

MAR - MARINE SCIENCE

MAR 105 Ecology and Evolution of Marine Organisms (4 Credit Hours)

This course introduces the basic principles of ecology and evolutionary biology with focus on the marine environment. Topics covered include marine ecology at the population, community and ecosystems level; evolutionary principles; and the systematics, taxonomy and general biology of marine consumers and producers. Fieldwork and laboratory investigations are an integral part of the course.

Equivalent to BIO 101, BIO 105.

Academic Level: Undergraduate

Corequisites: MAR 105L

MAR 105L Eco/Evo of Mar Organisms Lab

Equivalent to BIO 101L, BIO 105L.

Academic Level: Undergraduate

Corequisites: MAR 105

MAR 106 Cellular and Molecular Biology of Marine Organisms (4 Credit Hours)

This course introduces the concepts and unifying principles of cellular and molecular biology, with a focus on marine organisms. Topics covered include the basic chemistry of life in the marine environment; the anatomy of cells and cellular processes; cellular metabolism and bioenergetics; genetics; and molecular biology and expression of genes. Laboratory investigations are an integral part of the course.

Equivalent to BIO 100, BIO 106.

Academic Level: Undergraduate

Corequisites: MAR 106L

MAR 106L Cell/Molec Bio/Marine Orgs Lab

Academic Level: Undergraduate

Corequisites: MAR 106

MAR 150 Discovering the Ocean Environment (4 Credit Hours)

This course is designed for non-science students and can fulfill the Core Lab-Science requirement. It provides students with a fundamental overview of the four major branches of ocean science: geology, chemistry, physics, and biology, but will address these areas in terms of broad concepts in science making it accessible to students with little formal training in the sciences. The laboratory will provide hands-on exercises, including field trips to local marine ecosystems and excursions on UNE's research vessel to reinforce concepts learned in class. Much of the work will be done in groups to emphasize shared learning and model the way science is often carried out. Note: This course does not fulfill the Oceanography requirement for Marine Science majors. 4.000 Credit hours

Equivalent to BIO 150.

Academic Level: Undergraduate

Corequisites: MAR 150L

MAR 150L Discovering the Ocean Environment Lab

Equivalent to BIO 150L.

Academic Level: Undergraduate

Corequisites: MAR 150

MAR 161 Introduction to Ecological Aquaculture Special Projects (3 Credit Hours)

Lecture on current topics in ecological aquaculture will be combined with hands-on project-based work to advance the pedagogical philosophy of experiential learning in the School of Marine and Environmental Programs. Current events and literature on ecological aquaculture topics will be shared and discussed with the students. In addition, students will work with peers on a designated special project related to ecological aquaculture. Students will learn and practice the scientific method, in the context of ecological aquaculture research. They may achieve this through learning techniques for systematic literature review, relevant laboratory techniques and/or relevant field techniques for the purpose of data acquisition and subsequent analysis. Students will practice scientific communication by formulating scientific hypotheses, exploring experimental design, and/or articulating project objectives and methodologies. Students are expected to participate in relevant safety trainings as needed for their research, such as boat safety, cold water training, laboratory safety, or chemical hygiene. This course would currently be a general elective for MARM, MARO, SEA, and AAA students.

Academic Level: Undergraduate

Enrollment is limited to students with a major in Aquacult Aquar Sci, Aquaponics, Aquaculture Aquarium Science, Mar Sci Mar Bio, Mar Sci Oceanography or Sustainable Eco Aquaculture.

MAR 210 Intro to Marine Sci Research (1-5 Credit Hours)

This course is for students who wish to begin to undertake directed research as a special course. Prerequisites: 1) A carefully prepared written plan of proposed research must be presented to and approved by the instructor prior to registration; 2) Must be a marine sciences major with a minimum of a "B" average; 3) Must register in person with instructor signature required.

May be repeated for credit.

Academic Level: Undergraduate

Enrollment limited to students with the UG Research attribute.

MAR 220 Cellular & Molecular Approaches in Marine Sciences (4 Credit Hours)

Cellular and molecular mechanisms are the basis of all animals living in their respective environments. This course will provide a broad theoretical background in cellular and molecular biology, and emphasizes approaches and methods that are commonly used in modern marine sciences. All the applied techniques are easily transferable to terrestrial and human systems.

Academic Level: Undergraduate

Corequisites: MAR 220L

Enrollment limited to students in the *School of Math Physical Sci, *School of Prof. Studies, School of Arts Humanities, School of Biological Sciences, School of Comp. Sci Data, School of Education, School of Mar Env Programs, School of Molecular Phys Sci, School of Social Behav Sci or Student Support Services departments.

MAR 220L Cell/Mole Approaches in MS Lab

MAR 220L is the co-requisite lab for MAR 220 Cellular and Molecular Approaches in Marine Science. 0.000 Credit hours

Academic Level: Undergraduate

Corequisites: MAR 220

Enrollment limited to students in the *School of Math Physical Sci, *School of Prof. Studies, School of Arts Humanities, School of Biological Sciences, School of Comp. Sci Data, School of Education, School of Mar Env Programs, School of Molecular Phys Sci, School of Social Behav Sci or Student Support Services departments.

MAR 221 Principles of Aquaculture (3 Credit Hours)

This course will provide an overview of the basics of aquaculture, providing the foundation from which more detail about the application of aquaculture techniques and processes can be covered in subsequent courses. We will discuss the different methods of water filtration and disinfection as well as the diversity of production systems used to culture aquatic organisms. The principles and techniques covered can be scaled in application for large- or small-scale production facilities as well as public and private aquariums. Other topics include examples of candidates for aquaculture, the business of aquaculture, environmental and social challenges and the future of aquaculture.

Equivalent to BIO 221.

Academic Level: Undergraduate

MAR 222 Finfish/Shellfish Culture Tech (4 Credit Hours)

This course will examine the principles and practices of finfish and shellfish aquaculture from many perspectives and take a deep dive into the techniques, systems and methods that are required for a diversity of the animals commonly produced, both locally and internationally. Topics include an overview of these culture methods, hatchery management, product processing and environmental issues. The course will also explore some topics in fish physiology and endocrinology that are critical knowledge for practicing aquaculture. Finally, we will examine some alternative perspectives within the discipline of aquaculture such as conservation and open ocean aquaculture. The objective is to learn critical analysis of techniques and systems and their appropriate application to a given species in a certain environment. This course is a co-requisite for MAR 222L.

Equivalent to BIO 222L.

Academic Level: Undergraduate

Corequisites: MAR 222L

MAR 222L Finfish/Shellfish Culture Tech Lab

This lab will emphasize hands-on techniques used for a diversity of culture methods. We will work with pumps and PVC to help acquire comfort working with or familiarizing yourself with each. You will be introduced to Maine aquaculture professionals to build your network.

This course is a co-requisite for MAR 222.

Equivalent to BIO 222L.

Academic Level: Undergraduate

Corequisites: MAR 222

MAR 223 Health, Nutrition, Feeding Cultured Organisms (4 Credit Hours)

This course will emphasize the knowledge and skills to design water systems, check water quality, and to knowledgeably critique established systems. We will discuss how to identify markers of health and learn how to supply good nutrition through appropriate feeds. We will start out learning about live food production and then progress into pelleted food production. We will segue from there into health – how to identify a healthy organism, how to keep an organism healthy, how to identify some common diseases, and what can be done to intervene. We will also discuss how the health of these organisms relate to the health of the environment and to the health of the consumer of aquacultured products. This course is a co-requisite for MAR 223L.

Equivalent to BIO 223.

Academic Level: Undergraduate

Corequisites: MAR 223L

MAR 223L Health, Nutrition, Feeding Cultured Organisms Lab

The foci of this lab will be on food production, appropriate feed items and ways of providing food for a diversity of cultured organisms. The lab will also cover such topics as bacteriology, anesthesia, and an overview of disease treatment in public aquariums. This course is a co-requisite for MAR 223.

Equivalent to BIO 223L.

Academic Level: Undergraduate

Corequisites: MAR 223

MAR 235 Sustainable Harvest of Aquatic Organisms (3 Credit Hours)

This course covers environmental, social and economic sustainability issues pertaining to the culture, harvest and use of marine and freshwater resources. Focused on both fisheries and aquaculture, this course examines production, distribution and management of harvested aquatic resources with a climate change overlay.

Academic Level: Undergraduate

MAR 250 Marine Biology (4 Credit Hours)

This course examines the biology, morphology, diversity, and evolution of marine organisms. Focus is placed on the marine flora and fauna in and along the northwest Atlantic Ocean. Lecture and laboratory emphasize hands-on, place-based, experiential studies that employ field and lab methodologies to explore the interaction between organisms and with the environment.

Equivalent to BIO 250.

Academic Level: Undergraduate

Corequisites: MAR 250L

MAR 250L Marine Biology Lab

Equivalent to BIO 250L.

Academic Level: Undergraduate

Corequisites: MAR 250

MAR 252 Natural History of Marine Mammals (3 Credit Hours)

This class emphasizes study of the marine mammal species found in the Northwest Atlantic. Via illustrated lectures, readings and videos, we will investigate their ecology, behavior, unique anatomical features, and interactions with humans in order to better understand those species that inhabit the ocean near us. This course will help you identify the species you see on your next whale watching trip.

May be repeated for credit. *Equivalent to BIO 252.*

Academic Level: Undergraduate

MAR 270 Oceanography (4 Credit Hours)

This course examines oceanographic processes, with emphasis given to local, regional, and global systems. Physical and chemical processes in the ocean are investigated, along with the geology of the seafloor and coastal environments, and biological processes in open waters and the deep sea. The importance of oceans to human societies and global environmental phenomena is examined. Laboratory and field investigative studies are an integral part of the course.

Academic Level: Undergraduate

Corequisites: MAR 270L

MAR 270L Oceanography Lab

Academic Level: Undergraduate

Corequisites: MAR 270

MAR 295 Marine Science Internship (3-4 Credit Hours)

An internship is a high impact learning experience where knowledge and theory from students' program of study are integrated with shadowing, volunteering, or paid employment with a private company, not-for-profit organization or government agency toward the intentional development of transferable knowledge, skills and abilities and practical application of professional competencies. The semester prior to the internship, Academic and Career Advising Center staff assist students with preparing their application materials and searching and applying for marine-related internships within the local community, stateside or abroad, as well as in defining learning objectives, educational and career goals, and professional deliverables to be met throughout the course of training and practice. During the semester of the internship course, under the mentorship of a dedicated professional who has the education and/or background and expertise of the students' discipline of study, students immerse in a remote, hybrid or in-person professional setting. Through guidance, support and regular feedback from the mentor and internship course instructor, students strive to satisfactorily learn and practice their internship position and achieve their learning objectives. Students follow a course curriculum including: 40 contact hours at the host site per credit hour registered; participation in classes, meetings or workshops as scheduled by the course instructor; timely completion of homework assignments in support of student learning outcomes, professional readiness and career exploration; and end of semester evaluations. Internships culminate in a letter grade determined by the above criteria. Written pre-approval of the internship by the course instructor and Academic Director is required.

May be repeated for credit. *Equivalent to BIO 295.*

Academic Level: Undergraduate

Enrollment limited to students with the UG Internships attribute.

MAR 305 Aquatic Health Management (4 Credit Hours)

This course integrates applied perspectives from animal physiology to understand how environmental stressors could lead to altered metabolism and stress responses, thereby increasing disease susceptibility in aquatic organisms. Emphasis is placed on the metabolic and physiological processes that must function properly for growth, stress tolerance, and disease resistance, and on the environmental conditions (e.g., water quality parameters, stocking density, pathogen virulence) that place aquatic health at risk. Based on physiological foundation, students will examine approaches for disease treatment, management, and biosecurity to address the health and welfare of cultured fish and shellfish. Through lectures, literature analysis, and hands-on laboratories, students will develop critical thinking skills and apply physiological concepts to real-world challenges such as biodiversity protection, climate change resilience, and sustainable seafood production. MAR 305L is a corequisite for this course. This course is a co-requisite with MAR 305L.

Academic Level: Undergraduate

Corequisites: MAR 305L

MAR 305L Aquatic Health Management Lab

This laboratory is a co-requisite for MAR 305. It is designed to complement information learned in MAR 305 and will allow students to gain practical skills in Aquatic Health Management. Students will develop water quality monitoring technology, practice identifying and describing stress and disease indicators in aquacultured animals, and learn how to design an aquaculture system that will be biosecure. This class is a co-requisite with MAR 305.

Academic Level: Undergraduate

Corequisites: MAR 305

MAR 312 Plankton Ecology (4 Credit Hours)

Plankton are important in ecology as the base of aquatic food webs and as producers of more than half of the world's oxygen. This course introduces students to the importance of plankton, their identification, growth and reproduction, and how to use them as indicators of water quality, climate change, and disturbance. Students will conduct field observations and analyses from a range of environments to gain an understanding of habitats, distributions and life histories. They will also design and perform their own experiments and observations in the laboratory. This course may fulfill either the "Organismal Area" or "Process Area" requirement.

Academic Level: Undergraduate

Corequisites: MAR 312L

MAR 312L Plankton Lab

Academic Level: Undergraduate

Corequisites: MAR 312

MAR 315 Systems Thinking (World Problems) (3 Credit Hours)

This course offers an introduction to systems thinking and complex adaptive systems. Where reductionist thinking tends to produce simple solutions to simple problems, systems thinking allows for the visualization of an entire complex, interconnected and adaptive system, enabling much greater impact in addressing the wicked problems facing humanity. This course will provide students an introduction to the basic concepts of systems thinking and tools for implementation. With a focus on specific situations within the ocean-based aquaculture industry, the scope of material will be relevant to students across the marine and environmental disciplines.

Academic Level: Undergraduate

MAR 316 Science in Society (3 Credit Hours)

This course will focus on and investigate specific examples of biological and marine science that are important in recent developments in politics and society. Students will research issues, learn about the information and context behind them, and develop critical thinking skills in examining the role science plays in marine management. We will explore in-depth ongoing debates in New England regarding fisheries management and the impacts of climate change on the marine environment, and the roles that media coverage, politics and scientists play.

Academic Level: Undergraduate

MAR 320 Invertebrate Zoology (4 Credit Hours)

In this course, students will learn about many aspects of marine invertebrates including their morphology, life histories, distributions, taxonomy, and ecology. Comparisons in body plan and structure and discoveries made with modern molecular techniques will be included in discussions of phylogenetic relationships. Laboratory work will involve identification and dissection of common invertebrate species along with practice of some of the elements of the Scientific Method.

Equivalent to BIO 320.

Academic Level: Undergraduate

Corequisites: MAR 320L

MAR 320L Invertebrate Zoology Lab

Equivalent to BIO 320L.

Academic Level: Undergraduate

Corequisites: MAR 320

MAR 323 Aquarium Science and Operations (4 Credit Hours)

This course involves in-depth study of the scientific, curatorial, technical, managerial and educational components of aquarium operations.

We will examine, in depth, each component of a life support system (LSS) for many captive organisms that depend on water for their existence. Students will become familiar with the general need, care, and maintenance of animals and their environment. We will split our time and attention between the biological portion and the physical systems for the aquaria. We will also examine topics such as animal welfare, the ethics of keeping animals in captivity, and the place aquariums play in the face of the changing planet. This course is a co-requisite for MAR 323L.

Equivalent to BIO 323.

Academic Level: Undergraduate

Corequisites: MAR 323L

MAR 323L Aquarium Science and Operations Lab

We will delve more deeply into the skills required when working with life support systems (LSS). We will cover topics such as microprocessor technology, pumps, water quality probes, lighting and filtration. This course is a co-requisite for MAR 323.

May be repeated for credit. *Equivalent to BIO 323L.*

Academic Level: Undergraduate

Corequisites: MAR 323

MAR 325 Marine Science Speaker Series (1 Credit Hours)

This seminar will provide an opportunity to experience professional scientific seminars about primary research in the field of marine science. Discussions of primary source literature articles will alternate with speaker presentations. 1.000 Credit Hours

Equivalent to BIO 325.

Academic Level: Undergraduate

MAR 331 Biology of Fishes (4 Credit Hours)

Ichthyology encompasses the study of fishes, including major groups such as the jawless, cartilaginous and bony fishes. Lecture material will cover morphology, physiology, development, behavior, evolution, and ecology of this diverse group of vertebrates. Laboratory work will center on identification of field collected specimens in order to become familiar with the major fish families in both the fresh and marine waters of Maine. The course objectives are to develop a broad knowledge of the adaptations of fishes to their environment, to develop knowledge of the scientific classification of fishes, to develop species identification skills, and to develop critical thinking skills related to fish ecology. 4.000 Credit Hours

Equivalent to BIO 331.

Academic Level: Undergraduate

Corequisites: MAR 331L

MAR 331L Biology of Fishes Lab

May be repeated for credit. *Equivalent to BIO 331L.*

Academic Level: Undergraduate

Corequisites: MAR 331

MAR 335 Animal Behavior and Behavioral Ecology (4 Credit Hours)

This course emphasizes the study of the behavior of animals in their natural environment. The course reviews the underlying mechanisms of behavior (genetics, evolution, physiology), the behavior of individuals (migration, habitat selection, foraging), as well as behavioral interactions (predator-prey, social behavior, sexual selection, parental care, mating systems and altruism). The laboratory includes both field and lab investigations of these topics as well as videos demonstrating species and concepts discussed in class.

May be repeated for credit. *Equivalent to BIO 335.*

Academic Level: Undergraduate

Corequisites: MAR 335L

MAR 335L Animal Behav/Behav Ecology Lab

May be repeated for credit. *Equivalent to BIO 335L.*

Academic Level: Undergraduate

Corequisites: MAR 335

MAR 350 Marine Ecology (4 Credit Hours)

In this course, fundamental ecological concepts will be reviewed and put into a marine context. Interactions between organisms and their environment will be examined on the individual, population and community level in a variety of ecosystems. Students will learn about what makes each marine ecosystem unique, as well as the various processes that tie them together on a regional and global scale. Topics related to applied ecology such as fisheries and aquaculture and current issues such as global climate change will also be covered. Lab and field work will expand upon topics covered in lecture and emphasize hypothesis testing, analytical and scientific communication skills. Field work will focus on population and community dynamics of regional benthic and pelagic ecosystems.

May be repeated for credit. *Equivalent to BIO 350.*

Academic Level: Undergraduate

Corequisites: MAR 350L

MAR 350L Marine Ecology Lab

May be repeated for credit. *Equivalent to BIO 350L.*

Academic Level: Undergraduate

Corequisites: MAR 350

MAR 355 Biology of Marine Mammals (4 Credit Hours)

This class is an overview of the field of marine mammalogy. Aspects of marine mammal biology covered include: evolution, taxonomy, morphology, physiology, cognition, foraging and reproductive energetics, mating systems, and ecology. The laboratory includes discussing and using methods/tools in marine mammal research, studies of marine mammal skull characteristics, and demonstrations of concepts discussed in class.

May be repeated for credit. *Equivalent to BIO 355.*

Academic Level: Undergraduate

Corequisites: MAR 355L

MAR 355L Biology of Marine Mammals Lab

May be repeated for credit. *Equivalent to BIO 355L.*

Academic Level: Undergraduate

Corequisites: MAR 355

MAR 356 Marine Mammal Seminar (1 Credit Hours)

For this seminar, participants will read and discuss journal articles concerning current issues in marine mammalogy. Participants will lead the discussion on a rotating basis. The class will meet once per week for one hour. Registration for this one credit class is by permission of instructor only.

May be repeated for credit.

Academic Level: Undergraduate

MAR 361 Leadership in Ecological Aquaculture Special Projects (3 Credit Hours)

Lecture on current topics in ecological aquaculture will be combined with hands-on project-based work to advance the pedagogical philosophy of experiential learning in the School of Marine and Environmental Programs. Current events and literature on ecological aquaculture topics will be shared and discussed with the students. In addition, students will work on a designated special project related to ecological aquaculture. Students practice the scientific method, in the context of ecological aquaculture research. They may achieve this through demonstrating proficiency in techniques for systematic literature review, relevant laboratory techniques and/or relevant field techniques for the purpose of data acquisition and subsequent analysis. Students will model scientific communication to their peers through articulation of testable scientific hypotheses, experimental design, and/or development of attainable research methodologies given available resources and budget. Students are expected to demonstrate leadership by demonstrating effective communication, logistics planning, and safe practice in the lab and field. Students are expected to participate in relevant safety trainings as needed for their research, such as boat safety, cold water training, laboratory safety, or chemical hygiene. This course can be taken as a marine elective for MARM students and a general elective for MARO, SEA, and AAA students.

Academic Level: Undergraduate

Enrollment is limited to students with a major in Aquacult Aquar Sci Aquaponics, Aquaculture Aquarium Science, Mar Sci Mar Bio, Mar Sci Oceanography or Sustainable Eco Aquaculture.

MAR 366 Adv Oceanography I:Bio/Geo (3 Credit Hours)

This course includes a survey of the major organismal groups in the sea, autotrophic and heterotrophic production, bio-optical processes, the carbons and nitrogen cycles, food web structure/diversity, succession, pelagic, benthic, and intertidal communities. The second half of the course would investigate the origin and morphology of ocean basins and margins, as well as topics including, but not limited to: sources and composition of marine sediments, effects of waves and currents on sediment transport, sea level change, patterns of deep-sea sedimentation, climatic zonation of marine sediments, and resources from the ocean floor. Reading of current literature in both areas will be a major component of the course.

Academic Level: Undergraduate

MAR 368 Advanced Oceanography II: Chemical and Physical Oceanography (3 Credit Hours)

This course covers dynamic physical oceanography, the properties of seawater, basic physical laws, waves, tides, geostrophy, currents with friction, and thermohaline circulation. This information will be synthesized through discussion of descriptive physical oceanography. The second part of this course will discuss chemical thermodynamics/kinetics, acid/base chemistry, the dissolved carbon dioxide equilibria, precipitation/dissolution, re-dox equilibria, nutrient chemistry, the organic carbon cycle, and regulation of the chemical composition of natural waters. Reading of current literature in both areas will be a major component of the course.

Academic Level: Undergraduate

MAR 370 Recirculating Aquaculture Workshop (1 Credit Hours)

This course seeks to familiarize the participants with what is entailed in maintaining recirculating aquaculture systems (RAS). It will explore all aspects of a healthy system, such as water quality, bioloads, filtration, sterilization, and pumps. It will also examine the association between a well-built system and healthy fish.

Academic Level: Undergraduate

MAR 376 Bio of Sharks, Skates, Rays (3 Credit Hours)

This specialized course will provide an overview of elasmobranch biology with an emphasis on anatomy, physiology, and ecology of sharks, skates, and rays. A comparative approach will be used to illustrate the similarities and fascinating differences between these animals and other organisms within their environment. The uniqueness of this group and their adaptations will be demonstrated through selected topics that will be addressed using lecture/discussion of contemporary literature.

Academic Level: Undergraduate

MAR 380 Exp. Animal Physiology (4 Credit Hours)

This course uses marine organisms to explore the physiology of animals. Following the Krogh's principle that "for each physiological problem there will be an animal of choice on which it can be most conveniently studied" this course will highlight broadly applicable physiological principles using selected animal experiments. The course will be centered around the four main parameters affecting the animals' physiology in their environment: temperature, osmolarity, oxygen, and size, and will also cover muscle and neuro physiology. Students will be exposed to hands-on experiences, literature research, presentations, and lectures and gain an advanced level of understanding in physiological mechanisms. We will examine a range of species in the context of homeostasis and adaptation.

Academic Level: Undergraduate

Corequisites: MAR 380L

MAR 380L Exp. Animal Physiology Lab

This lab is a co-requirements of MAR 380 and will complement and expand upon topics covered in the lecture. Students will, through first-hand experience, learn general concepts of animal physiology, as well as get familiar with instrumentation and approaches used in physiology by examining marine organisms. In addition to assignments, students will also be required to read peer-reviewed journal articles and develop good scientific communication skills. The use of the scientific method will be emphasized throughout the semester.

Academic Level: Undergraduate

Corequisites: MAR 380

MAR 399 Special Projects in Aquaculture, Aquarium Science or Aquaponics (4 Credit Hours)

This course allows students the opportunity to work with a faculty member on selected research topics in Aquaculture, Aquarium Science, or Aquaponics. Students will engage in background research and then design and implement a research project. Expectations include participation in faculty-led work, group work and independent work as well as formal communication of findings at the end of the semester. May be repeated for credit.

Academic Level: Undergraduate

MAR 401 Marine & Coastal Field Techniques (4 Credit Hours)

This class is designed to provide the student with practical experience in the theory and application of present-day sampling techniques used in the management of sport fish. This course will emphasize hands-on learning and will immerse the student in the study of field techniques which are most commonly used by resource management agencies and those which students may be expected to master as future marine scientists working in coastal waters on sport fish species (e.g. Tuna and sharks). As part of this class, students will learn basic boating skills, how to deploy and repair various gear, tie knots, and handle different species of live fish.

Academic Level: Undergraduate

MAR 410 Marine Science Research (1-9 Credit Hours)

This course is for advanced students who wish to undertake directed research as a special course. Prerequisites: 1) A carefully prepared written plan of proposed research must be presented to and approved by the instructor prior to registration; 2) Must be a third or fourth year marine sciences, major with a minimum of a "B" average; 3) Must have previously completed one 200 level and one 300 level marine science course with a combined "B" average; 4) Must register in person with instructor signature required.

May be repeated for credit.

Academic Level: Undergraduate

Enrollment limited to students with the UG Research attribute.

MAR 415 Indep Study/Marine Science (1-9 Credit Hours)

In this course students pursue directed studies under the supervision of a faculty sponsor. Students may engage in study of topics which are not part of the regularly offered courses. A carefully prepared written plan of study and evaluation approved in advance by the instructor is required.

May be repeated for credit.

Academic Level: Undergraduate

MAR 418 Symbiosis (3 Credit Hours)

This course will explore in detail many of the symbioses that exist in nature. Students will learn and discuss examples of all three categories of symbioses; mutualism, parasitism, and commensalism. The variety of specific benefits and losses experienced by organisms in symbiotic relationships, such as increased food access and protection, and nutritional deprivation and increased reproductive success will be explored in behavioral, morphological, physiological, and in some cases, molecular context. Students will learn how symbioses are initiated and how they are terminated in the life of the individuals involved. The long-term evolutionary origins and modification of symbiotic relationships will be a theme revisited throughout the semester. Terrestrial examples of symbioses such as mycorrhizae and nitrogen-fixation nodules will be covered, but emphasis will be put on symbioses found in the marine environment. Students will read many peer-reviewed journal articles, present at least one article, and write a review paper.

Academic Level: Undergraduate

MAR 421 Marine Science Topics (3-4 Credit Hours)

This is an upper-level seminar and laboratory course exploring in detail an advanced topic in marine biology. Topics can include new areas of marine biology, threatened and endangered marine mammals, and marine resource biology. Three previous credits of 300 level Biology (C- or higher) is required. Topics vary by semester. Past topics include: Conservation Ecology of a Caribbean Island, and Coral Reefs.

May be repeated for credit.

Academic Level: Undergraduate

Corequisites: MAR 421L

MAR 421L Marine Science Topics Lab

May be repeated for credit.

Academic Level: Undergraduate

Corequisites: MAR 421

MAR 422 Coral Biology (3 Credit Hours)

This course is designed to give students an overall view of the biology of coral reefs. Topics to be covered will include the making of a coral reef, community structure, pharmaceuticals from the sea, customary marine tenure, artificial reefs and reef rehabilitation, the role of coral reefs in the carbon cycle, reef management, the health of the world's reefs, and discussion of the Coral Reef Initiative. We will also read and discuss current journal publications concerning bleaching events, marine protected areas, and weather and anthropogenic effects to the health of the world's coral reefs.

Equivalent to BIO 422.

Academic Level: Undergraduate

Corequisites: MAR 422L

MAR 422L Coral Biology Lab (1 Credit Hours)

This course is a field lab that runs in conjunction with BIO 422 Coral Biology and is held in its entirety at a remote field station at Basil Jones Cut at the northern tip of Ambergris Caye, Belize. The lab is designed to give students an overall view of a live, intact reef system with its surrounding ecosystems such as a mangrove forest and a sea grass bed. The Belize Reef system is part of the larger Mesoamerican Barrier Reef System, the second largest barrier reef system of which 30% is off the coast of Belize. The barrier reef actually makes its only land contact at the northern end of Ambergris Caye at a Pleistocene beach at Rocky Point. Belize has 30 marine protected areas (MPAs) covering almost 35,000 km² with three separate protected areas on Ambergris Caye. The course is intended to increase the comfort of the student in distinguishing cnidarians, and more specifically scleractinian corals, from other sedentary invertebrates found in the field and to gain experience familiarizing themselves with the appearance that the different families of corals take in nature. Additionally, having such close proximity to the largest barrier reef system in the western hemisphere provides visual comparisons of habitats, geology, biodiversity and anthropogenic influence. Topics to be covered will include the genesis of a coral reef, community structure, pharmaceuticals from the sea, customary marine tenure, artificial reefs and reef rehabilitation, the role of coral reefs in the carbon cycle, reef management, the health of the world's reefs, and discussion of the Coral Reef Initiative. We will also read and discuss current journal publications concerning bleaching events, marine protected areas, and weather and anthropogenic effects to the health of the world's coral reefs.

Equivalent to BIO 422L.

Academic Level: Undergraduate

Corequisites: MAR 422

MAR 423 Marine Mammal Policy (3 Credit Hours)

In this course marine mammals, particularly threatened and endangered species, are used as case studies to study legislation designed to protect them. We will examine the Endangered Species Act, the Marine Mammal Protection Act, Recovery Plans, and other governmental efforts to protect species in jeopardy. We will also evaluate whether or not these efforts have succeeded in improving population numbers for these species. Current controversies concerning marine mammals such as the effects of ocean warming on marine mammals will be investigated, and guest experts in the field will discuss these issues with the class. Participation in class discussions and student presentations are required in this class.

Academic Level: Undergraduate

MAR 427 Ocean Aquaculture Design and Operation (3 Credit Hours)

This course will be based on the Ecological Approach to Aquaculture articulated by the Food and Agriculture Organization (FAO) for sustainable food production in the ocean which incorporates principles of human equity and sustainable resource use. This course builds on biological, ecological and aquaculture principles students learn in their freshman and sophomore years and will dive deeper into the specifics of near-shore and open ocean farming. Topics will include site selection, shellfish culture methods, and seaweed farming. The course will make extensive use of the teaching sea farm and the associated infrastructure.

Academic Level: Undergraduate

MAR 428 Marine Conservation (3 Credit Hours)

Extinctions due to overexploitation, habitat destruction, and the introduction of non-native species are occurring at an increasing pace all over the globe. Understanding the basic principles of Conservation Biology is essential to determining what information must be gathered before the most beneficial steps toward the conservation of a species can be determined. Knowing how the marine environment differs from terrestrial systems, and how species interact with this environment is also important in order to devise solutions to the unique challenges aquatic systems impose. In addition, comprehending how the impact of humans can be reduced is an important component of conservation studies. This class will emphasize using the knowledge of species biology, ecology, behavior and genetics to solve conservation problems using case studies. Students will be required to participate in seminar discussions and to present independent analyses to the class.

Academic Level: Undergraduate

MAR 432 Fisheries Biology (4 Credit Hours)

This course is designed to acquaint students with contemporary fisheries management concepts and practices with emphasis on techniques (both lab and field) used to assess the biological characteristics of fish populations, Atlantic Northwest commercial fishing methods, and the economic aspects of the U.S. commercial fishing industry. Students will gain an understanding of the concepts and applications of ecosystem management, biological diversity, the Endangered Species Act, and habitat restoration, as they apply to fisheries management"

Academic Level: Undergraduate

Corequisites: MAR 432L

MAR 432L Fisheries Biology Lab

Academic Level: Undergraduate

Corequisites: MAR 432

MAR 435 Natural History of Iceland (4 Credit Hours)

With its location at the Arctic Circle and volcanic origin, Iceland represents a unique ecosystem for marine and terrestrial organisms, but also a unique human history and culture. This course will explore the natural history of Iceland, covering its geology, biology, history, culture, and sustainable energy production. A combination of lectures, student presentations and papers will lead to a broad understanding of the natural history, with a heavy focus on its marine biology and adaptations to life in a subarctic climate. A 10 day trip to Iceland in May will provide opportunities to learn about and experience: geothermal energy production, volcanic activity, marine mammals of the North Atlantic, Birds of Iceland, sustainable approaches in aquaculture, and more.

Academic Level: Undergraduate

MAR 436 Natural History of Iceland (3 Credit Hours)

With its location at the Arctic Circle and volcanic origin, Iceland represents a unique ecosystem for marine and terrestrial organisms, but also a unique human history and culture. This course will explore the natural history of Iceland, covering its geology, biology, history, culture, and sustainable energy production. A combination of lectures, student presentations and papers will lead to a broad understanding of the natural history, with a heavy focus on its marine biology and adaptations to life in a sub arctic climate. A 10 day trip to Iceland in May will provide opportunities to learn about and experience: geothermal energy production, volcanic activity, marine mammals of the North Atlantic, Birds of Iceland, sustainable approaches in aquaculture, and more.

Academic Level: Undergraduate

Corequisites: MAR 436L

Enrollment limited to students with the Global Ed. Travel Course Appro attribute.

MAR 436L Natural History of Iceland (1 Credit Hours)

This 11-day field experience in Iceland is the study abroad component of the lecture course MAR 436. We will explore cities, areas, volcanoes, and other sites that we covered in the lecture part of the course in great detail. We will explore Icelandic history and culture through visits to Thingvellir National Park (the site of the Althing, the world's oldest continuously running parliament), different museums, the cities of Reykjavik and Akureyri, and the old Episcopal see of Holar. We will experience the unique geology of Iceland through hiking to and into several volcanic craters, hiking and snorkeling in-between the tectonic plates of America and Eurasia, walking through several recent lava fields and other geological features. We will deepen our understanding of the sub arctic flora and fauna through guided nature walks, birding tours, and a boat excursion. We will learn about sustainable practices by visiting 2 geothermal powerplants, seeing geothermally heated green houses, and learn about sustainable fishing practices by visiting a fish processing plant in Akureyri.

Additional fees may exist.

Academic Level: Undergraduate

Corequisites: MAR 436

Enrollment limited to students with the Global Ed. Travel Course Appro attribute.

MAR 442 Aquatic Invasive Species (3 Credit Hours)

Invasive species present a significant threat to marine ecosystems worldwide. This seminar course examines marine bioinvasions with emphasis given to ecology, evolution and biogeography. Topics include the process of invasion, characteristics of invasive species, vectors of invasion, ecological impacts and the role of invasive species as mechanisms of evolutionary change. The role of climate change and globalization are also examined. Attention is given to the economic and social impacts and the management of species invasions. Student-led discussions and presentations are based on current peer-reviewed literature, reports and landmark papers.

Academic Level: Undergraduate

MAR 445 Social Ecological Aquaculture (3 Credit Hours)

This course will be based on the Ecological Approach to Aquaculture articulated by the Food and Agriculture Organization (FAO) for sustainable food production in the ocean which incorporates principles of human equity and sustainable resource use. This course examines potential impacts of ocean-based aquaculture systems on the environment and the carrying capacity of those systems to support food production.

Academic Level: Undergraduate

MAR 452 Nat Hist & Ev of Galapagos Faun (3 Credit Hours)

Natural History and Evolution of Galapagos Fauna: The semester long lecture portion of this class is designed to familiarize students with the biota of the Galapagos Islands. Although we will emphasize the natural history, ecology, behavior and evolution of the animals that inhabit the Galapagos, we will also learn about some of the endemic flora of the islands. The unique evolutionary history of the faunal assemblage will be compared to their mainland congeners. Students will be required to participate in discussions, research species and present their findings to the class. This study will prepare the class for the laboratory portion of the class, our trip to the Galapagos Islands. **NO REPEATS FOR THIS CLASS.** 3.000 Credit hours.

Academic Level: Undergraduate

Corequisites: MAR 452L

Enrollment limited to students with the Global Ed. Travel Course Appro attribute.

MAR 452L Nat His&Evo Galapagos Faun Lab (1 Credit Hours)

This is the laboratory portion of the lecture course MAR 451, Natural History and Evolution of Galapagos Fauna. This travel experience includes a trip to Quito Ecuador and introduction to the Ecuadorian culture. We will visit the Otavalo market while on the Ecuadorian mainland. Next we fly to the Galapagos Islands and board the M/C Tip Top II, our base for the excursion. We will visit the Islands of: Santa Cruz, Santiago, Rabida, Fernandina, Isabela, and North Seymour. Most of the species studied during the MAR 451 lecture class will be observed including blue footed boobies, Galapagos sea lions, flightless cormorants, Galapagos penguins, marine iguanas and giant tortoises. **NO REPEATS FOR THIS CLASS.** 1.000 Credit hour.

Additional fees may exist.

Academic Level: Undergraduate

Corequisites: MAR 452

Enrollment limited to students with the Global Ed. Travel Course Appro attribute.

MAR 459 Conservation and Ecology of the Caribbean Islands (3 Credit Hours)

This course will examine basic ecological concepts pertaining to issues relevant to insular areas and tropical regions such as the importance of scale to biodiversity and human impact. We will explore how changes in a system brought on by forest fragmentation due to logging, resource management, or resource scarcity and conflict can affect species richness. We will spend some time relating the rich natural history of a region and its impact on the draw of tourists to the interface between need and want and then relate this to population viability and resilience. We will compare communities disrupted by wildlife management to those in protected areas and discuss in terms of its effect on biodiversity and richness and assess the effectiveness of human intervention and the tolerance limits of each community. The impact of small-scale artisanal fisheries on species richness and the contrast with industrial fisheries will be discussed. Other topics will include forest ecology in the context of a tropical forest dominated by plants or invertebrates and the presence of unique representation of forest beta-diversity. The prerequisites are Bio 105 or BIO 104 or MAR 105.

Equivalent to BIO 459.

Academic Level: Undergraduate

Corequisites: MAR 459L

MAR 459L Conservation and Ecology of the Caribbean Islands Lab (1 Credit Hours)

This course is a field lab course that runs in conjunction with BIO 459 Conservation and Ecology of a Caribbean Island and is held in its entirety in Panama. This lab is designed to immerse students in the neotropical forests and coastal ecosystems of Central America and to create the opportunity to examine the biodiversity and the topography that are the results of the unique geologic origins of the isthmus of Panama. The area is considered a hotbed of diversity owing to the tectonic collision of the two huge land masses of North and South America which brought into existence the land bridge that was dubbed the Great American Interchange. This has attracted the attention of researchers from around the world and brought into existence numerous Smithsonian facilities as well as the world renowned facilities at Barro Colorado Island. This course is designed to expose students to the unique nature of Panamanian jungles through visits to museums, accessing the jungle canopy on ropes, hiking through jungles and into caves, patrolling turtle nesting beaches and swimming on gorgonian dominated reefs. We will examine the geologic process that led to its formation and how this impacted its biodiversity. We will delve into a review of the natural history and discuss how the relationship between the government and its indigenous population is one of the most advanced in the world. We will also discuss how this relationship has opened the door to a more equitable fair trade based ecotourism. Topics covered include the geologic formation of the isthmus, the indigenous population of Panama and how they provide an ecotourism experience, sea turtle and bat biology, the polymorphism of Bocas del Toro poison dart frogs, sloths, sustainable farming of cacao, community-based wildlife management, the biodiversity of Panamanian jungles, and the methods that scientists use to research the natural history of the region.

Equivalent to BIO 459L.

Academic Level: Undergraduate

Corequisites: MAR 459

MAR 460 The Scientific Basis for Global Climate Change (3 Credit Hours)

This course will be an in depth study of the physical mechanisms responsible for climate change. The emphasis will be on global change, anthropogenic forcing as well as the measured and predicted consequences of this forcing. Global climate change affects everyone on the planet. However, there are a lot of misconceptions and misinformation concerning the science behind climate change. The course work is intended to be rigorous, and the general goal of the course is to give you an understanding of the science of modern climate change. This course satisfies requirements for the Marine Science and Environmental Science majors as well as those for the Climate Change minor.

Academic Level: Undergraduate

MAR 495 Adv Marine Science Internship (3-12 Credit Hours)

An internship is a high impact learning experience where knowledge and theory from students' program of study are integrated with shadowing, volunteering, or paid employment with a private company, not-for-profit organization or government agency toward the intentional development of transferable knowledge, skills and abilities and practical application of professional competencies. The semester prior to the internship, Academic and Career Advising Center staff assist students with preparing their application materials and searching and applying for marine related internships within the local community, stateside or abroad, as well as in defining learning objectives, educational and career goals, and professional deliverables to be met throughout the course of training and practice. During the semester of the internship course, under the mentorship of a dedicated professional who has the education and/or background and expertise of the students' discipline of study, students immerse in a remote, hybrid or in-person professional setting. Through guidance, support and regular feedback from the mentor and internship course instructor, students strive to satisfactorily learn and practice their internship position and achieve their learning objectives. Students follow a course curriculum including: 40 contact hours at the host site per credit hour registered; participation in classes, meetings or workshops as scheduled by the course instructor; timely completion of homework assignments in support of student learning outcomes, professional readiness and career exploration; and end of semester evaluations. Internships culminate in a letter grade determined by the above criteria. Written pre-approval of the internship by the course instructor and Academic Director is required.

May be repeated for credit.

Academic Level: Undergraduate

Enrollment limited to students with the UG Internships attribute.

MAR 497 IS: Dev GPS/Costal Current (3 Credit Hours)

Academic Level: Undergraduate

MAR 503 Research Methods (3 Credit Hours)

This graduate course is designed to help students learn how to conduct research in a rigorous and quantitative manner by outlining the steps in experimental design. The design process emphasizes hypotheses development from observations by creating explanatory models. Formal hypotheses formulation and methods will be covered. Statistics appropriate to the different hypotheses and data will be discussed in detail. Students are expected to develop a research plan suitable for submission to a grant-funding agency to show mastery of the material. 3.000 Credit Hours

May be repeated for credit. *Equivalent to BIO 503.*

Academic Level: Undergraduate, Graduate

Enrollment is limited to Graduate level students.

MAR 505 Aquatics Health Management (4 Credit Hours)

This course integrates applied perspectives from animal physiology to understand how environmental stressors could lead to altered metabolism and stress responses, thereby increasing disease susceptibility in aquatic organisms. Emphasis is placed on the metabolic and physiological processes that must function properly for growth, stress tolerance, and disease resistance, and on the environmental conditions (e.g., water quality parameters, stocking density, pathogen virulence) that place aquatic health at risk. Based on physiological foundation, students will examine approaches for disease treatment, management, and biosecurity to address the health and welfare of cultured fish and shellfish. Through lectures, literature analysis, and hands-on laboratories, students will develop critical thinking skills and apply physiological concepts to real-world challenges such as biodiversity protection, climate change resilience, and sustainable seafood production. MAR 505L is a corequisite for this course. Graduate students are expected to engage with the material at a deeper analytical level by (1) leading selected group discussions and literature critiques, (2) mentoring undergraduate peers during the semester presentation project, and (3) submitting a short reflective synthesis paper that integrates physiological mechanisms, stress ecology, and aquaculture management perspectives from current primary literature.

Academic Level: Graduate

MAR 505L Aquatic Health Management Lab

This laboratory is a co-requisite for MAR 505. It is designed to complement information learned in MAR 505 and will allow students to gain practical skills in Aquatic Health Management. Students will develop water quality monitoring technology, practice identifying and describing stress and disease indicators in aquacultured animals, and learn how to design an aquaculture system that will be biosecure. While MAR 305L serves as an undergraduate laboratory emphasizing applied skills, graduate students enrolled in MAR 505L will engage at a supervisory and analytical level. Graduate students will contribute to lab design, implementation, and critical evaluation, helping refine experimental procedures and linking results to current research literature. They will also provide mentorship and guidance to undergraduate lab groups, supporting inquiry-based learning and ethical reflection.

Academic Level: Graduate

Corequisites: MAR 505

MAR 512 Marine Science Center Seminar (1 Credit Hours)

This seminar will provide an opportunity to experience professional scientific seminars about primary research in the field of marine science. Discussions of primary source literature articles will alternate with speaker presentations. 1.000 Credit Hours

May be repeated for credit. *Equivalent to BIO 512.*

Academic Level: Graduate, Undergraduate

Enrollment is limited to Graduate level students.

MAR 513 Plankton Ecology (4 Credit Hours)

Plankton are important as the base of food webs, as producers of more than half of the world's oxygen, and as pathogens. This course introduces students to the importance of plankton, their identification, growth and reproduction, and how to use them as indicators of water quality/ climate change/disturbance. Students will make field collections in lakes, rivers, estuaries and the ocean to gain an understanding of habitats, distributions and life histories. Topics include the planktonic larval life stages of benthic macroinvertebrates and fish. The course will provide an opportunity to explore the interactions between planktonic organisms and water chemistry and physics, and also the management implications for water quality and commercially valuable species.

Academic Level: Graduate

Corequisites: MAR 513L

Enrollment is limited to Graduate level students.

MAR 513L Plankton Lab

Plankton are important as the base of food webs, as producers of more than half of the world's oxygen, and as pathogens. This course introduces students to the importance of plankton, their identification, growth and reproduction, and how to use them as indicators of water quality/ climate change/disturbance. Students will make field collections in lakes, rivers, estuaries and the ocean to gain an understanding of habitats, distributions and life histories. Topics include the planktonic larval life stages of benthic macroinvertebrates and fish. The course will provide an opportunity to explore the interactions between planktonic organisms and water chemistry and physics, and also the management implications for water quality and commercially valuable species.

Academic Level: Graduate

Corequisites: MAR 513

Enrollment is limited to Graduate level students.

MAR 515 Ocean Food Systems Seminar (3 Credit Hours)

This seminar will meet twice weekly where assigned publications are read beforehand and discussed by students in one meeting and a high-level presentation will be given by an invited guest in the other meeting. Each presentation will be followed by an in-depth discussion of the assigned scientific/policy papers suggested by the UNE Faculty and the invited speaker congruent with their expertise. This course is required for all students enrolling in the UNE Professional Science Master's (PSM) Graduate Program in Ocean Food Systems.

Academic Level: Graduate

MAR 516 Responsible Conduct Research (1 Credit Hours)

This seminar-style course aligns with the National Institute of Health (NIH), National Science Foundation (NSF), and United States Department of Agriculture (USDA) requirements for training in the responsible conduct of research. It provides graduate students with a comprehensive overview of the ethical and regulatory framework for scientific research. Topics include: research and reporting misconduct, research security and export control towards ensuring national security, data and research integration, data management, conflicts of interest, authorship, plagiarism, mentoring, peer review, intellectual property, working with human and animal subjects, reproducibility, and the responsible use of artificial intelligence (AI) in research.

Equivalent to BIO 516.

Academic Level: Graduate

MAR 519 Scientific Literacy and Literature Review (3 Credit Hours)

Scientific Literacy and Literature Review is a graduate-level course designed to strengthen students' ability to critically engage with scientific literature in the marine, biological, and environmental sciences. In addition to learning the content of specific papers, this course emphasizes how to read, interpret, and evaluate research articles with precision and confidence. Students will learn to dissect the structure of scientific writing, assess methodologies, interpret data, and identify biases and limitations. Through guided practice, peer discussion, and reflective writing, students will develop the skills to synthesize findings across studies and articulate informed critiques. The course also supports students in navigating the transition into graduate-level scholarship. Weekly topics and assignments are designed to help students build a scientific identity, manage literature alongside lab work, and understand the role of reading in thesis development, publishing, and professional growth. By the end of the semester, students will be able to select a peer-reviewed paper and defend its quality, demonstrating mastery of both analytical reading and scholarly judgment.

Equivalent to BIO 519.

Academic Level: Graduate

MAR 530 Graduate Research Seminar (1 Credit Hours)

The seminar will be a weekly meeting involving all graduate students and faculty to discuss ongoing progress of graduate student research. Each week, a graduate student will present an update of his/her research. Faculty and other graduate students will be able to comment on the work and offer helpful guidance. For new graduate students, this will offer the opportunity to test out ideas for their thesis proposals and seek ways to improve it. For more senior graduate students, this will enable them to prepare for their thesis defense, presentations at meetings, and publications of manuscripts. Having all the faculty in attendance will bring together a diversity of ideas, and prepare students for the challenges that will meet them.

May be repeated for credit.

Academic Level: Graduate

Enrollment is limited to Graduate level students.

MAR 532 Fisheries Biology (4 Credit Hours)

This course is designed to acquaint students with contemporary fisheries management concepts and practices with emphasis on techniques (both lab and field) used to access the biological characteristics of fish populations, Atlantic Northwest commercial fishing methods, and the economic aspects of the U.S. commercial fishing industry. Students will gain an understanding of the concepts and applications of ecosystem management, biological diversity, the Endangered Species Act and habitat restoration, as they apply to fisheries management.

Academic Level: Graduate

Corequisites: MAR 532L

MAR 532L Fisheries Biology Lab

Academic Level: Graduate

Corequisites: MAR 532

MAR 533 Ocean Food Systems Research Seminar (3 Credit Hours)

The seminar will meet twice weekly meeting and involve all PSM graduate students to discuss relevant scientific/policy papers in topical areas in ocean food systems as well as deliver individual updates on the progress of their PSM Master's projects. For the first ten weeks, classes will be devoted to student-led (and faculty facilitated) discussions on the topics listed below (these may change according to student interests). For the last part of the course, each student will briefly present (10 minutes presentation) an update of his/her research (with a 10 minute discussion to follow). Faculty and other graduate student peers will be able to comment on the work and offer helpful guidance. Feedback from faculty and graduate students will enable students to prepare for their project defense, presentations at meetings, and/or publications of manuscripts. This course is required for all students enrolling in the UNE Professional Science Master's (PSM) Graduate Program in Ocean Food Systems.

Academic Level: Graduate

MAR 550 Directed Study: Grad Mar (3-9 Credit Hours)

May be repeated for credit.

Academic Level: Graduate

Enrollment is limited to Graduate level students.

MAR 551 Marine Ecology (4 Credit Hours)

In this course, fundamental ecological concepts will be reviewed and put into a marine context. Interactions between organisms and their environment will be examined on the individual, population and community level in a variety of ecosystems. Students will learn about what makes each marine ecosystem unique, as well as the various processes that tie them together on a regional and global scale. Topics related to applied ecology such as fisheries and aquaculture and current issues such as global climate change will also be covered. Lab and field work will expand upon topics covered in lecture and emphasize hypothesis testing, analytical and scientific communication skills. Field work will focus on population and community dynamics of regional benthic and pelagic ecosystems.

Academic Level: Graduate, Undergraduate

Corequisites: MAR 551L

Enrollment is limited to students with a major in Marine Sciences.

Undergraduate level students may **not** enroll.

MAR 551L Marine Ecology Lab

Academic Level: Graduate

Corequisites: MAR 551

Undergraduate level students may **not** enroll.

MAR 555 Biology of Marine Mammals (4 Credit Hours)

The purpose of this course is to familiarize students with the comparative biology of marine mammals - including their evolution, phylogeny, adaptations, skeletal systems, diving, foraging, social systems and ecology. Topics of current interest by marine mammalogists will be emphasized. This course is also designed to give students familiarity with the primary literature concerning marine mammals.

Equivalent to BIOG 555.

Academic Level: Graduate, Undergraduate

Corequisites: MAR 555L

Enrollment is limited to Graduate level students.

MAR 555L Biology of Marine Mammals Lab

Equivalent to BIOG 555L.

Academic Level: Graduate

Corequisites: MAR 555

Enrollment is limited to Graduate level students.

MAR 556 Marine Mammal Seminar (1 Credit Hours)

For this seminar, participants will read and discuss journal articles concerning current issues in marine mammalogy. Participants will lead the discussion on a rotating basis. The class will meet once per week for one hour. Registration for this one credit class is by permission of instructor only.

May be repeated for credit.

Academic Level: Graduate

MAR 566 Adv Oceanography I: Bio & Geo (3 Credit Hours)

This course includes a survey of the major organismal groups in the sea, autotrophic and heterotrophic production, bio-optical processes, the carbons and nitrogen cycles, food web structure/diversity, succession, pelagic, benthic, and intertidal communities. The second half of the course would investigate the origin and morphology of ocean basins and margins, as well as topics including, but not limited to: sources and composition of marine sediments, effects of waves and currents on sediment transport, sea level change, patterns of deep-sea sedimentation, climatic zonation of marine sediments, and resources from the ocean floor. Reading of current literature in both areas will be a major component of the course.

Equivalent to BIO 566.

Academic Level: Undergraduate, Graduate

Enrollment is limited to Graduate level students.

MAR 568 Advanced Oceanography II: Chemical and Physical Oceanography (3 Credit Hours)

This course covers dynamic physical oceanography, the properties of seawater, basic physical laws, waves, tides, geostrophy, currents with friction, and thermohaline circulation. This information will be synthesized through discussion of descriptive physical oceanography. The second part of this course will discuss chemical thermodynamics/kinetics, acid/base chemistry, the dissolved carbon dioxide equilibria, precipitation/dissolution, re-dox equilibria, nutrient chemistry, the organic carbon cycle, and regulation of the chemical composition of natural waters.

Equivalent to BIO 568.

Academic Level: Graduate

Enrollment is limited to Graduate level students.

MAR 572 Ocean Food Systems in the North Atlantic I (6 Credit Hours)

During this intensive residency course in either Cobscook Bay, Maine or Akureyri and Holar, Iceland, (locations will alternate each year) students will explore the full range of ocean food systems issues, problems, peoples, and places. The course will begin by reviewing the major fisheries, aquaculture, and seafood processing, value-chain and trade issues globally and how these affect local conditions. Course instruction will be a combination of lectures, discussions, small group activities, guest speakers, and field trips. This class is pass/fail. This course satisfies a requirement for students enrolled in the UNE Professional Science Master's (PSM) Graduate Program in Ocean Food Systems.

Academic Level: Graduate

MAR 573 Ocean Food Systems in the North Atlantic II (6 Credit Hours)

During this intensive residency course in either Cobscook Bay, Maine or Akureyri and Holar, Iceland, (locations will alternate each year) students will review the full range of ocean food systems issues, problems, peoples, and places as well as complete their final report for the program, advise and mentor incoming students, and assist OFS faculty in helping incoming students determine their projects. Course instruction will be a combination of lectures, discussions, small group activities, guest speakers, and field trips. This class is pass/fail. This course satisfies a requirement for students enrolled in the UNE Professional Science Master's (PSM) Graduate Program in Ocean Food Systems.

Academic Level: Graduate

Enrollment is limited to students with a major in Ocean Food Systems.

MAR 581 Ocean Food Systems Internship (3 Credit Hours)

An internship is a high impact, intentional learning experience where knowledge and theory from the courses within the Professional Science Masters in Ocean Food Systems (OFS) are integrated with shadowing, volunteering, or paid employment with a private company, not-for-profit organization or government agency toward practical application and the development of transferable knowledge, skills and abilities. The semester prior to the internship, students are assisted with searching and obtaining internships within the local community, stateside or abroad by the OFS Coordinator. With the aid of the OFS Coordinator and their internship supervisor, students define learning objectives, educational goals and professional deliverables to be met throughout the course of training and practice. During the semester of the internship, under the mentorship of a dedicated professional who has the expertise in Ocean Food Systems, students immerse in an in-person, remote, or remote/in-person hybrid professional setting. Through guidance, support and regular feedback from the internship supervisor, students strive to satisfactorily learn and perform their position description. Students follow a course curriculum including: 120 contact hours at the host site; participation in classes, meetings or workshops as scheduled by the internship faculty/coordinator; timely completion of homework assignments in support of student learning outcomes and career reflection, exploration and readiness; and end of semester evaluations. Internships culminate in a letter grade determined by the above criteria and calculated using the weights described in this syllabus. This course satisfies a requirement of the Professional Science Masters in Ocean Food Systems program. May be repeated for credit.

Academic Level: Graduate

MAR 590 Marine Science Research/Thesis (1-12 Credit Hours)

This course is for post-baccalaureate students who wish to undertake directed research toward their MS degree. The project topic will be negotiated to meet the interests of both the student and instructor. This class is P/F only.

May be repeated for credit. *Equivalent to BIO 590.*

Academic Level: Graduate

Enrollment is limited to Graduate level students.

MAR 592 Ocean Food Systems Research: Project Work I (3 Credit Hours)

This course is for graduate students enrolled in the PSM OFS degree program who are conducting active, transdisciplinary research and/or internships which will lead to the completion of a final project paper and oral presentations for graduation. This course is thereby designed to provide expert academic and stakeholder guidance to the PSM OFS student from the student's primary advisor, from committee members, and from the PSM OFS program coordinator to assist in the progress of the student's transdisciplinary research project efforts or internship by introducing the skills needed to meet the learning outcomes of the program. This course is required for all students enrolling in the UNE Professional Science Master's (PSM) Graduate Program in Ocean Food Systems.

Academic Level: Graduate

MAR 593 Ocean Food Systems Research: Project Work II (3 Credit Hours)

This course is for graduate students enrolled in the PSM OFS degree program who are conducting active, transdisciplinary research and/or internships which will lead to the completion of a final project paper and oral presentations for graduation. This course is thereby designed to continue to provide expert academic and stakeholder guidance to the PSM OFS student from the student's primary advisor, from committee members, and from the PSM OFS program coordinator to assist in the progress of the student's transdisciplinary research project efforts by reinforcing the skills needed to meet the learning outcomes of the program. This course satisfies a requirement for students enrolled in the UNE Professional Science Master's (PSM) Graduate Program in Ocean Food Systems.

May be repeated for credit.

Academic Level: Graduate

MAR 594 Ocean Food Systems Research: Project Work III (3 Credit Hours)

This course is for graduate students enrolled in the PSM OFS degree program who are conducting active, transdisciplinary research and/or internships which will lead to the completion of a final project paper and oral presentations for graduation. This course is thereby designed to continue to provide expert academic and stakeholder guidance to the PSM OFS student from the student's primary advisor, from committee members, and from the PSM OFS program coordinator to assist in the progress of the student's transdisciplinary research project efforts or internship by introducing the skills needed to master the learning outcomes of the program. This course is required for all students enrolling in the UNE Professional Science Master's (PSM) Graduate Program in Ocean Food Systems.

Academic Level: Graduate

MAR 595 Thesis Writing/Data Analysis (1 Credit Hours)

This course is for students enrolled in the Masters of Science program who have accomplished the following requirements: completed 4 semesters of graduate study as a full-time student; successfully passed all classes required for their program with a grade of B- or better; have completed 36 credits of graduate level courses. Thesis continuation tuition fee will apply each semester. This class is P/F only. Note: for students using campus facilities, a separate student services fee will also apply.

May be repeated for credit. *Additional fees may exist.*

Academic Level: Graduate

Enrollment is limited to Graduate level students.

Enrollment limited to students in the *Marine Sciences or School of Mar Env Programs departments.

MAR 596 OFS Project Writing (1 Credit Hours)

This course is for graduate students enrolled in the OFS degree program who have met all requirements for graduation except the successful completion of their final project. The course is designed to assist OFS students in their completion of their final project paper for graduation. The course is designed to provide guidance to project completion and to prepare students for their final oral presentation. A project continuation tuition fee will apply each semester. This course is pass/fail.

May be repeated for credit.

Academic Level: Graduate

Enrollment is limited to students with a program in Ocean Food Systems.