MARINE SCIENCE

College of Science and Engineering
Dean: Keith Bowman

Based at the Romberg Tiburon Center
As of Fall 2017, this Program is temporarily not accepting students.

For students interested in Marine and Estuarine Science at the Romberg Tiburon Center, please visit: http://rtc.sfsu.edu/riptides/index.htm

Administered by the Department of Biology
Website: http://biology.sfsu.edu/graduate/marine_sciencesRTC
Graduate Coordinator: Ellen M. Hines ehines@sfsu.edu

The M.S. in Marine Science program is an interdisciplinary program offered at San Francisco State University (SF State) by the College of Science and Engineering, based at the Romberg Tiburon Center (RTC; http://rtc.sfsu.edu), and administered by the Department of Biology. Faculty mentors in the program are from the Departments of Biology, Chemistry and Biochemistry, Physics, Geography & Environment, and Earth & Climate Sciences

Program Scope
The interdisciplinary MS in Marine Science program includes faculty from a broad spectrum of marine, coastal and estuarine researchers from across SF State departments. The program provides the opportunity for students to acquire a practical and theoretical education in the marine sciences to prepare them for careers as research scientists, teachers, and marine technicians. Through RTC the program provides extensive field and laboratory work for advanced study in the marine sciences.

Master of Science in Marine Science

Admission to the Program
Prospective students from a variety of undergraduate backgrounds are encouraged to apply. Applications are administered by the Biology Department and must comply with the application procedures and deadlines of the Biology Department (http://biology.sfsu.edu/content/applying-sfsu-biology-graduate-programs). Note, the M.S. in Marine Science is distinct from the M.S. in Biology with a concentration in marine biology.

Marine Science (M.S.) — 30 units

Coursework Requirements
Students are required to complete a total of 30 units, structured as follows:

- 9–10 units of research credits, comprised of:
  - Research
  - BIOL/CHEM/ 6
  - ERTH 897/ 3
  - GEOG 896 3

- Thesis
  - BIOL/CHEM/ 4
  - ERTH/GEOG 898

- 20 units of coursework that must include:
  - 6–8 units of graduate seminar courses
  - 12–15 units of remaining coursework, as described below.

The 20 units of coursework are broken down below in the following categories I-V:

1. Scientific Methods for Professional Aquatic Scientists BIOL 708, 3 units:
   Required in the first semester of graduate school.

2. Students pick at least three of the following core seminars:
   - BIOL 862 Advances in Ecology and Systematic Biology 2
   - BIOL 863 Advances in Marine Biology 2
   - BIOL 864 Advances in Microbiology 2
   - BIOL 865 Advances in Physiology and Behavioral Biology 2
   - GEOG 857 Issues in Marine and Estuarine Conservation 3

   • Students who have completed these courses under their undergraduate courses can take other courses after advisor’s approval.

3. Students can choose from a wide range of electives in consultation with their advisor.
   - Electives taught at RTC include:
     - BIOL 582 Biological Oceanography 4
     - CHEM 680 Chemical Oceanography 3
     - ERTH 870 Physical Oceanography 4
     - BIOL 534 Wetland Ecology 3
     - or BIOL 585 Marine Ecology 3
     - ERTH 834 Coastal Processes 3
     - BIOL 731 Animal Physiology Laboratory - GWAR 4
     - BIOL 702 Biology of the Algae 3
     - GEOG 629 Coastal and Marine Applications of GIS 3

   - Electives taught at SF State, MLML, or elsewhere (e.g. UC Berkeley):
     - For example, Biometry, Environmental GIS, Conservation Biology, etc…

4. Current RTC Research, BIOL 883, 2-4 units. MS in MS students are expected to participate each semester in this formal course for the Wednesday RTC lecture series. Students are expected to enroll in BIOL 883 each semester, though the course can only count twice (4 units total) towards the degree. This course does not fulfill the graduate seminar requirement.

Moss Landing Marine Laboratories Courses
Most courses for the MS in Marine Science are offered at SF State’s Romberg Tiburon Center and on the main campus. Students may also take equivalent core courses or any elective courses at the Moss Landing Marine Laboratories on advisement. Consult the current Moss Landing Marine Laboratories course schedule, https://gradprog.mlml.calstate.edu/class-schedule.

MSCI 303 Marine Ecology (Units: 4)
Prerequisites: Ecology, statistics (or concurrent registration in MSCI 304), or consent of instructor.

- Interrelationships between marine and estuarine organisms and their environment; quantitative data collection and analysis. Classwork, 2 units; laboratory, 2 units. (Plus-minus letter grade only)

MSCI 304 Quantitative Marine Science (Units: 4)
Prerequisite: College mathematics.

- Mathematical methods for the analysis of biological, chemical, and physical data from the marine environment; experimental design, parametric and non-parametric statistics. Classwork, 3 units; laboratory, 1 unit. (Plus-minus letter grade only)
MSCI 305 Marine Science Diving (Units: 3)
Prerequisite: Certified SCUBA diver, or equivalency as determined by instructor.

Skin and scuba diving; five ocean dives include underwater sampling and survey techniques. Successful completion gives NAUI and MLML certification. (No credit toward major.) Classwork, 1 unit; laboratory and fieldwork, 2 units. (Plus-minus letter grade only)

MSCI 312 Marine Birds and Mammals (Units: 4)
Prerequisites: Upper division college vertebrate zoology; MSCI 303 or BIOL 585 recommended.

Systematics, morphology, ecology, and biology of marine birds and mammals. Classwork, 2 units; laboratory and fieldwork, 2 units. (Plus-minus letter grade only)

MSCI 313 Marine Ichthyology (Units: 4)
Prerequisites: College-level zoology or equivalent; MSCI 303 or BIOL 585 recommended.

The taxonomy, morphology, function, and ecology of marine fishes. Classwork, 2 units; laboratory and fieldwork, 2 units. (Plus-minus letter grade only) (Not open to students who have completed BIOL 571.)

MSCI 324 Marine Invertebrate Zoology I (Units: 4)
Prerequisites: College zoology or consent of instructor; MSCI 303 recommended.

Structure, systematics, evolution, and life histories of the major and minor marine phyla. Classwork, 2 units; laboratory, 2 units. (Plus-minus letter grade only)

MSCI 331 Marine Botany (Units: 4)
Prerequisite: MSCI 303 recommended.

Plants of the sea, marshes, and dunes; morphology, taxonomy, and natural history of seaweeds and vascular plants. Classwork, 2 units; laboratory, 2 units. (Plus-minus letter grade only)

MSCI 335 Physiological Ecology of Marine Algae (Units: 4)
Prerequisites: MSCI 344, MSCI 331, MSCI 303, or consent of instructor.

Physiological basis for understanding the adaptation of marine algae to their environment. Classwork, 2 units; laboratory, 2 units.

MSCI 341 Geological Oceanography (Units: 4)
Prerequisite: MSCI 342 or MSCI 343 (may be taken concurrently).

The structure, physiography, and composition of the sea bottom and shoreline. Classwork, 2 units; laboratory, 2 units. (Plus-minus letter grade only)

MSCI 342 Physical Oceanography (Units: 4)
Prerequisites: College algebra; college physics recommended.

Nature and causes of various oceanic motions including currents, waves, tides, and mixing, and the physical properties of seawater. Limited use of calculus. Classwork, 2 units; laboratory, 2 units. (Plus-minus letter grade only)

MSCI 343 Chemical Oceanography (Units: 4)
Prerequisite: One year of college chemistry.

Chemistry of the oceans, including major salts, dissolved gases, nutrient ions, carbonate system, transient tracers, and shipboard sampling techniques. Classwork, 2 units; laboratory, 2 units. (Plus-minus letter grade only)

MSCI 344 Biological Oceanography (Units: 4)
Prerequisites: General biology, general chemistry.

Complexity of organismal-environmental interaction of the plankton, the transfer of organic matter between trophic levels and nutrient cycles. Sampling, shipboard techniques, identification of the plankton, and analytical techniques. Classwork, 2 units; laboratory, 2 units. (Plus-minus letter grade only)

MSCI 699 Independent Study (Units: 1-3)
Prerequisite: Consent of instructor.

Faculty-directed study of selected research problems in the marine sciences. Open to undergraduate students having adequate subject matter preparation for the selected problem. May be repeated for credit.

MSCI 701 Library Research Methods in Marine Science (Unit: 1)
Prerequisites: Graduate status and consent of instructor.

The nature of scientific information. Framework for evaluating and interweaving the history of science with a variety of information sources and bibliographic tools. (Plus-minus letter grade only)

MSCI 706 Molecular Biological Techniques (Units: 4)
Prerequisites: Graduate status, college genetics or molecular biology or consent of instructor.

A laboratory-based overview of concepts and techniques for the isolation, characterization, and analysis of DNA and RNA. Covers standard methods (amplification, cloning, and sequencing), as well as selected specialized techniques (analysis of gene expression), emphasizing application in marine sciences. Classwork, 1 unit; laboratory, 3 units. (Plus-minus letter grade only)

MSCI 708 Scientific Methods (Units: 4)
Prerequisites: Graduate status and consent of instructor.

Information and skills for graduate students beginning their research careers, such as the philosophy of science, scientific writing, design of experiments and sampling programs, and using library and other resources. Classwork, 3 units; laboratory, 1 unit. (Plus-minus letter grade only)

MSCI 709 Foundations in Global Change in Urbanized Coasts and Estuaries (Units: 6)
Prerequisites: Admission to the Interdisciplinary MS RIP TIDES Graduate Training Program; concurrent enrollment in BIOL 708.

Developing interdisciplinary working knowledge at intersection of global change (climate change, ocean acidification, invasive species, disease, land use), coastal oceanography (physical, biological, chemical, geological), marine/estuarine biology (biodiversity, population, ecosystem, physiology), and societal issues (general public, managers, policymakers). (Plus-minus letter grade only)

MSCI 711 Ecology of Marine Birds and Mammals (Units: 4)
Prerequisites: MSCI 303, MSCI 304, and MSCI 312.

Ecology of marine birds and mammals using experimental and sampling methodology. Distribution, abundance, trophic ecology, and behaviors of birds and mammals in Elkhorn Slough. Aerial and boat surveys to determine distribution and abundance. Classwork, 2 units; laboratory, 2 units. (Plus-minus letter grade only)

MSCI 717 Writing and Professional Skills Workshop I: Introduction and Methods, Data Analysis and Graphics (Unit: 1)
Prerequisite: Admission to the Interdisciplinary MS RIP TIDES Graduate Training Program.

Weekly discussion of scientific writing, statistical analysis, and professional skills with a focus on thesis writing, submit proposals for research funding and fellowships, learn the statistical tests needed for their research projects, and have a clear understanding of how to apply to Ph.D. programs. (Plus-minus letter grade only)
MSCI 718 Writing and Professional Skills Workshop II: Completion of the thesis manuscript (Unit: 1)
Prerequisite: Admission to the Interdisciplinary MS RIP TIDES Graduate Training Program.
Weekly discussion of scientific writing, data analysis/scientific graphics, and professional skills geared towards job and Ph.D. program opportunities following completion of MS degree. Includes completing an entire draft of MS Thesis and learn to submit it for publication. Students gain skills in interviewing for Ph.D. programs and employment opportunities. (Plus-minus letter grade only)

MSCI 721 Advanced Topics in Marine Invertebrates: Marine Invertebrates (Units: 4)
Prerequisites: MSCI 324 and consent of instructor.
Advanced considerations of the ecology, physiology and phylogeny of the various invertebrate phyla emphasizing current literature and research. Classwork, 2 units; laboratory, 2 units. May be repeated once for credit.

MSCI 731 Biology of Seaweeds (Units: 4)
Prerequisite: MSCI 331 or consent of instructor.
Lecture-discussions on marine macroalgae biology with extensive reading of original literature. Ecologically oriented individual research projects involving laboratory culture and field experimentation. Classwork, two units; laboratory, two units. (Plus-minus letter grade only)

MSCI 733 Advanced Topics in Marine Ecology: Marine Ecology (Units: 4)
Prerequisite: Graduate standing.
Study of various topics in marine ecology. Classwork, 2 units; laboratory, 2 units. (Plus-minus letter grade only)

MSCI 734 Advanced Biological Oceanography (Units: 4)
Prerequisite: MSCI 344 or consent of instructor.
Experimental techniques in biological oceanography: problems in plankton ecology. Individual research project required. Classwork, 2 units; laboratory, 2 units. (Plus-minus letter grade only)

MSCI 746 Geology of the Monterey Bay Region (Units: 4)
Prerequisite: Graduate status or consent of instructor.
Geology, tectonics, and active naturally occurring processes in the Monterey Bay region and in the Monterey Bay National Marine Sanctuary. The geologic and tectonic history of central California, plate tectonic processes, representative stratigraphy and geomorphology of the Monterey Bay region. Classwork, 1 unit; laboratory, 3 units. (Plus-minus letter grade only)

MSCI 748 Marine Benthic Habitat Mapping Techniques (Units: 4)
Prerequisite: Graduate status or consent of instructor.
The collection and interpretation of geophysical data used to characterize marine benthic habitats. Basic geophysical principals are reviewed. Application of techniques to identify and characterize marine benthic habitats, including echosounders, multibeam bathymetry and backscatter, sidescan sonar, seismic profiling, and GIS. Classwork, 2 units; laboratory, 2 units. (Plus-minus letter grade only)

MSCI 761 Ocean Circulation and Mixing (Units: 4)
Prerequisites: MSCI 342; college physics strongly recommended.
Mathematical description of the distribution of various properties in the oceans relating to physical and biochemical processes. Distribution of variables, geostrophic method. Classwork, 3 units; laboratory, 1 unit. (Plus-minus letter grade only)

MSCI 763 Applications of Computers in Oceanography (Units: 4)
Prerequisites: College mathematics and consent of instructor.
Discussion and technical programming with MATLAB for computation and visualization with applications in marine science. Use of existing program libraries for data I/O and analysis. Classwork, 2 units; laboratory, 2 units. (Plus-minus letter grade only)

MSCI 771 Population Biology (Units: 3)
Prerequisites: MSCI 303 or BIOL 585 and MSCI 304 or statistics or consent of instructor.
Interactions among marine organisms which result in the alteration of population structures. Techniques for assessment and management of animal populations. Classwork, 2 units; laboratory, 1 unit. (Plus-minus letter grade only)

MSCI 772 Subtidal Ecology (Units: 4)
Prerequisites: MLML diver certification and marine ecology; knowledge of marine algae, invertebrates, and statistics recommended.
The ecology of near shore, rocky, subtidal populations and communities with emphasis on kelp forests. Field work with SCUBA including group projects on underwater research techniques and community analysis. (Plus-minus letter grade only)

MSCI 773 Marine Environmental Studies of the Gulf of California (Units: 4)
Prerequisite: Graduate standing or consent of instructor.
An analysis of Gulf of California marine environments. Lectures, readings, intensive fieldwork, and writing a scientific paper based on original research. Topics vary. Taught with Mexican faculty and students from La Paz, Mexico. Classwork, 2 units; laboratory, 2 units. (Plus-minus letter grade only)

MSCI 774 Advanced Topics in Oceanography: Oceanography (Units: 4)
Prerequisite: Graduate standing or consent of instructor.
Selected topics in oceanography. Topics and emphases vary with term and instructor. Classwork, 2 units; laboratory, 2 units. (Plus-minus letter grade only)

MSCI 781 Coastal Dynamics (Units: 4)
Prerequisite: Graduate standing and MSCI 341 or MSCI 342.
Oceanographic dynamics of coastal environments, emphasis on eastern boundary current systems influenced by coastal upwelling. Focus on how physical and geological oceanography interact with each other, and how both affect coastal ecosystem dynamics.

MSCI 788 Professional Internship in Marine and Estuarine Sciences (Units: 3)
Prerequisite: Admission to the Interdisciplinary MS RIP TIDES Graduate Training Program.
Professional internship with a partner organization one day per week. Partners are from wide range of organizations where scientific information is used, not generated. Students will relate what they learn to classmates during weekly group meetings and group discussions with internship mentors to address student career planning questions. (Plus-minus letter grade only)

MSCI 885 Seminar in Marine Biology (Units: 2)
Prerequisite: Graduate standing or consent of instructor.
Topic to be specified in Class Schedule. May be repeated once. (Plus-minus letter grade only)
MSCI 897 Research (Units: 1-4)
Prerequisites: Filing of petition, "Course by Individual Study," and consent of adviser, instructor, and department chair.

Independent investigations for the student with adequate preparation. May be repeated.

MSCI 898 Master’s Thesis (Units: 4)
Prerequisite: Consent of instructor and approval of Advancement to Candidacy (ATC) and Culminating Experience (CE) forms by Graduate Studies. ATC and Proposal for Culminating Experience Requirement forms must be approved by the Graduate Division before registration. (CR/NC grading only)