Undergraduate Marine Science Program
Student Advising Guide
2015-2016
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INTRODUCTION

Marine Science has been part of the academic curriculum at the University of Miami since 1949, when the Marine Laboratory, now known as the Rosenstiel School of Marine and Atmospheric Science (RSMAS), initiated a program of studies leading to the Master of Science degree. RSMAS is now one of the largest oceanographic institutes in the country with a faculty of over 90 scientists who conduct sponsored research and engage in academic training. In 1977, the College of Arts and Sciences and RSMAS joined together to establish an undergraduate Marine and Atmospheric Science Program. The degree granting authority for this program was formally transferred to the Rosenstiel School in 2008.

Our curriculum is designed to take full advantage of the University's subtropical location, with year-round access to a variety of marine environments including the deep ocean waters offshore, the coral reef tracts of the Florida Keys, and the estuarine sea grass beds and mangrove shoreline of South Florida. Students are introduced to the general complexities of the ocean and atmosphere through lectures, laboratories and field trips. Undergraduate students are encouraged to work with the faculty in their laboratories, and are able to earn course credit by conducting independent research under the supervision of leading scientists in their field.

Prospective students: From September 1st through mid-May, the Marine Science (MSC) office on the University of Miami’s Coral Gables welcomes visitors at 1:00-1:45PM Monday-Friday (except on holidays), following the 10AM Coral Gables main campus tour. Please note that prospective students apply through the Office of Admissions and not through the MSC Office. The admissions process at the University of Miami is ‘blind’ in that undergraduate programs do not review applicant folders. Additionally, any requests for financial assistance are evaluated through the Office of Financial Aid. For additional information on admissions, including campus tours, please see: http://www.rsmas.miami.edu/academics/undergraduate/prospective-students/

FOR ADDITIONAL INFORMATION:

Marine Science Program
University of Miami
1365 Memorial Drive
210 Ungar Building
Coral Gables, FL 33124-4250

Telephone: (305) 284-2180
Fax: (305) 284-4911
E-mail: marsci@miami.edu
Web:http://rsmas.miami.edu/undergrad
Marine Science Program Undergraduate Curriculum

Marine Science is an interdisciplinary program dealing with the study of the world’s oceans: their physical and biological constituents, the influence of oceanic resources on human society and the conservation and future development of those resources. The program offers the following areas of study:

Marine Affairs
Marine Affairs prepares students to contribute to the policy development and management of marine resources through integration of scientific, economic and social perspectives. Research at UM focuses on aquaculture, fisheries management, political ecology, natural resource economics, coastal zone management, marine spatial planning and marine protected areas, coastal and ocean law, and marine cultural resources.

Marine Science/Biology
Marine biologists study the structure and function of marine organisms from the cell and molecular level to their role in ecosystem function. Research at UM focuses on tropical marine and coral reef ecology, fisheries conservation and management, and the use of marine organisms as models for environmental stress and human disease. Students interested in these latter areas should also consider Marine Science/Biochemistry and Molecular Biology or Marine Science/Microbiology and Immunology.

Marine Science/Chemistry
Marine chemists study the biogeochemical cycling of nutrients, the impact and fate of marine pollutants, marine geochemistry and ocean/atmosphere interactions. Research at UM focuses on the role of ocean processes in carbon cycling and global climate change.

Marine Science/Computer Science
Ocean modelers and computer scientists provide the skills and expertise required for research in applied aspects of ocean science and management. Research at UM focuses on development of algorithms for data capture, visualization and analysis, model development, instrumentation programming and remote sensing applications. Interested students should also consider Marine Science/Mathematics.

Marine Science/Geological Sciences
Marine geologists study the origin of the Earth and its oceans, and the ongoing processes of geophysical and geochemical change. Research at UM focuses on carbonate sedimentology of the Florida reef tract, stable isotope geochemistry and micropaleontology of deep ocean cores to reconstruct paleoclimate, tectonic processes (volcanoes and earthquakes), and the impact of rising sea level on coastal systems.

Marine Science/Physics
Physical oceanographers study the spatial and temporal variability in the ocean. Measurements from current meters, profilers and satellites are used to develop models of ocean circulation, water and heat transport, and effects of circulation patterns on the biology and chemistry of the ocean. Research at UM focuses on ocean/atmosphere interactions, remote sensing, and the ocean’s effect on weather and climate.

Meteorology/Marine Science
This physical science based curriculum, which includes a Mathematics minor, is ideal for those interested in the physical aspects of climate, well as the interaction of the ocean and the atmosphere. The Meteorology curriculum follows the program guidelines established by the American Meteorological Society.
**BACHELOR OF ARTS IN MARINE AFFAIRS**

The Rosenstiel School of Marine and Atmospheric Science (RSMAS) offers a Bachelor of Arts in Marine Affairs degree with a major in Marine Affairs and a minor in Anthropology, Business, Communication, Economics, Ecosystem Science and Policy, Geography and Regional Studies, Latin American Studies, International Studies, or Political Science. This program is designed for students who wish to prepare themselves for graduate studies and careers in ocean related areas of business, policy, management, law, and communication. A five year BA/Master of Professional Science program in Marine Affairs is also offered. Please see advisor for details.

Students are required to complete the University’s general education (“Gen Ed”) requirements (see page 5) along with the core requirements for the major in Marine Affairs and a chosen minor. For BAMA students, the major and minor satisfy the Science (STEM) and Social Science (People and Society) Gen Ed requirements respectively.

The remaining General Education Requirements for the B.A.M.A. degree are:

- English Composition (6 credits: ENG 105 and ENG 106 or ENG 107)
- Arts and Humanities cognate (9 credits)
- Mathematics (3 credits above MTH107)
- Five writing intensive courses (W) beyond ENG105 and 106 or 107. Students are required to write at least 4000 words in each W course. Writing assignments will be graded on both content and style. All literature and modern language literature courses receive W credit.

The required courses for the Bachelor of Arts in Marine Affairs degree are:

- Biology 150 (General Biology), 160 (Evolution & Biodiversity)
- Chemistry 111, 112 (Principles of Chemistry I, II)
- Economics 211 (Economic Principles: Microeconomics)
- Geological Science 110 (Earth System) or 111 (Earth System History)
- Marine Science 111 (Intro. Marine Science), 215 (Marine Chemistry), 230 (Marine Biology), 313 (Coastal Law) or 314 (Ocean Law), 310 (Living Resources of the Ocean) or 340 (Coastal Policy), 345 (Economics of Natural Resources and the Environment), 460 (Spatial Applications in Marine Science)
- plus 9 credits of approved electives
- One approved course in computer programming or statistics (e.g. MSC204)
- 3 credits of 300+ level elective (some 200-level courses may be eligible if they require prerequisites).
- 3 credits of elective

The choice of courses for the minor must be approved by an advisor. Requirements for minors are listed in the University Bulletin under the individual programs. RSMAS courses at the 500-level may be taken for undergraduate credit with junior standing and departmental consent.
## Sample Curriculum – Marine Affairs

### Freshman Year
- **MSC 111** 3 cr
- **CHM 112** 3 cr
- **MTH 101** 3 cr
- **MTH 113** 3 cr
- **ENG 105** 3 cr
- **ENG 106** 3 cr
- **HUM #1** 3 cr
- **GSC 110** 3 cr
- **CHM 111** 3 cr
- **BIL 160** 4 cr

Total Crs: 15 cr

### Sophomore Year
- **BIL 150** 4 cr
- **MSC** 3 cr
- **MINOR** 3 cr
- **ECON 211** 3 cr
- **ELECTIVE** 3 cr
- **ELECTIVE** 3 cr
- **STATS** 3 cr
- **HUM #3** 3 cr

Total Crs: 16 cr

### Junior Year
- **HUM #2** 3 cr
- **MSC 345** 3 cr
- **MSC 313** 3 cr
- **MINOR** 3 cr
- **MSC** 3 cr
- **MSC 215** 3 cr
- **ELECTIVE** 3 cr
- **ELECTIVE** 3 cr
- **300 ELEC** 3 cr

Total Crs: 15 cr

### Senior Year
- **300 ELECT** 3 cr
- **ELECTIVE** 3 cr
- **MINOR** 3 cr
- **MINOR** 3 cr
- **ELECTIVE** 3 cr
- **ELECTIVE** 3 cr
- **MSC 340** 3 cr
- **MSC** 3 cr
- **MSC** 3 cr

Total Crs: 15 cr
BACHELOR OF SCIENCE CURRICULA IN MARINE SCIENCE

The Rosenstiel School of Marine and Atmospheric Science offers a Bachelor of Science in Marine and Atmospheric Science degree (B.S.M.A.S.) with majors in, Marine Science/Biology, Marine Science/Chemistry, Marine Science/Geological Sciences, Marine Science/Physics, Marine Science/Biochemistry, Marine Science/Computing Science, Marine Science/Mathematics, Marine Science/Microbiology and Meteorology/Marine Science. Each of these degrees involves a major in Marine Science with a second major in the accompanying field. Double major combinations of Marine Science with Engineering disciplines are also possible. Contact us for details.

The double major prepares students for admission to graduate programs and for careers in teaching and research as well as for technical careers in government and private industries concerned with the oceans. Each of the areas of concentration constitutes a rigorous program requiring 120-130 credits for graduation. Only those courses passed with a grade of "C-" or better may be applied to the major or minor. RSMAS courses at the 500-level may be taken for undergraduate credit with junior standing and departmental consent.

The General Education Requirements for the B.S.M.A.S. degree are:

- English Composition (6 credits: ENG105 and either ENG106 or ENG107)
- Arts and Humanities cognate (9 credits)
- People and Society (Social Sciences) cognate (9 credits)
- Mathematics - two semesters of calculus (e.g. MTH161, MTH162) plus one approved statistics or computer programming course (e.g. MSC204 or CSC120)
- Five writing intensive courses (W) beyond ENG105 and 106 or 107. Students are required to write at least 4000 words in each W course. Writing assignments will be graded on both content and style. All literature and modern language literature courses receive W credit.

**General Education requirements and Cognates**: In order to fulfill the University of Miami’s General Education requirements, students must complete courses in English composition and Mathematics, as well as five writing intensive courses. In addition, students must complete a 9-credit cognate in each of the three “areas of knowledge”: Arts and Humanities, People and Society (Social Sciences) and Science, Technology, Engineering and Mathematics (STEM). All undergraduate students in the Rosenstiel School will be required to complete the Arts and Humanities cognate but will fulfill their STEM cognate requirement through their major. Students in Marine Affairs will fulfill their People and Society cognate requirement through their minor. Students in Marine Science may elect to fulfill the People and Society cognate requirement with a Marine Policy cognate or minor (see pg 23). Cognates integrating study abroad courses are also available Information on cognates, along with a search engine, is available at: www.miami.edu/cognates
MARINE SCIENCE/BIOLOGY

Marine Science 111 (Intro Marine Science), 215 (Marine Chemistry), 230, 232 (Marine Biology with lab), 301 (Physical Oceanography), either 216 (Marine Chem lab) or 302 (Phys Oceanogr lab), and 12 elective credits in Marine Science, at least 6 of which must be at the 300-level or higher Biology 150, 151 (General Bio with lab), 160, 161 (Evolution & Biodiversity with lab), 250 (Genetics), 255 (Cellular & Molecular Bio), 330 (Ecology), 360 (Physiology) and twelve** credits of elective as described for Biology majors for a total of 34 credits Chemistry 111, 112, 113, 114 (Chem. Principles I, II, with labs), 201, 202*, 205, 206* (Organic Chem I and II with labs). A minor in Chemistry is earned with an adequate CHM GPA. Geological Science 110/114 (Earth System, with lab) or GSC111 (Earth System History) Mathematics 161 and 162 (Calculus I and II) plus an approved statistics or computer science course Physics 205, 206, 207, with one laboratory; or 205, 210 with one laboratory; or 101, 102, 106 and 108 3 credits of 300+ level electives (200-level courses may be eligible if they require prerequisites). 3 credits of elective

* CHM 202/206 may be replaced by courses leading to a minor in one of Chemistry, Computer Science, Geological Science, Mathematics, Microbiology and Immunology, or Physics.
**MSC 230 and one 300 level Biology elective count towards both the Marine Science and Biology major.

SAMPLE CURRICULUM– MARINE SCIENCE/BIOLOGY

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**MARINE SCIENCE/CHEMISTRY**

Marine Science 111(Intro Marine Science), 215 (Marine Chemistry), 216 (Marine Chemistry lab), 230 (Marine Biology), 301 (Physical Oceanography), either 232 (Marine Bio lab) or 302 (Phys Oceanogr lab), and 12 credits of elective in Marine Science at least 6 of which must be at the 300-level or higher.

Biochemistry and Molecular Biology 401 (Biochemistry for Medical Sciences)

Biology 150/151 (General Bio with lab), or 160/161 (Evolution & Biodiversity with lab)

Chemistry 111, 112, 113, 114 (Chem. Principles I, II, with labs), 201, 202, 205, 206 (Organic Chem I and II with labs), 304 (Structural ID of Organics), 316 (Analytical Chem), 320 (Instrumental Methods), 360, 364 (Physical Chem I with lab), 365 (Physical Chem II), 441 (Inorganic Chem) and one of 317 (Chem. Food), 401* (Environmental Chem), or any 500 level course, as described for the Chemistry major.

Geological Science 110/114 (Earth System, with lab) or GSC111 (Earth System History)

Mathematics 161 and 162 (Calc I & II) plus an approved statistics or computer science course

Physics 205, 206, 207, with one laboratory; OR 205, 210 with one laboratory

3 credits of elective

*CHM401 will count either as a MSC or CHM elective

**SAMPLE CURRICULUM - MARINE SCIENCE/CHEMISTRY**

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MARINE SCIENCE/GEOLOGICAL SCIENCES

Marine Science 111 (Intro Marine Science), 215 (Marine Chemistry), 230 (Marine Biology), 301 (Physical Oceanography), two laboratories from 216 (Marine Chem lab), 232 (Marine Bio lab) and 302 (Phys Oceanogr lab) and 12 credits of elective in Marine Science, at least 6 of which must be at the 300-level or higher.

Biology 150/151 (General Bio with lab), or 160/161 (Evolution & Biodiversity with lab)

Chemistry 111, 112, 113, 114 (Chem. Principles I, II, with labs)

Geological Sciences 110,114 (Earth System, with lab), 111 (Earth Syst. History) 260 (Earth Materials), 360 (Depositional Systems), 380 (Paleontology & Stratigraphy), 410 (Geochemistry) or 420 (Geophysics), 440 (Igneous & Metamorphic Petrology), 480 (Structures), 482 (Field methods), and 580 (Summer Field Geology) as described for the Geological Sciences major for a total of 38 credits

Mathematics 161, 162 (Calc I, II), plus an approved statistics or computer science course

Physics 205, 206, 207, with one laboratory; OR 205, 210 with one lab. OR 101,102, 106, 108

3 credits of 300+ level electives (200-level courses may be eligible if they require prerequisites). 3 credits of elective

SAMPLE CURRICULUM – MARINE SCIENCE/GEOLOGICAL SCIENCES

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**MARINE SCIENCE/PHYSICS**

Marine Science 111 (Intro Marine Sci), 215 (Marine Chemistry), 230 (Marine Biology), 301, 302 (Physical Oceanography with lab), either 216 (Marine Chem lab) or 232 (Marine Bio lab), and 12 credits of elective in Marine Science, at least 6 of which must be at the 300-level or higher.

Biology 150/151 (General Bio with lab), or 160/161 (Evolution & Biodiversity with lab)

Chemistry 111, 112, 113, 114 (Chem. Principles I, II, with labs)

Geological Sciences 110, 114 (Earth System, with lab), or 111 (Earth Syst. History)

Mathematics 161, 162, 211 (Calculus I, II, III), 210 (Linear Algebra), 311 (Ordinary Differential Equations), plus an approved computing or statistics course. A **minor in Mathematics** is earned with an adequate MTH GPA.

Physics 205, 206, 207, 208, 209, (University Physics I, II, III with labs), 321 (Thermodynamics & Kinetic Theory), 340 (Classical Mechanics), 350, 351 (Intermediate Electricity & Magnetism I, II), 360 (Modern Physics), 362 (Seminar), 540 (Classical Mech II), and 560 (Quantum Mechanics). Physics 210 may be substituted for Physics 206 and 207

3 credits of 300+ level electives (200-level courses may be eligible if they require prerequisites).

3 credits of elective

**SAMPLE CURRICULUM – MARINE SCIENCE/PHYSICS**

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9
MARINE SCIENCE/COMPUTER SCIENCE

Marine Science 111 (Intro. Marine Science), 215 (Marine Chemistry), 230 (Marine Biology), 301, 302, (Physical Oceanography with lab), 321 (Programming for Atmospheric/Marine Science), either 216 (Marine Chem lab) or 232 (Marine Bio lab), and 9 credits of elective in MSC, at least 6 of which must be at the 300-level or higher.

Biology 150/151 (General Bio with lab), or 160/161 (Evolution & Biodiversity with lab)
Chemistry 111, 112, 113, 114 (Chem. Principles I, II, with labs)
Geological Sciences 110,114 (Earth System, with lab), or 111 (Earth Syst. History)
Mathematics 161, 162 (Calculus I, II), 210 (Linear Algebra), 309 (Discrete Math), 311 (Ordinary Differential Equations), plus an approved statistics course (MSC204, MTH 224). A minor in Mathematics is earned with an adequate MTH GPA.

Computer Science 120, 220 (Programming I, II), 314 (Computer Architecture), 322 (Programming and UNIX), 431 (Intro to Software Engineering) and 6 credits of approved electives
Physics 205, 206, 207 and one semester of laboratory
3 credits of 300+ level electives (200-level courses may be eligible if they require prerequisites).
3 credits of elective

SAMPLE CURRICULUM – MARINE SCIENCE/COMPUTER SCIENCE

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**MARINE SCIENCE/MICROBIOLOGY AND IMMUNOLOGY**

Marine Science 111 (Intro Marine Science), 215 (Marine Chemistry), 230, 232 (Marine Biology with lab), 301 (Physical Oceanography), either 216 (Marine Chem lab) or 302 (Phys Oceanogr lab), and 12 elective credits in Marine Science, at least 6 of which must be at the 300-level or higher Biochemistry and Molecular Biology 401 (Biochemistry for the Medical Sciences) Biology 150/151 (General Bio with lab), and 160/161 (Evolution & Biodiversity with lab) Chemistry 111, 112, 113, 114 (Chem. Principles I, II, with labs), 201, 202, 205, 206 (Organic Chem I and II with labs). A **minor in Chemistry** is earned with an adequate CHM GPA.

Geological Science 110/114 (Earth System, with lab) or GSC111 (Earth System History) Mathematics 161 and 162 (Calc I & II) plus an approved statistics or computer science course Microbiology and Immunology 301 or 303/304 (Intro Microbiology & Immunology),319 (Innate Immunity), 321 (Immunobiology), and 16 credit hours in Microbiology and Immunology electives earned from: MIC 322 (Medical Parasitology), 323 (Microbial Pathogenesis), 434 (Microbial Genetics & Molecular Immunology), 436 (Virology), 441 (Colloquium), and 451-456 (Special Projects). In addition, (BIL 352 or BIL 554) and/or (BIL 255) and/or (GSC 310) may also be used. MSC 462 and/or MSC 465 may double count as both MSC and MIC upper electives.

Physics 205, 206, 207, 208/209 or 101, 102, 106, 108

3 credits of 300+ level electives (200-level courses may be eligible if they require prerequisites).

3 credits of elective

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**SAMPLE CURRICULUM - MARINE SCIENCE/MICROBIOLOGY AND IMMUNOLOGY**

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**MARINE SCIENCE/BIOCHEMISTRY AND MOLECULAR BIOLOGY**

Marine Science 111 (Intro Marine Science), 215, 216 (Marine Chemistry with lab), 230, 232 (Marine Biology with lab), 301 (Physical Oceanography), and nine elective credits in Marine Science, at least 6 of which must be at the 300-level or higher. Three credits from BMB501/511/545 may double count if Marine Science related.

Biochemistry 401 (Biochem for Biomed), 402 (Intro to Exp BMB), 506 (Principles of Biochemistry and Molecular Biology), 507 (Proteins and Enzymes), 509 (Molecular Biology of the Gene), plus 4 credits from among 145, 151, 245, 251 (Soph. Seminar), 411, 501 (Seminars), 511 (Topics) and 545 (Research)

Biology 150, 151 (General Bio with lab), and 160, 161 (Evolution & Biodiversity), 250, (Genetics), 255 (Cellular & Molecular Bio), one lab from (251 or 252) and MIC301 (Intro Microbiology & Immunology)

Chemistry 111, 112, 113, 114 (Chem. Principles I, II, with labs), 201, 202, 205, 206 (Organic Chem I and II with labs). A **minor in Chemistry** is earned with an adequate CHM GPA.

Geological Science 110/114 (Earth System, with lab) or GSC111 (Earth System History)

Mathematics 161 and 162 (Calc I & II) plus statistics (MSC204, MTH224 or BIL331)

Physics 205, 206, 207, 208/209 or 101, 102, 106, 108

3 credits of 300+ level electives (200-level courses may be eligible if they require prerequisites). 3 credits of elective

**SAMPLE CURRICULUM - MARINE SCIENCE/BIOCHEMISTRY**

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*10 Elective courses include: 2 MSC, 3 Arts and Humanities cognate, 3 People and Society cognate and 2 free elective courses*
**MARINE SCIENCE/MATHEMATICS**

Marine Science 111 (Intro. Marine Science), 215 (Marine Chemistry), 230 (Marine Biology), 301, 302, (Physical Oceanography with lab), 321 (Programming for Atmospheric/Marine Science), either 216 (Marine Chem lab) or 232 (Marine Bio lab), and 6 credits of elective in MSC, at least 3 of which must be at the 300-level or higher.

Biology 150/151 (General Bio with lab), or 160/161 (Evolution & Biodiversity with lab)

Chemistry 111, 112, 113, 114 (Chem. Principles I, II, with labs)

Geological Sciences 110,114 (Earth System, with lab), or 111 (Earth Syst. History)

Mathematics 161, 162 (Calculus I, II), 210 (Linear Algebra), 230 (Abstract Math), 310 (Multivariable Calculus), 311 (Ordinary Differential Equations), 433 (Advanced Calculus) or 533 (Real Analysis), 461 (Modern Algebra) or 561 (Abstract Algebra), 512 (Complex Analysis), and one of the following two-course sequences: 513-514 (Partial Differential Equations I, II) or 515-516 (Ordinary Differential Equations, Dynamics). The above constitutes the Applied Analysis track. Other Mathematics tracks including Computational Mathematics and Probability and Statistics are also possible.

Two courses from: Computer Science 120 (Programming I), Atmospheric Science 103 (Survey of Modern Meteorology), or one statistics course from (MTH 224 or MSC 204).

Physics 205, 206, 207, with one Laboratory (208 or 209)

3 credits of 300+ level electives (200-level courses may be eligible if they require prerequisites). 3 credits of elective

**SAMPLE CURRICULUM – MARINE SCIENCE/MATHEMATICS**

**Freshman Year**

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**Sophomore Year**

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**Junior Year**

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**Senior Year**

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**Total Credits:** 31 cr

*10 Elective courses include: 2 MSC, 3 Arts and Humanities cognate, 3 People and Society cognate and 2 free elective courses*
**METEOROLOGY/MARINE SCIENCE**

Atmospheric Science: 103 (Survey of Modern Meteorology), 118 (Weather Topics), 243 (Weather Forecasting), 303 (Meteorol. Instrumentation), 305 (Thermodynamics), 405, 406 (Atmospheric Dynamics I, II), 407 (Weather Analysis), 409 (Physical Meteorology), and either 220 (Global Climate Change) or 307 (Physics of Climate)

Marine Science 111 (Intro. Marine Science), 215 (Marine Chemistry), 230 (Marine Biology), 301, 302, (Physical Oceanography with lab), either 216 (Marine Chem lab) or 232 (Marine Bio lab), and 9 credits of elective in MSC, at least 6 of which must be at the 300-level or higher.

Biology 150/151 (General Bio with lab), or 160/161 (Evolution & Biodiversity with lab)

Chemistry 111, 112, 113, 114 (Chem. Principles I, II, with labs)

Computer Science 120 (Programming)

Geological Sciences 110,114 (Earth System, with lab), or 111 (Earth Syst. History)

Mathematics: 161, 162 (Calculus I, II), 210 (Linear Algebra), 310 (Multivariate Calculus), and either 311 (Ordinary Differential Equations) or 320 (Numerical Analysis). A minor in Mathematics is earned with adequate MTH GPA.

Physics: 205, 206, 207 and 208

Statistics: MSC 204 or MTH 224

**SAMPLE CURRICULUM - METEOROLOGY/MARINE SCIENCE**

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**Junior Year**

**Senior Year**

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*9 Elective courses include: 3 MSC, 3 Arts and Humanities cognate, and 3 People and Society cognate courses*
MARINE SCIENCE WITH OTHER APPROVED SCIENCE MAJOR

Marine Science 111 (Intro. Marine Science), 215 (Marine Chemistry), 230 (Marine Biology), 301 (Physical Oceanography), two laboratories from (216 Marine Chem lab, 232 Marine Bio lab or 302 Physical Oceanogr lab), and 12 credits of elective in MSC, at least 6 of which must be at the 300-level or higher.

Biology 150/151 (General Bio with lab), or 160/161 (Evolution & Biodiversity with lab)
Chemistry 111, 112, 113, 114 (Chem. Principles I, II, with labs)
Geological Sciences 110,114 (Earth System, with lab), or 111 (Earth Syst. History)
Mathematics: 161, 162 (Calculus I, II), plus an approved statistics or computer science course
Physics 205,206,207 and one semester of laboratory; or Physics 101, 102, 106 and 108.
3 credits of 300+ level electives (200-level courses may be eligible if they require prerequisites).
3 credits of elective

Plus all requirements of the second major. One course in the second major may double count for MSC. See advisor for details.
MARINE SCIENCE COURSE DESCRIPTIONS

(Please note – the semester(s) in which a course is offered is subject to change)

Courses for non-major/non-minor credit only – see UM Bulletin for course descriptions:

101  Survey of Oceanography (3 cr)
104  Molecules of Life (3 cr)
107  Life in the Sea (3 cr)
108  Environmental Oceanography (3 cr)
115  Marine Environments of South Florida (Summer Scholars program only, 3 cr)
111  Introduction to Marine Science (3 cr) Offered Fall Semester
Geological, physical, chemical and biological processes of the world's oceans; the role of the oceans in
global dynamics and ocean management. Laboratory and Field trips included.

118  Current Weather and Climate Topics (1 cr) Offered Spring Semester

180  Marine Science Seminar (1 cr) Offered Spring Semester
Seminar in current research as conducted by Marine Science faculty and graduate students. This course
is intended as an introduction for first year students to contemporary research topics.

204  Environmental Statistics (3 cr) Offered Fall & Spring Semesters
This introductory course provides an overview of parametric and nonparametric statistics with an
emphasis on applications in the analysis of environmental data. MSC204 does not fulfill the MSC
elective requirement for the major or minor, but does fulfill the statistics requirement.

205  Mathematical Methods of Marine Science (3 cr) Offered Spring Semester
Is an applied mathematics course to provide students with the mathematical tools required to pursue
advanced topics in Marine Science. Prerequisite: MTH162

210  The Dynamic Oceans (3 cr) Offered Spring Semester
The principal means of observing and quantifying oceanic circulation including descriptive treatments
of ocean circulation at various time and length scales such as eddies, gyres, and strong currents such
as the Gulf Stream. Sea water properties, water masses, conservation principles, forcing mechanisms,
and the role of the oceans in earth's climate. Co-req: MTH161

215  Chemical Oceanography (3 cr) Offered Fall & Spring Semesters
An introduction to the chemistry of the oceans; descriptive chemical oceanography of the components
of ocean waters (metals, gases, organic compounds and nutrients); biogeochemical cycles in oceanic
systems. Prerequisite: CHM 112

216  Chemical Oceanography Laboratory (1 cr) Offered Fall & Spring Semesters
Chemical and physical methods in chemical oceanography; analytical and instrumental techniques
used to determine density, salinity, chlorinity, dissolved oxygen, nutrients and components of the
carbonate system. Co-req: MSC 215

220  Global Climate Change (3 cr) Offered Fall and Spring Semesters
The Earth’s climate and the role of natural and anthropogenic processes in shaping climate change.
Prerequisite: MSC 103, MSC 111, GSC 110 or GEG 120
222 Earth’s Climate (3 cr) Offered Spring Semester
This course will provide students with the foundation to better understand climate change on
geological to human timescales. Prerequisite: MSC 111, GSC 110 or GSC111, or Permission of
instructor

230 Introduction to Marine Biology (3 cr) Offered Fall Semester
The sea as an environment; marine life, its special problems and adaptations; emphasis on Caribbean
organisms. Prerequisite: One semester of biology and chemistry with laboratories. Recommended Co-
req: MSC 232

232 Marine Biology Laboratory (1 cr) Offered Fall Semester
Laboratory exploring ecology, physiology and behavior of marine organisms in South Florida marine
habitats; exercises cover laboratory techniques in behavior, functional morphology, productivity,
fisheries research, osmoregulation and community ecology. Co-req: MSC 230

240 Introduction to Marine Geology (3 cr) Offered Spring Semester
The principal marine geological environments of the world, their substrate, their sediments, their flora
and fauna, and their evolution through time. Prerequisite: GSC 110 or 111

301 Introduction to Physical Oceanography (3 cr) Offered Fall and Spring Semesters
Application of the laws of physics to the study of the properties and circulation of the world's oceans
and atmosphere. Prerequisite: MTH162; PHY 101 or 205

302 Introduction to Physical Oceanography Lab (1 cr) Offered Fall and Spring Semesters
Laboratory exercises and field work on basic fluid mechanics applicable to the ocean. Prerequisite:
MTH162 and PHY 101 or 205

310 Living Resources of the Ocean (3 cr) Offered Spring Semester
Biology of marine fish and shellfish of major economic interest, techniques of harvesting, and resource
management. Prerequisite: MSC 230

313 Coastal Law (3 cr) Offered Fall Semester
Basic doctrines and public policy related to the use and regulation of the United States coastal zone
and seabed. Prerequisite: Junior standing

314 Ocean Law (3 cr) Offered Spring Semester
The principles of ocean law regarding ocean management; ocean delimitation and issues of
environmental ocean regulation within an international legal framework. Prerequisite: Junior standing

316 Global Primary Production (3 cr) Offered by announcement only
This course reviews the magnitude and the processes that shape primary production in terrestrial,
oceanic, and freshwater habitats. It includes the fate of primary production in the earth’s biomes, and
the role of terrestrial and aquatic productivity in regulating, and responding to, variable climate.
Prerequisite: BIL 160

317 Earth’s Biogeochemistry (3 cr) Offered Fall Semester
Outstanding features of planet Earth, including its vast oceans, climate and atmosphere, are strongly
impacted by life. Scientists investigate these impacts, such as ocean acidification, variable atmospheric
CO2 concentrations, coastal anoxia, and permafrost melting, through their biogeochemical dynamics.
Prerequisite: CHM 111 or 112
323  **Invertebrate Zoology** (3 cr) *Offered Spring Semester*
Biology of invertebrates, with emphasis on tropical and subtropical marine forms. Field work and combined lecture-laboratory sessions. Prerequisite: MSC 230

324  **The Biology of Fishes** (3 cr) *Offered Spring Semester*
Selected topics on the ecology and physiology of fishes. Lectures on reproduction, respiration, osmoregulation, sense systems, hormonal control. Prerequisite: MSC 230

325  **Biological Oceanographic Techniques** (3 cr) *Offered by announcement only*
Methodology of use to biological oceanographers. Field sampling of plankton and benthic biomass and productivity. Methodology of selected physical and chemical parameters. Experimental design and use of remote sensing in oceanographic studies. Prerequisite: MSC 230

326  **Marine Genomics** (3 cr) *Offered Spring Semester*
Intensive lecture/laboratory course with emphasis on using genomic tools to address an independent research project of importance in the marine sciences. Prerequisite: BIL 250 Co-req: MSC463

327  **Marine Animal Neurophysiology and Behavior** (3 cr) *Offered Fall Semester*
This course will look at neural and endocrine systems in a variety of marine animal invertebrate and vertebrate models and how these systems work together to control elements of physiology, sensation and perception of the environment and behavior. Prerequisite: MSC 230 and BIL255

328  **Introduction to Aquaculture** (3 cr) *Offered Fall Semester*
This course will provide an introduction to the field of aquaculture, which represents one of the fastest growing industries in food production in the world and is a field that offers exciting job opportunities in science, business, marketing, resource management, and socioeconomics. Pre-requisite: MSC111 Pre-requisite/Co-req: MSC230

329  **Marine Vertebrate Zoology** (3 cr) *Offered Spring Semester*
The course will be a comprehensive examination of the form and function of the vertebrate lineage of marine animals from early chordates to the evolution of cartilaginous and bony fish and the emergence of tetrapods, those that evolved from marine ancestors and have since returned to the seas.
Prerequisite: MSC 230

333  **Oceans and Human Health** (3 cr) *Offered Spring Semester*
The focus of this course is on the present, future, and potential effects of oceanic processes and marine organisms on human health and wellbeing and on human impacts on the marine environment. Pre-requisite: MSC 230

340  **Ocean Policy** (3 cr) *Offered Fall Semester*
Analysis of ocean policy issues in US fisheries, marine conservation and marine protected areas, marine pollution, coastal management and regulation of offshore oil and gas activities.

342  **Decision Making and the Environment** (3cr) *Offered Spring Semester*
A basic, critical appreciation of interdisciplinary decision theory as applied to natural resources management. Specific goals include comprehension of: decision making under uncertainty, evolutionary social science, managing common pool resources, and behavioral economics.
345 Economics of Natural Resources and the Environment (3 cr) Offered Spring Semester
A comprehensive overview of the economics of national, international, and global environmental problems. Economic reasoning is used to examine causes and consequences of environmental and resource problems, and measures for dealing with them. Prerequisite: ECO211

346 Climate Science and Policy (3cr) Offered Spring Semester
The scientific evidence for, and the projected consequences of, climate change. The political and geo-engineering responses to the problem. Prerequisites: MSC111, ATM103 or ECS111.

350 Survey of Marine Mammals (3 cr) Offered Spring Semester
The evolution and ecology of the cetaceans, pinnipeds, manatees and allies. The natural history, zoogeography, physiology, husbandry, and biochemical aspects of each species are emphasized. Prerequisites: MSC 230

351 Physical-Biological Interaction in Ocean Ecosystems I (3 cr) Offered Fall Semester
Part 1 of a 2 course sequence encompassing physical oceanography, marine ecosystems and fisheries. Prerequisites: MTH 162 or 172

352 Physical-Biological Interaction in Ocean Ecosystems II (3 cr) Offered Spring Semester
Part 2 of a 2 course sequence encompassing physical oceanography, marine ecosystems and Prerequisites: MSC 352 and Prerequisite/Co-req: MSC204 or MTH224

355 Limnology (3 cr) Offered Spring Semester
This course is an introduction to the physical, chemical, and biological properties of freshwater ecosystems. It emphasizes the ecological process of lakes, rivers, and to less extent, streams. The role of watershed processes is considered in the context of management of rivers and estuaries. Prerequisite: MSC 230 or Permission of instructor

364 Life in Moving Fluids (3 cr) Offered Fall Semester
The physical characteristics of air and water are described in relation to various flow phenomena that play a part in life functions. Adaptations of form and function reflect the very different properties of the media (air and water) of terrestrial and aquatic life. Prerequisite: PHY 101, MSC 230, or BIL 265

365 Tropical Coastal Ecosystems (3 cr) Offered Spring
This course will cover basic concepts of the ecology, management, conservation, and restoration of tropical marine ecosystems. The ecosystems and habitats to be discussed include coral reefs, seagrass beds, and mangrove forests. Prerequisite: MSC 230 and Junior standing

371 Readings in Marine Science (1-2 cr) Offered Fall and Spring Semesters
Library research with faculty supervision; bibliography to be submitted in preparation for laboratory and/or field research project.

372 Special Topics in Marine Science (1-2 cr) Offered Fall and Spring Semesters
Content varies by semester and is indicated in parentheses following course number and title in class schedule. Requires permission of instructor

380 Field Studies in Marine and Aquatic Science (1-4 cr) Offered by announcement only
Field course to selected marine, estuarine and/or aquatic sites in the United States and abroad. Travel fee may be required.
381  **Marine Field Ornithology** (1-4 cr) *Offered by announcement only*
This course will provide an introduction to waterbird biology and conservation, including a variety of
different field trips to waterbird communities.

403  **Introduction to Ocean Engineering** (3 cr) *Offered Fall Semester*
Introduction to analytical and experimental techniques in coastal and harbor engineering, offshore
structures, ships and ship dynamics, underwater technology, and underwater acoustics. Prerequisites:
MTH 311

410  **Marine Conservation** (3 cr) *Offered by announcement only*
An advanced undergraduate course in conservation science with case studies and field work; it is
designed to cover marine ecology and the science information needs of tropical marine parks and
protected areas with a focus on the particular threats to Caribbean protected areas; Prerequisite:
Permission of instructor.

411  **Projects in Marine Science** (1-3 cr) *Offered Fall and Spring Semesters*
Individual, independent research with faculty supervision. A formal written report is required.
Prerequisite: MSC 371, and Permission of instructor.

415  **Coral Reef Management** (3 cr) *Offered Spring Semester*
This interdisciplinary course examines the nature of coral reef science and management; biological,
environmental, ecological and socioeconomic aspects of coral reef science, coral reef management
problems and approaches at local to global scales, and the implications of climate change for coral reef
science and management. Prerequisite: MSC 230

417  **Marine Biota and Biogeochemical Cycles** (3 cr) *Offered Fall Semester*
The distribution of dissolved and particulate materials in the sea is not uniform in time and space. This
variability reflects the diverse sources, transformations, and sinks of chemical constituents in the sea.
This course provides an introduction to marine biogeochemistry stressing the role of marine organisms.
Prerequisite: MSC317

420-424: **UGalapagos courses** (see pg. 22)

432  **Comparative Ecology of Terrestrial and Marine Systems** (3 cr) *By announcement only*
The course stresses proximate mechanisms and underlying evolutionary processes. Analysis methods
and models of various ecosystems are compared and critiqued. Prerequisites: MTH162, BIL 330

460  **Spatial Applications in Marine Science** (3 cr) *Offered Fall and Spring Semesters*
The concepts and marine applications of Geographic Information Systems. Every class period will
entail short class lectures and hands on computer based GIS exercise on marine science related issues.
Students will learn how to use ArcGIS 9.2 and create simple GIS models.

462  **Marine Biomedicine** (3 cr) *Offered Spring Semester*
The course will cover diverse bioactive molecules that are derived from marine sources ranging from
sponges to sharks. The isolation and characterization of these compounds as well as their potential
application in clinical medicine and human health will be reviewed. Prereq: BIL 255 & CHM 112

463  **Marine Conservation Genetics** (3 cr) *Offered Spring Semester*
This course seeks to integrate lectures, fieldwork and laboratory genetics to enhance an understanding
of biodiversity, genetic diversity, and current conservation issues. Co-req: MSC463
**464 Marine Comparative Immunology Lab (1 cr) Offered Fall Semester**
The laboratory course will cover immunology techniques used in the assessment of immune function and immune reactivity in diverse marine taxa from sponges to fish to mammals. Prerequisite/ Co-req: MSC 465

**465 Comparative Immunology (3cr) Offered Fall Semester**
The immune function in diverse marine taxa from sponges to fish and the evolution of immune mechanisms from a comparative point of view. Adaptations related to living in a microbe-rich marine environment will be highlighted. Prerequisite: BIL 250 and 255

**466 Environmental Physiology: Oxygen, Water and Ion regulatory Stress (3 cr) Fall Semester**
This intensive laboratory course combines and elaborates on concepts learned in BIL 360. Topics include homeostasis, interactions with the external environment, and life with limited oxygen and water. Prerequisite: BIL360 &Permission of instructor.

In addition, any 500 level courses offered by The Rosenstiel School (AMP, MAC, MAF, MBF, MGG, MPO and RSM) are open to juniors and seniors, with permission of the instructors, and may count as MSC electives. Prerequisites apply.

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**Study Abroad**

UGalapagos, the UM semester abroad program in the Galapagos Islands is described below. Study abroad affiliations with universities in Australia (James Cook, Flinders, Woolongong), Britain (Cardiff, Southampton), and elsewhere allow students to explore marine issues and communities in a variety of physical and political contexts and to network with fellow marine science students from around the world. See http://www.miami.edu/index.php/study_abroad for a full list of programs. Study abroad is also possible at institutions without formal exchange agreements with UM. See your advisors for details.

Students may apply scholarships and financial aid to study abroad programs. Preliminary applications should be made in the spring of the freshman year to ensure that curricular requirements are met.
UGalapagos

UGalapagos is an exciting semester study abroad program that takes students and University of Miami faculty to the famed Galapagos Islands for a field-oriented semester of study. Through an academic partnership with the Isabela Oceanographic Institute, located in the community of Puerto Villamil on Isabela Island, UM offers a full five-course (15 credit) semester each Spring tailored to Marine Science students. Courses are taught sequentially as intensive two-week experiences by RSMAS faculty. See http://ugalapagosspring.miami.edu.

420  Political Ecology of the Galapagos (3 cr)
This field course in the Galapagos National Park offers a rare chance to examine the human interactions in this highly politicized landscape of conservation. Students practice the political ecology approach for doing ethnographic fieldwork and explore how it can lead to wiser resource management. Prerequisite: Permission of Instructor.

421  Terrestrial Biology and Adaptations of the Galapagos (3 cr)
This course will examine the terrestrial plant and animal life of Isabela Island, discuss the biology and how it adapted to life on Isabela. Through field and laboratory exercises we will explore the power of organisms’ DNA in shaping life into unique forms like those famously present in today’s Galapagos. Prerequisite: BIL 160 and Permission of Instructor.

422  Marine Ecology of the Galapagos (3 cr)
This course focuses on marine ecosystems of the Galapagos, emphasizing near-shore environments. Topics will include how the unique location and oceanography of the Galapagos have shaped the species composition of resident and migrant marine animals. The role of genetic drift, local habitat characteristics and natural selection on marine ecosystems will be examined. Prerequisite: BIL 160 or MSC 230 and Permission of Instructor. MSC422 fulfills BIL 330 requirement for MSC students.

423  Oceanography, Climatology and Conservation Biology of the Galapagos (3 cr)
The Galapagos are located in a uniquely productive area of the sea, which has allowed the development of a rich and unique marine biota. The first week of the course will carry the students through the dynamic, climatic, and oceanographic circumstances that determine the unique character of the Galapagos. The second week will cover scientific evaluation of the threats to the marine biodiversity of the Galapagos, focusing on sharks, penguins, sea turtles and other at-risk species and habitats. Prerequisite: BIL 160 or MSC 230 and Permission of Instructor.

424  Origin and Geology of the Galapagos Islands (3 cr)
This course will explore the origin and geology of volcanic oceanic islands, using the Galapagos Islands as a natural laboratory. The emphasis of this course will be to lay out the underlying geological processes that have led to the formation of the islands and to their present state, and then to explore the ways the physical environment has influenced adaptation and biodiversity. Prerequisite: Permission of Instructor. MSC424 fulfills GSC requirement for MSC students.
MINOR OR COGNATE IN MARINE POLICY
For BS students in Marine Science, a cognate (9 credits or 3 courses) or minor (15 cr or 5 courses) in Marine Policy may be used to fulfill the People and Society cognate requirement. Courses for the cognate or minor may be chosen from the following: MSC 111 (cognate only), 310, 313, 314, 340, 345, 346, 410, 415, 420 and 460 as well as MAF 501, 504, 510, 512, 518, and 530. Courses applied to the minor may not be applied to the major.

MINOR IN CLIMATE SCIENCE AND POLICY
For Marine Science or Marine Affairs students, a minor (15 cr or 5 courses) in Climate Science and Policy may be used to fulfill the People and Society cognate requirement. Courses for the minor are: MSC346 plus three of A (ATM102 or ATM 103, MSC220, MSC222 and ATM307) plus one of B (MSC 313, 314, 340, 342, RSM 520). Courses applied to the minor may not be applied to the major. Note: students in Meteorology/Marine Science should replace ATM102/103 with an additional course from the “B” list.

Honors in Marine and Atmospheric Science

The honors in Marine and Atmospheric Science Program gives you an opportunity to do original research in an area of your choice, working closely with a faculty member. In addition to the requirements for the Bachelor of Science in Marine and Atmospheric Science or Bachelor of Arts in Marine Affairs degree, a student must select a three member faculty thesis committee, complete at least 4 credits of independent research, and present a poster of the research at the RSMAS Undergraduate Research Form or the UM Research and Creativity Forum. To graduate with “Departmental Honors in Marine and Atmospheric Science”, have a final G.P.A. of 3.5 in Marine Science, Meteorology or Marine Affairs and 3.5 overall, and have your senior thesis reviewed and accepted by your faculty committee.
Student Activities
Marine Science students complement classroom study with active participation in marine related clubs and organizations.

Aquarium Club - The club maintains the coral culture tanks in the MSC laboratory, and works with coral and invertebrate culture projects in the field, and on the RSMAS campus.

SCUBA Club - The scuba club is open to students across the campus and is one of the most active student organizations. Members must be certified divers before joining. The club meets weekly for speakers and trips.

RhoRhoRho is the marine and atmospheric honor society. Students with a 3.0 average who have made a significant contribution to environmental awareness and scholarship are invited to join.

Marine Mammal Stranding Network - This student organized network works with the National Marine Fisheries Service to respond to marine mammal strandings in South Florida. The club organizes training for members in photo identification, anatomy, physiology, ecology and pathology.

Propeller Club - The student chapter of the Propeller Club is sponsored by the cruise line, shipping and business interests at the port of Miami. Students network with industry personnel and address projects and concerns of the local shipping community.

Earth Alert - Open to students across campus, Earth Alert members think globally and act locally to improve the environment on and off campus. The club is very active in promoting recycling, highway and beach cleanups, and environmental education.
FACULTY OF THE MARINE SCIENCE PROGRAM

Associate Dean for Undergraduate Education
William Drennan, Ph. D.
University of Waterloo
Air-sea interaction, waves and turbulence

Director, Marine Science Program
Gary Hitchcock, Ph.D.
University of Rhode Island
Phytoplankton ecology

Associate Director
Donald Olson, Ph.D.
Texas A&M University
Ocean circulation dynamics, mesoscale phenomena, ecosystem dynamics

Coordinator for Marine Affairs
Maria E. Estevanez, MBA, M.A. in Marine Affairs
University of Miami
Marine resource allocation and policy

Academic Advisor
Lynne Fiebe, Ph.D.
University of Miami
Neurophysiology, electrophysiology of marine organisms

Academic Advisor
M. Danielle McDonald, Ph.D.
McMaster University
Animal physiology, molecular biology, pharmacology and toxicology

Academic Advisor and MSC Laboratory Manager
Liza Merly, Ph.D.
Florida International University
Immunology, Marine Biology

Academic Advisor
Larry Peterson, Ph.D.
Brown University
Paleoclimatology and global change

Teaching Faculty

Elizabeth Babcock, Ph.D.
University of Washington
Marine Conservation Biology

Andrew Bakun, Ph. D.
Oregon State University
Fisheries Biology

Harry DeFerrari, Ph.D.
Catholic University
Underwater acoustics, signal processing

Rana Fine, Ph.D.
University of Miami
Chemical oceanography and tracers

Peter W. Glynn, Ph.D.
Stanford University
Coral reef biology/ecology

Rick Riera-Gomez
RSMAS Diving Safety Officer
Scientific Diving

Dennis Hansell, Ph.D.
University of Alaska
Biogeochemical cycles

Brian Haus, Ph. D.
University of Michigan
Air-sea interaction, ocean engineering

Anthony J. Hynes, Ph.D.
University of Leeds
Atmospheric Chemistry, laser spectroscopy

Mohamed Iskandarani, Ph.D.
Cornell University
Numerical methods, ocean flow simulation

Igor Kamenkovich, Ph.D.
MIT/Woods Hole Oceanographic Institution
Ocean dynamics, large-scale ocean circulation
Ben Kirtman, Ph.D.
University of Maryland
El Niño prediction, dynamics and variations

Chris Langdon, Ph.D.
University of Rhode Island
Coral and algae primary production, coral reefs

Kevin Leaman, Ph.D.
MIT/Woods Hole Oceanographic Institution
Current profiling techniques

David Letson, Ph.D.
University of Texas at Austin
Natural resource economics

John McManus, Ph.D.
University of Rhode Island
Coral Reef Management

Sarah Meltzoff, Ph.D.
Columbia University
Coastal cultures, political ecology

Josefina Olascoaga, Sc.D.
CICESE, Baja California, Mexico
Biophysical interactions and ocean dynamics

Marjorie Oleksiak, Ph.D.
MIT/Woods Hole Oceanographic Institution
Evolutionary genomics

Claire Paris, Ph.D.
SUNY Stony Brook
Coastal oceanography, ecology

Pamela Reid, Ph.D.
University of Miami
Stromatolite geology

Mike Schmale, Ph.D.
University of Miami
Fish pathology and immunology

Daniel Suman, Ph.D., J.D.
Scripps Institution of Oceanography,
Law School, University of California Berkeley
Environmental law and policy

Peter Swart, Ph.D.
University of London-King College
Geochemistry

Gary Thomas, Ph.D.
University of Washington
Sustainable fisheries

John Van Leer, D.Sc.
MIT/Woods Hole Oceanographic Institution
Marine instrumentation, ocean dynamics

Jorge Willemsen, Ph.D.
University of Chicago
Applied marine physics

Jingfeng Wu, Ph.D.
University of Delaware
Marine geochemistry

Chidong Zhang, Ph.D
Pennsylvania State University
Tropical meteorology and climate

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Program Staff

Whitney Nolton
Program Manager

Earika Cenord
Office Supervisor