

UNIVERSITY
OF MIAMI

ROSENSTIEL
SCHOOL of MARINE &
ATMOSPHERIC SCIENCE



Undergraduate Marine Science Program
Student Advising Guide
2013-2014

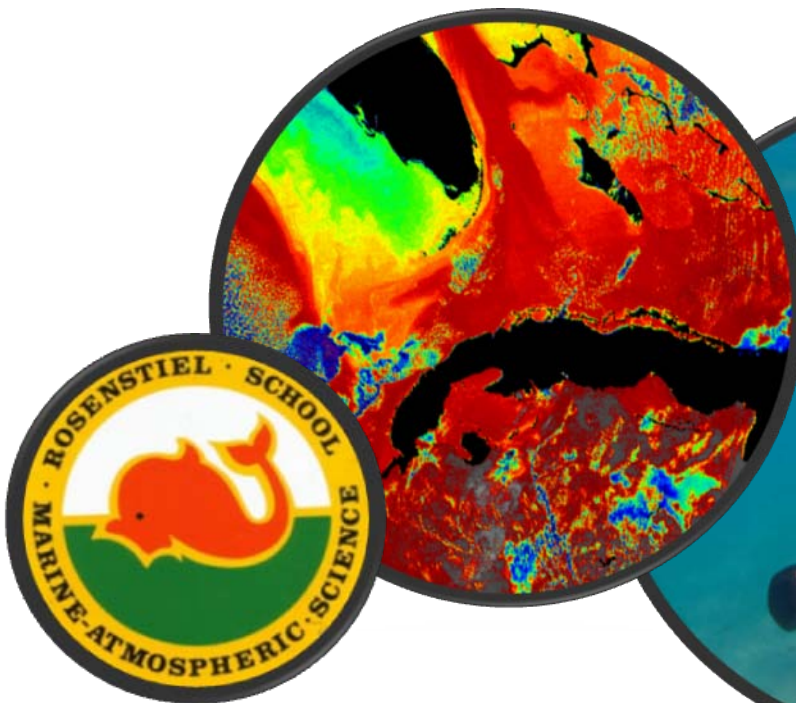




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INTRODUCTION

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 through May, the Marine Science (MSC) office on the University of Miami's Coral Gables welcomes visitors at 9:00-9:50AM Monday-Friday (except on holidays), immediately before the 10AM 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:

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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.

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.

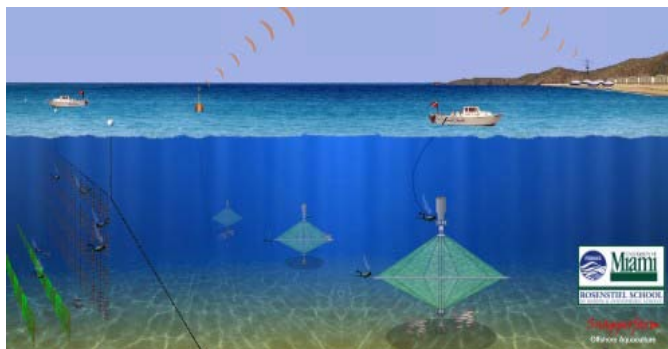
Marine Science/Geological Sciences

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.





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, General 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 150,160

Chemistry 111,112

Economics 211

Geological Sciences 110 or 111

Marine Science 111,215,230,313 or 314, 310 or 340, 345, 460

Nine credits of approved electives in Marine Science

One approved course in computer programming or statistics (e.g. MSC204)

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

The choice of courses for the minor must be approved by an advisor. Requirements for minors are listed on page 15, or 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	MTH 113	3
ENG 105	3	ENG 106	3
HUM #1	3	GSC 110	3
CHM 111	<u>3</u>	BIL 160	<u>4</u>
	15 cr		16cr

Sophomore Year

BIL 150	4 cr	MSC	3cr
MINOR	3	MINOR	3
MSC 230	3	ECO211	3
ELECTIVE	3	ELECTIVE	3
STATS	<u>3</u>	HUM #3	<u>3</u>
	16 cr		15cr

Junior Year

HUM #2	3 cr	MSC 345	3 cr
MSC 313	3	MINOR	3
MSC	3	MSC 215	3
ELECTIVE	3	ELECTIVE	3
300 ELEC	<u>3</u>	ELECTIVE	<u>3</u>
	15 cr		15 cr

Senior Year

300 ELECT	3cr	ELECTIVE	3cr
MINOR	3	MINOR	3
ELECTIVE	3	MSC 460	3
MSC 340	3	MSC	3
MSC	<u>3</u>	ELECTIVE	<u>3</u>
	15 cr		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/Computer Science, Marine Science/Geological Sciences, and Marine Science/Physics. 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 one of Mathematics, Microbiology and Immunology, Biochemistry and Molecular Biology or any Engineering discipline are also possible.

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 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 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 17). Cognates integrating study abroad courses are also available. Note: *transfer students* are exempt from the cognate requirements, but must complete nine credits in Arts and Humanities courses and nine credits in People and Society courses. Information on cognates, along with a search engine, is available at: www.miami.edu/cognates



MARINE SCIENCE/BIOLOGY (WITH CHEMISTRY MINOR)

Marine Science 111, 215, 216, 230, 232, 301 and 12 elective credits in Marine Science, at least 6 of which must be at the 300-level or higher

Biology 150, 151, 160, 161, 250, 255, 330, 360 and twelve* credits of elective as described for Biology majors for a total of 34 credits

Chemistry 111, 112, 113, 114, 201, 202, 205, 206

Geological Science 110/114 or GSC111

Mathematics 161 and 162 plus an approved statistics or computer programming course.

Physics 205, 206, 207, with one laboratory; or 205, 210 with one laboratory; or 101, 102, 106 and 108

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

*MSC 230 and one 300 level Biology elective count towards both the Marine Science and Biology major.

SAMPLE CURRICULUM- MARINE SCIENCE/BIOLOGY

Freshman Year				Sophomore Year			
MSC 111	3 cr	BIL 160	4 cr	CHM112	3 cr	BIL 250	3 cr
BIL150	4	BIL 161	1	CHM114	1	MSC 215	3
BIL151	1	CHM 111	3	MSC 230	3	MSC 216	1
ENG 105	3	CHM 113	1	MSC 232	1	GSC111	4
MTH161	<u>4</u>	ENG 106	3	STATS	3	SSC#1	3
		MTH 162	<u>4</u>	HUM#1	<u>3</u>	HUM#2	<u>3</u>
	15 cr		16 cr		15cr		17cr
Junior Year				Senior Year			
BIL 255	3 cr	BIL 330	3 cr	PHY 206	3 cr	MSC 301	3 cr
CHM 201	3	CHM 202	3	BIL 360	3	BIL/MSC	4
CHM 205	1	CHM 206	1	PHY Lab	1	SSC#3	3
MSC	3	PHY 205	3	MSC	3	PHY 207	3
SSC#2	3	MSC	3	BIL	3	Elective	<u>3</u>
BIL	<u>3</u>	HUM#3	<u>3</u>	Elective	<u>3</u>		16 cr
	16 cr		16 cr		16 cr		



MARINE SCIENCE/CHEMISTRY

Marine Science 111, 215, 216, 230, 232, 301 and 12 credits of elective in Marine Science at least 6 of which must be at the 300-level or higher

Biology 150/151 or 160/161

Chemistry 111, 112, 113, 114, 201, 202, 205, 206, 304, 316, 320, 360, 364, 365, and one of 401, 441, 520, 563, or Biochemistry and Molecular Biology 401 or 506 as described for the Chemistry major.

Geological Sciences 110/114 or GSC111

Mathematics 161 and 162 plus an approved statistics or computer programming course.

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

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

*CHM401 "Environmental Chemistry" will count either as a MSC or CHM elective

SAMPLE CURRICULUM - MARINE SCIENCE/CHEMISTRY

Freshman Year				Sophomore Year			
MSC 111	3 cr	CHM 112	3 cr	CHM 201	3 cr	CHM 202	3 cr
CHM 111	3	CHM 114	1	CHM 205	1	CHM 206	1
CHM 113	1	MTH 162	4	STAT	3	GSC 111	4
ENG 105	3	ENG 106	3	BIL 150	4	MSC 215	3
MTH 161	<u>4</u>	MSC180	1	BIL 151	1	MSC216	1
		HUM #1	<u>3</u>	SSC #1	<u>3</u>	HUM#2	<u>3</u>
	14 cr		15 cr		15 cr		15 cr
Junior Year				Senior Year			
CHM 304	3 cr	CHM 316	3 cr	CHM 360	3 cr	CHM	3 cr
MSC 230	3	MSC	3	CHM 364	1	CHM 365	3
MSC232	1	MSC	3	PHY 207	3	MSC 301	3
PHY205	3	PHY 206	3	PHY 208/9	1	SSC#3	3
SSC#2	3	Elective	<u>3</u>	MSC	3	MSC	3
HUM#3	<u>3</u>			Elective	<u>3</u>	CHM 320	<u>2</u>
	16 cr		15 cr		14 cr		17 cr



MARINE SCIENCE/GEOLOGICAL SCIENCES

Marine Science 111, 215, 216, 230, 232, 301 and 12 credits of elective in Marine Science, at least 6 of which must be at the 300-level or higher.

Biology 150/151 or 160/161

Chemistry 111, 112, 113, 114

Geological Sciences 110,111,114, 260,360,380,410 or 420, 440, 480,482, and 580 as described for the Geological Sciences major for a total of 38 credits

Mathematics 161 and 162 plus an approved statistics or computer programming course.

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

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

SAMPLE CURRICULUM – MARINE SCIENCE/GEOLOGICAL SCIENCES

Freshman Year				Sophomore Year			
MSC 111	3 cr	GSC 110	3 cr	GSC 260	4 cr	MSC 215	3 cr
GSC 111	4	GSC 114	2	MTH 161	4	MSC 216	1
CHM 111	3	CHM 112	3	BIL 150	4	MTH 162	4
CHM 113	1	CHM 114	1	BIL 151	1	GSC 360	4
ENG 105	<u>3</u>	ENG 106	3	SSC #1	<u>3</u>	Comp/Stat	<u>3</u>
		HUM #1	<u>3</u>		16 cr		15 cr
	14 cr		15 cr				
Junior Year				Senior Year			
GSC 410	3 cr	GSC 480	4 cr	GSC 482	2 cr	GSC 380	4 cr
MSC 230	3	PHY 206	3	MSC	3	MSC 301	3
MSC 232	1	HUM#3	3	GSC 440	4	MSC	3
PHY 205	3	MSC	3	PHY 207	3	Electives	<u>6</u>
SSC#2	3	MSC	<u>3</u>	PHY 208/209	1		
HUM#2	<u>3</u>			SSC#3	<u>3</u>		16 cr
	16 cr		16 cr		16 cr		
Summer Field Camp	GSC 580	4 cr					

MARINE SCIENCE/PHYSICS (WITH MATHEMATICS MINOR)

Marine Science 111, 215, 216, 230, 232, 301 and 12 credits of elective in Marine Science, at least 6 of which must be at the 300-level or higher.

Biology 150/151 or 160/161

Chemistry 111, 112, 113, 114

Geological Sciences 110, 114 or GSC111

Mathematics 161, 162, 210, 211, 311, plus an approved computer programming or statistics course.

Physics 205, 206, 207, 208, 209, 321, 340, 350, 351, 360, 362, 540, and 560.

(Physics 210 may be substituted for Physics 206 and 207)

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

SAMPLE CURRICULUM – MARINE SCIENCE/PHYSICS

Freshman Year				Sophomore Year			
MSC 111	3 cr	MTH 162	4 cr	PHY 207	3 cr	BIL 150	4cr
MTH 161	4	CHM 111	3	PHY 209	1	BIL 151	1
PHY 205	3	CHM 113	1	MTH 210	3	MSC 215	3
ENG 105	3	PHY 206	3	MTH 211	3	MSC 216	1
HUM #1	<u>3</u>	PHY 208	1	HUM#2	3	MTH 311	3
		ENG 106	<u>3</u>	CHM 112	4	SSC#1	<u>3</u>
	16 cr		15 cr	CHM 114	<u>1</u>		
					18 cr		15 cr
Junior Year				Senior Year			
GSC 111	4 cr	PHY 321	3 cr	PHY 560	3 cr	PHY 360	3 cr
Elective	3	PHY 351	3	PHY 540	3	PHY362	1
PHY 340	3	MSC 301	3	SSC#2	3	Elective	3
MSC 230	3	Comp/Stat	3	MSC	3	MSC	3
MSC 232	1	HUM#3	<u>3</u>	MSC	<u>3</u>	MSC	3
PHY 350	<u>3</u>					SSC#3	<u>3</u>
	17cr		15cr		15 cr		16 cr

MARINE SCIENCE WITH OTHER APPROVED SCIENCE MAJOR

Marine Science 111, 215, 216, 230, 232, 301 and 12 credits of elective in MSC, at least 6 of which must be at the 300-level or higher.

Biology 150/151 or 160/161

Chemistry 111, 112, 113, 114

Geological Sciences 110, 114 or GSC111

Mathematics 161 and 162 plus an approved computer programming or statistics course.

Physics 205,206,207 and one semester of laboratory; or Physics 101, 102, 106 and 108.

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

Plus all requirements of the second major. Approved majors are: Mathematics, Microbiology and Immunology, Biochemistry and Molecular Biology or any Engineering discipline. One course in the second major may double count for MSC. See advisor for details.

MARINE SCIENCE/COMPUTER SCIENCE (WITH MATHEMATICS MINOR)

Marine Science 111, 215, 216, 230, 232, 301, 321 and 9 credits of elective in MSC, at least 6 of which must be at the 300-level or higher.

Biology 150/151 or 160/161

Chemistry 111, 112, 113, 114

Geography 199

Geological Sciences 110, 114 or GSC111

Mathematics 161, 162, 210, 309, and 311 plus an approved statistics course (e.g. MSC204).

Computer Science 120,220,314,322,531 and 6 credits of approved elective

Physics 205,206,207 and one semester of laboratory

3 credits of upper level elective.

SAMPLE CURRICULUM – MARINE SCIENCE/COMPUTER SCIENCE

Freshman Year				Sophomore Year			
MSC 111	3 cr	MTH 162	4 cr	PHY 205	3 cr	PHY 206	3cr
MTH 161	4	CSC120	4	CSC220	4	MSC 301	3
GEG199	3	ENG106	3	GSC111	4	CHM112	3
ENG 105	3	BIL160	4	CHM 111	3	CHM114	1
HUM#1	<u>3</u>	BIL161	<u>1</u>	CHM113	<u>1</u>	MTH311	3
						SSC#1	<u>3</u>
	16 cr		16 cr		15cr		16 cr
Junior Year				Senior Year			
PHY207	3 cr	CSC322	3 cr	CSC531	3 cr	CSC	3 cr
PHY208	1	MSC215	3	MSC230	3	MSC	3
MTH309	3	MSC216	1	MSC232	1	MSC	3
CSC314	3	MSC321	3	CSC	3	Elective	3
HUM#2	3	STATS	3	MSC	3	HUM#3	<u>3</u>
MTH210	<u>3</u>	SSC#2	<u>3</u>	SSC#3	<u>3</u>		
	16 cr		16 cr		16 cr		15 cr

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 (3cr)

107 Life in the Sea (3cr)

115 Marine Environments of South Florida (Summer Scholars program only, 2cr)

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.

180 Marine Science Seminar (1 cr) Offered Spring Semester

201 Research Diving Techniques: Now offered as RSM 500

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.

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-requisite: 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.

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-requisite: 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

307 Introduction to the Physics of Climate (3 cr) *Offered Spring Semester*

The physical mechanisms which govern the earth's climate and climate variability. Prerequisite: MSC 305

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 international ocean law regarding ocean management; ocean delimitation and issues of environmental ocean regulation within an international legal framework. Prerequisite: junior standing

315 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. Prereq: MSC215 or permission of instructor.

316 Global Primary Production (3 cr) *Offered by announcement only*

Photosynthesis supports the vast majority of life on planet earth. 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

321 Scientific Programming in the Atmospheric Sciences (3 cr) *Offered Spring Semester*

An introduction to scientific programming in a Linux environment using the FORTRAN 90/95 language with specific applications to meteorology. Prerequisites: CSC 120, MTH 162 and either MTH 210 or 309.

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. Prereq: 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

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.

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. A unifying theme throughout is sustainable development. 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.

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. Energy conversion and transfer limit form and function and enable a wide variety of survival strategies. Prerequisite: PHY 101, MSC 230, or BIL 265

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

403 Introduction to Ocean Engineering (3 cr) *Offered Fall semester*
History and development of major fields within Ocean Engineering. 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 the coordinator.

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

420-424: UGalapagos courses (see pg. 15)

432 Comparative Ecology of Terrestrial and Marine Systems (3 cr) *By announcement*

A comparison of various biotic and abiotic controls on terrestrial and marine ecosystems is undertaken. 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.

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*

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. Prereq:BIL360 & instructor permission.

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.

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](http://ugalapagospring.miami.edu). A fall program focused on Biology started in 2012.

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.

REQUIREMENTS FOR COMMON MINORS AT UM

These are only a few of the many minors offered at UM. This summarizes information appearing in the 2012-13 Bulletin. Please see your UM bulletin year for changes, or qualifications. Most minors require course grades of C or C- or above; many have UM residency rules. Minors fulfill cognate requirements in their respective areas (†: STEM; §: People and Society; ¶: Arts and Humanities)

§**Anthropology:** 15 credits of APY courses, including any two APY courses at 200-level

§**Business Administration:** ACC 211, FIN 300, MGT 304 and MKT 301.

†**Chemistry:** 8 credits from CHM 200-level or above, exclusive of CHM 381, 382, 488, 490.

¶**Classics:** 3 credits in GRE or LAT plus 12 credits from among CLA, GRE and LAT

§**Communication:** 15 credits, including 6 at 300-level or higher (approved by COM adviser).

†**Computing Science:** CSC 120, 220 and 314 plus 6 credits from CSC 200-level or higher.

§**Economics:** ECO 211, 212 and 302 plus 6 credits of additional economics courses

§/†**Ecosystem Science and Policy:** ECS 111, 113, and 9 more credits in ECS (6 of which are 300-level or above)

§**Education (PTO):** TAL 101, 103, 304, 305* and 540 plus one of 506, 524, 541, 542, 543, 544. (*TAL 305 in 2012-13 Bulletin replaced by TAL 204 in earlier Bulletins)

¶**English:** 15 credits of ENG at 200+ level (excluding ENG 208), including one 200-level Literature course, one 200- or 300-level Lit course and one 400-level Lit course.

§**Geography:** 15 credits of GEG courses, including 6 credits at 300-level or above

†**Geological Sciences:** 16 credits in GSC courses numbered 110 or higher

§**International Studies:** Two of INS 101, 102, 201, 202 plus 9 credits at 300-level or above.

§**Latin American Studies:** 15 or more credits in courses on Latin America and the Caribbean, provided that they are selected from outside MSC. Courses must include LAS501 or LAS494.

†**Mathematics:** Three of MTH 210, 211 (or 310), 224, 230, 309, 311, 320, 359, 433, 461, 500-level. (MTH 210, 311, 359 and either 211 or 310 are recommended for MSC students)

§**Marine Policy:** See next page

¶**Modern Language (French, German, Italian, Portuguese, or Spanish):** 12 credits with a minimum of 9 credits at the 300-level or above.

§**Political Science:** 15 credits, 3 of which must be from POL 201, 202, or 203. (Not POL 213)

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.

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. Requirements for admission are:

- * Sophomore status
- * Completion of at least 2 semesters of science laboratory or calculus courses, and
- * An overall GPA of at least 3.3

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 six credits of independent research, and present a poster of the research at 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 3.3 overall, and have your senior thesis reviewed and accepted by your faculty committee.

Study Abroad

UGalapagos, the UM semester abroad program in the Galapagos Islands is described on page 16. 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.



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.

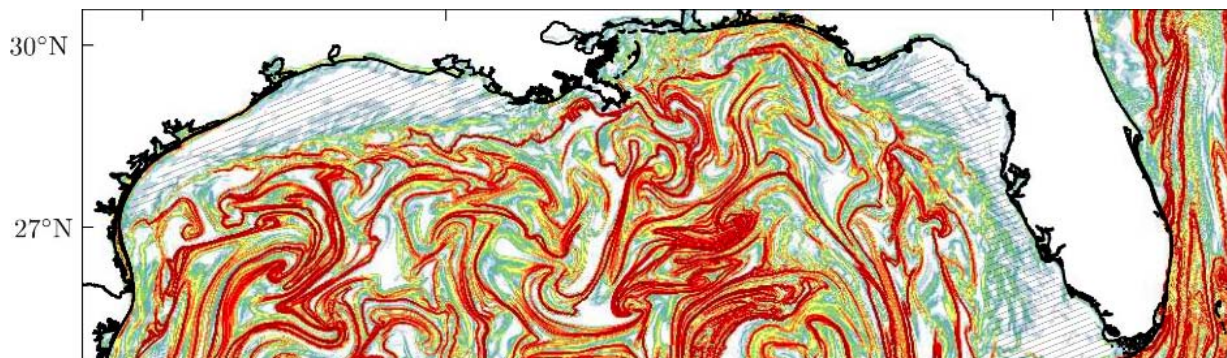
SCUBA Club - The scuba club is open to students across the campus and is one of the most active student organizations. Members must be certified divers before joining. The club meets weekly for speakers and trips.

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 Fieber, 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

Christopher Harrison, D.Sc
Cambridge University
Geophysics, plate tectonics

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

Frank Millero, Ph.D.
Carnegie-Mellon University
Physical chemistry, chemical oceanography

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

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

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SUNY Stony Brook
Coastal oceanography, ecology

Pamela Reid, Ph.D.
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Stromatolite geology

Jill Richardson, Ph.D.
University of Miami
Coral biology, ecology, pathology

Mike Schmale, Ph.D.
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