



MEMORANDUM

To: Julio Frenk, President

From: Linda L. Neider
Chair, Faculty Senate

A handwritten signature in blue ink, appearing to read 'L. Neider'.

Date: March 1, 2021

Subject: Faculty Senate Legislation #2020-62(B) – Curriculum Changes to the Bachelor of Science in Marine and Atmospheric Science (BSMAS) in Marine Biology and Ecology, Rosenstiel School of Marine and Atmospheric Science.

The Faculty Senate, at its February 24, 2021 meeting, had no objections to the approval of the curriculum changes to the Bachelor of Science in Marine and Atmospheric Science (BSMAS) in Marine Biology and Ecology in the Rosenstiel School of Marine and Atmospheric Science. These changes were made to reduce core course requirements so that Marine Biology and Ecology (MBE) can achieve its goals to educate undergraduates, giving them a deeper understanding that is provided by upper-level courses.

This legislation is now forwarded to you for your action.

LLN/va/rh

Enclosure

cc: Jeffrey Duerk, Executive Vice President and Provost
Roni Avissar, Dean, Rosenstiel School of Marine and Atmospheric Science
Douglas Crawford, Professor, Rosenstiel School of Marine and Atmospheric Science
Patty Murphy, Associate Provost for University Accreditation, Office of Assessment and Accreditation

CAPSULE: Faculty Senate Legislation #2020-62(B) – Curriculum Changes to the Bachelor of Science in Marine and Atmospheric Science (BSMAS) in Marine Biology and Ecology, Rosenstiel School of Marine and Atmospheric Science.

APPROVED: _____ DATE: 4/16/21

(President's Signature)

OFFICE OR INDIVIDUAL TO IMPLEMENT: Roni Avissar, Dean, Rosenstiel School of Marine and Atmospheric Science

EFFECTIVE DATE OF LEGISLATION: (Pending any further Board of Trustees approval)

_____ I _____ IMMEDIATELY
NOT APPROVED AND REFERRED TO: _____

REMARKS (IF NOT APPROVED): _____

Program Change Request

Date Submitted: 11/02/20 5:15 pm

Viewing: **B.S.M.A.S. in Marine Biology and Ecology : RSMR_BSMAS**

Last approved: 05/06/20 5:58 pm

Last edit: 01/11/21 2:24 pm

Changes proposed by: Whitney Nolton (wnolton)

Catalog Pages Using
this Program

[B.S.M.A.S. in Marine Biology and Ecology](#)

In Workflow

1. PG University Accreditation
2. PG FS Office for UCC
3. PG University Curriculum Committee
4. PG FS Office for GWC
5. PG FS GWC
6. PG Faculty Senate
7. PG FS Office for President
8. PG Registrar

Approval Path

1. 01/11/21 2:31 pm
Patty Murphy
(pxm491): Approved for PG University Accreditation

History

1. May 6, 2020 by Whitney Nolton (wnolton)

Please list the authors of this proposal including name, rank/title, program/department, and school.

Proposer(s) Name

Proposer: Ruth Goodin, Senior Program Coordinator, RSMAS Undergraduate Program

Author: Douglas L. Crawford, Professor, Marine Biology and Ecology, RSMAS

Change Type All Other Changes

Provide a brief
summary of the
change

Reducing the number of required courses to allow undergraduate the ability to take more
upper-level science courses and more readily complete other STEM minors.

Career Undergraduate

Academic Structure

School/ College	Department
School of Marine & Atm Science	Marine Biology and Ecology

Plan Type Major and/or Degree

Who can take this program?

Degree Type B.S.

Degree Name Bachelor of Science in Marine and Atmospheric Science

Proposed Plan Code

Plan Name B.S.M.A.S. in Marine Biology and Ecology

Will there be any subcomponents within the program such as concentrations, specializations, thesis/non-thesis options, or tracks?

No

Effective Term Spring 2021

First Term Valid Fall 2021

Program Instruction Mode In Person

Where is the program offered?	Location	Please provide the % of instruction at each location.
	Coral Gables Campus	100

Program Length (Years) 4

Total Credits **124-137** ~~121~~

Areas of Knowledge

STEM

To Be Published in the Academic Bulletin

Program Overview

Marine Biology and Ecology

The Marine Biology & Ecology degree is a Bachelor of Science degree (BSMAS) and is designed to give students a strong background in biology and quantitative skills, as well as research experience in biomedicine, genomics, evolution, physiology, microbiology, immunology, and ecology. The strength of the Marine Biology & Ecology program is the opportunity for undergraduates to fully participate in the research with Marine Biology and Ecology diverse faculty. These research opportunities provide skills to excel in medicine, graduate school, and other diverse fields..

Program Mission Statement

Mission ~~Mission~~

The mission of the Rosenstiel School of Marine and Atmospheric Science is to deepen our collective knowledge of our planet through cutting-edge scientific research on the oceans, atmosphere, geology, biota, and the human dimension, while training the next generation of scientists. We transfer the knowledge gained to our students, the national and international scientific community, and to policymakers and the **public**.

~~public:~~

The educational mission of the BS degree in Marine Biology and Ecology at the University of Miami is to graduate students with the ability to integrate knowledge of the marine system, and its biota, ecology, physiology, and genetics to provide students a foundation for successful careers.

Program Goals

Goals

The MBE departmental major curriculum will provide the rigor, flexibility, depth and integration to enable students to:

Design their course of study that provides both depth and breadth in marine biology and ecology and science related courses.

Undertake active research experiences, which will allow them to gain a strong understanding of the scientific process.

Learn from the diverse and outstanding group of professors, researchers, and classmates.

Prepare themselves for the public and private sector employment, graduate school, and successful careers.

Student Learning Outcomes

Student Learning Outcomes

Students completing the MBE departmental major will be able to:

Master a broad set of fundamental biological knowledge including how to search for, **understand the understand;** **and-synthesize** primary scientific literature, and **understand understand** how fundamental biological principles relate to **the the** marine environment.

Solve problems competently by identifying the relevant features of the problem and developing a strategy to solve the problem.

Use computers and computational approaches to acquire and process data as well as use software to analyze data.

Understand and synthesize the objectives of research experiments, properly conduct experiments, and appropriately record, analyze, and communicate the results.

Effectively communicate the concepts, results, and implications of their laboratory experiments and independent research both orally and in the written form to experts in the field, scientists in other disciplines, and the general public.

Curriculum Requirements

Curriculum Requirements

Marine Science & Marine Biology

MSC 111	Introduction to Marine Science	3
MSC 112	Introduction to Marine Science Lab (Research Requirement and MBE Elective)	1
MSC 230	Introduction to Marine Biology	3
MSC 232	Introduction to Marine Biology Laboratory	1

Marine Biology & Ecology

MSC 306	Marine Ecology 1	3
or MSC 422	Marine Ecology of the Galapagos	
MSC 307	Physiology of Marine Organisms 1	3
MSC 308	Genetics and Evolution 1	3
MSC 329	Marine Vertebrate Zoology	3-4
or MSC 323	Invertebrate Zoology	

~~Approved Upper-level animal diversity course~~

~~Select one of the following:~~ **3-4**

Select 16 credit hours of approved electives in Marine Biology and Ecology at the 300-level or above which must include research 2 **16**

Other Required Courses

BIL 150	General Biology	4
BIL 160	Evolution and Biodiversity	4

BIL 161	Evolution and Biodiversity Laboratory	±
<u>BIL 151</u>	General Biology Laboratory	1
or <u>BIL 161</u>	Evolution and Biodiversity Laboratory	
<u>BIL 255</u>	Cellular and Molecular Biology	3
BIL 360	Comparative Physiology	3
Select 9 credit hours of approved electives in Biological Sciences 2		9
<u>CHM 121</u>	Principles of Chemistry 3	4
CHM 113	Chemistry Laboratory I	±
<u>CHM 221</u>	Introduction to Structure and Dynamics 3	4
CHM 205	Chemical Dynamics Laboratory	±
<u>MSC 203</u>	Foundations of Computational Marine Science	4
or <u>CSC 120</u>	Computer Programming I - COURSE PROPOSAL IN PROGRESS	
Select 16 to 21 credit hours of approved electives in STEM or approved minor 4		16 - 21
Select one of the following:		3-4
MSC 323	Invertebrate Zoology	
<u>GSC 111</u>	Earth System History	
<u>GSC 110</u>	The Earth System	
<u>MSC 215</u>	Chemical Oceanography	
<u>MSC 301</u>	Introduction to Physical Oceanography	
<u>MSC 424</u>	Origin and Geology of the Galapagos Islands.	
Select 12 credit hours of approved electives in Marine Science 1		12
<u>ENG 105</u>	English Composition I	3
<u>ENG 107</u>	English Composition II: Science and Technology	3
or <u>ENG 106</u>	English Composition II	
Select one of the following options: 4		8-12
Select one of the following options: 5		8-14
Option #1		
<u>MTH 161</u>	Calculus I	
or <u>MTH 171</u>	Calculus I	
<u>MTH 162</u>	Calculus II	
or <u>MTH 172</u>	Calculus II	
Option #2		
<u>MTH 140</u>	Calculus Concepts with Foundations A	
<u>MTH 141</u>	Calculus Concepts with Foundations B	
<u>MTH 162</u>	Calculus II	
Select one of the following:		3
Option #3		
<u>MTH 107</u>	Precalculus Mathematics I	
<u>MTH 108</u>	Precalculus Mathematics II	
<u>MTH 161</u>	Calculus I	

MTH 162 Calculus II

Select one of the following: 3

- ~~BIL 330 Ecology~~
- ~~MSC 366 Tropical Coastal Ecosystems~~
- ~~MSC 422 Marine Ecology of the Galapagos~~

Select one of the following: 3

- ~~BIL 250 Genetics~~
- ~~MSC 318 Course MSC 318 Not Found – COURSE DEACTIVATION IN PROGRESS~~
- ~~MSC 204 Environmental Statistics~~
- BIL 511 Advanced Biostatistics**
- ~~MTH 224 Introduction to Probability and Statistics~~
- PSY 292 Introduction to Biobehavioral Statistics for Non-Majors**

Select one of the following options: 6 10

Option 1:

- ~~PHY 201 University Physics I for the Sciences~~
- ~~PHY 106 College Physics Laboratory I~~
- ~~PHY 202 University Physics II for the Sciences~~
- ~~PHY 108 College Physics Laboratory II~~

Option 2:

- ~~PHY 221 University Physics I~~
- ~~PHY 222 University Physics II~~
- ~~PHY 223 University Physics III~~
- ~~PHY 224 University Physics II Lab~~
- or ~~PHY 225 University Physics III Lab~~

Option 3:

- ~~PHY 101 College Physics I~~
- ~~PHY 106 College Physics Laboratory I~~
- ~~PHY 102 College Physics II~~
- ~~PHY 108 College Physics Laboratory II~~

Electives

Arts and Humanities Cognate Courses	9
People and Society Cognate Courses	9
300+ Level Elective	3
Additional Electives	6
Total Credit Hours	124-
	137

1 Equivalent Biology course with permission.

2 Research requirement can be satisfied by taking 16 credits in Saltwater Semester, study abroad (e.g., Galapagos) or 4 independent research credits, including a minimum of 3 credits in [MSC 411](#) and one credit in [MSC 412](#) (thesis research).

Saltwater Semester (SWS) fulfills MBE research requirement. SWS is a full semester (16 credits) at the Marine campus doing authentic field and laboratory research with lectures to enhance learning and the practical importance of scientific research. All courses are research intensive (much of the day is working in the field or laboratory) and involve authentic research. Students will do novel experiments focused on course concepts.

3 Principles of Chemistry must be passed with a grade of "C-" or higher. Chemistry laboratories will count as STEM electives and should be taken by Pre-Medical and Pre-Veterinarian students.

4 16 to 21 credits in STEM (with an emphasis on specialization in MBE, MSC, BIL, BMB, NEU, MIC, CHM, CSC) or a minor in any field can be approved.

5 Calculus I must be passed with a grade of "C-" or higher.

6 Option 1 is recommended for Physics.

Plan of Study

Suggested Plan of Study

Plan of Study Grid

Freshman Year

		Credit Hours
<u>MSC 111</u>	Introduction to Marine Science	3
<u>MSC 112</u>	Introduction to Marine Science Lab	1
<u>BIL 150</u>	General Biology	4
<u>BIL 151</u>	General Biology Laboratory	1
<u>ENG 105</u>	English Composition I	3
<u>MTH 161</u>	Calculus I	4
	Credit Hours	16

Spring

<u>BIL 160</u>	Evolution and Biodiversity	4
BIL 161	Evolution and Biodiversity Laboratory	1
<u>CHM 121</u>	Principles of Chemistry	4
CHM 113	Chemistry Laboratory I	1
ENG 107	English Composition II: Science and Technology	3
<u>CSC 120</u>	Computer Programming I	4
<u>MTH 162</u>	Calculus II	4
	Credit Hours	16

Sophomore Year

Fall		
<u>MSC 230</u>	Introduction to Marine Biology	3
<u>MSC 232</u>	Introduction to Marine Biology Laboratory	1
<u>BIL 255</u>	Cellular and Molecular Biology	3
<u>CHM 221</u>	Introduction to Structure and Dynamics	4
CHM 205	Chemical Dynamics Laboratory	1

ENG 107	English Composition II: Science and Technology	3
HUM Course #1		3
	Credit Hours	17
Spring		
<u>MSC 204</u>	Environmental Statistics	3
MSC 318 or BIL 250	Course MSC 318 Not Found or Genetics	3
MSC 366 or BIL 330	Tropical Coastal Ecosystems or Ecology	3
MSC 306	Marine Ecology	3
MSC 307	Physiology of Marine Organisms	3
MSC 308	Genetics and Evolution	3
<u>GSC 111</u>	Earth System History	4
HUM Course #2		3
	Credit Hours	16
Junior Year		
Fall		
MSC Course		3
BIL 360	Comparative Physiology	3
PHY 201	University Physics I for the Sciences	4
PHY 106	College Physics Laboratory I	1
HUM Course #3		3
PS Course #1		3
Saltwater Semester. 16 credit Research Intensive Courses: Lab and Lectures.16		
	Credit Hours	16
Spring		
<u>MSC 329</u>	Marine Vertebrate Zoology	3
PHY 202	University Physics II for the Sciences	4
PHY 108	College Physics Laboratory II	1
STEM Elective #1		3
HUM Course #2		3
PS Course #1		3
PS Course #2		3
	Credit Hours	15
Senior Year		
Fall		
MSC 411-1		3
<u>PHY 201</u>	University Physics I for the Sciences	4
<u>PHY 106</u>	College Physics Laboratory I	1
STEM Elective #2		3
STEM Elective #3		3

HUM Course #3		3
PS Course #3		3
	Credit Hours	17
Spring		
MSC 411	Research in Marine Science	3
& MSC 412	and Undergraduate Thesis in Marine Science 1	
PHY 202	University Physics II for the Sciences	4
PHY 108	College Physics Laboratory II	1
Elective #4		3
Elective #5		3
Elective #6		3
	Credit Hours	14
	Total Credit Hours	127

- * ~~9 elective courses must include:~~
- ~~3 Arts and Humanities Cognate courses~~
- ~~3 People and Society Cognate courses~~
- ~~1 Course (3 credits) at the 300+ level~~
- ~~1 Recommended electives to take for the Marine Biology and Ecology major.~~

Rationale

Rationale

Marine Biology and Ecology (MBE) is implementing a more concise program of studies for our undergraduate majors. MBE will be reducing the number of required courses to allow undergraduate the ability to take more upper-level science courses and more readily complete other STEM minors. Currently, our major has a plethora of introductory biology classes, it leaves little time to take advance courses, be involved in independent research, attend the Saltwater Semester or achieve a minor in math, computer science, neurobiology or other science degrees. Our current program has so many lower-level course requirements it is difficult to achieve MBE’s goals of excellence in education, to provide a rich set of research intensive courses and allow for sufficient enrollment in the Saltwater Semester. Thus, we need to reduce core course requirements so that MBE can achieve its goals to educated undergraduates so that they have a deeper understanding that is provided by upper-level courses and research intensive courses.

Market Demand

Relationship to Other Programs

Library Resources Available and Needed to Support the Program

Laboratory Facilities, Equipment, and Space Available and Needed to Support the Program

Other Resources Available or Needed to Support the Program

Curriculum

Program Curriculum

Upload Syllabi for Any New Courses

Proposed Schedule of Course Offerings for the First Three Years

CIP Code

Proposed CIP Code

Faculty

Program Directors

Upload CV(s)

Program Faculty

Students

Applicant Pool

Enrollment Projections

Administration

Program Administration

Comparison

Peer Comparisons

Documents

Attach Supporting Documentation

[BSMAS in MBE Supporting Documents.pdf](#)

Reviewer

Comments

Patty Murphy (pxm491) (01/11/21 2:31 pm): The proposed changes do not represent a significant departure from currently approved programs and therefore will not require notification to or approval from SACSCOC.

Key: 186

The Department of Marine Biology & Ecology's (RSMAS) modified Academic Bulletin.

What follows:

- 1) A written description of the changes, including a comparison to MBE's previous Academic Bulletin
- 2) The modified MBE (Marine Biology & Ecology) Academic Bulletin
- 3) The modified MBE Plan of Study
- 4) MBE Chair Memo: Faculty Approval
- 5) School Council Memo Approving changes
- 6) Dean Avissar Memo Approving changes
- 7) A description of SWS (Saltwater Semester)

Summary of MBE Relevant Modifications to the Academic Bulletin

MBE seeks to modify its academic bulletin to provide undergraduates greater access to upper-level and research-intensive courses. Unchanged are general requirements including cognates, English, and STEM requirements in Chemistry, Physics, Mathematics and Statistics. What does change is an increase in upper-level courses and a reduction in the number of required lower-level course. With these changes are the addition of three core courses with greater marine focus than their biological counterpart. These three courses are taught by MBE faculty and include: 1) Physiology of Marine Organisms, 2) Marine Ecology and 3) Genetics and Evolution. These courses are taught by faculty who have taught similar courses for Arts and Sciences and more advanced courses in the same field. These changes enhance the number of upper-level electives (16 in MBE, 16 in STEM or any other approved minor) and allows MBE to require computational science courses. These changes also provide undergraduates greater opportunity to take research intensive courses. One example of research-intensive courses is the Saltwater Semester (SWS, see appended document). SWS was revived seven years ago after being initiated more than 20 years ago. SWS offers research intensive courses that in the last seven years have resulted in four undergraduate peer-reviewed publications. Providing more undergraduates greater opportunities to do authentic research is the primary motivation for the changes in MBE's academic bulletin described below and as detailed in the Academic Bulletin.

MBE DEPARTMENTAL MAJOR CHANGE IN THE ACADEMIC BULLETIN

MBE seeks to improve their undergraduate degree program by offering undergraduates the opportunity to take more upper-level courses, inclusion of a computer science requirement, and more opportunities to take electives within MBE and among STEM courses in other schools and departments. These changes allow Marine Biology undergraduates greater opportunities to learn and specialize in specific fields (e.g., ecology, physiology, biochemistry, and genomics). Thus, for example, with these modifications students have greater capacity to earn a minor in Biology (9 credits), Biochemistry (16 credits), CHM (16 credits) Computer Science(17 credits), Math (9 credits +Cal II), or Microbiology & Immunology (12 credits). This more engaging and concise program reduces the number of introductory courses to enhance the opportunity to take upper-level course including Saltwater semester courses.

CHANGES TO MBE PLAN OF STUDY

The summary of changes is detailed in Table 1 (next page). Overall, all University of Miami general requirements and science requirements are maintained (e.g. Cognates, English, Calculus II, Physics and Chemistry). The largest change is the replacement of some Biology course credits with more marine centered courses. MSC 111 (Introduction to Marine Science) and MSC 230 (Introduction to Marine Biology) replace some of the introductory BIL courses. Some of the core biological courses are replaced with three new MBE courses: 1: Physiology of Marine Organisms, 2: Marine Ecology and 3: Genetics and Evolution. These courses form the foundation for upper-level courses in Marine Biology and are taught by faculty with research and teaching experience in these courses.

Additional changes include an increase in upper-level STEM course electives and inclusion of a computer science course requirement. Specifically, credits in upper-level MBE elective courses are increased to 16 credits, credits in STEM elective courses are increased from 6 to 16 credits, and a computer science course requirement has been added.

MBE's objective is to provide all MBE undergraduates a strong foundation in Marine Biology and Ecology that allows them to seek careers typical of biologists and to enhance their depth of understanding in additional fields of interest that will both enrich and enhance their careers.

UM RSMAS Core Requirements UNCHANGED	Credits
English	6
Cognates	18
Chemistry Required Courses,	10
Mathematics Requirements	8
Physics Requirements	10
Statistics	3
	55

Calculus I
and Cal II

Current MBE Major	Credits	MBE Modified: Concise	Credits
MSC Physical Science Options	4	MSC Physical Science Options	4
Marine Science Introductory. 111,112,230,232	8	Marine Biology Introductory 111,112,230,232	8
Marine Biology & Ecology Foundation Requirement: Ecology, Genetics, Zoology	9	Marine Biology Foundation**: Ecology, Physiology, Genetic, Evolution, Zoology	12
MBE Electives 300 or above	12	MBE Electives 300 or above	16
Biology Required Courses: 150,151,160,161,255,360	25	Biology Required Courses BIL 150, 160, 255	7
STEM Electives 9 Credits (BIL, MSC, MBE, BMB, NUE...) 9 credit in upper BIL for Double Major	9	Computer Science Courses	3 or 4
Electives	6	Science Courses in MBE, BIL, MBE, MSC, BIL, BMB, MIC, CHM, CSC	16
Total Credit Hours	128	Total Credit Hours	125

** Three new approved courses:

- MSC306 - Marine Ecology
- MSC307 - Physiology of Marine Organisms
- MSC308 - Genetics and Evolution

Science Electives: 16 credits with an emphasis on specialization in MBE, MSC, BIL, BMB, MIC, CHM, CSC or any other approved minor.

RSMR_BSMAS: B.S.M.A.S. IN MARINE BIOLOGY AND ECOLOGY

In Workflow

1. PG University Accreditation (pxm491@miami.edu)
2. PG MBE Chair (c.langdon@miami.edu)
3. PG University Accreditation (pxm491@miami.edu)
4. PG Registrar (j.zwanziger@miami.edu)

History

1. May 6, 2020 by Whitney Nolton (wnolton)

Date Submitted: Mon, 02 Nov 2020 22:15:31 GMT

Viewing: B.S.M.A.S. in Marine Biology and Ecology : RSMR_BSMAS

Last approved: Wed, 06 May 2020 21:58:22 GMT

Last edit: Mon, 02 Nov 2020 22:15:22 GMT

Changes proposed by: Whitney Nolton (wnolton)

Please list the authors of this proposal including name, rank/title, program/department, and school.

Proposer(s) Name

Proposer: Ruth Goodin, Senior Program Coordinator, RSMAS Undergraduate Program
Author: Douglas L. Crawford, Professor, Marine Biology and Ecology, RSMAS

Change Type

Minimal Change or Correction Only

Career

Undergraduate

Academic Structure

School/ College	Department
School of Marine & Atm Science	Marine Biology and Ecology

Plan Type

Major and/or Degree

Degree Type

B.S.

Degree Name

Bachelor of Science in Marine and Atmospheric Science

Plan Name

B.S.M.A.S. in Marine Biology and Ecology

Will there be any subcomponents within the program such as concentrations, specializations, thesis/non-thesis options, or tracks?

No

Effective Term

Spring 2021

First Term Valid

Fall 2021

Program Instruction Mode

In Person

Where is the program offered?

Location	Please provide the % of instruction at each location.
Coral Gables Campus	100

Program Length (Years)

4

Total Credits

124-137

Areas of Knowledge

STEM

To Be Published in the Academic Bulletin

Program Overview

Marine Biology and Ecology

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Mission

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Student Learning Outcomes

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- Master a broad set of fundamental biological knowledge including how to search for, understand the primary scientific literature, and understand how fundamental biological principles relate to the marine environment.
- Solve problems competently by identifying the relevant features of the problem and developing a strategy to solve the problem.
- Use computers and computational approaches to acquire and process data as well as use software to analyze data.
- Understand and synthesize the objectives of research experiments, properly conduct experiments, and appropriately record, analyze, and communicate the results.
- Effectively communicate the concepts, results, and implications of their laboratory experiments and independent research both orally and in the written form to experts in the field, scientists in other disciplines, and the general public.

Curriculum Requirements

Curriculum Requirements

Code	Title	Credit Hours
Marine Science & Marine Biology		
MSC 111	Introduction to Marine Science	3
MSC 112	Introduction to Marine Science Lab (Research Requirement and MBE Elective)	1
MSC 230	Introduction to Marine Biology	3

MSC 232	Introduction to Marine Biology Laboratory	1
Marine Biology & Ecology		
MSC 306	Marine Ecology ¹	3
or MSC 422	Marine Ecology of the Galapagos	
MSC 307	Physiology of Marine Organisms ¹	3
MSC 308	Genetics and Evolution ¹	3
MSC 329	Marine Vertebrate Zoology	3-4
or MSC 323	Invertebrate Zoology	
Select 16 credit hours of approved electives in Marine Biology and Ecology at the 300-level or above which must include research ²		16
Other Required Courses		
BIL 150	General Biology	4
BIL 160	Evolution and Biodiversity	4
BIL 151	General Biology Laboratory	1
or BIL 161	Evolution and Biodiversity Laboratory	
BIL 255	Cellular and Molecular Biology	3
CHM 121	Principles of Chemistry ³	4
CHM 221	Introduction to Structure and Dynamics ³	4
MSC 203	Foundations of Computational Marine Science	4
or CSC 120	Computer Programming I - COURSE PROPOSAL IN PROGRESS	
Select 16 to 21 credit hours of approved electives in STEM or approved minor ⁴		16 - 21
Select one of the following:		3-4
GSC 111	Earth System History	
GSC 110	The Earth System	
MSC 215	Chemical Oceanography	
MSC 301	Introduction to Physical Oceanography	
MSC 424	Origin and Geology of the Galapagos Islands.	
ENG 105	English Composition I	3
ENG 107	English Composition II: Science and Technology	3
or ENG 106	English Composition II	
Select one of the following options: ⁵		8-14
Option #1		
MTH 161	Calculus I	
or MTH 171	Calculus I	
MTH 162	Calculus II	
or MTH 172	Calculus II	
Option #2		
MTH 140	Calculus Concepts with Foundations A	
MTH 141	Calculus Concepts with Foundations B	
MTH 162	Calculus II	
Option #3		
MTH 107	Precalculus Mathematics I	
MTH 108	Precalculus Mathematics II	
MTH 161	Calculus I	
MTH 162	Calculus II	
Select one of the following:		3
MSC 204	Environmental Statistics	
BIL 511	Advanced Biostatistics	
MTH 224	Introduction to Probability and Statistics	
PSY 292	Introduction to Biobehavioral Statistics for Non-Majors	
Select one of the following options: ⁶		10
Option 1:		
PHY 201	University Physics I for the Sciences	
PHY 106	College Physics Laboratory I	
PHY 202	University Physics II for the Sciences	
PHY 108	College Physics Laboratory II	
Option 2:		

PHY 221	University Physics I	
PHY 222	University Physics II	
PHY 223	University Physics III	
PHY 224	University Physics II Lab	
or PHY 225	University Physics III Lab	
Option 3:		
PHY 101	College Physics I	
PHY 106	College Physics Laboratory I	
PHY 102	College Physics II	
PHY 108	College Physics Laboratory II	
Electives		
Arts and Humanities Cognate Courses		9
People and Society Cognate Courses		9
Total Credit Hours		124-137

- 1 Equivalent Biology course with permission.
- 2 Research requirement can be satisfied by taking 16 credits in Saltwater Semester, study abroad (e.g., Galapagos) or 4 independent research credits, including a minimum of 3 credits in MSC 411 and one credit in MSC 412 (thesis research).
 - **Saltwater Semester** (SWS) fulfills MBE research requirement. SWS is a full semester (16 credits) at the Marine campus doing authentic field and laboratory research with lectures to enhance learning and the practical importance of scientific research. All courses are research intensive (much of the day is working in the field or laboratory) and involve authentic research. Students will do novel experiments focused on course concepts.
- 3 Principles of Chemistry must be passed with a grade of "C-" or higher. Chemistry laboratories will count as STEM electives and should be taken by Pre-Medical and Pre-Veterinarian students.
- 4 16 to 21 credits in STEM (with an emphasis on specialization in MBE, MSC, BIL, BMB, NEU, MIC, CHM, CSC) or a minor in any field can be approved.
- 5 Calculus I must be passed with a grade of "C-" or higher.
- 6 Option 1 is recommended for Physics.

Plan of Study

Suggested Plan of Study

Freshman Year		Credit Hours
Fall		
MSC 111	Introduction to Marine Science	3
MSC 112	Introduction to Marine Science Lab	1
BIL 150	General Biology	4
BIL 151	General Biology Laboratory	1
ENG 105	English Composition I	3
MTH 161	Calculus I	4
	Credit Hours	16
Spring		
BIL 160	Evolution and Biodiversity	4
CHM 121	Principles of Chemistry	4
CSC 120	Computer Programming I	4
MTH 162	Calculus II	4
	Credit Hours	16
Sophomore Year		
Fall		
MSC 230	Introduction to Marine Biology	3
MSC 232	Introduction to Marine Biology Laboratory	1
BIL 255	Cellular and Molecular Biology	3
CHM 221	Introduction to Structure and Dynamics	4
ENG 107	English Composition II: Science and Technology	3
HUM Course #1		3
	Credit Hours	17
Spring		
MSC 204	Environmental Statistics	3
MSC 306	Marine Ecology	3

MSC 307	Physiology of Marine Organisms	3
MSC 308	Genetics and Evolution	3
GSC 111	Earth System History	4
	Credit Hours	16
Junior Year		
Fall		
Saltwater Semester. 16 credit Research Intensive Courses: Lab and Lectures.		16
	Credit Hours	16
Spring		
MSC 329	Marine Vertebrate Zoology	3
STEM Elective #1		3
HUM Course #2		3
PS Course #1		3
PS Course #2		3
	Credit Hours	15
Senior Year		
Fall		
PHY 201	University Physics I for the Sciences	4
PHY 106	College Physics Laboratory I	1
STEM Elective #2		3
STEM Elective #3		3
HUM Course #3		3
PS Course #3		3
	Credit Hours	17
Spring		
PHY 202	University Physics II for the Sciences	4
PHY 108	College Physics Laboratory II	1
Elective #4		3
Elective #5		3
Elective #6		3
	Credit Hours	14
	Total Credit Hours	127

Rationale

Rationale

Marine Biology and Ecology (MBE) is implementing a more concise program of studies for our undergraduate majors. MBE will be reducing the number of required courses to allow undergraduate the ability to take more upper-level science courses and more readily complete other STEM minors. Currently, our major has a plethora of introductory biology classes, it leaves little time to take advance courses, be involved in independent research, attend the Saltwater Semester or achieve a minor in math, computer science, neurobiology or other science degrees. Our current program has so many lower-level course requirements it is difficult to achieve MBE's goals of excellence in education, to provide a rich set of research intensive courses and allow for sufficient enrollment in the Saltwater Semester. Thus, we need to reduce core course requirements so that MBE can achieve its goals to educated undergraduates so that they have a deeper understanding that is provided by upper-level courses and research intensive courses.

Key: 186

UNIVERSITY OF MIAMI

ROSENSTIEL
SCHOOL of MARINE &
ATMOSPHERIC SCIENCE



Miami, Florida 33149-1031

Nov 23rd, 2020

To: Patty Murphy, Executive Director of Assessment and Accreditation

From: Martin Grosell, Professor and Chair of Marine Biology and Ecology

The Department of Marine Biology and Ecology (MBE) are committed on improving its undergraduate program and associated learning outcome. To accomplish this, the MBE faculty discussed changes to the program at our Departmental meetings on Dec 6th 2019 and on April 24th 2020. The faculty strongly supported the changes to streamline requirements and emphasize research opportunities. The MBE faculty voted unanimously to support the change in our undergraduate program as reflected in the revised Academic Bulletin on April 24th 2020.

UNIVERSITY OF MIAMI

ROSENSTIEL**SCHOOL of MARINE &
ATMOSPHERIC SCIENCE**

Speaker for School Council
Rosenstiel School of Marine and Atmospheric Science
University of Miami
4600 Rickenbacker Causeway
Miami, FL 33149, USA

Paquita Zuidema

Phone: 305-421-4276 Email: pzuidema@miami.edu

9 December, 2020

Dear Patty Murphy, Executive Director of Assessment and Accreditation

The School Council of the Rosenstiel School of Marine and Atmospheric Science unanimously approved the change to the undergraduate curriculum of the Marine Biology and Ecology (MBE) department on Dec. 9, 2020, as reflected in the revised Academic Bulletin. The MBE undergraduate population has been growing rapidly in recent years, with the department seeking to expand options and research opportunities for their undergraduates. The revised curriculum, which offers more upper-level courses and a stronger research experience, is more flexible and better prepares MBE's undergraduates for a post-baccalaureate career in today's professional climate.

Sincerely,

Speaker for the RSMAS School Council



MEMORANDUM

TO: P. Murphy, Executive Director of Assessment & Accreditation
FROM: Roni Avissar, Dean *Roni Avissar*
DATE: December 16, 2020
SUBJECT: Marine Biology & Ecology (MBE) Undergraduate Curriculum

Based on the unanimous support of our School Council, the MBE Department faculty and Chair's support and my own evaluation of the change to the undergraduate curriculum proposed by the department, I enthusiastically support this request. Clearly, the major advantage that a student has by joining the Rosenstiel School of Marine & Atmospheric Science (RSMAS) is the opportunity to study through participation in research with world-class scientists. This proposal is about facilitating this opportunity and is unambiguously in line with the School and University strategic initiative in education.

Roni Avissar, Ph.D.
Professor and Dean

Phone: 1 305 421-4000 • Fax: 1 305 421-4711 • E-mail: ravissar@rsmas.miami.edu

What is the Saltwater Semester?

Saltwater Semester is a full semester (16 credits) at the Marine campus doing authentic field and laboratory research with lectures to enhance learning and the practical importance of scientific research. All courses are research intensive (much of the day is working in the field or laboratory) and involve authentic research. Students will do novel experiments focused on course concepts. For example, Tropical Marine Ecology: Sampling, Monitoring and Restoration Methods, will provide the fundamentals of experimental ecology and students will work in the field to test a novel hypothesis. Or in Genomics, students will collect animals, isolate their genomic DNA and sequence their genomes to address question about conservation genetics. Sixteen credits will fulfill most science electives and some required courses in MBE program (e.g., ecology, physiology, invertebrate/vertebrate zoology)

There are two “tracks” of 4 courses (each course is 3 weeks long, 09:00 -3:30 MTWThF, each course emphasizes authentic research). You have to take all four courses in one of the tracks.

Week 1 and 15: Introduction to research: practical methods and tools to prepare and present your data. Week 1 and 15 are joint course work for both tracks.

Track1: Coral and Invertebrate Ecology, Physiology and Conservation.

- 1: MSC 409: Tropical Marine Ecology: Sampling, Monitoring and Restoration Methods
- 2: MSC 407: Molecular Ecology and Physiology of Reef Coral Symbiosis
- 3: MSC 408: Climate Change: Limits of Marine Invertebrate Adaptability
- 4: MSC409: Coral Immunology and Microbiology

Track 2: Experimental, Neural Physiology and Genomics

- 1: MSC463: Conservation Genomics
- 2: MSC467: Marine Animal Neurophysiology and Behavior
- 3: MSC 466: Experimental Physiology
- 4: MSC 326: Marine Genomics

SWS_2020 Course Description:

Track1: Coral and Invertebrate Ecology, Physiology and Conservation.

1: Diego Lirman -- MSC 409: Tropical Marine Ecology: Sampling, Monitoring and Restoration Methods

This course integrates lectures, discussions and authentic research on the ecology, conservation, and restoration of the three main tropical coastal ecosystems found in South Florida: Mangroves, Seagrasses, and Coral Reefs. This research-intensive course focuses on the application of field sampling methods and integrate ecological theory to define the health and success of coastal ecosystems.

This course is part of Saltwater Semester so that students can be actively involved in intensive research. As part of the Saltwater Semester, students are required to enroll in four of the 4-credit Saltwater Semester courses (16 credits) where each course meets for 3 weeks. These courses meet from M-F 9:00 to 4:00 with all courses at the Marine campus. Co-required courses: MSC406, MSC407 and MSC408.

2: Baker-- MSC 407: Molecular Ecology and Physiology of Reef Coral Symbiosis

Reef corals requires an intracellular symbiont to succeed. This course integrates lectures and molecular genetic research to quantify this symbiotic relationship. Students will be involved in research to define and quantify coral-symbionts interactions and how these interactions influence coral physiology and success.

This course is part of Saltwater Semester so that students can be actively involved in intensive research. As part of the Saltwater Semester, students are required to enroll in four of the 4-credit Saltwater Semester courses (16 credits) where each course meets for 3 weeks. These courses meet from M-F 9:00 to 4:00 with all courses at the Marine campus. Co-required courses: MSC406, MSC408 and MSC409

3: Chris Langdon --MSC 408: Climate Change: Limits of Marine Invertebrate Adaptability

This course integrates lectures, discussions and authentic research on the effect of global climate change on the success of marine invertebrates. Students will be involved in research to understand how the predicted changes in the ocean environment (temperature, oxygen, and pH) affects the ability for marine organisms to acclimatize and adapt to these environments.

This course is part of Saltwater Semester so that students can be actively involved in intensive research. As part of the Saltwater Semester, students are required to enroll in four of the 4-credit Saltwater Semester courses (16 credits) where each course meets for 3 weeks. These courses meet from M-F 9:00 to 4:00 with all courses at the Marine campus. Co-required courses: MSC406, MSC407 and MSC409.

4: Traylor-Knowles/del Campo -- MSC409: Coral Immunology and Microbiology

This course integrates lectures, discussions and authentic research on coral immunology and microbiology for students to learn how the coral immune response and the coral associated microbes affect coral success. This research-intensive course integrates coral microbiome analysis with immunology assays to generate data on coral wellbeing.

This course is part of Saltwater Semester so that students can be actively involved in intensive research. As part of the Saltwater Semester, students are required to enroll in four of the 4-credit Saltwater Semester courses (16 credits) where each course meets for 3 weeks. These courses meet from M-F 9:00 to 4:00 with all courses at the Marine campus. Co-required courses: MSC406, MSC407 and MSC408

Track 2: **Experimental, Neural Physiology and Genomics**

1: Douglas Crawford --MSC463: Conservation Genomics

This course integrates lectures, discussions and research on genetics and genomics to understand population biology, conservation, susceptibility of endangered species to extinction and the effect of invasive species on natural communities. This research-intensive course sequences genomes and uses the data to better understand the health of species and ecological communities.

This course is part of Saltwater Semester so that students can be actively involved in intensive research. As part of the Saltwater Semester, students are required to enroll in four of the 4-credit Saltwater Semester courses (16 credits) where each course meets for 3 weeks. These courses meet from M-F 9:00 to 4:00 with all courses at the Marine campus. Co-required courses: MSC326, MSC466 and MSC467

2: Lynne Fieber -- MSC467: Marine Animal Neurophysiology and Behavior

This course integrates lectures, discussions of the primary literature, and research on the nervous system and endocrine systems of marine animal models. The course goals are an understanding of how these systems work together to control elements of physiology, sensation and perception of the environment and behavior.

This course is part of Saltwater Semester so that students can be actively involved in intensive research. As part of the Saltwater Semester, students are required to enroll in four of the 4-credit Saltwater Semester courses (16 credits) where each course meets for 3 weeks. These courses meet from M-F 9:00 to 4:00 with all courses at the Marine campus. Co-required courses: MSC326, MSC463 and MSC466.

3: Danielle McDonald -- MSC 466: Experimental Physiology

This is an intensive laboratory and discussion course that combines experimental analyses with lectures and discussion to explore and understand marine physiology. Topics will include homeostasis, interactions with the external environment, and life with limited oxygen and water. Class meetings will be highly discussion-based; students will be expected to read literature, including primary research articles as suggested by the professor, to foster participation in problem sets, class discussions, form hypotheses and design laboratory experiments. Students will be required to develop hypotheses in class and design experiments that will test these hypotheses and also highlight different techniques in experimental physiology.

This course is part of Saltwater Semester so that students can be actively involved in intensive research. As part of the Saltwater Semester, students are required to enroll in four of the 4-credit Saltwater Semester courses (16 credits) where each course meets for 3 weeks. These courses meet from M-F 9:00 to 4:00 with all courses at the Marine campus. Co-required courses: MSC326, MSC463 and MSC467

4: Marjorie F. Oleksiak -- MSC 326: Marine Genomics

This course integrates lectures, discussions and research on genomics to understand the demography and evolutionary processes affecting populations. This research intensive course uses genomic data to better understand the health of species and ecological communities.

This course is part of Saltwater Semester so that students can be actively involved in intensive research. As part of the Saltwater Semester, students are required to enroll in four of the 4-credit Saltwater Semester courses (16 credits) where each course meets for 3 weeks. These courses meet from M-F 9:00 to 4:00 with all courses at the Marine campus. Co-required courses: MSC463, MSC466 and MSC467