

# MARINE SCIENCE AND LIMNOLOGY (MSL)

College of Fisheries and Ocean Sciences (<https://www.uaf.edu/cfos/academics/>)  
907-474-7824

## MSL F102 Fact or Fishin': Case Studies in Fisheries and Marine Sciences

1 Credit  
Offered Fall

This seminar will promote active learning, critical thinking, and problem solving through a series of case studies involving current issues in fisheries and marine sciences conservation and management. Students enrolled in this course will also receive instruction on fundamental skills required to successfully complete a four-year degree at UAF.

**Crosslisted with FISH F102.**

**Lecture + Lab + Other:** 1.5 + 0 + 0

## MSL F111L MSL F111X Laboratory

0 Credit  
**Co-requisites:** MSL F111X.

**Attributes:** UAF GER Natural Science Req

**Lecture + Lab + Other:** 0 + 0 + 0

## MSL F111X The Oceans (n)

4 Credits  
Offered Fall, Spring and Summer

Broad study of our ocean through combining insights from biology, physics, chemistry and geology. Topics include evolution of the ocean basins, seawater composition, generation of ocean currents and waves, and the combined processes that sustain life in the ocean. Societal topics related to climate change, fisheries and pollution are discussed.

**Prerequisites:** Placement in WRTG F111X; placement in MATH F105.

**Co-requisites:** MSL F111L.

**Attributes:** UAF GER Natural Science Req

**Lecture + Lab + Other:** 3 + 3 + 0

## MSL F211 Introduction to Marine Science I

3 Credits  
Offered Fall

This is the first part of a two-semester sequence in Marine Science: MSL F211 and MSL F212. This course introduces students to the geology, chemistry and physics of the ocean and the roles of the hydrosphere, cryosphere and atmosphere in the climate system.

**Prerequisites:** MATH F151X (may be taken concurrently).

**Lecture + Lab + Other:** 3 + 0 + 0

## MSL F212 Introduction to Marine Science II

3 Credits  
Offered Spring

This course explores the diversity of marine life, from microbes to mammals, and the interactions of marine organisms with each other and with their environment. Topics include primary productivity, marine food webs, physiological adaptations, and ecology of marine habitats from coastal to deep-sea systems. Students will also be introduced to current topics in marine and fisheries research.

**Prerequisites:** MSL F211.

**Lecture + Lab + Other:** 3 + 0 + 0

## MSL F219 Marine Mammals of the World

2 Credits  
Offered Spring

We will go on a tour of the 129 currently recognized extant marine mammal species in the world. We will explore taxonomy, species description and identifying characteristics, distribution, ecology, including feeding strategies, reproduction etc., status, threats and conservation.

**Prerequisites:** MSL F111X, FISH F102, FISH F103, BIOL F115X or BIOL F116X.

**Lecture + Lab + Other:** 2 + 0 + 0

## MSL F220 Scientific Diving

2 Credits  
Offered Spring

Introduction to cold water diving and SCUBA techniques used in the research community. Includes familiarization with Alaska subtidal flora and fauna. Opportunity to work underwater and assist with diving projects conducted by MSL F421 students at the Kasitsna Bay Marine Lab during spring break. Completion of this course will allow students to be eligible to join the UAF (AAUS) dive program and to dive on the UAF sanctioned diving projects and have reciprocity to dive with other universities and other government agencies. Through this course, students also can be certified with a Research Diver Specialty (PADI) and a Dry Suit Specialty (PADI). CPR, First Aid (Red Cross), and Emergency Oxygen Administration (DAN) are offered through this course. Special Conditions: Must have current SCUBA physical approved.

**Prerequisites:** Basic biology/ecology courses, SCUBA (open water) certification.

**Lecture + Lab + Other:** 1 + 1 + 8

## MSL F303 Data Analysis and Writing for Aquatic Sciences

3 Credits  
Offered Fall

In this course, students will develop skills in basic data analysis, scientific writing and interpretation of published research. This course will utilize public data sets and peer-reviewed scientific writing samples drawn from the fields of fisheries, marine sciences and limnology that address an important question in aquatic science.

**Prerequisites:** STAT F200X, MSL F211, MSL F212.

**Lecture + Lab + Other:** 3 + 0 + 0

## MSL F306 Aquatic Invertebrate Zoology

4 Credits  
Offered Fall Even-numbered Years

We will explore the phylogenetics, life history, reproduction, physiology, morphology, and sexual systems of aquatic invertebrates. Hands on approaches, including a survey and comparison of taxonomic groups using microscopy and visual observations, recorded in a lab notebook, are central to the laboratory component of this course.

**Prerequisites:** MSL F211; MSL F212, BIOL F115X; BIOL F116X.

**Lecture + Lab + Other:** 3 + 3 + 0

## MSL F315 Marine Geological Drama and Undersea Catastrophes

3 Credits  
Offered Fall

Case studies of geological events that disrupt the ocean environment as an introduction to geological oceanography. Geological concepts are covered as part of the background and context for each one. The case studies include everyday geological drama, sudden catastrophes, and slow-motion catastrophes on a geologic time scale.

**Prerequisites:** MSL F111X, MSL F211.

**Lecture + Lab + Other:** 3 + 0 + 0

**MSL F317 Introduction to Marine Mammal Biology**

3 Credits

Offered Spring

The course will introduce students to the biology and diversity of cetaceans, pinnipeds, sirenians, and other marine mammals. Topics will include evolution, ecology, reproduction, and behavior of marine mammals, their special adaptations, such as diving, osmo- and thermoregulation, and will explore some current conservation and management issues. The course will be structured in a lecture format.

**Prerequisites:** BIOL F116X or MSL F212.**Lecture + Lab + Other:** 3 + 0 + 0**MSL F320 Aquatic Ecology**

3 Credits

Offered Fall

An introduction to the relationship between aquatic species and their environment, with an emphasis on biological interactions and environmental factors that structure these communities.

**Prerequisites:** (MSL F211 and MSL F212) OR (BIOL F115X and BIOL F116X).**Lecture + Lab + Other:** 3 + 0 + 0**MSL F410 Marine Bird Ecology and Conservation**

3 Credits

Offered Fall Even-numbered Years

This course will introduce students to the biology, ecology and conservation of marine birds, with emphasis on seabirds, sea ducks and shorebirds, especially species found in Alaska and the Northern hemisphere. Through ecological and evolutionary perspectives, topics will include biodiversity, adaptations, life histories, population ecology, demography, community ecology and conservation.

**Prerequisites:** BIOL F371 or MSL F320.**Lecture + Lab + Other:** 3 + 0 + 0**MSL F412 Early Life Histories of Marine Invertebrates**

3 Credits

Offered Fall Odd-numbered Years

This course will explore the diversity of reproductive strategies and larval forms in marine invertebrates, and consider selective pressures governing the evolution of these forms. Topics include: larval ecology and evolution, environmental constraints on early life histories, reproductive biology, population dynamics, sources of larval mortality, dispersal and recruitment. Graduate standing or instructor permission and invertebrate zoology recommended.

**Prerequisites:** MSL F212 and upper-division standing.**Lecture + Lab + Other:** 3 + 0 + 0**MSL F415 Physiology of Marine Organisms**

3 Credits

Offered Fall

We will study the problems and challenges vertebrates and invertebrates are facing in the marine environment, and their responses and solutions. Characteristic issues for marine animals include oxygen supply, salinity, temperature and pressure, and adaptations can vary widely or be remarkably similar.

**Prerequisites:** BIOL F310, MSL F212, (BIOL F111X & BIOL F112X).**Stacked with** MSL F615.**Lecture + Lab + Other:** 3 + 0 + 0**MSL F419 Concepts in Physical Oceanography**

3 Credits

Offered Fall Even-numbered Years

This course establishes the physical concepts that drive ocean motion on our rotating earth including the roles of the Coriolis force, ocean stratification, wind driven and thermohaline circulation, tides and why the major ocean gyres exist.

**Prerequisites:** MATH F251X or PHYS F211X.**Lecture + Lab + Other:** 3 + 0 + 0**MSL F421 Nearshore Ecology Field Course**

2 Credits

Offered Spring

Students will propose a hypothesis that they will develop in the first two months of the semester and then experimentally test during a spring break field trip to the Kasitsna Bay Marine Lab. Projects may be subtidal (if the student is a current AAUS diver) or intertidal.

**Prerequisites:** MSL F220, successful completion of a 200 level marine biology, ecology, or equivalent courses; If the student wants to dive as part of their project, they must be AAUS divers with current CPR, First Aid, O2 Administration certifications, and have a current AAUS medical physical.

**Stacked with** MSL F623.**Lecture + Lab + Other:** 1 + 1 + 8**MSL F425 Subarctic Oceanography Field Course**

3 Credits

Offered Fall

This two-week intensive course provides students with skills and techniques for modern oceanographic investigation. Students develop, carry out and present their own field program conducted within fjords surrounding Seward, Alaska. An additional course fee covers ship time, lodging and meals in Seward. Fairbanks-to-Seward return travel costs are covered by students.

**Prerequisites:** MSL F211; MSL F212.**Stacked with** MSL F625.**Lecture + Lab + Other:** 11 + 20 + 17**MSL F431 Polar Marine Science**

3 Credits

Offered Fall Odd-numbered Years

Physical, biological, chemical and geological oceanography of the polar oceans with emphasis on comparing and contrasting the Arctic and Antarctic. **Prerequisites:**

**Prerequisites:** MSL F211; MSL F212.**Stacked with** MSL F621.**Lecture + Lab + Other:** 3 + 0 + 0**MSL F443 Fisheries Oceanography**

4 Credits

Offered Fall Odd-numbered Years

Oceanography of marine processes affecting vertebrates and invertebrates. Interactions between fisheries resources and physical and biological oceanography, and climatological and meteorological conditions that support sustainable management. Topics include recruitment, transport, mortality, feeding, distribution, abundance, El Nino/La Nina, regime shifts, and climate change. Global to local scales. Worldwide ecosystems and examples.

**Prerequisites:** FISH F110 or FISH F288; STAT F200X, MSL F111X, or CHEM F105X; PHYS F123X.**Cross-listed with** FISH F443.**Stacked with** MSL F643, FISH F643.**Lecture + Lab + Other:** 4 + 0 + 0

**MSL F449 Biological Oceanography**

3 Credits

Offered Fall

Survey of biological processes emphasizing organic matter synthesis and transfer including topics essential to a basic understanding of contemporary biological oceanography. Primary and secondary production, standing stocks, distribution, and structure and dynamics of phytoplankton and zooplankton populations. The transfer of organic matter to higher trophic levels and food webs. Nutrient cycling, especially but not exclusively nitrogen, phosphorus and silicon, microbiological processes relevant to nutrient cycling. Heterotrophic production, benthic communities, coastal ecosystems, the influence of organisms on the composition of seawater, particularly with reference to oxygen and carbon dioxide regimes. Aspects of regional oceanography.

**Prerequisites:** Upper Division standing in a Science major; MSL F212 for undergraduate students.

**Stacked with** MSL F650.

**Lecture + Lab + Other:** 3 + 0 + 0

**MSL F450 Marine Biology and Ecology Field Course**

4 Credits

Offered Summer Odd-numbered Years

Advanced understanding of marine organisms in an ecological and evolutionary context through field and laboratory work at the Kasitsna Bay Marine Lab (Kachemak Bay, Alaska). Includes the study of marine macroalgae, invertebrates and plankton and relating their anatomical organization to habitat, lifestyle and ecology.

**Prerequisites:** One year of biology.

**Recommended:** Basic courses in ecology and invertebrate zoology.

**Stacked with** MSL F651.

**Lecture + Lab + Other:** 3 + 6 + 0

**MSL F453 Zooplankton Ecology**

3 Credits

Offered Fall Even-numbered Years

Survey of marine zooplankton and processes that influence their production and dynamics. Emphasis is placed upon zooplankton communities of northeast Pacific and Arctic oceans. Field and lab methodology reviewed include fixing, preserving, subsampling, identifying and quantifying zooplankton collections. Reviewed laboratory techniques cover culture of zooplankton, including physiological measurements of parameters.

**Prerequisites:** MSL F449.

**Stacked with** MSL F663.

**Lecture + Lab + Other:** 3 + 0 + 0

**MSL F455 Phytoplankton and Marine Microbes**

3 Credits

Offered Spring Even-numbered Years

An in-depth exploration of microbial life in the marine environment focusing on phytoplankton, microzooplankton, bacteria and archaea. Students will learn the importance of marine microbes, including their impacts on fisheries and biogeochemical cycles. Topics include harmful algal blooms and the impacts of climate change on marine microbial communities.

**Prerequisites:** MSL F212.

**Stacked with** MSL F655.

**Lecture + Lab + Other:** 3 + 0 + 0

**MSL F456 Kelp Forest Ecology**

2 Credits

Offered Summer Even-numbered Years

Introduction to knowledge, hypotheses and disputes regarding kelp forest ecology, including the environmental and ecological interactions that influence their distribution, structure and function. Course includes lectures, discussions, labs and scuba diving field trips. We take a global perspective but focus on local Alaska subtidal flora and fauna.

**Prerequisites:** UAF Science Diver certification.

**Stacked with** MSL F656.

**Lecture + Lab + Other:** 5 + 35 + 0

**MSL F457 Field Techniques in Ocean Acidification Research**

3 Credits

Offered Summer Even-numbered Years

An introduction to the design and fabrication of experimental ocean acidification systems and oceanographic pH sensors for the study of ocean acidification. This course will require extra fees to cover laboratory activities, room and board. Students are responsible for the travel to and from Kasitsna Bay Laboratory, near Seldovia, Alaska.

**Prerequisites:** MSL F211 and MSL F212.

**Lecture + Lab + Other:** 2 + 4 + 3

**MSL F459 Computer Programming for Scientific Applications**

3 Credits

Offered Spring Odd-numbered Years

Introduction to scientific programming techniques and applications. This MATLAB-based course will cover programming fundamentals, input/output operations, and mapping and other data visualization techniques. Students will work with NetCDF and OpenDAP protocols and remote large-volume data repositories. No prior programming experience required.

**Prerequisites:** Senior or graduate level standing.

**Lecture + Lab + Other:** 3 + 0 + 0

**MSL F461 Chemical Oceanography**

3 Credits

Offered Spring

An integrated study of the chemical, biological, geological and physical processes that control the chemical composition of seawater. Boundary interactions with the atmosphere and lithosphere, biogeochemical cycles and tracers of these complex cycles are examined. The marine chemistry of inorganic carbon is considered in detail.

**Prerequisites:** Upper-division standing, CHEM F106X, BIOL F116X.

**Stacked with** CHEM F660; MSL F660.

**Lecture + Lab + Other:** 3 + 0 + 0

**MSL F463 Chemical Coastal Processes**

3 Credits

Offered Spring Even-numbered Years

A study of chemical processes in the coastal ocean, including interactions at boundaries, and physical and biological controls on the chemistry of coastal environments. Key topics include riverine input, coastal acidification, photochemistry, coastal productivity, and challenges in coastal management. Intended for students with general chemistry and marine science backgrounds.

**Prerequisites:** Upper-division standing; CHEM F105X; CHEM F106X;

MSL F111X or (MSL F211;MSL F212).

**Stacked with** MSL F663.

**Lecture + Lab + Other:** 3 + 0 + 0

**MSL F467 Ecology and Physiology of Marine Macroalgae (n)**

3 Credits

Offered Spring Odd-numbered Years

This course will provide an overview of marine seaweed related to their diversity, structure, physiology, ecology, and basic grouping approaches, and marine seaweed's relation to human affairs. This course will allow students to increase their awareness of the ecological and economic relevance of marine seaweeds.

**Prerequisites:** BIOL F115X; MSL F212.**Stacked with** MSL F667.**Lecture + Lab + Other:** 3 + 0 + 0**MSL F476 Aquatic Food Web Ecology**

3 Credits

Offered Fall Even-numbered Years

Examines theoretical and applied aspects of aquatic food web ecology, from the ecological processes that give rise to patterns in aquatic communities to the incorporation of trophic interactions into ecosystem-based management. Includes a lecture component focused on peer reviewed studies and a lab component focused on applying concepts with data.

**Prerequisites:** Upper-level undergraduate standing.**Cross-listed with** BIOL F470; FISH F476.**Stacked with** BIOL F670; FISH F676; MSL F676;.**Lecture + Lab + Other:** 2 + 3 + 0**MSL F481 The Oceans and Global Change**

3 Credits

Offered Fall

Explores how human activities are affecting Earth's oceans. Topics include climate change, sea-level rise, coastal erosion, declining sea ice, shifting ecosystems, ocean acidification, pollution and various mitigation proposals. The course will investigate the causes and effects of these changes and consider the challenges and opportunities that arise from them.

**Prerequisites:** Upper-division standing or MSL F212.**Stacked with** MSL F681.**Lecture + Lab + Other:** 3 + 0 + 0**MSL F482 Human Impacts to the Marine Biosphere**

3 Credits

Offered Spring

A review of the biological mechanisms that marine species utilize to respond to ocean change focusing on the links between physical, chemical and biological systems and human activities.

**Prerequisites:** (MSL F211 and MSL F212) or (BIOL F115X and BIOL F116X).**Lecture + Lab + Other:** 3 + 0 + 0**MSL F492 Seminar**

1-6 Credits

**Lecture + Lab + Other:** 0 + 0 + 0**MSL F498 Research**

1-6 Credits

**Lecture + Lab + Other:** 1-6 + 0 + 0**MSL F499 Senior Thesis**

3 Credits

Under the supervision and mentorship of a fisheries and ocean sciences faculty member, students will complete a self-designed project that is the capstone of a student's exemplary academic performance. The student will complete a senior thesis based on field and/or laboratory data collected during a field course or work that was completed with the faculty mentor within the context of the existing literature relevant to the study topic. Students are required to present their study results as an oral or poster presentation at a UAF seminar or symposium, or at a state or national scientific conference. In addition, students are encouraged to work with their mentor to submit their thesis for publication in a peer-reviewed scientific journal.

**Prerequisites:** Permission of a fisheries and ocean sciences faculty mentor.**Lecture + Lab + Other:** 0 + 0 + 9**MSL F601 Professional Development**

1 Credit

Offered Spring Odd-numbered Years

Improve ability to make oral and poster presentations and to write resumes and cover letters. Includes lectures, discussions, and four individual projects. Students are encouraged to use their thesis/ dissertation material for the posters and oral presentations. Feedback on all projects will be given by both instructor and students.

**Recommended:** Graduate status.**Lecture + Lab + Other:** 1 + 0 + 0**MSL F602 Proposal Writing**

1 Credit

Offered Fall

Familiarize students with the proposal writing process. Writing proposals is a common requirement during graduate school and will be continuing during the career as a scientist and researcher. This class aims to cover some common rules about good proposal writing. Students will be required to write a proposal and to give feedback to 1-2 proposals of classmates. Course may be repeated for credit.

**Recommended:** Graduate status.**Lecture + Lab + Other:** 1 + 0 + 0**MSL F604 Modern Applied Statistics for Fisheries**

4 Credits

Offered Fall Odd-numbered Years

Covers general statistical approaches to quantitative problems in marine science and fisheries with guidance on how to collect and organize data, how to select appropriate statistical methods and how to communicate results. A variety of advanced statistical methods for analyzing environmental data sets will be illustrated in theory and practice.

**Prerequisites:** STAT F200X; STAT F401; proficiency in computing with R.**Cross-listed with** FISH F604.**Lecture + Lab + Other:** 3 + 3 + 0**MSL F605 Controversies in Marine Science**

1 Credit

Offered Spring Even-numbered Years

Introduction to the idea that science is fluid and controversies and disagreements do occur. These disagreements are often published in the primary literature. This course will be a discussion/debate of various controversial topics in marine science.

**Recommended:** Graduate status.**Lecture + Lab + Other:** 1 + 0 + 0

**MSL F610 Marine Biology**

3 Credits

Offered Spring

Biology of the major plant and animal groups in the sea and their roles in pelagic and benthic systems. Physical, chemical and geological features affecting marine organisms and the role of bacteria in the sea. The basic biology and adaptations of selected species of zooplankton and nekton. The benthos-shore biota, shelf and deep-sea organisms: basic biology, trophic roles and adaptations of selected species.

**Prerequisites:** Degree in biology.**Recommended:** Courses in invertebrate zoology, ichthyology, and vertebrate zoology.**Lecture + Lab + Other:** 3 + 0 + 0**MSL F612 Early Life Histories of Marine Invertebrates**

3 Credits

Offered Fall Odd-numbered Years

This course will explore the diversity of reproductive strategies and larval forms in marine invertebrates, and consider selective pressures governing the evolution of these forms. Topics include: larval ecology and evolution, environmental constraints on early life histories, reproductive biology, population dynamics, sources of larval mortality, dispersal and recruitment. Graduate standing or instructor permission and invertebrate zoology recommended.

**Lecture + Lab + Other:** 3 + 0 + 0**MSL F613 Veterinary Nutrition and Metabolism**

2 Credits

Offered Spring

This course will examine the nutritional needs of major species of veterinary importance. Discussion will revolve around specific nutritional needs as they relate to life-stages and production status of monogastric and ruminant animals. Course topics deal with the classification and function of nutrients, digestive processes (monogastric, ruminant, hind-gut fermenters), evaluation of feedstuffs and feed labels, and principles of disease related to nutritional deficiency as well as nutritional excess.

**Prerequisites:** Successful completion of first-semester veterinary courses.**Cross-listed with** DVM F623.**Lecture + Lab + Other:** 2 + 0 + 0**MSL F615 Physiology of Marine Organisms**

3 Credits

Offered Fall

We will study the problems and challenges vertebrates and invertebrates are facing in the marine environment, and their responses and solutions. Characteristic issues for marine animals include oxygen supply, salinity, temperature and pressure, and adaptations can vary widely or be remarkably similar.

**Prerequisites:** Graduate standing.**Stacked with** MSL F415.**Lecture + Lab + Other:** 3 + 0 + 0**MSL F618 Functional Anatomy**

8 Credits

Offered Fall

The course will include an introduction to veterinary anatomy in which the basics veterinary anatomy, orientation, nomenclature, locomotion apparatus, circulatory system, digestive, respiratory apparatus, lymphatic organs and nervous system of domestic animals will be explained. A general explanation of the basic anatomical preparation techniques will be presented to improve the manual skills of the students. The course will place the anatomical knowledge in a clinical context.

**Prerequisites:** Admittance to the professional veterinary program.**Cross-listed with** DVM F616.**Lecture + Lab + Other:** 5 + 6 + 0**MSL F619 Biology of Marine Mammals**

3 Credits

Offered As Demand Warrants

Introduction to a broad range of research and conservation topics associated with marine mammals. Topics include physiological adaptations, phylogeny and evolution, behavior, ecology, population dynamics and conservation.

**Prerequisites:** Graduate standing; or upper-division ecology and biology courses.**Lecture + Lab + Other:** 3 + 0 + 0**MSL F620 Physical Oceanography**

4 Credits

Offered Fall

Physical description of the sea, physical properties of seawater, methods and measurements, boundary processes, currents, tides and waves, and regional oceanography.

**Prerequisites:** MATH F253X; PHYS F123X or PHYS F211X; science or engineering degree.**Lecture + Lab + Other:** 3 + 3 + 0**MSL F621 Polar Marine Science**

3 Credits

Offered Fall Odd-numbered Years

Physical, biological, chemical and geological oceanography of the polar oceans with emphasis on comparing and contrasting the Arctic and Antarctic.

**Prerequisites:** graduate standing.**Stacked with** MSL F431.**Lecture + Lab + Other:** 3 + 0 + 0**MSL F623 Nearshore Ecology Field Course**

2 Credits

Offered Spring

Students will propose a hypothesis that they will develop in the first two months of the semester and then experimentally test during a spring break field trip to the Kasitsna Bay Marine Lab. Projects may be subtidal (if the student is a current AAUS diver) or intertidal.

**Prerequisites:** Graduate standing; MSL F220, successful completion of a 200 level marine biology, ecology, or equivalent courses; If the student wants to dive as part of their project, they must be AAUS divers with current CPR, First Aid, O2 Administration certifications, and have a current AAUS medical physical.**Stacked with** MSL F421.**Lecture + Lab + Other:** 1 + 1 + 8

**MSL F625 Subarctic Oceanography Field Course**

3 Credits  
Offered Fall

This two-week intensive course provides students with skills and techniques for modern oceanographic investigation. Students develop, carry out and present their own field program conducted within fjords surrounding Seward, Alaska. An additional course fee covers ship time, lodging and meals in Seward. Fairbanks-to-Seward return travel costs are covered by students.

**Stacked with** MSL F425.

**Lecture + Lab + Other:** 11 + 20 + 17

**MSL F627 Statistical Computing with R**

2 Credits  
Offered Fall

Using the free, open-source software R to teach computing, programming, and modeling concepts for the statistical computing of fisheries and biological data. Prepares students for other graduate-level, quantitative fisheries courses and covers exploratory statistical and graphical analyses, as well as computer-intensive methods such as bootstrapping and randomization tests.

**Prerequisites:** STAT F200X, STAT F401, and proficiency with Excel.

**Cross-listed with** FISH F627.

**Lecture + Lab + Other:** 1 + 3 + 0

**MSL F630 Geological Oceanography**

3 Credits  
Offered Spring

Topography and structure of the ocean floor. Theory of plate tectonics. Geology of ocean basins, continental slope, shelf and coastal environments. Major sediment types and distributions. Sediment transport and deposition. Interaction between seawater, rock, and sediment. Paleoceanography. Upper-division standing are invited to contact the instructor.

**Prerequisites:** Graduate standing.

**Lecture + Lab + Other:** 3 + 0 + 0

**MSL F631 Data Analysis in Community Ecology**

3 Credits  
Offered Spring Odd-numbered Years

This course will provide an overview of statistical methods that have been specifically developed to aid our understanding and interpretation of the structure, abundance, and distribution of species and communities in relation to resources and the environment.

**Prerequisites:** STAT F200X; STAT F401; FISH F627 (Statistical Computing with R) or familiarity with R, general ecology, graduate standing in fisheries.

**Cross-listed with** FISH F631.

**Lecture + Lab + Other:** 3 + 0 + 0

**MSL F632 Oceanographic Data Analysis and Visualization**

3 Credits  
Offered Spring Even-numbered Years

This course introduces students to data analysis and visualization techniques commonly applied to oceanographic datasets. Students will gain a theoretical and practical understanding of propagation of errors, linear least squares regression, and time series analyses such as correlation, coherence and spectral estimation.

**Prerequisites:** Graduate standing; MATH F253X; MATH F314.

**Lecture + Lab + Other:** 3 + 0 + 0

**MSL F637 Veterinary Bacteriology and Mycology**

2 Credits  
Offered Spring

This course will discuss bacterial structure, differences between bacterial families, and fungi and their pathogenesis. The basic principles of bacterial and fungal pathogenesis will be presented. Host response to bacterial or fungal infection, immunity and the role of vaccines in disease prevention will be explained.

**Prerequisites:** Successful completion of first-semester veterinary courses.

**Cross-listed with** BIOL F632; DVM F637.

**Lecture + Lab + Other:** 2 + 0 + 0

**MSL F639 Veterinary Virology**

2 Credits  
Offered Spring

This course will explore current concepts in the field of veterinary virology, with an emphasis on the viral structure, viral genetic material and viral replication strategies of various animal viruses. In addition, mechanisms of viral pathogenesis, prevention and treatment of viral infection will be presented.

**Prerequisites:** Successful completion of first-semester veterinary courses.

**Cross-listed with** BIOL F639; DVM F639.

**Lecture + Lab + Other:** 2 + 0 + 0

**MSL F642 Veterinary Pathology/Biology of Disease I**

5 Credits  
Offered Spring

This course will discuss basic principles of disease with special emphasis on processes likely to be encountered veterinary practice. We will discuss these topics organized by underlying disease mechanism. The discussions will move from general cell-mediated processes to more specific disease mechanisms.

**Prerequisites:** Successful completion of first-semester veterinary courses.

**Cross-listed with** BIOL F640; DVM F640.

**Lecture + Lab + Other:** 4 + 3 + 0

**MSL F643 Fisheries Oceanography**

4 Credits  
Offered Fall Odd-numbered Years

Oceanography of marine processes affecting vertebrates and invertebrates. Interactions between fisheries resources and physical and biological oceanography, and climatological and meteorological conditions that support sustainable management. Topics include recruitment, transport, mortality, feeding, distribution, abundance, El Nino/La Nina, regime shifts, and climate change. Global to local scales. Worldwide ecosystems and examples.

**Prerequisites:** Graduate standing.

**Cross-listed with** FISH F643.

**Stacked with** MSL F443, FISH F443.

**Lecture + Lab + Other:** 4 + 0 + 0

**MSL F650 Biological Oceanography**

3 Credits

Offered Fall

Survey of biological processes emphasizing organic matter synthesis and transfer including topics essential to a basic understanding of contemporary biological oceanography. Primary and secondary production, standing stocks, distribution, and structure and dynamics of phytoplankton and zooplankton populations. The transfer of organic matter to higher trophic levels and food webs. Nutrient cycling, especially but not exclusively nitrogen, phosphorus and silicon, microbiological processes relevant to nutrient cycling. Heterotrophic production, benthic communities, coastal ecosystems, the influence of organisms on the composition of seawater, particularly with reference to oxygen and carbon dioxide regimes. Aspects of regional oceanography.

**Prerequisites:** Upper-division standing in a science major.**Stacked with** MSL F449.**Lecture + Lab + Other:** 3 + 0 + 0**MSL F651 Marine Biology and Ecology Field Course**

4 Credits

Offered Summer Odd-numbered Years

Advanced understanding of marine organisms in an ecological and evolutionary context through field and laboratory work at the Kasitsna Bay Marine Lab (Kachemak Bay, Alaska). Includes the study of marine macroalgae, invertebrates and plankton and relating their anatomical organization to habitat, lifestyle and ecology.

**Prerequisites:** One year of biology; graduate standing.**Recommended:** Basic courses in ecology and invertebrate zoology.**Stacked with** MSL F450.**Lecture + Lab + Other:** 3 + 6 + 0**MSL F652 Marine Ecosystems**

3 Credits

Offered Fall Even-numbered Years

Understanding ecosystems of the sea in the context of evaluating the impact of human activities. Focus on current concepts, trends and perspectives.

**Prerequisites:** BIOL F472; MSL F620; MSL F650.**Lecture + Lab + Other:** 3 + 0 + 0**MSL F653 Zooplankton Ecology**

3 Credits

Offered Fall Even-numbered Years

Survey of marine zooplankton and processes that influence their production and dynamics. Emphasis is placed upon zooplankton communities of northeast Pacific and Arctic oceans. Field and lab methodology reviewed include fixing, preserving, subsampling, identifying and quantifying zooplankton collections. Reviewed laboratory techniques cover culture of zooplankton, including physiological measurements of parameters.

**Stacked with** MSL F453.**Lecture + Lab + Other:** 3 + 0 + 0**MSL F654 Benthic Ecology**

3 Credits

Offered Fall Even-numbered Years

Ecology of marine benthos, from subtidal to hadal zone. Methods of collecting, sorting, narcotizing, preserving and analyzing benthic assemblages, including video analytical techniques from submersibles and ROVs. Hydrothermal vent and cold seep assemblages. Physiology/energetics of benthic organisms, including animal-sediment relationships, feeding, reproduction and growth. Depth, spatial and latitudinal distribution patterns.

**Prerequisites:** Invertebrate zoology course, marine biology course.**Cross-listed with** FISH F654.**Lecture + Lab + Other:** 3 + 0 + 0**MSL F655 Phytoplankton and Marine Microbes**

3 Credits

Offered Spring Even-numbered Years

An in-depth exploration of microbial life in the marine environment focusing on phytoplankton, microzooplankton, bacteria and archaea. Students will learn the importance of marine microbes, including their impacts on fisheries and biogeochemical cycles. Topics include harmful algal blooms and the impacts of climate change on marine microbial communities.

**Stacked with** MSL F455.**Lecture + Lab + Other:** 3 + 0 + 0**MSL F656 Kelp Forest Ecology**

2 Credits

Offered Summer Even-numbered Years

Introduction to knowledge, hypotheses and disputes regarding kelp forest ecology, including the environmental and ecological interactions that influence their distribution, structure and function. Course includes lectures, discussions, labs and scuba diving field trips. We take a global perspective but focus on local Alaska subtidal flora and fauna.

**Prerequisites:** UAF Science Diver certification.**Stacked with** MSL F456.**Lecture + Lab + Other:** 5 + 35 + 0**MSL F660 Chemical Oceanography**

3 Credits

Offered Spring

An integrated study of the chemical, biological, geological and physical processes that control the chemical composition of seawater. Boundary interactions with the atmosphere and lithosphere, biogeochemical cycles and tracers of these complex cycles are examined. The marine chemistry of inorganic carbon is considered in detail.

**Prerequisites:** Graduate standing.**Cross-listed with** CHEM F660.**Stacked with** MSL F461.**Lecture + Lab + Other:** 3 + 0 + 0**MSL F661 Stable Isotope Techniques in Environmental Research**

3 Credits

Offered Spring

An examination of the use of added or naturally occurring isotope tracers in ecological studies. Demonstration of equipment and modern techniques.

**Prerequisites:** Graduate standing.**Lecture + Lab + Other:** 3 + 0 + 0

**MSL F663 Chemical Coastal Processes**

3 Credits

Offered Spring Even-numbered Years

A study of chemical processes in the coastal ocean, including interactions at boundaries, and physical and biological controls on the chemistry of coastal environments. Key topics include riverine input, coastal acidification, photochemistry, coastal productivity, and challenges in coastal management. Intended for students with general chemistry and marine science backgrounds.

**Prerequisites:** Graduate standing.**Stacked with** MSL F463.**Lecture + Lab + Other:** 3 + 0 + 0**MSL F667 Ecology and Physiology of Marine Macroalgae**

3 Credits

Offered Spring Odd-numbered Years

This course will provide an overview of marine seaweed related to their diversity, structure, physiology, ecology, and basic grouping approaches, and marine seaweed's relation to human affairs. This course will allow students to increase their awareness of the ecological and economic relevance of marine seaweeds.

**Prerequisites:** Upper-division standing in a natural science for undergraduates or graduate standing.**Stacked with** MSL F467.**Lecture + Lab + Other:** 3 + 0 + 0**MSL F676 Aquatic Food Web Ecology**

3 Credits

Offered Fall Even-numbered Years

Examines theoretical and applied aspects of aquatic food web ecology, from the ecological processes that give rise to patterns in aquatic communities to the incorporation of trophic interactions into ecosystem-based management. Includes a lecture component focused on peer reviewed studies and a lab component focused on applying concepts with data.

**Cross-listed with** BIOL F670; FISH F676.**Stacked with** BIOL F470; FISH F476; MSL F476.**Lecture + Lab + Other:** 2 + 3 + 0**MSL F677 Scientific Writing Techniques**

3 Credits

Students learn to write scientifically with skill and clarity by practicing using easy-to-follow writing techniques to write and rewrite a draft manuscript. Topics include writing approaches, storytelling, outlines, style, grammar, punctuation, and editorial review. Most beneficial for graduate students writing theses, but provides excellent writing experience for new students.

**Prerequisites:** Graduate Standing.**Cross-listed with** MSL F677.**Lecture + Lab + Other:** 3 + 0 + 0**MSL F681 The Oceans and Global Change**

3 Credits

Offered Fall

Explores how human activities are affecting Earth's oceans. Topics include climate change, sea-level rise, coastal erosion, declining sea ice, shifting ecosystems, ocean acidification, pollution and various mitigation proposals. The course will investigate the causes and effects of these changes and consider the challenges and opportunities that arise from them.

**Prerequisites:** Upper-division standing or MSL F212.**Stacked with** MSL F481.**Lecture + Lab + Other:** 3 + 0 + 0**MSL F692 Seminar**

1-6 Credits

**Lecture + Lab + Other:** 1-6 + 0 + 0**MSL F692A Seminar**

1-6 Credits

**Lecture + Lab + Other:** 1-6 + 0 + 0**MSL F692D Seminar**

1-6 Credits

**Lecture + Lab + Other:** 1-6 + 0 + 0**MSL F692P Seminar**

1-6 Credits

**Lecture + Lab + Other:** 1-6 + 0 + 0**MSL F698 Non-thesis Research/Project**

1-9 Credits

**Lecture + Lab + Other:** 0 + 0 + 0**MSL F699 Thesis**

1-12 Credits

**Lecture + Lab + Other:** 0 + 0 + 0