MARINE, ESTUARINE AND FRESHWATER BIOLOGY (MEFB)

Equivalent(s):

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Marine Laboratory on Appledore Island, where students, and some

professors, will be in residence. "Marine Immersion" introduces students

to the breadth, excitement, and challenges of marine sciences through

lectures, demonstrations, and field experiences offered by a cohort of

UNH faculty, and through short research projects carried out on the

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MEFB 401 - Marine Estuarine and Freshwater Biology: Freshmen Seminar
Credits: 1

The purpose of this course is threefold: First to acquaint freshmen MEFB
majors to the wide range of topics that are included in the broad area
of marine, estuarine and freshwater biology. Second, to introduce new
UNH students to many of the MEFB faculty at UNH and give them the
opportunity to become aware of the types of research that is being
conducted at UNH. Finally, to begin teaching freshmen how to read the
primary literature, write concise summaries of papers they read, give oral
presentations to their peers, and understand how scientific knowledge is
acquired and disseminated. Students attend a series of seminars
presented by a wide range of MEFB faculty. The topics presented vary
from year to year depending on the faculty that agree to participate. In
addition students are required to read the current literature, write short
papers and give presentations to the class. Cr/F.

MEFB 403 - Investigative Marine Biology Laboratory
Credits: 2-4

This course in an intensive marine-based introduction to the scientific
method and experimental biology taught a Shoals Marine Laboratory. The
course takes advantage of the unique learning opportunities afforded
by the pristine marine environment (especially the intertidal) around
Appledore Island. The overall course philosophy is to allow students to
learn the scientific method by doing it themselves under the guidance
of veteran marine biologists. The course is structured around two
class projects that are designed to expose students to concepts and
techniques in marine ecophysiology and biomechanics. Permission
required. Special fee. (Summers only at Shoals Marine Lab.)

MEFB 410 - Marine Immersion
Credits: 2

An intensive 2-credit course for incoming freshmen, surveying a range
of marine-related fields (with an emphasis on biology and ecology),
research approaches, and organisms. The course is based at the Shoals
Marine Laboratory on Appledore Island, where students, and some
faculty, will be in residence. "Marine Immersion" introduces students
to the breadth, excitement, and challenges of marine sciences through
lectures, demonstrations, and field experiences offered by a cohort of
UNH faculty, and through short research projects carried out on the
island. It also introduces them to resources and opportunities available
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and lets them begin building a network among their peers even before
they arrive in Durham. Special fee. (Summers only at Shoals Marine Lab.)

Equivalent(s): ZOOL 410

MEFB 500 - Coastal Habitat Field Research Methods
Credits: 4

This two-week intensive field based course is intended for students who
wish to explore and gain proficiency in various research and assessment
methods of terrestrial and aquatic plant communities of the Isles of
Shoals and nearby coastal habitats of the Seacoast and Great Bay
Estuary. Topics covered will include quantitative surveys methods,
GIS based an aerial (UAV) mapping of plant communities, taxonomy
and systematics of major vascular taxa, island biogeography, rare
species ecology and conservation, and the management of invasive
species. Through both field and classroom exercises, we will use a variety
of sampling protocols to document the existing plant communities,
contribute to ongoing plant community studies, investigate the floristic
changes that the Isles of Shoals have experienced from past to present,
and use these data to predict trends into the future to help preserve
their unique flora. Student will use skills developed in class to design
and implement brief field research project in a related topic of their
choice. Prereq: BIOL 411 or BIOL 412. Permission required. Special fee.
(Summers only at Shoals Marine Lab.)

MEFB 503 - Introduction to Marine Biology
Credits: 0 or 4

Emphasizes the organization of marine biological communities. Various
marine environments pelagic, benthic, temperate, tropical, and their
characteristic communities. Major emphasis on the approaches (e.g.,
analysis of energy flow and predator-prey interactions) used to analyze
marine communities as well as the sampling techniques employed for
each approach and the characteristic habitat type. Prereq: BIOL 411 and
BIOL 412. Special fee.

Equivalent(s): BOT 503, PBIO 503, ZOOL 503

MEFB 504 - Field Wildlife Forensics
Credits: 2

Introduction to forensic science and the utilization of marine biology
within the justice system. Comprehensive instruction concerning
the recognition, documentation, collection, and preservation of
physical evidence. Students develop practical incident response, scene
management, and forensic teamwork skills. Prereq: BIOL 411 or BIOL 412.
Special fee. Permission required. (Summers only at Shoals Marine Lab.)

MEFB 505 - Introduction to Applied Science Communication
Credits: 4

In this course students develop the capacity to solve increasingly
challenging problems with greater independence. Students fill their
science communication "tool box," learning how to engage a nonscientist
audience. They will be introduced to video production, podcasts,
Wikipedia editing, public science events, social media platforms,
blogging and press release writing. After gaining basic skills with these
communication platforms and tools, students will apply their skills to a
topic of their own research interest on the island. Students will actively
participate in a local public science event (Rock talks) and learn how to
start a science cafe on their own. Students will receive feedback from
their peers and their instructors, and by the end of this course they will
become more effective science communicators. Skills gained in this
course in this unique environment can be applied to any research field
and are essential for every scientist. Prereq: BIOL 411, BIOL 412. Special
Fee. (Summers only at Shoals Marine Lab.)
MEFB 506 - Marine Parasitology and Disease
Credits: 4
This course will focus on one of the most diverse and fascinating groups of marine organisms: parasites. The course will explore marine parasites and pathogens at multiple levels, including: (1) the evolutionary perspective with an emphasis on coevolutionary relationships; (2) parasitic diseases and life cycles (from simple to complex); (3) taxonomic and phylogenetic understanding of parasite and host groups (with a focus on metazoan parasites and hosts); (4) ecological implications of parasitism in marine systems at the population, community, and ecosystem levels; and (5) the effects of human induced global change on parasitism in marine communities. Prereq: Biol 411, BIOL 412. Special Fee. (Summers only at Shoals Marine Lab.)

MEFB 507 - Examining Marine Climate Changes on Appledore Island, ME
Credits: 2
Marine climatic changes will severely impact ocean-based ecosystems, coastlines, and human communities. Hands-on inquiry research in this course at the Shoals Marine Laboratory located on Appledore Island, ME will involve students in examining alterations to the marine environment due to global climatic changes. Students will use the Columbia University-National Aeronautics and Space Administration (NASA) Goddard Institute for Space Studies (GISS) Educational Global Climate Model (EdGCM) and smartphone applications to envision future shorelines. Guest lectures and fieldwork will be led by marine and climate scientists from University of New Hampshire and the Woods Hole Oceanographic Institution and involve examination of changes to the littoral zone, Gulf of Maine, and the world's oceans more broadly. Topics covered in this one-week field course include: Examining the evidence that the Earth's climate is changing, the greenhouse effect and natural forcings on global climate, climate change and sea-level rise, sea-levels and coasts of the geologic past, alterations to ocean chemistry and temperature, marine ecological impacts, human coastal impacts, and possible policy solutions. This course is targeted toward early and mid-career students with backgrounds in Earth and environmental science, marine science, or environmental policy. Prereq: BIOL 411, BIOL 412. Special Fee. (Summers only at Marine Shoals Lab.)

MEFB 508 - Integrated Ecosystem Research and Management
Credits: 4
The Gulf of Maine is experiencing rapid ecological change as a result of multiple stressors. Students will explore current issues and engage in solutions integrating science into conservation & management goals. They will use integrated ecosystem research tools through field and laboratory exercises and then apply them in the Isles of Shoals and the Gulf of Maine. Each student will conduct independent research on a topic of choice to make recommendations to an outside panel of experts. Prereq: BIOL 412, BIOL 541. Special Fee. (Summers only at Shoals Marine Lab.)

MEFB 510 - Field Ornithology
Credits: 4
Introduces field ornithology focusing on the biology, ecology, and behavior of avifauna on the Isles of Shoals. Includes such ornithological field methods as censuring techniques, territory mapping, banding, behavioral observation, and creating a field notebook. Fieldwork is designed to supplement many classroom concepts, including territoriality, breeding biology, and survivorship. Prereq: one year of college-level biology. Lab. Special fee. Permission required. (Summers only at Shoals Marine Lab.)
Equivalent(s): ZOOL 510

MEFB 530 - Evolution and Marine Diversity
Credits: 4
Patterns of diversity and processes of evolution. Topics include the diversity of life, the fossil record, macro-evolutionary patterns, the genetics and developmental basis of evolutionary change, processes at the population level, evolution by natural selection, modes of speciation, long-term trends in evolution, and human evolution. Prereq: BIOL 411 or BIOL 412. Special fee. Permission required. (Summers only at Shoals Marine Lab.)

MEFB 535 - Marine Mammal Biology
Credits: 4
This course explores the biology and conservation of the whales and seals, with a particular focus on species of the Gulf of Maine. Lectures examine many facets of marine mammal science including: taxonomy and species diversity, morphological and physiological adaptations for life in the sea, foraging ecology and behavior, reproductive cycles, bioacoustics, anthropogenic interactions, and management of threatened species. Land and open water observations of whale and seal behavior give students hands on opportunities to study marine mammals in the field. Prereq: BIOL 411 or BIOL 412. Special fee. Permission required. (Summers only at Shoals Marine Lab.)

MEFB #540 - Introductory Field Oceanography
Credits: 2 or 4
Over 70% of the earth's surface is covered by oceans. Students in this course will gain familiarity with the basic concepts and field techniques (and equipment) used by biological oceanographers as we explore the Gulf of Maine waters using the Isles of Shoals as our base. Minimal lecture time, maximum boat time is the theme of this field immersion course. Special fee. Prereq: BIOL 411 or BIOL 412. Permission required.

MEFB 625 - Introduction to Marine Botany
Credits: 5
Life history, classification, and ecology of micro- and macroscopic marine plants, including phytoplankton, seaweed, and salt marsh plants, and the interactions between humans and marine plant communities. Occasional Saturday morning field trips. Prereq: BIOL 412 or BIOL 409 or permission. Special fee. Lab. Offered alternating years only.
Equivalent(s): BOT 625, PBio 625

MEFB 628 - Marine Invertebrate Evolution and Ecology
Credits: 5
Stresses the rich diversity of marine invertebrates by integrating phylogenetic trends with physiological and behavioral adaptation, and with ecological and symbiotic interactions. Offers a comparative survey of invertebrates from protozoans to protochordates; deals with aspects of form and function, development, evolution, classification, ecology, and natural history. Students work with live and preserved animals. Extensive dissections and a field component are required. Prereq: BIOL 411 and BIOL 412. Special Fee.

MEFB 630 - Biodiversity and Biology of Marine Invertebrates
Credits: 4
An introduction to the biology and evolution of the major invertebrate phyla, concentrating on marine representatives. Emphasis placed on the evolution of form and function, and the ecology, behavior, physiology, chemical ecology, and natural history of invertebrates. Appledore Island's unique location provides an excellent venue for the study of freshly collected and in situ representatives of most of the major phyla. Special fee. (Summers only at Shoals Marine Lab.) Prereq: one year college level biology. Permission required. Special Fee. (Summers only at Shoals Marine Lab.)
Equivalent(s): ZOOL 628, ZOOL 630

Equivalent(s):
MEFB 631 - Ecotoxicology and Quantitative Reasoning  
Credits: 4  
An introduction to the field of ecotoxicology through hands-on laboratory research on the impact of biotoxins on wildlife, humans and ecosystems. Focus of the course is on development of the students ability to design and carry out actual research projects using modern technique in this field. Concepts and application of quantitative thinking and biostatistics are integrated throughout the course. Results are communicated through oral and written reports, publications and posters.  Pre- or Co-reqs: BIOL 411, BIOL 412, CHEM 403, CHEM 404.

MEFB 674 - Ecology and Marine Environment  
Credits: 4  
Introduces the marine sciences with an emphasis on field work in natural habitats. Examines aspects of the systematics, morphology, physiology, behavior, and ecology of marine organisms, including intertidal plants and invertebrates, fishes, marine mammals and birds; fisheries biology; oceanography, marine geology; and human impacts on the marine environment. Sessions include lectures, discussions, field work, experience aboard a coastal research vessel, and excursions to distinctive habitats. Offered in cooperation with Cornell University. Students may not take Field Marine Science after taking Field Marine Biology and Ecology. Prereq: one full year of college-level biology/or permission. (Summers only at Shoals Marine Lab.) Permission required. Special Fee. (Summers only at Shoals Marine Lab.)  
Equivalent(s): ZOOL 674, ZOOL 675

MEFB 702 - Sustainable Marine Fisheries  
Credits: 4  
An intensive course for undergraduate students that introduces students to the complex challenges facing today's fishing industry, which is being asked to simultaneously sustain the livelihood of fishermen while meeting long-term conservation goals. The course is held both at the UNH Campus and at the Shoals Marine Laboratory. New England fisheries are used as a case-study for this course through global fishing management, trends, and issues are also discussed. Special fee. Permission required. (Summers only at Shoals Marine Lab.)

MEFB 714 - Field Animal Behavior  
Credits: 4  
An animal's behavioral patterns represent its abilities to deal with the environment dynamically. Course focuses on ecological and evolutionary significance of behavioral patterns found in all organisms, particularly those animals that inhabit coastal marine environments. Strong emphasis on methods of behavioral research and interpretation of behavioral patterns using field observations of diverse fauna of Appledore Island and surrounding waters. Prereq: one year college biology or permission. Special fee. Permission required. (Summers only at Shoals Marine Lab.)  
Equivalent(s): ZOOL 714

MEFB 717 - Lake Ecology  
Credits: 4  
Introduces the ecology of freshwater systems with emphasis on lakes. Origins of lakes and the effects of watersheds on lake chemistry and nutrient cycling are explored. Other topics include the impact of human disturbances on productivity and aquatic food webs and methods used for the management and restoration of lakes. Comparisons are made of the structure and functions of lake ecosystems found in temperate, tropical and arctic regions. Prereq: general biology.  
Equivalent(s): BOT 717, PBIO 717, ZOOL 717

MEFB 719 - Field Studies in Lake Ecology  
Credits: 4  
Ecology of lakes and other freshwater habitats examined through field studies. Emphasizes modern methods for studying lakes; analysis and interpretation of data; and writing of scientific papers. Seminars on research papers and student presentations of class studies. Field trips to a variety of lakes, from the coastal plain to White Mountains; investigate problems, such as eutrophication, acidification, biodiversity and biotoxins. Capstone experiences include interaction with state agencies, lake stakeholders and the submission of written manuscripts for publication. Prereq: introductory biology. Special fee. Writing intensive.  
Attributes: Writing Intensive Course  
Equivalent(s): BOT 719, PBIO 719, ZOOL 719

MEFB 721 - Aquatic Invasive Species  
Credits: 4  
Capstone course for a limited number of biological science majors to work closely with and help teach a Discovery course for non-majors in biology. Involves lectures, discussions, and laboratory and field exercises and write-ups focusing on managing aquatic invasive species based on an understanding of their ecology. Special Fee.

MEFB 725 - Marine Ecology  
Credits: 4  
Marine environment and its biota, emphasizing intertidal and estuarine habitats. Includes field, laboratory exercises, and independent research project. Prereq: general ecology; permission. Marine invertebrate zoology, oceanography, and statistics are desirable. Special fee. (Offered alternate years.)  
Equivalent(s): PBIO 725, ZOOL 725

MEFB 730 - Underwater Research  
Credits: 4  
Hypothesis testing and experimental design, theoretical and practical aspects of sampling, and critiques of current research papers. Includes special problems of conducting research underwater (diving physics and physiology, theory and use of diving tables, hyperbaric medicine) and underwater techniques (underwater photography and video, photo quadrates, tagging and marking, cages and enclosures). Students must supply their own equipment. Students with special research interests are encouraged to enroll in an additional third week of independent underwater research. Prereq: recognized scuba certification, a medical examination, one year of biology or other supporting science. Special fee. Permission required. (Summers only at Shoals Marine Lab.)  
Equivalent(s): KIN 730, ZOOL 730

MEFB 732 - Lake Management  
Credits: 4  
Lectures and seminars on interpreting lake water quality, developing a natural history inventory for lakes, the process of creating a lake management plan, and resolution of conflicting uses of lakes. Students develop lake management plans in cooperation with governmental agencies and lake associations. Guest speakers from state agencies and non-governmental organizations. Introduces use of GIS (Geographic Information Systems) methods for the analysis of lakes and watersheds. Presents lake management issues from scientific and social science points of view. Open to students from all disciplines. (Also offered as ZOOL 732,) Special fee. Lab.  
Equivalent(s): BOT 732, PBIO 732, ZOOL 732
MEFB 741 - Sharks: Biology and Conservation  
Credits: 4  
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. Prereq: BIOL 411, BIOL 412; ZOOL 518 or ZOOL 625. Special Fee. (Summers only at Shoals Marine Lab.)

MEFB 747 - Aquatic Plants in Restoration/Management  
Credits: 4  
A field-intensive class focusing upon freshwater and marine vascular plants with an emphasis on species commonly associated with ecological restoration, the identification and conservation of rare species, and the adaptations and management of invasive species of aquatic habitats in New England. Field trips emphasize the flora of various wetland habitats, including open water and vegetated fresh water wetlands, as well as coastal and estuarine habitats. Lectures and readings examine the current trends in research and management focusing upon specific taxa and pertinent facets of their taxonomy, physiology, and natural history. Prereq: BIOL 566 or permission. Special fee. Offered alternating years only.  
Equivalent(s): BOT 747, P BIO 747

MEFB #750 - Marine Ecological Genomics  
Credits: 4  
This course combines fieldwork for sample collection with extensive training in marine genomics research approaches including next generation sequence analysis, phylogenomics, differential gene expression and population genomics. Prereq: BIOL 411 and BIOL 412. Special fee.

MEFB 751 - Research in Marine Biology  
Credits: 4  
Introduces the adaptations of organisms to marine environments and the role these adaptations have in structuring marine communities using an experimental approach. Emphasizes experimental design, implementation, data analysis, and scientific presentations. Prereq: one year of college-level biology or permission. Additional experience in biology, ecology or physiology is recommended. Prereq: BIOL 411, BIOL 412. Special fee. (Summers only at Shoals Marine Lab.)  
Equivalent(s): ZOOL 751

MEFB 754 - Anatomy and Function of Marine Vertebrates  
Credits: 4  
The course is designed to introduce students to a comparative study of the principal organ systems of vertebrates (i.e., fishes, sea turtles, marine birds, marine mammals) that are specifically adapted to the marine environment. Rather than focusing only on description of anatomical structure, the anatomy of structures are investigated with function, biological role, and evolutionary relationships. Laboratory exercises cover osteology, dissection, behavior and biomechanics. Special fee. Prereq: one year college biology or permission. Permission required. (Summers only at Shoals Marine Lab.)  
Equivalent(s): ZOOL 753, ZOOL 754

MEFB 755 - Biological Oceanography  
Credits: 4  
Biological processes of the oceans, including primary and secondary production, trophodynamics, plankton diversity, zooplankton ecology, ecosystems and global ocean dynamics. Field trips on R/V Gulf Challenger and to the Jackson Estuarine Laboratory. Prereq: one year of biology or permission of the instructor. Special Fee. Lab.  
Equivalent(s): ESCI #750, ZOOL 750

MEFB 770 - Senior Capstone in Marine, Freshwater, and Estuarine Biology  
Credits: 2  
Explore and synthesize your undergraduate zoological knowledge and skills through an integrated outlook at a topic relating to your professional future. Each semester revolves around a different overarching topic on which students read assigned topical papers, prepare critical analyses, and give presentations to the class.

MEFB 772 - Fisheries Biology: Conservation and Management  
Credits: 3  
Globally, many fished populations are declining, but 3.2 billion people eat fish and the average human eats >40 pounds of fish a year. This course identifies what biological characteristics are important to management and how they are measured. The course also explores quantitative methods describing fishery-population interactions and other management tools. Lastly, students will learn about the impacts of fishing on ecosystems. Prereq: BIOL 411 and BIOL 412 or equivalent.

MEFB 773 - Physiology of Fishes  
Credits: 4  
Investigates the physiological processes responsible for maintaining homeostasis in fishes. Focuses on the function and regulation of the major organ systems during stress and environmental adaptation. Topics include reproduction, osmoregulation, digestion, endocrinology, and sensory perception.

MEFB 795 - Independent Investigations in Marine, Estuarine, and Freshwater Biology  
Credits: 1-4  
Independent study in a topic related to Marine, Estuarine, or Freshwater Biology, arranged by the student with a faculty sponsor. Enrollment by permission only.  
Repeat Rule: May be repeated for a maximum of 8 credits. May be repeated up to 5 times.