  4

Fisheries and Aquaculture

MEFB 702  Sustainable Marine Fisheries (SML)  4
MEFB 755  Biological Oceanography (C)  3
MEFB 772  Fisheries Biology Conservation and Management  4
MEFB 773  Physiology of Fishes  4
ZDOL 610  Principles of Aquaculture  4
ZDOL 710  Sharks and Bony Fishes  0 or 4

Marine, Estuarine and Freshwater Ecology

BIOL 720  Plant Animal Interactions  4
ESCI 501  Introduction to Oceanography  4
GEN 712  Microbial Ecology and Evolution  4
MEFB 500  Coastal Habitat Field Research Methods (SML)  4
MEFB 508  Marine Ecosystem Research and Management (SML)  4
MEFB 625  Introduction to Marine Botany  5
MEFB 628  Marine Invertebrate Evolution and Ecology  5
MEFB 674  Ecology and Marine Environment (SML)  4
MEFB 714  Field Animal Behavior (SML)  4
MEFB 717  Lake Ecology  4
MEFB 721  Aquatic Invasive Species  4
MEFB 725  Marine Ecology  4
MEFB 741  Sharks: Biology and Conservation (SML)  4
MEFB 747  Aquatic Plants in Restoration/Management (C)  4
MEFB 751  Research in Marine Biology (SML)  4
MEFB 755  Biological Oceanography (C)  3
NR 703  Watershed Water Quality Management  4
NR 744  Biogeochemistry  4
ZDOL 708  Stream Ecology  4
ZDOL 739W  Behavioral Ecology  0 or 4

Physiology, Behavior and Cell Biology

ANSC 701  Physiology of Reproduction  4
BIOL 701  Plant Physiology  4
BMCB 605  Principles of Cell Biology  4
BMS #715  Public Health: Food- and Water borne Diseases  4
MEFB 504  Field Wildlife Forensics (SML)  2
MEFB 506  Marine Parasitology and Disease (SML)  4
MEFB 714  Field Animal Behavior (SML)  4
MEFB 773  Physiology of Fishes  4
ZDOL 625  Principles of Animal Physiology
& Animal Physiology Laboratory
ZDOL 626W  Principles of Animal Physiology

ZDOL 739W  Behavioral Ecology  0 or 4
ZDOL 736  Genes and Behavior (C)  4
ZDOL 777W  Neuropsychology  4

Restoration Management and Policy

MAR #405  Introduction to Marine Mammal Science and Policy  3
MAR 705  Introduction to Marine Policy: Understanding US Ocean, Coastal and Great Lakes Policy  3
MEFB 505  Introduction to Applied Science Communication (SML)  4
MEFB 702  Sustainable Marine Fisheries  4
MEFB 747  Aquatic Plants in Restoration/Management (C)  4
MEFB 772  Fisheries Biology Conservation and Management  4
ZDOL 610  Principles of Aquaculture  4
Research and Special Projects

BIOL 795  Independent Investigations in Biology  1-4
BMS 795  Investigations in Biomedical Science  1-8
BIOL 799H  Honors Senior Thesis  2-8
MEFB 403  Investigative Marine Biology Laboratory (SML)  2-4
MEFB 500  Coastal Habitat Field Research Methods (SML)  4
MEFB 500  Field Experience in Marine, Estuarine, and Freshwater Biology  1-4
MEFB 730  Underwater Research (SML)  4
MEFB 751  Research in Marine Biology (SML)  4
MEFB 770  Senior Seminar in Marine, Freshwater, and Estuarine Biology (C)  2
MEFB 795  Independent Investigations in Marine, Estuarine, and Freshwater Biology  1-4
TECH 797  Undergraduate Ocean Research Project (C)  2
MEFB 799H  Honors Senior Thesis in Marine, Estuarine, and Freshwater Biology  2-4

1 A single course cannot be used for both a core requirement and an elective (e.g., ZDOL 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 August. Summer experiences could only be used as individual capstone experiences if completed the summer before the student’s senior year.

Student Learning Outcomes

- 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.