Academic Quality Assessment and Development Self-Study

The University of Massachusetts

Intercampus Marine Science Graduate Degree Program

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UMass IMS AQAD Self-Study

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Introduction – The AQAD Process

Academic Quality Assessment and Development (AQAD) is an essential part of the university's Performance Measurement System, as specified by the UMass Board of Trustees (document T98-033). The AQAD reviews focus on academic majors and graduate programs, grouped by the academic department or other unit that offers them. In the case of interdepartmental or intercampus programs, the review is carried out by the program's director or coordinator. For the Intercampus Marine Science graduate program, UMass Dartmouth serves as the lead campus with participation by UMass Amherst, Boston and Lowell. The Dean of the School for Marine Science and Technology (SMAST) serves as the program coordinator.

The AQAD process asks program faculty to assess academic qualities such as currency of curriculum, student successes, and faculty interests and strengths. Each review involves a self-study, a visit by external evaluators, and formation of an action plan. AQAD focuses on program quality and effectiveness. Its results can be used as input to guide strategic and programmatic decisions.

The AQAD process culminates in an approved Action Plan that is arrived at in a consultative process between the Dean and the faculty of the program being reviewed. The Action Plan indicates how the program will address any issues raised during the review and establishes programmatic priorities for the next review period.

Core criteria to be addressed in the review process include the following:

1) Relevance of program goals and objectives to campus mission and priorities;
2) Relevance of curriculum to current standards of the discipline and rigor and coherence of curriculum;
3) Faculty quality and productivity;
4) Assurance that teaching and learning processes facilitate student success;
5) Effective use of resources (including budgetary and human resources).

In the remainder of this self-study, we address these criteria and provide a self-analysis of strengths and challenges as well as steps to effect improvement and realize program goals.

Overview of IMS Program

Establishment of IMS and its relevance to campus mission and priorities

Coastal and marine-related activities are critically important to the economy and societal well-being of the Commonwealth of Massachusetts and the Nation. The NOAA Fisheries Economics of the United States Report (NOAA, 2017) stated that commercial fishing in Massachusetts accounted for the largest employment impact in the New England Region with 83,000 jobs and was second largest nationally (California being the highest). Similarly, a recent report released by the UMass Dartmouth Public Policy Center, titled "Navigating the Global Economy: A Comprehensive Analysis of the Massachusetts Maritime Economy," found that the Massachusetts Maritime Economy is one of the largest employment sectors in the state and growth in the maritime sector is more robust than the statewide industry total. The importance of the marine sector to our economy and societal well-being is clear, and strong programs in marine research and education are critical to sustaining that.

In addition to the economic benefits, our coasts and oceans contribute a great deal to the quality and enjoyment of life for the residents of Massachusetts as well as visitors coming from outside the state. However, the increasing pressures of coastal population growth along with dire projections of increasing threats to our coasts and oceans necessitate a proactive agenda for improved understanding and informed management. While marine environments provide tremendous economic and societal benefits, they are also a precious asset that must be carefully observed and managed to ensure the continued sustainable use of resources.

A thriving coastal and marine economic sector that is carefully managed and sustained requires an increasingly sophisticated workforce to meet the employment needs of both public and private sector entities. Projected rates of employment growth in areas including environmental management and geoscience are roughly 10%, comparable to that of U.S. industry as a whole. In addition, projections of workforce need exceed the expected supply of newly trained graduates given anticipated growth in key areas of the marine sector and accelerating attrition due to an aging demographic (American Geosciences Institute, 2016). The complex issues facing our coastal and marine environments will require innovative approaches to educate K-12 students, their teachers, and the general public to provide for an informed citizenry. For these reasons and others, a robust research and educational capability in marine science and technology has been and must remain a high priority for the UMass system.

Recognition of the importance of a strong marine science academic and research program within the University of Massachusetts was evidenced by the formation of the Intercampus Graduate School of Marine Sciences and Technology (IGS) in 2000 (T00-005) followed by approval of the application for the M.S. and Ph.D. Degree Programs in Marine Science and Technology submitted to the Board of Trustees in 2001 (T01-006). The IGS later became in 2007 (by approval letter) the UMass School of Marine Sciences (SMS). The SMS was a highly successful program, expanding to an enrollment of more than 60 graduate students, a research program supported by more than $38M in external funding, and more than 400 peer-reviewed publications by faculty associated with the program.

In the interest of streamlining the administration of the marine science degree program, on May 23, 2012, the UMass Board of Trustees (BoT) rescinded the establishment of the SMS with the intent that the administrative structure would be modeled after the UMass Biomedical Engineering and Biotechnology (BMEBT) Multi-campus Joint Degree Program. The goal was to retain the strengths of a multi-campus interdisciplinary program, but improve effectiveness and efficiency by relying on existing administrative structures within the participating campuses. Under this reorganization, the SMS became the Intercampus Marine Science (IMS) Graduate Program. A key objective was also to foster a more diverse, adaptable, and responsive curriculum. It is important to emphasize that changes in the administration of the program do not change the approved degrees since each was a separate action by the Board of Trustees and Board of Higher Education, respectively. The action by the Board of Trustees necessitated a clarification of the revised administrative structure of the marine science program so as to ensure program continuity and minimal disruption to students in the program.

Program Overview

The Intercampus Marine Science graduate degree program is a UMass system-wide degree program in marine science. Participating campuses include Amherst, Boston, Dartmouth and Lowell. Students graduating from IMS receive a degree from the University of Massachusetts Amherst, Boston, Dartmouth, and Lowell. The degree program is fundamentally grounded in a broad, integrated, interdisciplinary approach to the study of marine sciences and technology and science management. The program

prepares students for employment opportunities in the private and governmental sectors and academia. Emphasis is placed on the education of researchers and scholars who will contribute not only to research, but also to the application of that research in environmental stewardship, resource management, marine technology, and economic development.

Role of Campuses

The IMS program draws on significant programs in marine sciences and technology and related areas at four of its five campuses (Amherst, Boston, Dartmouth and Lowell). UMass Dartmouth serves as the lead campus. Combining the various campus strengths and programs in the IMS permits the University to reap the benefits of numerous "synergies" among the campuses. For example, in the area of coastal and ocean policy and management, which is a specialty at the Boston campus, combining faculty at the Amherst, Boston and Dartmouth campuses in marine policy and management, environmental and natural resource management law, fishery management, resource and environmental economics, and land use planning has substantially increased the University's capacity in this area.

Mission and Vision of IMS and Relationship to University

The vision of the IMS, as originally expressed in the petition to establish the degree program, is to provide an interdisciplinary program in marine science and technology integrated across the four campuses of the UMass system.

The program mission is to improve the quality of graduate education in marine sciences and related technology within the University as well as foster research and public service in support of the Commonwealth's efforts in protection, preservation, restoration, and sustainable economic development of its extensive coastal and ocean lands, waters, and resources. The program was designed to prepare students academically in marine sciences and technology, to contribute to the economic development of the Commonwealth through technology transfer, and serve as a catalyst for research and development in marine sciences and technology. All of these functions support the University of Massachusetts's mission: "to provide an affordable and accessible education of high quality and to conduct programs of research and public service that advance knowledge and improve the lives of the people of the Commonwealth, the nation and the world."

Goals and Objectives of IMS Program

The primary purpose of establishing the IMS was to create a nationally and internationally recognized educational "center of excellence" contributing to scientific understanding, management, and the economic growth and sustainability of our oceans, continental shelf, coastal zone, and the communities of Massachusetts that border on the ocean.

The M.S. and Ph.D. in Marine Sciences and Technology programs have as their major purpose the education and training of marine scientists able to perform successfully in academia and the public and private sectors. Because the fundamental nature of issues and problems in marine sciences and technology lies in their complexity and "interconnection," the approach to graduate education and training in marine sciences is to require that both M.S. and Ph.D. students master the elements of several disciplines in order to address these problems. Our approach requires that students take both natural and social marine science and technology courses, based upon our belief that the underlying issues and problems we face in understanding, managing, and protecting our ocean and coastal resources are never

strictly a matter of natural or social science alone but will always involve a complex mix of natural, social, and economic elements.

At the Ph.D. level, our goal is to educate and train graduates able to pursue careers in academia and in high management positions in government, industry, business, and non-governmental organizations concerned with marine sciences and technology. At the M.S. level, our goal is to produce graduates who have mastered the basic knowledge and skills in both the natural and social marine sciences in order to perform successfully as coastal and ocean resource managers and specialists in governmental, private sector, and non-governmental positions.

To assess program performance and effectiveness, the following metrics were identified in the original program proposal as measurable objectives for the program:

1. Student Enrollment and Graduates- Annual reports of enrollments and graduates, as compared with projections.

2. Educational Opportunities for Students- Annual report and assessment of educational opportunities provided on the campuses during the five-year period of review. Student input via surveys, focus groups and other methods concerning their views of educational and research opportunities.

3. Placement of Graduates- Annual report of placement of graduates in positions of responsibility in industry, government, and academia. The goal is to place all graduates in such positions.

4. Increased Faculty Interactions- This goal relates to faculty research, teaching, and service activities involving interactions with other program faculty and staff (e.g., faculty exchanges, joint student advising, and collaborative research) and assess their effectiveness.

5. Enhanced Role of the University in Marine Science Policymaking Arenas - Faculty affiliations in marine policy organizations and committees, service projects, and grants and contracts will be reported annually to measure Graduate School performance.

6. Grants and Contracts – The IMS will maintain a record of all grants and contracts of participating program faculty and staff, which will permit an accurate assessment of the external funds received. The goal is to achieve a substantial increase in new IMS (formerly Intercampus Graduate School) grants and contracts.

Curriculum

IMS offers three graduate degree programs: M.S., Ph.D., and Professional Science Masters (PSM). Students located at the four participating campuses are required to complete “core” courses selected from the natural and social sciences to equip them for interdisciplinary studies and research followed by additional courses in an area of concentration. The core courses are intended to provide a common grounding in the biological, chemical, and physical oceanographic areas of marine sciences and technology, and in related marine policy and management disciplines. At least two core courses are offered each semester. These courses will ensure that all students master key concepts and skills central to an interdisciplinary marine sciences graduate program. Students normally complete the core courses in the first two semesters.

To build on the core courses, each student selects an area of concentration and chooses electives appropriate to this concentration, as approved by their faculty advisor and/or thesis committee. Option areas, which are intended as guidelines, are listed below:

- MASMA - Marine and Atmospheric System Modeling and Analysis
- CSS - Coastal Systems Science
- ICM - Integrated Coastal Management
- LMRSM - Living Marine Resources Science and Management
- MBEC - Marine Biogeochemical Cycles and Environmental Change
- MOT - Marine Observation Technologies
- OHH - Ocean and Human Health

The course load for full-time graduate students is nine (9) or more credits per semester; part-time graduate student status is defined as eight (8) or fewer credits in a semester. For doctoral candidates, students must spend the equivalent of at least one continuous academic year of full-time graduate work (nine credits per semester) in residence at the University.

Curriculum Delivery

The IMS graduate degree programs are fundamentally grounded in a broad, integrated, interdisciplinary approach to the study of marine sciences and technology. Students located at the four participating campuses are required to complete "core" courses selected from the natural and social sciences to equip them for interdisciplinary studies and research before focusing upon an area of concentration. Each IMS student must complete four core courses (12 credits), one in each of four core areas: biological oceanography, chemical oceanography, physical oceanography, and Marine Policy and/or Management areas (including law and economics). The core courses are intended to provide a common grounding in the biological, chemical, and physical oceanographic areas of marine sciences and technology, and in related marine policy and management disciplines. At least two core courses are offered each semester using the University's substantial distance learning facilities and technology. Students normally complete the core courses in the first two semesters.

List/Description of Core Courses

MAR 510 – Introduction to Chemical Oceanography - Chemical oceanography starting with the basic chemical and physical properties of sea water and going through the major processes shaping chemical distributions in the ocean. A brief review of basic thermodynamics and chemical equilibria precedes a discussion of carbonate equilibria and trace metal speciation. Throughout much of the course an interdisciplinary approach is taken and pertinent material on the interaction between ocean chemistry and marine physics, biology, and geology will be presented. Whenever possible, the results of recent studies will be incorporated into class material and the last few class periods are devoted to special topics.

MAR 515 – Geological Oceanography (core option for Professional Science Master's) – Process-oriented geological oceanography starting with the history of ocean floor exploration, theories of ocean basin formation, determination of geologic time and going through the major dynamic processes shaping and characterizing the seafloor - from beaches to basins, reefs to estuaries. Overviews of marine geophysics and plate tectonics, sea level variation and the formation of coastlines and reefs, and the importance of paleoceanography to assessing climate change will be presented and discussed. Throughout the course

an interdisciplinary approach is taken and pertinent material on the interaction between marine geology/sediments/sedimentation processes and marine chemistry, physics, and biology will be presented. Wherever possible, the results of recent studies and special topics will be incorporated into the class material and tailored to the students' areas of research.

MAR 545 - Biological Oceanography - The cycle of productivity in the marine environment and the physiological and morphological adaptations of plant, animal and bacterial populations within various oceanic regions. Interrelationships of the plankton, the nekton, and the benthos are stressed. BIO 545

MAR 555 – Introduction to Physical Oceanography - A descriptive treatment of ocean atmosphere interactions, water properties, general wind driven and thermohaline circulation, waves and tides, and coastal processes. Simplified conceptual models demonstrate the important principles.

Marine Policy Core Requirement (choice of one below or other approved policy-related course):

MAR 525 - U.S. Ocean Policy - Review of contemporary issues in U.S. Ocean Policy. The course is organized into general topics. Students are largely responsible to lead class discussion, and material will be derived from specific publications including books, papers, and other media. When possible specialists will visit or will be interviewed via teleconference, and discuss specific topics relating to U.S. National Ocean Policy. Specific class topics will require a brief written analysis. The course concludes with an oral synthesis paper and discussion.

POL 663 Ocean Policy and Law - The interrelation between law and policy in the particular context of the marine environment. Course surveys coastal zone management, offshore resource management, marine pollution, and domestic and international ocean policy. Students are offered a broad perspective on legal and administrative issues affecting the oceans worldwide.

Curriculum Quality and Relevance

The core curriculum for the IMS graduate program is consistent with other well-recognized graduate programs. See, for example, peer programs at the University of Maine (https://umaine.edu/marine/graduate-programs/oceanography/), University of Delaware (https://www.ceoe.udel.edu/schools-departments/school-of-marine-science-and-policy/oceanography-program), and University of Maryland (http://mees.umd.edu/ocean/).

Curriculum quality is maintained through regular updates of course content and evaluation of teaching based on student feedback as well as review by faculty peers.

A number of courses are offered through distance learning or remote delivery in a “blended” delivery mode allowing students can view course lecture notes and recorded lectures at a later time. This increases accessibility of courses to a wider student population and across the different UMass campuses. Graduate courses emphasize “engaged” learning approaches, whereby students are challenged to think critically in interactive discussions, problem solving, and laboratory exercises.

UMass Dartmouth Courses

Course descriptions are available at http://catalog.umassd.edu/index.php.

Marine Science Courses:

MAR 510 – Introduction to Chemical Oceanography
MAR 513 - Numerical Methods in Ocean Sciences I
MAR 514 - Quantitative Methods for Multidisciplinary Marine Applications
MAR 515 - Geological Oceanography
MAR 520 - Thesis Proposal Development
MAR 524 - Marine Ecosystem Modeling
MAR 525 - U.S. Ocean Policy
MAR 527 - Fisheries Management
MAR 530 - Ecosystem-Based Fisheries Management
MAR 535 - Biological Statistics I
MAR 536 - Biological Statistics II
MAR 540 – Introduction to Fisheries Science
MAR 542 - Marine Invertebrate Fisheries
MAR 544 - Stock Assessment of Fishery Resources
MAR 545 - Biological Oceanography
MAR 547 - Fisheries Survey Sampling
MAR 549 - Analysis of Tagging Data
MAR 550 - Laboratory in Oceanography - Data and Methods
MAR 554 - Physics of Fluids
MAR 555 – Introduction to Physical Oceanography
MAR 557 - Geophysical Fluid Dynamics
MAR 558 - Waves and Tides
MAR 560 - Acoustical Oceanography
MAR 562 - Satellite Oceanography
MAR 565 - Pollutant Transport in the Environment
MAR 572 - Environment and Resource Economics and Policy
MAR 580 - Special Topics: Fisheries Oceanography
MAR 585 - Special Topics: Estuarine and Ocean Sciences
MAR 590 - Masters Non-Thesis Research Project
MAR 595 - Independent Study
MAR 596 - Directed Study
MAR 599 - Special Topics
MAR 600 - Master's Thesis Research
MAR 603 - Pre Dissertation Research
MAR 610 - Ocean Turbulence
MAR 615 - Dynamics of Estuarine Circulation
MAR 620 - Studies Estuarine Dynamics
MAR 622 - Case Studies in Fisheries Science and Management
MAR 630 - Estuarine Biogeochemistry
MAR 640 - Global Marine Biogeochemistry
MAR 645 - Ocean Circulation and Modeling

MAR 650 - Marine Ecosystem Dynamics
MAR 655 - Numerical Methods in Ocean Sciences II
MAR 656 - Ocean Atmosphere Dynamics
MAR 660 - Coastal Physical Oceanography
MAR 661 - Physical Oceanography of Shallow Seas
MAR 662 - Physical-Biological Interactions in the Ocean
MAR 670 - Advanced Marine Time Series Analysis
MAR 675 - Scientific Writing
MAR 698 - Projects in Environmental Science
MAR 700 - Graduate Seminar
MAR 701 - Doctoral Dissertation Research
MAR 720 - Applied Statistics
MAR 721 - Remote Sensing
MAR 722 - Environmental Model Raster GIS
MAR 725 - Estuarine Ecology & Management
MAR 726 - Introduction to Geographic Information Systems
MAR 727 - Boundary Layer Meteorology
MAR 731 - Environmental Policy & Administration
MAR 732 - Environmental Law & Policy
MAR 733 - Chemistry of Natural Waters
MAR 734 - Coastal and Ocean Law
MAR 735 - Legal Foundations for Ecosystem Management
MAR 736 - The Role of Science in the Policy Process
MAR 738 - Coastal Zone Management

Biology Courses:
BIO 514 - Biology of Marine Mammals
BIO 540 - Env Physio Marine Animal
BIO 554 - Biology Of Sharks
BIO 571 - Marine Microbiology

Engineering Courses:
ECE 597 - Underwater Acoustics I
ECE 598 - Underwater Acoustics II
MNE 557 - Geophysical Fluid Dynamics

UMass Boston Courses

Cross-disciplinary Courses:

ENVSCI 600	Responsible Conduct in Research
ENVSCI 601	Intro. Probability & Applied Statistics
ENVSCI 603	Coasts and Communities I
ENVSCI 604	Coasts and Communities II
ENVSCI 607	Intro. To Environmental Innovation Clinic
ENVSCI 611	Applied Statistics
ENVSCI 623	Introduction to GIS

ENVSCI 625	Principles & Applucations of Remote Sensing
ENVSCI 635	Environmental Toxicology
ENVSCI 641	Geochemistry of a Habitable Planet
ENVSCI 642	Laboratory for Geochemistry of a Habitable Planet
ENVSCI 654	Professional Science Communication
ENVSCI 662L	Chemometrics
ENVSCI 665L	Ecological Risk Assessment
ENVSCI 710	Environmental Biogeochemistry
ENVSCI 715	Isotope Geochemistry
ENVSCI 718	Environmental Law
BIOL 607	An Introduction to Computational Data Analysis for Biology

Marine Science Courses:

ENVSCI 613	Oceans and Human Health
ENVSCI 630	Biological Oceanography
ENVSCI 640	Chemistry of Natural Waters
ENVSCI 650	Physical Oceanography
ENVSCI 658	Geomorphology Coastal Water
ENVSCI 660L	Coastal Ecological Processes
ENVSCI 688	Advanced Marine GIS
ENVSCI 693	Ecophysiology of Fishes
BIOL 506	Marine and Coastal Ecological Research
BIOL 533	Marine Invertebrates Lecture
BIOL 540	Marine Mammal Biology
BIOL 559	Caribbean Tropical Ecology, and Conservation Biology

Marine Policy Courses:

ENVSCI 616	Environmental Policy & Admin.
ENVSCI 680	Coastal and Ocean Law
ENVSCI 685	Ecosystem Management, Law, Policy
ENVSCI 716	Sci. & Tech. Info. & Policy Proc.
ENVSCI 726	Coastal Zone Management

UMass Amherst Courses

BIOL 584	Ichthyology
BIOL 566	Comparative Physiology
ENVIRSCI 585	Inorganic Contaminants
GEO-SCI 557	Coastal Processes
GEO-SCI 571	Geophysics
GEO-SCI 587	Hydrology
GEO-SCI 591NE	Climate Change Impacts in New England
GEO-SCI 597I	Isotope Geochemistry
NRC 563	Wetlands, Wildlife Ecology & Management

NRC 566	Restoration Ecology
NRC 568	Wetland Soils
NRC 570	Fish Ecology
NRC 571	Fisheries Science and Management
NRC 577	Ecosystem Modeling and Simulation
NRC 578	Watershed Science and Management
NRC 580	Conservation Genetics
NRC 585	Introduction to GIS
NRC 587	Digital Remote Sensing
NRC 590	Global Change Ecology
NRC 590AE	Aquatic Ecology
NRC 590C	Clean Energy and Climate Policy in Massachusetts
NRC 590TP	Adapting to Climate Change: Theories, Policy, & Action
NRC 597	WebGIS
BIOSTATS 650	Applied Regression Modeling
BIOSTATS 730	Applied Bayesian Statistical Modeling
ECO 601	Research Concepts
ECO 624	Diadromous Fisheries Ecology & Conservation
ECO 632	Multivariate Statistics for Environmental Conservation
ECO 634	Analysis of Environmental Data
ECO 636	Applied Ecological Statistics
ECO 690P	Public Engagement & Communications
ECO 691A	Conservation Seminar
ECO 697	Federal Environmental Law and Regulation
ECO 697EC	Environmental Social Science
ECO 697LG	Landscape Genetics
ECO 697RF	Recreational Fisheries Science and Management
ECO 679SU	Applied Sustainability
ECO 697SV	Design, Implementation, & Analysis of Surveys of People
ECO 757	Advanced Fisheries Management
ECO 777	Advanced Systems Ecology
GEOG 666	Water Resource Policy
GEOG 668	GIS and Spatial Analysis
GEO-SCI 691GW	Surface-Groundwater Interactions
REGIONPL 553	Resource Policy and Planning
REGIONPL 575	Environmental Law and Resource Management
RES-ECON 720	Environmental and Resource Economics
RES-ECON 721	Advanced Natural Resource Economics
POLSCI 784	Environmental Policy
PUBP&ADM 697EV	Environmental Policy

UMass Lowell Courses

ATMO.5010 Boundary Layer Meteorology
ATMO.5020 Advanced Synoptic Meteorology
ATMO.5030 - Remote Sensing of the Atmosphere
ATMO.5080 - The Climate System
ATMO.5100 - Regional Weather & Climate Modeling
ATMO 5140 – Numerical Sol/Simple Atmospheric Models
ATMO.5150 - Atmospheric Structure and Dynamics
ATMO.5240 - Simple Atmospheric Models
ATMO.5400 - Tropical Meteorology
ATMO.5710 - Air Pollution Phenomenology
ATMO.6740 - Air Quality Modeling
BIOL.5040 - Environmental Microbiology
BIOL.5130 - Invertebrate Zoology II
BIOL.5150 - Invertebrate Zoology II Lab
BIOL.5160 - Climate Change: Science, Communication, and Solutions
BIOL.5260 - Evolutionary Biology
BIOL.5370 - Biology & Evolution of Arthropoda
BIOL.5390 - Biology & Evolution of Arthropoda Lab
BIOL.5570 - Advanced Invertebrate Zoology
BIOL.5590 - Advanced Invertebrate Zoology Lab
CHEM.6530 - Chemical Oceanography
CHEM.6010/6020 Analytical/Environmental Seminar
CIVE.5010 - Wetlands Ecology
CIVE.5100 - Water Resource System Assessment
CIVE.5620 - Physical and Chemical Hydrogeology
CIVE.5680 - Environmental Fate and Transport
CIVE.5760 - GIS Application in Civil & Env.
CIVE.5780 - Biological Wastewater Treatment
CIVE.5790 - Wastewater Treatment and Storm Water Management Systems
ENVI.5040 - Geographic Information Systems
ENVI.5100 - Environmental Pollution
GEOL.5010 – Paleoclimatology
GEOL.5020 - Quantitative Geomorphology
GEOL.5240 - Regional Hydrogeology
GEOL.5820 - Geological Oceanography
GEOL.5310 - Isotopes in Environmental and Geosciences
MECH.5810 - Advanced Fluid Mechanics
MECH.5830 - Advanced Aerodynamics
MECH.5840 - Ocean Engineering
MATH.5090 - Probability and Mathematical Statistics
MATH.5190 - Introduction to Probability and Statistics II
BIOL.5020 – Limnology

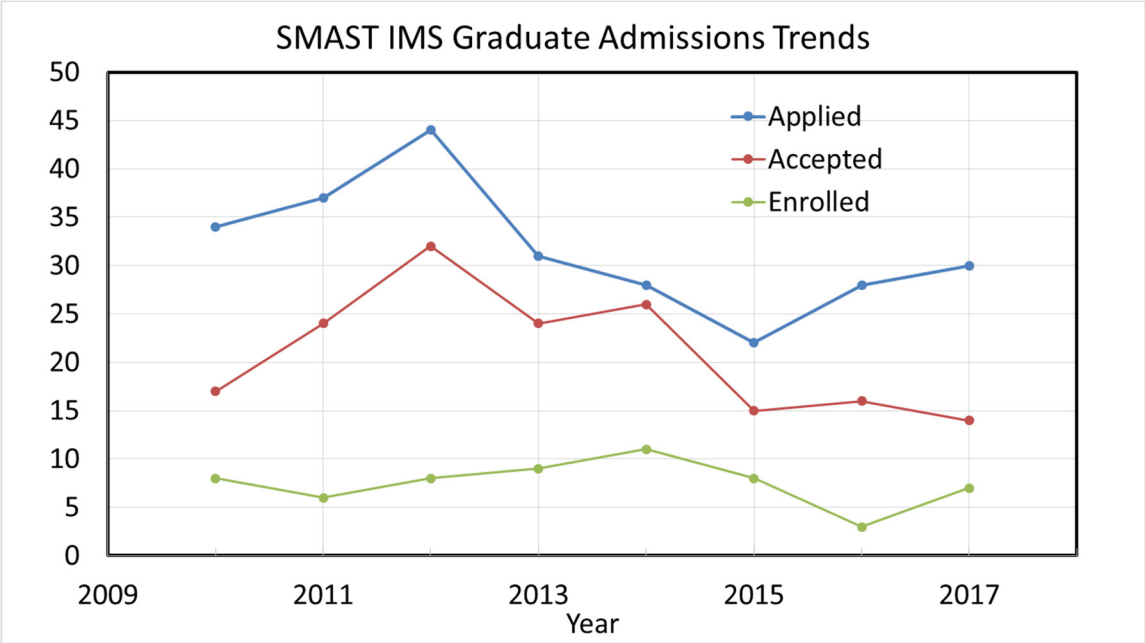
Student Admissions, Enrollment, and Graduates

UMass Dartmouth – Admissions Data

Table 1. UMass Dartmouth IMS admissions data.

Graduate Admissions														
	Fall 2010		***Fall 2011***		***Fall 2012***		***Fall 2013***		***Fall 2014***		***Fall 2015***		***Fall 2016***	
	M.S.	***Ph.D.***	***M.S.***	***Ph.D.***	***M.S.***	***Ph.D.***	***M.S.***	***Ph.D.***	***M.S.***	***Ph.D.***	***M.S.***	***Ph.D.***	***M.S.***	***Ph.D.***
Applied	21	20	14	23	16	28	14	17	16	12	11	11	14	12
Accepted	5	9	8	16	12	20	12	12	14	12	10	5	11	8
Denied	8	5	2	0	1	4	2	2	2	0	0	5	2	3
Enrolled	3	7	1	5	4	4	4	5	7	4	5	3	8	3
% Accepted	24%	45%	57%	70%	75%	71%	86%	71%	88%	100%	91%	45%	79%	67%
% Enrolled	60%	78%	13%	31%	33%	20%	33%	42%	50%	33%	50%	60%	73%	38%
Average College GPA	**	**	***	3.10	***	***	***	3.86	3.34	***	3.39	***	3.48	***
Average GRE Quan	*	*	*	*	763	*	--	707	--	--	--	--	--	--
Average GRE Quan Scaled	--	--	--	--	--	--	*	162	157	163	153	*	155	*
Average test scores are only shown when 3 or more enrolled students submitted scores.														
****Starting Fall 2011 College GPA was reported.***														
*****Average College GPA is only shown when 3 or more enrolled students submitted College GPA.***														

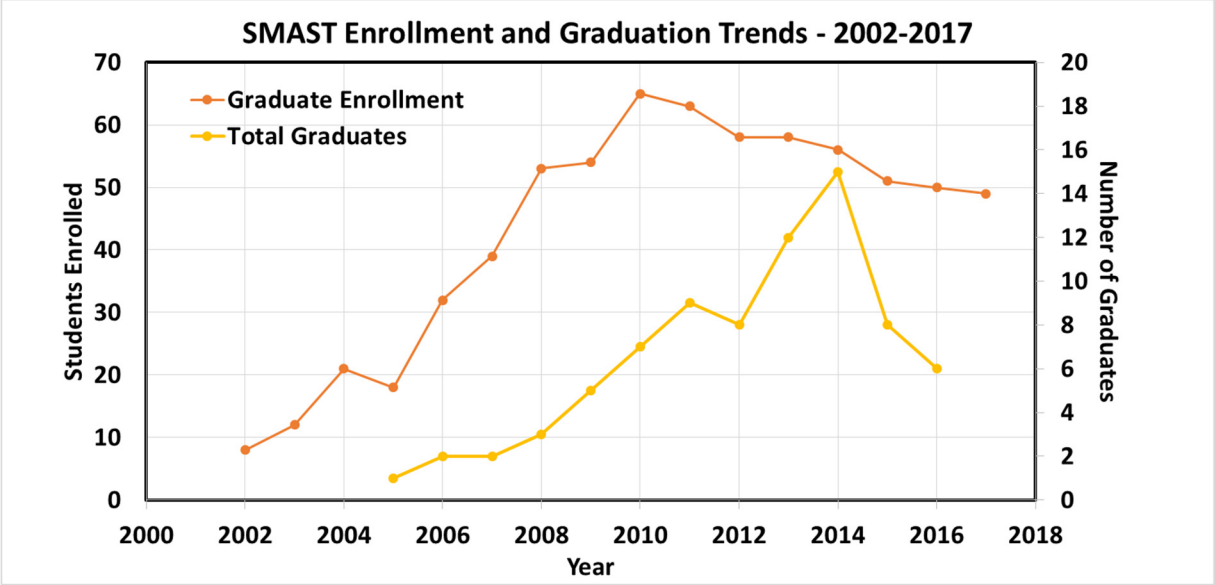
Figure 1. UMass Dartmouth IMS admissions data.



Applications as well as number of applicants accepted to the UMass Dartmouth graduate program peaked in 2012 (Table 1 and Figure 1). Numbers of applications declined until 2015, when a concerted effort was made to update the website and enhance recruiting efforts. This was believed to be a factor in the increase in numbers of applications from 2015-2017. However, numbers of accepted students has leveled off. This may in part be due to the fact that students are not generally accepted unless they have an advisor and funding for the student is identified.

UMass Dartmouth – Enrollment and Graduation Trends

Figure 2. UMass Dartmouth IMS enrollment and graduation trends.



UMass Dartmouth enrollment in the IMS graduate program reached a high of 65 students in 2010 (Figure 2). This coincided with a peak in research expenditures (see Faculty Workload), which can also be linked to the amount of student funding available through external sources. Enrollment has declined steadily to a low of 49 students in 2017. This trend can be attributed to reduced availability of student funding as well as a decline in numbers of faculty in the program (see Faculty Workload). Enrollment in core courses (see Table 2) has remained fairly consistent since 2013 despite the decline in overall enrollment (see table). This is partially due to the fact that these courses also serve students outside the IMS program.

Numbers of UMass Dartmouth IMS graduates per year peaked in 2014, a reflection of the prior peak in enrollment in 2010. As of fall 2017, SMAST has graduated 96 students with 105 degrees conferred, including 33 Ph.D. recipients. Five SMAST alumni received their undergraduate degrees from the College of Arts and Sciences and one from the College of Engineering. Average time to degree for full-time students was 3.1 years for M.S. students and 5.7 years for Ph.D. students. Of students who have enrolled in the IMS program at UMass Dartmouth, 29 have left the program without completing their degree.

Of the graduates to date, 46 were female and 50 were male. U.S. students accounted for approximately 70% of graduates. Asian students were the next largest demographic at 15%. Other nationalities represented included India (5%), Brazil (3%), and European countries (3%).

Table 2. Enrollment in Core Courses at UMass Dartmouth

Year	Semester	Course No.	Title	Enrollment
2013	fall	MAR 515	Geol Ocean	4
2013	fall	MAR 555	Intro Phys Ocean	12
2013	fall	POL 663	Ocean Pol & Law	12
2014	spring	MAR 510	Intro Chem Ocean	8
2014	spring	BIO 545/MAR 545	Biol Ocean	10
2014	fall	MAR 515	Geol Ocean	4
2014	fall	MAR 525	U.S. Ocean Policy	8
2014	fall	MAR 555	Intro Phys Ocean	12
2015	spring	MAR 510	Intro Chem Ocean	7
2015	spring	BIO 545/MAR 545	Biol Ocean	13
2015	fall	MAR 515	Geol Ocean	5
2015	fall	MAR 555	Intro Phys Ocean	12
2015	fall	MAR 599	Sp Top: Marine Sci and Ethics	11
2016	fall	MAR 525	U.S. Ocean Policy	12
2016	spring	MAR 510	Intro Chem Ocean	7
2016	spring	BIO 545/MAR 545	Biol Ocean	8
2016	fall	MAR 515	Geol Ocean	6
2016	fall	MAR 555	Intro Phys Ocean	12
2016	fall	POL 663	Ocean Pol & Law	7
2017	spring	MAR 510	Intro Chem Ocean	7
2017	spring	BIO 545/MAR 545	Biol Ocean	11
2017	fall	MAR 515	Geol Ocean	4
2017	fall	MAR 555	Intro Phys Ocean	19
2017	fall	POL 663	Ocean Pol & Law	15
2018	spring	MAR 510	Intro Chem Ocean	6
2018	spring	BIO 545/MAR 545	Biol Ocean	7

UMass Dartmouth - Career Placement

IMS graduates have been highly successful in job placement in their fields, and are well regarded by the external community. Of the approximately 100 IMS graduates from UMass Dartmouth, 94% reported finding employment, 86% have obtained a professional position in a discipline related to their field of study, and about 42% have found positions in the New England region. Of those in a related professional position, about 30% work in government (federal or state), 11% obtained academic appointments in institutions of higher learning, 11% took on postdoctoral positions, about 8% went on to pursue advanced graduate study, and about 8% worked for non-profit/non-governmental organizations.

UMass Boston – Admissions, Enrollment and Graduated Students

Overview of the UMass Boston M.S. and Ph.D. in Marine Science and Technology degree programs

During spring 2017, there were seventeen Marine Sciences (MARSCI) graduate students (nine Ph.D. and eight MS) actively enrolled in the UMass Boston School for the Environment (SFE) graduate program. The SFE MARSCI degree program has seen a large increase in both applications and enrollments over the last two academic years (Table 3), with an average enrollment of two students per year prior to AY 2015 and five students per year since then. This is a direct result of the MOU between SFE and the New England Aquarium, which has drawn new students to the program as well as afforded some Aquarium researchers a chance to earn a graduate degree. The yield for MARSCI has generally been 70% or higher. Graduation rates have mimicked the applications rates, with approximately two MARSCI graduates per year between AY 2009-10 and 2016-17. The first two MARSCI Ph.D. students graduated in 2016, and we anticipate Ph.D. graduations will increase due to the increase in Ph.D. students into the program, beginning in AY 2015-16.

Table 3: Applications, enrollments and graduations for the Marine Sciences program.

	Complete applications		**Admitted to program**			**Enrolled in the program**		**Graduated from program**	
Year	MS	PhD	MS	PhD	**Yield**	**MS**	**PhD**	MS	PhD
2009-10	1	1	1	1	100%	1	0	3	0
2010-11	0	1	0	1	100%	0	1	2	0
2011-12	3	2	2	2	80%	2	2	1	0
2012-13	2	1	1	1	67%	1	1	1	0
2013-14	1	2	0	1	33%	0	1	1	0
2014-15	2	2	2	1	75%	2	1	0	0
2015-16	3	5	3	4	88%	3	3	2	2
2016-17	6	4	4	3	70%	4	3	3	0

Yield

Our average yield (the number of admitted students who enroll in the program) for M.S. students is 82% +/- 38% (AY09-10 through AY16-17). Our average yield for Ph.D. students is 81% +/- 33% (AY09-10 through AY16-17). Using a linear regression model of enrollment growth in the M.S. program from fall 2009 to Fall 2016 shows the program is enrolling new M.S. students at a flat rate with expected growth, annually of 0.12. Similarly, Ph.D. program enrollment is expected to stay constant with only slightly higher predicted growth (0.33 annually). The preparedness of students entering the Marine Science and Technology M.S. and Ph.D. programs continues to remain stable. Our M.S. students typically score higher on the GRE exam than our Ph.D. students but have lower previous institution GPAs.

Retention

For M.S. students, our 1-year retention rate of students who applied and enrolled into the M.S. program (does not include Ph.D. students who earned an M.S. along the way) is 75% +/- 42% (all data AY09-10 through AY16-17). On average, at least 25% of M.S. students will, by the end of their second year, transfer to the Ph.D. program. Our 2-year M.S. completion rate is only 10% +/- 42% meaning that few of our students complete their degrees within 2 years of enrolling. Our 4-year completion rate is 50% with some years showing no completions after 4 years of enrolling. Similarly, completions after 6-years are no higher than for 4-years indicating a high rate of attrition of the M.S. program.

For Ph.D. students (AY09-10 through AY16-17) our 2-year retention rate is 42% +/- 50%. On average, we lose 23% of the Ph.D. students who leave the University to pursue a Ph.D. elsewhere or decide not to pursue the Ph.D. at all. Of those students retained in the Ph.D. program the 4-year Ph.D. completion rate is 0%. Our 6-year completion rate is 58% with no additional students having completed the Ph.D. by the 8th year.

Graduation

The number of M.S. and Ph.D. degrees awarded each year fluctuates in concert with the number of students admitted to the program thereby retaining relatively constant enrollments in these programs. In AY16-17 we awarded 2 M.S. degrees and 2 Ph.D. degrees. Our placement of Marine Science and Technology M.S. graduates is exceptional with an average (AY09-10 to AY 16-17) of 95% of our M.S. graduates employed in their field of study or enrolled in a Ph.D. program within 6 months of graduation. Similarly, our Ph.D. graduates employed at the rate of 100% within 6 months of degree completion.

UMass Boston – Career Placement

SFE is proud of the fact that 100% of our graduate students are employed in jobs related to their fields of study after graduation. This holds true for SFE MARSCI graduate students as well. Table 4 lists the sectors in which the fifteen MARSCI students who graduated between AY 2009-10 and AY2016-17 are employed immediately after graduation and currently.

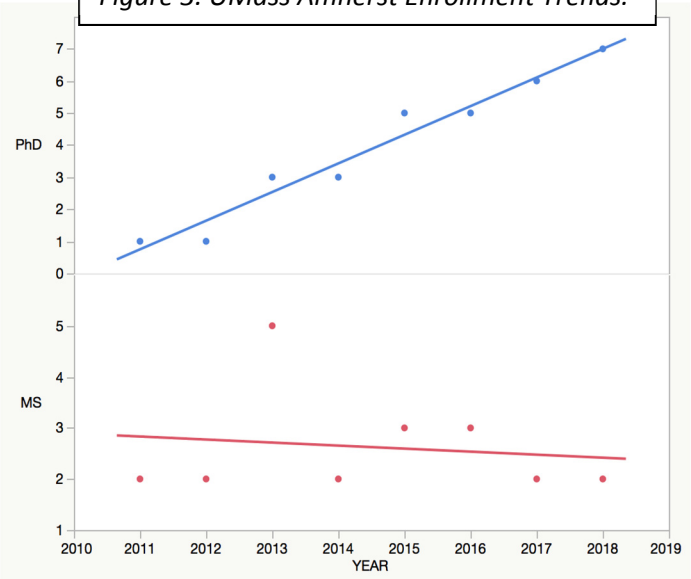
Table 4: MARSCI graduate employment sector since AY09-10

Sector	After graduation	Current Position
Government/public sector	2	1
Further study	4	4
Private (business/consulting)	4	5
Entrepreneurial/Independent	1	2
Education (K to Higher Ed)	2	1
Not-for-profit/NGO	1	1
Unknown	1	1

UMass Amherst – Admissions, Enrollment and Graduated Students

The number IMS graduate students at UMass Amherst has grown from three in 2011 to nine in 2018 (Figure 3). This growth can be attributed to a consistent increase in the number of Ph.D. students in the program, while the number of M.S. students has remained static. With two new IMS faculty in ECO, we are anticipating additional growth in the number of graduate students in the IMS program. On average, we have 8-10 applicants to the IMS program at UMass Amherst. Nearly all graduates of the IMS program at UMass Amherst are currently employed in a marine/aquatic discipline or have continued on in their graduate education and professional training.

Figure 3. UMass Amherst Enrollment Trends.



Academic Assessment

Evaluation of Teaching

At the end of each course, students are given the opportunity to evaluate the course using a scan-sheet-questionnaire. Course evaluations are an important part of reappointment, tenure and promotion decisions. Ultimately, it is the Chair's responsibility to share the results of the evaluation with faculty prior to having them filed in the faculty personnel file. All student evaluations are to be included in the candidate's tenure and promotion files. SMAST faculty teaching evaluation scores for FY2014-2017 ranged 3.95 to 4.52 out of 5 (median=4.30). This compares to an overall mean score for UMass Dartmouth faculty in FY2012-2013 of 4.31 out of 5.

Additional evaluation of teaching effectiveness is based on student survey results (see below) and faculty peer assessments of teaching either by direct observation or by assessment of course materials. This latter assessment is performed as part of the faculty annual evaluation process.

Student Surveys

UMass Dartmouth - Graduate student academic quality and well-being survey

A survey of UMass Dartmouth IMS graduate student well-being and satisfaction was conducted in fall 2017. The full survey results are included in the Appendices. Questions were modeled after the 2014 Berkley well-being study (http://ga.berkeley.edu/wellbeingreport) and grouped in categories of academic quality and environment, program climate, department climate, and general well-being. The response rate was 35 out of 49 students or 71.4%.

Related to academic quality and environment, 73% of respondents agreed or strongly agreed that the core course requirements are appropriate. However, only 56% of respondents agreed or strongly agreed that the core course content was relevant and useful to them. This may be a reflection of the diverse background and research areas of our students (e.g., fisheries versus physical oceanography). More than 50% of respondents either disagreed or strongly disagreed that the quality of instruction was high for the core courses. This is an important finding and steps are being taken to address the apparent student dissatisfaction with the core courses. Comments reflected concerns about the lecture format of some of the core courses, and the need to utilize more engaged learning practices that challenge critical thinking and enhance student understanding of material. This is clearly an area that will need to be addressed in efforts to improve the quality and delivery of the core courses. More than 70% of respondents agreed or strongly agreed that the quality of elective course instruction was high. However, respondents were split as to whether the variety of electives was suitable for their needs, and some comments expressed a need for more variety in electives.

Regarding advising, over 60% of respondents agreed or strongly agreed that the quality of advising was high and that their advisor was a real mentor to them and 76% agreed or strongly agreed that their advisors were real assets to the program. About 70% or more of respondents also agreed or strongly agreed that they were well-prepared for the work required in the program, were optimistic about their post-graduate career prospects, and had adequate space and resources.

Finally, related to well-being, more than 76% of respondents agreed or strongly agreed that they were valued by peers, administration, and faculty and more than 60% that their culture was valued and that they belong to a community. More than 76% of respondents agreed or strongly agreed that they

knew where to get help on campus for health needs, but a smaller percentage (52%) were aware of counseling and psychological services. Most respondents (~69%) felt that they did have someone with whom they could share their private worries and concerns. Clearly, an ongoing effort is needed to ensure that students are made aware of health and counseling resources offered by the campus. The SMAST Dean's Office also maintains an open door policy for students should they need assistance.

See Appendices for full survey results.

UMass Boston - Graduate student well-being survey

During fall 2017, we created a Graduate Student Well Being Survey to better understand the overall outlook and well-being of our SFE graduate students. This survey was based on the happiness and well-being survey developed at UC Berkeley and was slightly modified to fit the SFE programs. Our main goal was to identify what we are doing right and what we can do better to support our graduate students during their tenure in SFE. Responses were anonymous and participation was optional. The survey was created and then tested by two former graduate students and revised based upon their feedback. The revised survey was then reviewed by several core SFE faculty and revised again based on their feedback. In late January 2017, the survey was sent to 80 graduate students and 34 responded (29% response rate). The survey was divided into eight parts: 1. Satisfaction with life; 2. Depression scale; 3. Basic human needs; 4. Succeeding academically; 5. Departmental climate and belonging; 6. Well-being maintenance; 7. Achievement orientation scale; and 8. Demographic and open response questions.

Eight of our seventeen Marine Sciences graduate students responded, which represented 24% of the survey respondents. In a nutshell, the responses indicated that SFE graduate students are well-balanced and satisfied with their lives, they feel safe where they live and work and they feel valued by SFE faculty mentors and staff. At times, they struggle with motivation and getting adequate sleep, but a low percentage seemed to suffer from symptoms of depression. Not surprisingly, however, the majority of respondents do suffer from financial uncertainty and stress. Many have had to find supplemental income (from family, fellowships or part-time jobs) in order to make ends meet and they are somewhat unsure about their career paths. The most common open response was a request for increased stipends because of the high cost of living in the Boston area.

Assessment of Student Learning Outcomes

Student progress through the graduate program is assessed through performance in the coursework, as well as through regular meetings with advisor and student, maintaining student progress tracking sheets, meetings with advisory committees, dissertation proposal defense, comprehensive exams, writing of thesis or dissertation, and public and closed defense of thesis or dissertation. Additional metrics of student outcomes include student presentations at professional meetings, student authored or co-authored publications, and student involvement in service activities. Finally, program effectiveness is reflected in our alumni through tracking of career placement following graduation as well as alumni awards or other recognition.

Internal Metrics

Students are required to maintain a tracking sheet which provides a reporting on progress towards various program milestones. This tracking sheet is used to regularly review student progress towards their degree

by the advisory and graduate program coordinator. Student progress is reviewed on at least an annual basis. Assessment of student progress is made by tracking the following internal metrics:

I. Satisfactory completion of core courses
II. Committee/advisor meetings and approval of thesis concept
III. Dissertation proposal defense
IV. Comprehensive exam
V. Defense – oral public and closed sessions
VI. Completion of thesis or dissertation
VII. Certification of degree

External Metrics

External metrics of student performance include the following:

I. Student presentations at professional venues – 25 (50%) of currently enrolled UMass Dartmouth IMS students have presented their research at professional meetings
II. Student awards at professional venues -
III. Student publications - 14 (28%) of currently enrolled UMass Dartmouth IMS students have published some portion of their research
IV. Student involvement in service activities –Students are expected to be involved in service activities. Some examples are given in the policy section on page 23.
V. Successful career placement in related discipline - 86% of graduates have obtained a professional position in a discipline related to their field of study and about 42% have found positions in the New England region.
VI. Alumni awards and special recognition

To cite just a few examples, SMAST graduate and now Assistant Research Professor Cate O'Keefe was awarded the UMass Dartmouth Young Alumni Award in November 2014. Dr. O'Keefe was also invited to address the annual meeting of the American Association for the Advancement of Science (AAAS) in San Jose, California, in February of this year. Former Ph.D. student Corey Eddy (Biology/SMAST) won the "Best Student Paper Presentation" award at the American Fisheries Society annual meeting in 2013. Master's recipient Santhiska Pather received a Knauss Fellowship in 2013 working for the Ecological and Health Processes Branch within the Office of Science and Technology, Office of Water at the US-EPA. Ph.D. graduate Craig P. O'Connell was honored at the 45th Annual Alumni Achievement Awards, which took place at UMass Dartmouth.

Faculty Assessment

Faculty assessment is conducted annually on each of the campuses according to union-specified procedures. Details are given in the Appendices.

Description of Human Resources (See Appendices for CVs)

UMass Dartmouth Faculty (School for Marine Science and Technology)

Full-time, Regular Faculty

Department of Estuarine and Ocean Sciences:

Mark Altabet (Professor and Chair)
Wendell Brown (Professor)
Avijit Gangopadhyay (Professor)
Brian Howes (Professor)
Cynthia Pilskaln (Professor)
Miles Sundermeyer (Professor)

Department of Fisheries Oceanography:

Steve Cadrin (Professor and Chair)
Changsheng Chen (Professor)
Geoffrey Cowles (Associate Professor)
Gavin Fay (Assistant Professor)
Pingguo He (Professor)
Kevin Stokesbury (Professor)

Affiliate/Joint Faculty

Amit Tandon (Professor, Mechanical Engineering)
Dan MacDonald (Professor, Civil and Environmental Engineering)
Pia Moisander (Assistant Professor, Biology)
Jefferson Turner (Professor, Biology)

Research Faculty

N. David Bethoney (Research Assistant Professor)
Annie Bourbonnais (Research Assistant Professor)
Jianhua Qi (Research Associate Professor)

Emeritus Faculty

James Bisagni
Dan Georgianna
Lou Goodman
Brian Rothschild

Adjunct Faculty

Brink, Kenneth: Woods Hole Oceanographic Institution (senior scientist emeritus)
Farrington, John: Woods Hole Oceanographic Institution (emeritus)
Ford, Kathryn: Massachusetts Division of Marine Fisheries
Greene, Andrew: Naval UnderSea Warfare Center

Hebert, Dave: Bedford Institute of Oceanography
Honjo, Susumu: Woods Hole Oceanographic Institute (emeritus)
Lelong, M. Pascale: NorthWest Research Associates
Mahadevan, Amala: Physical Oceanographer, Woods Hole Oceanographic Institution
Pfister, Catherine: Hull Biological Laboratories, University of Chicago
Saint Laurent, Lou: Woods Hole Oceanographic Institution
Teal, John: Woods Hole Oceanographic Institution (emeritus)
Taylor, Craig: Woods Hole Oceanographic Institution
Warn-Varnas, Alex: Consultant, Jacobs Technology

Armstrong, Michael: Asst. Director, Fisheries Biology, Massachusetts Division of Marine Fisheries
Beardsley, Robert: Physical Oceanographer, Woods Hole Oceanographic Institution
Bochenek, Eleanor: Marine Scientist, Haskin Shellfish Research Laboratory, Rutgers University
Boreman, John: Director, Northeast Fisheries Science Center, NOAA National Marine Fisheries Service
Bucklin, Ann: Head, Department of Marine Sciences, University of Connecticut
Churchill, James: Research Scientist, Woods Hole Oceanographic Institution
Diodati, Paul: Director, Massachusetts Division of Marine Fisheries
Fogarty, Michael: Chief, Ecosystem Assessment Program, NOAA, NMFS, Northeast Fisheries Science Center
Hare, Jonathan: Supervisory Marine Research Scientist, NOAA National Marine Fisheries Service, Northeast Fisheries Science Center
Harris, Bradley: Assistant Professor of Marine Biology, Alaska Pacific University
Jacobson, Larry: Invertebrate Resources Task Leader, Northeast Fisheries Science Center, NOAA National Marine Fisheries Service
Ji, Rubao: Associate Scientist, Woods Hole Oceanographic Institution
Kritzer, Jake: Senior Marine Scientist, Environmental Defense Fund
Link, Jason: Program Leader, Food Web Dynamics Program, NOAA National Marine Fisheries Service
Mandelman, John: Research Scientist, New England Aquarium
McGillicuddy, Dennis: Senior Scientist, Woods Hole Oceanographic Institution
Miller, Timothy: Research Fishery Biologist, Woods Hole Oceanographic Institution
Murawski, Steven: Director of Scientific Programs, Chief Science Advisor, NOAA National Marine Fisheries Service; Research Professor, University of South Florida
Palka, Debra: Research Fishery Biologist, NOAA, NMFS, Northeast Fisheries Science Center
Pierce, David: Deputy Director, Massachusetts Division of Marine Fisheries
Rago, Paul: Chief Scientist, Population Dynamics Branch, Northeast Fisheries Science Center, NOAA National Marine Fisheries Service
Schizas, Nicolaos; Professor, University of Puerto Rico
Sherman, Kenneth: Director, U.S. Large Marine Ecosystems Program
Sissenwine, Michael: Visiting Scholar, Woods Hole Oceanographic Institution
Skomal, Gregory: Senior Marine Fisheries Biologist, Massachusetts Division of Marine Fisheries
Stevens, Bradley: Professor of Environmental Science, University of Maryland Eastern Shore
Thunberg, Eric: Economist, NOAA, NMFS, Northeast Fisheries Science Center
Townsend, David: Professor of Oceanography, University of Maine
Wahle, Rick: Research Associate Professor, Darling Marine Center, University of Maine
Weinberg, James: Fishery Biologist, NOAA, NMFS, Northeast Fisheries Science Center
Winger, Paul: Centre for Sustainable Aquatic Resources Fisheries and Marine Institute of Memorial University
Wu, Zhong-Xiang: Center for Exposure Assessment & Dose Reconstruction, Exponent Inc.

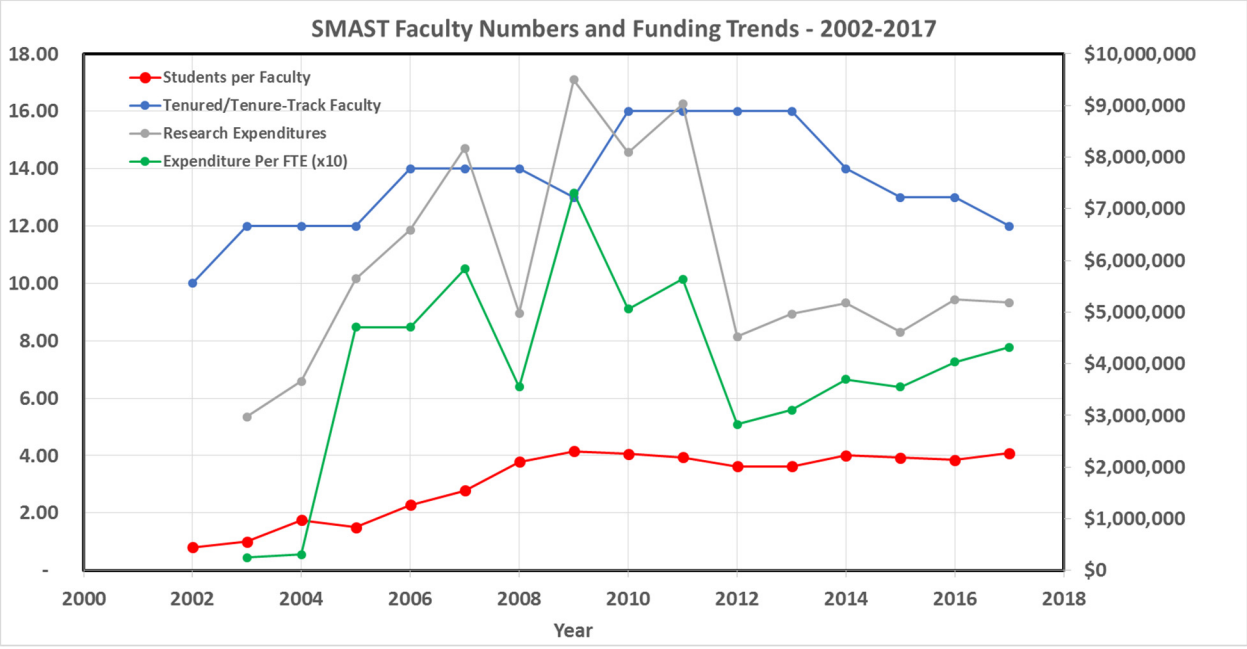
Faculty Workload

Allocation of the full-time faculty workload among activities varies among the different campuses and participating departments. Here, we provide an estimate based on information for the 2016-2017 Academic Year. These data include all courses taught and all current external grants. The time spent on each activity as well as the service contributions of faculty had to be estimated from experience and familiarity with departmental Annual Faculty Reports. Allocation of workload varies considerably among faculty. For example, senior faculty are expected to take on more service to enable junior faculty to focus on research. Overall all faculty have made significant contributions to research with contributions to service and teaching varying among faculty members. Percentages vary across the different campuses, but generally about 20% of faculty time is devoted to service, while 40-50% is devoted to research and 30-40% to teaching. Supervision of graduate students is included as part of the teaching responsibilities for faculty, although this may also involve a research component, including funding for students through grants. Additional teaching activity may include undergraduate courses and advising undergraduate interns. On average, about 28% of the total FTE goes to teaching general education and other undergraduate courses and the remainder to teaching graduate students.

UMass Dartmouth Faculty

The numbers of tenured/tenure-track at the School for Marine Science and Technology (SMAST) faculty reached a peak from 2010-2013 and has been steadily declining since then (Figure 4). Research expenditures peaked in 2009, coinciding with major earmark funding, which was subsequently eliminated. SMAST faculty have been highly successful in rebuilding the research funding portfolio through competitive funding sources and total research expenditures as well as expenditures per faculty FTE have increased from a low in 2012. Numbers of graduate students per faculty FTE showed a steady increase in the early years of the program until 2009 and have remained roughly the same since that time.

Figure 4. UMass Dartmouth SMAST faculty and external funding trends.



UMass Dartmouth IMS Scholarly Contributions

IMS-affiliated faculty at UMass Dartmouth have maintained a strong record of publication in peer-reviewed scientific journals. From 2013 to the present, SMAST faculty have published approximately 340 peer-reviewed articles in professional journals (averaging more than 60 per year). Of these, 95 publications were authored or co-authored by students in the program. Faculty have also produced various data products including contributions to databases, model products, and other products. For example, SMAST faculty and students participate in regional ocean observing systems, including the Northeast Regional Association Coastal Ocean Observing System (NERACOOS) and the Mid-Atlantic Bight Regional Association Coastal Ocean Observing System (MARACOOS). Ocean modeling work by Professor Changsheng through the Northeast Coastal Ocean Forecasting System (NECOFS) has contributed to storm surge forecasting and has been used by emergency managers in directing evacuation plans due to storms. Other model products support search and rescue efforts by the U.S. Coast Guard. A ship icing forecast model is also used by fishing vessels to avoid areas with dangerously high probability of ice accumulation on vessels.

Faculty are also routinely sought as reviewers of proposals and manuscripts, a testament to their reputations in their respective fields. Several faculty also hold editorial positions with professional journals.

Grants and Contracts – UMass Dartmouth

Over the past five years, SMAST has secured new research funding ranging from $4.8-$6.0M (Table 5). This represents between 32 and 41% of total external research awards to the University. Numbers of awards range from 59-77 annually. Sources of funding include NSF, NOAA, ONR, NASA, Commonwealth of Massachusetts, and various other sources including non-governmental. IMS-affiliated faculty in other units such as the departments of biology, civil engineering and mechanical engineering, are also research-active generating more than $650K in new awards in FY2017.

Table 5. UMass Dartmouth Awards by Unit

Fiscal Year	*Academic Affairs*	*Charlton College of Business*	*College of Arts & Sciences*	*College of Engineering*	*College of Nursing*	*School for Marine Science & Technology*	*Office of the Chancellor*
FY17	$1,163,955	$3,629	$3,967,443	$2,907,946	$766,587	$5,186,448	$135,118
FY16	$770,021	$0	$4,106,969	$3,198,945	$639,034	$5,958,249	$29,133
FY15	$762,955	$12,357	$3,678,695	$3,965,200	$239,315	$5,224,402	$50,000
FY14	$1,171,220	$0	$3,781,007	$3,733,077	$95,836	$4,780,693	$90,000
FY13	$812,360	$ $8,560	$2,955,082	$4,391,939	$314,099	$4,967,122	$92,896

Role of the University in Public Service and Marine Science Policymaking Arenas

SMAST and other IMS faculty and students at UMass Dartmouth continue to have a strong record of public engagement, from local schools and organizations to regional, national and international collaborations and partnerships. Some examples include the following:

- NOAA Cooperative Institute for North Atlantic Research (CINAR) - As part of the outcome of the discussions between the NOAA Northeast Fisheries Science Center, SMAST and DMF, NOAA

committed to provide funding to CINAR that included support for a tenure-track faculty position at SMAST in quantitative fisheries science. In addition to funding to support a new faculty member at SMAST, a portion of the funding has also been used for graduate students in fisheries science. Another aspect of the project includes a fellowship program at the Woods Hole Oceanographic Institution (WHOI) to foster interactions between WHOI scientists, SMAST, and the Fisheries Science Center.

- Northeast Regional Association Coastal Ocean Observing System (NERACOOS) and the Mid-Atlantic Bight Regional Association Coastal Ocean Observing System (MARACOOS) - SMAST is a member organization of the Northeast Regional Association Coastal Ocean Observing System (NERACOOS) and the Mid-Atlantic Bight Regional Association Coastal Ocean Observing System (MARACOOS). SMAST Dean Lohrenz has served on the Board of Directors of NERACOOS since 2011 and as president since 2014. Professor Changsheng Chen serves as a member of the NERACOOS Strategic Planning Committee. Professor Wendell Brown is a member of the Board of Directors of MARACOOS.
- Massachusetts Marine Fisheries Institute (MFI) - The Massachusetts Marine Fisheries Institute (http://www.umassd.edu/smast/research/massachusettsmarinefisheriesinstitute/) is a clear example of broad engagement on fisheries issues critical to the community and region. MFI Advisory Council meetings bring together a diverse group in a constructive dialogue, and provide recommendations for future research priorities. Both UMass Boston and UMass Amherst have representation on the MFI Advisory Council. The MFI hosts numerous events and activities that contribute to science support for policy development. In addition to MFI-related activities, SMAST faculty and students participate in various fisheries advisory groups. Since 2009, SMAST students have been participating directly in international fisheries science and management through the International Council for the Exploration of the Sea (ICES) under the guidance of Professor Steve Cadrin. Professor Cadrin also serves as a member of the Science and Statistical Committees of the New England Fishery Management Council and the South Atlantic Fishery Management Council. Professor Kevin Stokesbury and his students have participated in the New England Fishery Management Council Scallop Plan Development Team. Other faculty in the Department of Fisheries Oceanography also serve in various advisory groups related to fisheries science and management. Professor Pingguo He served as Chair of the ICES/FAO Fishing Technology and Fish Behavior Working Group meetings held in Lisbon, Portugal, May 2015, a major international effort.
- Offshore Wind and the Blue Economy Initiative – UMass Dartmouth, as the only Massachusetts national Tier 1 research university (US News & World Report) located south of Boston, plays a catalytic role in assisting the region in expanding its Blue Economy in a sustainable manner. SMAST and UMass Dartmouth has had a leading role in activities related to research and development of offshore wind in New England. UMass Dartmouth is a member of the Massachusetts Research Partnership (MRP), a collaboration of universities to advance offshore wind research and development. UMass Amherst, Boston, and Lowell are also active in the MRP. On November 8-9, SMAST was the site of a workshop on "Atlantic Offshore Renewable Energy Development and Fisheries" hosted by a committee of the National Academies of Sciences, Engineering, and Medicine and sponsored by the Bureau of Ocean Energy Management. Professor Kevin Stokesbury is a member of the workshop planning committee and presented at the meeting along with numerous other fisheries scientists, industry representatives, and government officials. The University of Massachusetts Dartmouth recently signed an MOU with the offshore wind

developer Deepwater Wind for a commitment of $1M over 5 years to examine interactions between offshore wind infrastructure and activities with other uses of the ocean (e.g., fisheries).

- Center for Innovation and Entrepreneurship – The Center for Innovation and Entrepreneurship (formerly the Advanced Technology and Manufacturing Center) is a center for research and development on new and emerging technologies. It offers conference facilities, incubator space for new start-ups, and capabilities for prototype development and biotechnology and biopharmaceutical development. The CIE is expanding its outreach to southeastern Massachusetts entrepreneurs, including the faculty and students at UMass Dartmouth. The CIE will continue to incubate on-site startups, but also serve as a virtual incubator, providing services to startups throughout the region. The CIE has been the site of several Maritime Innovation Conferences, the most recent being the MTS Tech Surge & Maritime Innovations event (http://www.umassd.edu/innovate/events/mtstechsurgemaritimeinnovations/) in November 2017. The CIE has been instrumental in promoting networking of marine technology companies and linking them with students and faculty researchers.
- Massachusetts Estuaries Program (MEP) - The Massachusetts Estuaries Project is another example of direct local and regional societal benefit of SMAST research. Led by SMAST faculty member Prof. Brian Howes, the Massachusetts Estuaries Project was initiated to reduce the level of municipal and state funds expended to meet the requirements of wastewater planning and implementation. This multimillion dollar program is a partnership between the Massachusetts Department of Environmental Protection (DEP) and the UMASS/Dartmouth School for Marine Science with participation by communities to provide information to help in sustaining water quality. The program has involved numerous IMS students and emphasizes "cost-effective" solutions with economic benefits to communities on the scale of millions of dollars.
- Massachusetts Ocean Science Advisory Council – SMAST is represented by Dean Steven Lohrenz and Professor Wendell Brown (as alternate) on the Massachusetts Ocean Science Advisory Council, 2011- present. The Council advises the Massachusetts Ocean Council in activities related to coastal zone management and marine planning.
- Consortium for Ocean Leadership - SMAST has represented the University of Massachusetts on the national ocean advocacy organization, the Consortium for Ocean Leadership, since 2012. Dean Lohrenz serves on the Board of Trustees and has held the position of Vice Chair since 2016.
- University Oceanographic Laboratory System (UNOLS) – Professor Miles Sundermeyer has served as the UMass representative to University Oceanographic Laboratory System from fall 2013 to the present. He was instrumental in developing an application for UMass Dartmouth to become a "Non-Operator" member of UNOLS; this new membership was approved by existing UNOLS membership in fall 2013.
- K-12 and Public Outreach – SMAST faculty contribute to K-12 and other public outreach efforts in the region. Faculty routinely give presentations at local and regional schools. A number of high school students have been involved in conducting projects at the SMAST facility. Some additional examples include:
    - SMAST technician W. Forrest Kennedy was honored the Massachusetts Marine Educators at their Annual Meeting and Conference in 2012, where he was presented with the 2012 John Patrick Crowley Memorial Teacher Grant for his work in support of marine education initiatives.
    - Former SMAST technician Chris Jakubiak was the New England Regional Coordinator for Marine Advanced Technology Education (MATE) program and helped to organize regional

competitions among high school students to design and test underwater remotely operated vehicles.

- SMAST was prominently featured at the Massachusetts Marine Educators High School Marine Science Symposium held at the UMass Dartmouth campus in March 2014. SMAST alumna and now Marine Science and Policy Analyst at the Division of Marine Fisheries Cate O'Keefe was the keynote speaker and SMAST students provided hands-on demonstrations for the over 300 high school students and teachers in attendance.
- Professor Wendell Brown hosted several groups of incoming freshman students this summer from Tabor Academy to tour the SMAST facility and learn about the research activities in our organization.
- As part of its ongoing outreach efforts, SMAST also maintains a public presence at trade shows, professional meetings, and other events with a marine theme, and students generally play a major role. These have included the New Bedford Commercial Marine Expo, annual Working Waterfront Festival, the Boston Seafood Festival, the New England Ocean Science Education Collaborative Ocean Literacy Summit, and the Coastal and Estuarine Research Federation.
- SMAST was the co-organizer along with the New Bedford Standard Times and other community groups of a regional Climate Summit on Resiliency (http://www.umassd.edu/publicaffairs/gaeasummit/) held in December 2015 held at the UMass Dartmouth campus. SMAST and other UMass Dartmouth faculty were featured as topical speakers on various aspects of climate change. A video archive of the presentations can be accessed at the following website: http://www.umassd.edu/smast/newsandevents/gaeasummit/gaeavideoarchive/.

Increased Faculty and Student Interactions among the UMass Campuses

Various efforts have contributed to greater levels of faculty and student interactions across the different UMass campuses participating in the IMS program. Here is a partial list of examples of cross-campus activities:

- A regular forum to enable student and faculty interactions and exchange of information has been the annual Intercampus Marine Science Symposium: (http://www.umassd.edu/news/marinescience-smast-news/membersoftheuniversityofmassachusettscommunitycelebrateandshowcasethei.html), which is hosted by the different campuses on a rotating basis.
- The MAR 510 Chemical Oceanography core course is taught jointly by UMass Dartmouth and UMass Lowell. Students also routinely take courses at campuses other than their home campus through the intercampus course exchange program.
- Faculty collaborations include involvement in joint research efforts. Professor Miles Sundermeyer and collaborators from four UMass campuses sought to establish a system-wide EXperimental Center for Environmental Lidar (EXCEL). As noted previously, both UMass Boston and UMass Amherst have representation on the MFI Advisory Council.
- SMAST Professors Cynthia Pilskaln and Brian Howes have been involved with UMass Boston in a collaborative project known as the Sustainable Seafood Collaboratory: (https://www.umb.edu/seafood).

UMass Dartmouth Administrative Staff

Dean: Steven Lohrenz - Develops and implements a strategic vision for SMAST that advances the scholarly and research enterprise and fosters academic programs that address critical societal needs and empowers students with the knowledge and skills they need to be successful. Additional responsibilities include increasing national and international recognition of the School and University, strengthening community engagement and partnerships, managing and building the financial base for the School (~$2.4M payroll, ~$0.23M operations, $4.8-6.0M research), enhancing the School's physical and academic infrastructure, and developing a closer integration between the School and the University community.

Assistant Dean for Operations: Michael Marino - Assists the Dean with the management of the SMAST Staff, multi-varied administrative duties of the office, and conducting other necessary tasks associated with the daily operation of the School. Forms part of a team with and supervises a facilities manager, aquaculture scientist, computer systems manager and scientific systems manager to assists in the coordination of SMAST facilities, including common infrastructure, building maintenance, research laboratories and support and IT infrastructure. Participates at a senior management level in strategic planning, allocation of resources and formulation of policies and procedures at SMAST. Oversee all research funding from federal, state and private funding sources. Assists principle investigators in the submission of grant applications and budgets including working with the Sponsored Projects Administration to facilitate grant proposal submission and subsequent progress reports. Prepare SMAST annual budgets, interim/final fiscal reports and ad hoc reports as requested by the SMAST Dean and Provost. Monitor and reconcile budget for operating, unrestricted, and foundation funds. Perform all SMAST Human Resource activities and serve as equal opportunity liaison by overseeing search committees to insure compliance with institutional and federal hiring policies.

Facilities manager: Eric Lyonnais - Oversees the day-to-day maintenance and security operations of SMAST campus including SMAST East (64,000-square-foot facility), SMAST West (32,000-square-foot facility) with docking facilities on Clark's Cove, Buzzards Bay. Both facilities include Temperature-controlled rooms, state-of-the art research laboratories, classrooms, and offices for faculty, staff, and students. The SMAST Facilities Manager serves as a liaison between SMAST, the University and contractors on construction projects. Coordinates the repair, general maintenance and preventive maintenance of the SMAST campus including the project oversight of foremen, maintenance specialists and trades workers.

Aquaculture scientist and Dive Safety Officer: Forrest Kennedy - Develops and maintains marine and freshwater aquaculture systems at SMAST. This includes overseeing a 6,000-square-feet seawater lab at SMAST East, which includes a large flume tank and enhanced automated features provide state-of-the-art remote operation and control capacities and 2,200 square-foot seawater research lab at SMAST West, which contains raw, filtered, heated or chilled seawater. As Dive Safety Officer, responsible for dive training, dive gear repair, and supervising SMAST diving programs.

Computer systems manager: Michael Deignan - Works as a member of the School for Marine Science and Technology (SMAST) Systems and Network Management Team, Coordinates any and all activity related to computing systems, network infrastructure, and electronic systems in use at SMAST. Conducts continuous monitoring of SMAST systems as necessary to address user

problems and take system-level corrective actions to ensure a high degree of network and system up-time/availability. The SMAST computer systems are in continuous operation and must be available at all times to faculty, staff, researchers and students.

Scientific systems manager: Andre Schmidt - Works as a member of the School for Marine Science and Technology (SMAST) Systems and Network Management Team, providing administrative redundancy, participating and leading in the planning, development, deployment and maintenance of assigned SMAST computing systems, maintaining the webserver, developing web applications for various functions including user access management and data access. Responsible for the day-to-day operations of assigned systems; and provides technical support for those systems. Works closely with faculty and staff members to help ensure the orderly flow of education, research, and service to students, staff, researchers and their clients. Consults with various campus CITS teams, including Networking Systems, Access Management, Information Systems Integration Team, and the IT Service Center, as needed to address end-user needs.

Administrative Assistant II: Cynthia Costa - Provides support for the Dean of the School of Marine Science and Technology (SMAST) and support to SMAST faculty, staff and students as designated by the Dean. This high level assistant will be required to have decision-making skills and to maintain confidentiality. This position requires skill in dealing with the public and with co-workers.

Administrative Assistant II: Gail Lyonnais - Serves as the Administrative Assistant to the SMAST Dean, working closely with the Assistant Dean for Operations. Responsible for making independent decisions, prioritizing and organizing workload pertaining to budget, human resources, student requests and other administrative and financial functions within SMAST.

Administrative Assistant II: Arlene Wilkinson - Provides administrative support for the Co-Chair of the Coordinating Council of the Massachusetts Marine Fisheries Institute and provide administrative, accounting, and grant management support for SMAST principal investigators (PIs). Additionally, the purpose of this position is to support the Dean and Graduate Program Director in administering the Intercampus Marine Science graduate program. This high level assistant will be required to have decision making skills and to maintain confidentiality. The position requires skill in dealing with the public.

Clerk IV: Chris Fox – Manages the clerical support functions of the Department of Fisheries Oceanography (DFO) office, supports the DFO Chairperson on department administration issues and supporting SMAST faculty and staff with purchasing, clerical work and grant administration support, which includes performing complex duties requiring a considerable degree of decision making and confidentiality. Students are to be supported in their research capacity as directed by their academic supervisor.

Clerk IV: Susan Silva - Supports the SMAST Department of Estuarine and Ocean Sciences Chair, faculty, staff, and students. The duties include supporting the SMAST Department Chair on department administration issues as well as supporting SMAST faculty and staff with purchasing and clerical work. The duties also include providing administrative redundancy to the Administrative Assistant II's in supporting the SMAST academic program.

UMass Boston IMS Faculty

The School for the Environment (SFE) welcomes faculty from other units of UMass Boston as well as faculty from outside the university to formally affiliate with the School. Our faculty include core and affiliated faculty and research faculty from across campus as well as from our partner institutions (e.g., the New England Aquarium, the Provincetown Center for Coastal Studies). The IMS faculty at UMass Boston is comprised of SFE faculty who are qualified and have agreed to mentor graduate students in the Marine Sciences and Technology degree programs.

For a listing of the entire SFE faculty, see https://www.umb.edu/academics/environment/people

Core IMS faculty

Robert Chen	Professor of Organic Geochemistry and Marine Organic
Ellen Douglas	Associate Professor of Hydrology
John Duff	Associate Professor of Environmental Law and Policy
Eugene Gallagher	Associate Professor of Benthic Ecology and Statistics
Robyn Hannigan	Founding Dean, Professor of Geochemistry
Paul Kirshen	Professor of Climate Adaptation
ZhongPing Lee	Professor of Optical Oceanography
Georgia Mavrommati	Assistant Professor of Ecological Economics
Helen C. Poynton	Associate Professor of Molecular Ecotoxicology
William E. Robinson	Professor of Environmental and Aquatic Toxicology
Crystal Schaaf	Professor of Remote Sensing/GIS
Michael Tlusty	Associate Professor of Sustainability and Food Solutions
Juanita Urban-Rich	Associate Professor of Zooplankton Ecology

Affiliate IMS Faculty

Solange Breault	Associate Professor of Biology - Population and Conservation Ecology
Jarrett Byrnes	Assistant Professor of Biology - Marine Ecology
Ron Etter	Professor of Biology - Evolution and Ecology of Marine
Michael Schiaris	Professor of Biology - Microbial Ecology
Jack Wiggin	Director, Urban Harbors Institute

Research IMS Faculty

Mark Borelli	Provincetown Center for Coastal Studies
Scott Kraus	New England Aquarium
Jonathan Mandelman	New England Aquarium

UMass Boston SFE Faculty Scholarship and Research

In AY16-17 the SFE faculty included 18 tenured or tenure-track faculty with an FTE equivalent of 12.75 (due to sabbaticals, one faculty member leaving and another on 50% administrative assignment). The following overview includes research faculty activities as well.

UMass Boston SFE External Funding

New and continuing external funding is accounted for under a fiscal year rather than academic year calendar (July 1 to June 30). Therefore, the FY17 new/continuing external funding secured by the SFE (PI's primary academic unit is the School for the Environment) was $2,858,422 which is expected to yield, in FY18, $610,398 in indirect funding to the University and $183,119 to the SFE. PIs in FY17 include 10 tenure stream faculty including non-unit administrators and 2 research faculty. These grants/contracts are 75% basic research and 25% instruction/training. In FY17, 28 proposals were submitted to funding agencies for a total request of $13,014,156. The tenure stream faculty submitted 89% of these proposals. The table below (Table 6) lists external award information for the last five years. External funding has increased approximately 40% between 2013 and 2016, but then dropped by nearly half in 2017. The drop in 2017 was due in large part to fiscal uncertainties at both the university and funding agency (mostly federal) levels.

Table 6. UMass Boston School for the Environment External Awards

External Awards	*Sum of Direct*	*Sum of Indirect*	*Sum of Total Cost Budget*
2013 (n=32)	$ 3,004,780	$ 931,245	$ 3,936,024
2014 (n=34)	$ 1,884,312	$ 593,095	$ 2,477,407
2015 (n=52)	$ 4,500,637	$ 1,013,327	$ 5,513,964
2016 (n=63)	$ 4,533,358	$ 990,211	$ 5,523,569
2017 (n=26)	$ 2,248,024	$ 610,398	$ 2,858,422
Grand Total	**$ 16,171,110**	**$ 4,138,276**	**$ 20,309,386**

Publications and Awards

Publications by researchers in the SFE, for reporting purposes, include years 2016 and 2017 and are discovered via a google scholar search. Publications not found in google scholar are not listed and thus the total is a minimum of those published by School researchers. SFE faculty (core, affiliate, and research) and staff published 115 peer-reviewed works of which 57% were authored (lead or co-) by core faculty and 12% included students as co-authors.

This year our faculty were honored with several awards. Drs. Ellen Douglas and Paul Kirshen received the Norman B. Leventhal award for Excellence in City Building- Environment award from A Better City. Dr. David Timmons and Adjunct Professor Robert Brock received Fulbright awards. Drs. Shiaris and Urban-Rich received the 2017 EPA New England award for Contributions to Environmental Stewardship.

Dr. Crystal Schaaf received the Harvard University Bullard Fellowship. Dr. Bob Chen was elected Fellow of the Association for the Sciences of Limnology and Oceanography.

UMass Boston Cross-Campus and Marine Policy Activities

The IMS faculty act as primary advisors for the IMS graduate students at UMass Boston. In addition, they regularly serve as committee members for M.S. thesis and Ph.D. dissertation research for IMS graduate

students at Dartmouth, Lowell and Amherst. Many of the IMS faculty are active in shaping marine policy in Massachusetts and beyond. A few examples of these activities are listed below:

- Member, Massachusetts Ocean Science Advisory Council: The Science Advisory Council (SAC) is made up of nine scientists with expertise in the marine sciences and data management assembled to assist the Secretary of Energy and Environmental Affairs in the science and technical aspects of developing and implementing the ocean management plan. The SAC assists with: reviewing data sources and identifying other viable data, assisting in the development of the baseline assessment and characterization of the ocean planning area, identifying "big picture" questions to improve understanding of the natural systems and/or human uses and influences, and helping to formulate a long-term strategy for addressing information gaps.
- Member, City of Boston Waterways Board: serves as a forum to guide development and use of the city's waterways and the sound implementation of laws applicable to waterfront access and boat excise taxes and mooring fees.
- Advisory role for Massachusetts State Marine Fisheries, Chief inspector for aquaculture. Focus on public health and oyster aquaculture
- Member, MWRA/EPA "Outfall Monitoring Science Advisory Panel" OMSAP – going on 20 years. Advisory panel for science-based policy by EPA and MWRA.
- Participate in the Massachusetts Research Partnership (MRP), a collaboration of university research centers, of which UMass is a founding partner, and industry. Participated in workshops on Offshore Wind Energy hosted by UMA/EC, UMD/SMAST, and UML, and a legislative briefing by the group at the State House. This group aspires to expand nationally through an initiative called Power US.
- Councilor, Gulf of Maine Council on the Marine Environment
- In an effort to advance the local seafood system conducted research funded by the Seaport Economic Council on policies, models, and best practices for supporting growth of the local fishing industry. This work involved exploring the feasibility of a UMass intercampus (UMB, UMD, UMA, UML) collaboration to support this goal. A funding proposal to support this collaboration is pending.
- This year, prepared harbor management plans for Plymouth, Provincetown, and Dartmouth. These plans define policies and recommendations for the municipalities' coastal waters and adjacent shorefronts.
- Preparing waterways regulations for Tisbury MA

UMass Boston SFE Administrative Staff

Dean: Robyn Hannigan. The Dean is responsible for the leadership, faculty development, management, budget and administrative structure of the School. The Dean shall appoint, with the advice and counsel of the faculty, administrative officers as deemed necessary to assist in the administrative functions of the School and notify the faculty of the officer's responsibilities and duties. The Dean may also appoint Visiting Scholars, renewable on an annual basis. The Dean may also form *ad hoc* faculty committees to advise him or her as needed. The Dean will present a report on the School's budget and organizational structure to a plenary meeting of the faculty each year.

Associate Dean: William Robinson. The Associate Dean is responsible for oversight of all School personnel actions as well as supporting the work of the Faculty Senate. The Dean shall task the Associate Dean, with the advice and counsel of the faculty, duties associated with supporting research, outreach, and advancement.

Assistant Dean: Alan Abend. The Assistant Dean serves as the chief financial and operations officer for the School and is responsible for managing all fiscal responsibilities related to budgeting, needs assessment and resource allocation. The incumbent is responsible for maintaining and supporting all operations within the School, including research, academic programs, Nantucket Field Station and faculty support needs. The Assistant Dean provides oversight and management of the research grant portfolios of multiple Principal Investigators (PIs); prepares and manages budgets of externally funded projects, including sub-awards, contracts and grants; and works closely with each faculty and staff member of all aspects of the administration of his/her research project, including provision of analysis and modifications.

Program Directors. The programs represent the primary academic and intellectual foci of the School. The Program Director is the official link between the program and the administration of the School. He or she represents program needs, objectives and evaluations of achievement to the Dean and transmits administration policy to his or her colleagues and implements the same. In consultation with the Dean, the Director(s) is/are responsible for appointment of administrative positions within the program, convening and chairing regular program committee meetings, budget preparation and oversight, assignment of academic and nonacademic staff, facilitation of faculty mentoring, assignment of teaching responsibilities that take into account program and cross-program teaching needs, student advising, and appointment of program faculty to committees as needed. Program Directors are appointed by the Dean for a term of three years to five years, and may be reappointed following review. The Directors are responsible for the "department level" management of academic programs in coordination with the Faculty Senate.

Manager of Personnel and Payroll: Schanna James. Is responsible for the administrative management and financial management of all SFE activities, including, but not limited to, SFE budget preparation, account maintenance (General Operating Funds, ESS and RTF accounts), personnel actions, SFE funding/expenditure reporting, and preparation of all SFE-related financial, payroll and personnel paperwork. Prepares and approves all faculty, staff and student personnel action forms and insures that the proper accounts are assigned. Maintains equipment, computer and space inventories.

Manager of Purchasing and Receiving: Paula Cameron. Is responsible for all purchasing and receiving activities in SFE, and is the primary liaison with University vendors. Initiates purchases for faculty and staff, and ensures that the proper accounts (specific grant and contract accounts, General Operating Fund account, ESS, RTF, etc.) are assigned prior to ordering. Tracks orders and keeps requestors appraised of delivery dates. Receives deliveries, ensures that orders are complete, notifies requestors and the Controller's office in a timely manner. Assists faculty and staff with travel arrangements and reimbursements. Processes paperwork for all other types of reimbursements.

Administrative Assistant I: Jolanda Omari. Performs administrative duties in support of the school's programs, students and faculty. The incumbent greets, directs and/or provides assistance to both internal and external customers; receives and directs internal and external phone and e-mail inquiries and when necessary, fields inquires to appropriate staff person; and provides program information regarding the school's academic programs to prospective and current students. S/he gathers, updates and enters information into departmental and/or university databases and systems; and manages the calendar for the Dean. The incumbent is responsible for interacting with a wide variety of staff, faculty and students to provide information and to direct them to the appropriate source for resolution of an issue.

Facilities and IT support: Francesco Peri. In coordination with UMass Boston's Facilities Department, oversees the maintenance and security operations of SFE within the Integrated Science Complex (ISC) and other buildings across campus. These facilities include temperature-controlled rooms, clean rooms, state-of-the art research laboratories, classrooms, and offices for faculty, staff, and students. Also coordinates with UMass Boston's Information Technology department to maintain computer and network systems and help troubleshoot issues as they arise. Also coordinates with UMass Boston's Marine Operations to schedule and maintain research vessels and equipment.

UMass Amherst IMS Faculty

IMS faculty at UMass Amherst come from a number of departments in the College of Natural Sciences (http://www.cns.umass.edu), including the Department of Environmental Conservation, Mechanical and Industrial Engineering, Electrical and Computer Engineering, and Geosciences. Several of these departments are a part of the new School of Earth and Sustainability (https://www.umass.edu/ses/). Also supporting IMS graduate students are faculty from our agency partners, including USGS, the US Forest Service, and US Fish & Wildlife Service.

IMS faculty

Adrian Jordaan	Assistant Professor of Fisheries Management
Andy Danylchuk	Associate Professor of Fish Conservation
John Finn	Professor of Ecological Modeling
Curt Griffin	Professor of Ecology
Kevin McGarigal	Professor of Landscape Ecology
Tim Randhir	Professor of Watershed Management
Lisa Komoroske	Assistant Professor of Conservation Genetics
Brian Cheng	Assistant Professor of Marine Ecology
Julie Brigham-Grette	Professor of Arctic/Glacial Ecology
Edward Calabrese	Professor of Environmental and Aquatic Toxicology
Jon Woodruff	Associate Professor of Sedimentology
Baoshan Xing	Professor of Environmental & Soil Chemistry
Qian Yu	Associate Professor of GIS/Remote Sensing
Blair Perot	Professor of Turbulence Modeling
Stephen Frasier	Professor Radio Oceanography

Affiliate IMS Faculty

Allison Roy	Assistant Research Professor of Aquatic Ecology, USGS
Stephen McCormick	Senior Scientist, USGS

UMass Amherst Marine-Related External Funding

External funding for marine related activities at UMass Amherst fuels research at local, regional, and global scales. We have a strong track record of receiving highly competitive federal and state funding, as well as grants from non-government organizations and private donors. The table below lists external award information for the last five years (Table 7).

Table 7. UMass Amherst External Awards Specific to Marine Sciences

External Awards	*Sum of Direct*	*Sum of Indirect*	*Sum of Total Cost Budget*
2010 (n=4)	199,467	90,530	289,997
2011 (n=2)	105,802	37,385	143,187
2012 (n=9)	2,111,952	200,279	2,312,231
2013 (n=5)	769,506	129,219	898,725
2014 (n=6)	541,370	70,498	611,868
2015 (n=5)	542,491	66,186	608,677
2016 (n=7)	1,377,803	192,095	1,569,898
2017 (n=4)	260,817	49,172	309,989
Grand Total	**5,909,208**	**835,364**	**6,744,572**

UMass Amherst IMS Scholarly Contributions

IMS-affiliated faculty and graduate students at UMass Amherst have an excellent track record for publishing in high-ranking, refereed scientific journals, including Marine Ecology Progress Series, Marine Biology, Oecologia, Conservation Biology, and Fisheries Research. IMS faculty and graduate students also spend considerable effort sharing their research and regional, national, and international conferences, including the annual meeting of the American Fisheries Society and the International Council for the Exploration of the Seas (ICES) annual science conference. Some of our IMS faculty hold positions on editorial boards for several journals, as well as advisory positions for industry and agency organizations. We also encourage our IMS graduate students to blend their research endeavors with public education and outreach opportunities to broaden the impact of marine-based research at UMass Amherst.

UMass Amherst IMS Administrative Support Staff

Administrative operations of IMS on the UMass Amherst campus are conducted through the Department of Environmental Conservation (ECO) in the College of Natural Sciences. The IMS Graduate Program Director and Campus Coordinator works in collaboration with the Department Head of ECO, the Dean of CNS, and the Dean of the Graduate School to uphold policies related to the IMS graduate program. Administrative support begins in ECO with a Business Manager that provides invaluable assistance with grant submissions and bookkeeping. Other administrative support staff in ECO assist with IMS Teaching Assistantship coordination, IMS-related travel, and purchasing.

UMass Lowell IMS Faculty

IMS faculty at UMass Lowell that actively participate in the IMS program are located in the Kennedy College of Sciences in three main departments. These include Biological Sciences, Chemistry and Environmental, Earth and Atmospheric Sciences (EEAS). Course offerings are contributed by faculty from the Francis College of Engineering particularly from Mechanical and Civil and Environmental Engineering.

IMS faculty

Matthew Barlow	Associate Professor
Nelson Eby	Professor
Richard Gaschnig	Assistant Professor
Rich Hochberg	Associate Professor
Daniel Obrist	Professor
David Ryan	Professor

Facilities

Graduate students at IMS have the unique benefit of choosing to work from one of five diverse campuses. More importantly, while a student chooses a specific campus as a base, the myriad of assets from the other four campuses are also available. This flexibility enables a broad and thorough examination of the complex problems at the forefront of marine science and technology while supporting innovative solutions. The system's breadth allows for commonality of mission, but diversity in location and expertise. Because it is located on the eastern U.S. coastline, Massachusetts is an ideal site for marine sciences study and research. Massachusetts has 192 miles of coastline–1,500 miles if the coastline of each bay and inlet is added. The commonwealth has 27 watersheds, 2,900 lakes, 590,000 wetlands, and 2,000 rivers and streams flowing over 8,200 miles. The campuses cover the wide range of the commonwealth's environments, from urban sites to rural settings. Campuses are located on the coast with proximity to the deep ocean, estuaries, and watersheds, and near forests, rivers, lakes, and valleys.

UMass Amherst Campus Facilities

UMass Amherst is the flagship public higher education campus in the Commonwealth of Massachusetts. Founded in 1863, we are the largest public research university in New England, distinguished by the excellence and breadth of our academic, research and community outreach programs. We are one of the nation's top public universities, and currently rank among the top 30 in a field of more than 700 public, four-year colleges and universities in the United States.

The 1,450-acre Amherst campus is located in a picturesque, culturally and educationally-rich New England town along the Connecticut River Valley, just a few hours from Boston and New York City. Its neighbors and collaborators include Smith College, Mt. Holyoke, Amherst College, and Hampshire College; collectively UMass Amherst along with these colleges making up the Five Colleges Consortium. Of special interest for marine science students is our new marine lab facility in Gloucester. Being located in western Massachusetts, our IMS faculty and students are ideally positioned to address issues related to coastal and marine ecosystems that stem from headwaters to the ocean. This holistic approach is supported by our close affiliations with Marine Fisheries Service Northeast Fisheries Science Center in Woods Hole, the Conte Anadromous Fish Research Center in Turner's Falls, the regional office of the USDI Fish and Wildlife Service in Hadley, and the Massachusetts Department of Environmental Management Division of Forest

and Park Region 4 Headquarters, which is within walking distance. We are also home to the Northeast Climate Science Center (https://necsc.umass.edu), providing a broader context for the work of our IMS faculty and graduate students.

UMass Boston Campus Facilities

The Boston campus is located on the Columbia Point Peninsula, three miles from downtown Boston, and overlooks Boston Harbor. It is nationally recognized as a model of excellence for urban universities. The city of Boston is renowned for its educational, cultural, and social opportunities. Campus surroundings include the Boston Harbor ecosystem, with its 31 islands, its salt marshes, tributary rivers, and proximity to Georges Bank. The university also maintains a marine station located on 115 acres in Nantucket. The university's coastal location provides the ideal environment for its marine science programs, which emphasize a science-policy interface. This integrated science and management approach includes both academic programs and the Urban Harbors Institute, which provides analysis and expertise in integrated coastal zone management and urban harbor management. Boston Harbor, which had been one of the most polluted harbors in the nation, is undergoing a $3.5 billion dollar cleanup by the Massachusetts Water Resources Authority that began in 1989. The secondary sewage treatment plant at Deer Island, opened in 1997, is also located near the campus. This ecosystem has provided numerous research opportunities for IMS faculty.

UMass Boston's Marine Operations maintains a fleet of vessels available for charter by (but not restricted to) the university community. Among these vessels are the all-weather passenger vessel *M/V Columbia Point*, the 46ft stern buoy tender *R/V Looney*, *M/V Avon,* and the 24ft Landing Craft. (For details, see https://www.umb.edu/marineops/vessels). Vessel support services include power supply (120/240V), fresh water, small boat hauling, power washing, mooring service, diving inspection, and boat tendering. Marine Operations manages two dock facilities: 1. the John T. Fallon Pier, a full service facility including; shore power, fresh water, 31/2 ton crane service, locked entry, security and lighting, one 50 ft. float w/gangways, 171 ft. large vessel dock face, and a dredged access channel (-13 ML W) and, 2. the Fox Point Dock, weather protected, 80 ft. main float with three 60 ft. finger floats for smaller vessels. This facility is fortified with steel pilings 50A shore power, and a quarter barge for secure storage. Marine Operations also has a full-service boat shop located on campus with welding, machine shop, wood working, and engineering capabilities and maintains 30 inspected moorings for the university community.

UMass Dartmouth Campus Facilities

The UMass Dartmouth School for Marine Science and Technology (SMAST) is headquartered in the port of New Bedford. The focus at SMAST is on interdisciplinary basic-to-applied marine sciences and the development of related innovative technologies. SMAST also emphasizes interaction with industry, government and non-governmental agencies to address compelling regional marine-related issues and technological development. It works to ensure the long-term sustainability of the fishing industry. The SMAST campus, located in the SouthCoast region of Massachusetts, includes a two-story, 32,000 square foot teaching and research building in New Bedford with pier accessing Buzzards Bay through Clark's Cove. This facility houses a 2000 sq. ft. seawater lab, a 90,000-gallon acousto-optic tank, classrooms equipped for video conferencing and live distance learning, and a greenhouse. The School also operates the R/V Lucky Lady, a 50-foot research vessel. A new 64,500 gross square foot facility adjacent to the existing facility was completed in fall 2017. The new facility includes flexible wet, dry, and computational research

labs and researcher offices, a state-of-the-art data center, expanded seawater research facility, flexible classroom space, dive operations, and administrative space.

UMass Lowell Campus Facilities

The Lowell campus is located in the historic industrial city of Lowell, 25 miles northwest of Boston. It lies along the Merrimack River, which was the power source for the mills built along the river, giving rise to America's first industrial city. Within easy distance are the lakes and mountains of New Hampshire, western Massachusetts, Vermont, and Maine, as well as the shores of the Atlantic Ocean and Cape Cod. Due to resurgence in the technology boom of the 1980's, today Lowell is a thriving commercial area in a technology rich environment. The University has a multitude of research centers and institutes that offer state-of-the art research and training opportunities. The IMS administration office is located on the Lowell Campus.

UMass Medical School, Worcester Campus Facilities

The UMass Worcester campus is a medical school, the commonwealth's only public academic health sciences center. In addition to its status as a top-ranked medical education center, the UMass Medical School is also an impressive research institution with a world-class faculty, including the 2006 Nobel Prize winner for Medicine Dr. Craig C. Mello. While no IMS students call the Worcester campus home, our partnership with them is strong. Research is conducted in such areas as chemical biology and neurobiology. All students are encouraged to take advantage of the unique opportunity that a partnership with a medical school provides, particularly those in the Oceans and Human Health concentration.

Budget

IMS Budget

Table 8. The UMass system IMS budget.

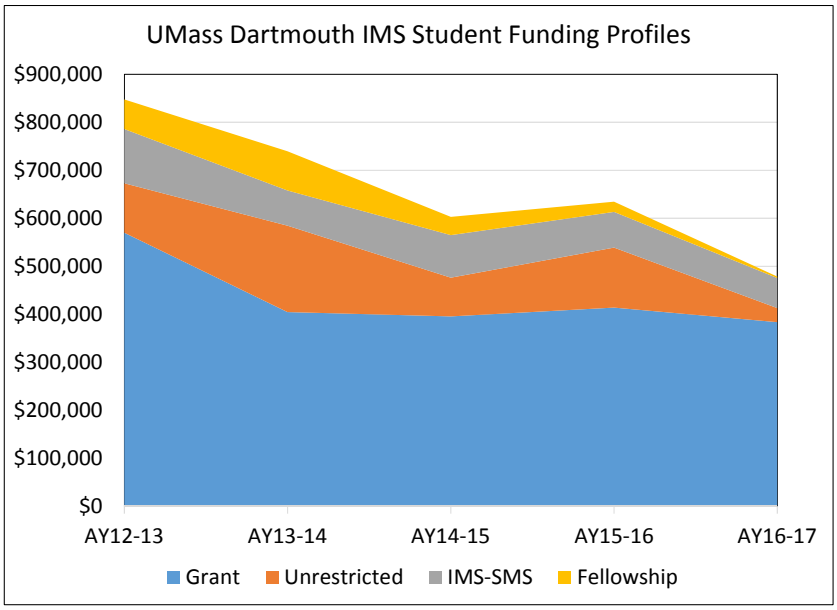
Intercampus Marine Science Graduate Program Budget	FY13	FY14	FY15	FY16	FY17
I. Annual Budget					
Budget Allocation	$ 297,000.00	$ 297,000.00	$ 252,500.00	$ 252,500.00	$ 239,875.00
15% E&E Reduction	$ -	$ 44,500.00	0		
Carry forward from FY13 to FY14		$ 81,861.44			
Total Annual Budget	***$ 297,000.00***	***$ 334,361.44***	***$ 252,500.00***	***$ 252,500.00***	***$ 239,875.00***
II. Expenditures					
a. Student Stipend Support					**$ 215,875.00**
Amherst - Stipend Support	$ 42,000.00	$ 47,102.80	$ 42,000.00	$ 42,000.00	$ 42,367.99
Boston - Stipend Support	$ 58,000.00	$ 65,046.73	$ 58,000.00	$ 58,000.00	$ 58,508.18
Dartmouth - Stipend Support	$ 90,000.00	$ 100,934.58	$ 90,000.00	$ 90,000.00	$ 90,788.55
Lowell - Stipend Support	$ 24,000.00	$ 26,915.89	$ 24,000.00	$ 24,000.00	$ 24,210.28
Total	***$ 214,000.00***	***$ 240,000.00***	***$ 214,000.00***	***$ 214,000.00***	***$ 215,875.00***
b. Coordinator Stipends					
IMS Coordinator Stipends $6000 x 4 IMS coordinators	$ -	$ 16,000.00	$ 24,000.00	$ 24,000.00	$ 24,000.00
Total	***$ -***	***$ 29,500.00***	***$ 24,000.00***	***$ 24,000.00***	***$ 24,000.00***
c. General IMS Support starting in FY14 - By Campus					**$ -**
Amherst - General Support		5,887.85	$ 1,766.36	$ 2,845.79	$ -
Boston - General Support		8,130.84	$ 2,439.25	$ 3,929.91	$ -
Dartmouth - General Support		12,616.82	$ 3,785.05	$ 6,098.13	$ -
Lowell - General Support		3,364.49	$ 1,009.35	$ 1,626.17	$ -
Total	***$ -***	***30,000.00***	***$ 9,000.00***	***$ 14,500.00***	***$ -***
d. Other Administrative Expenses					
Consortium for Oceanographic Annual Membership $13,500	$ -	$ 13,500.00	$ -		
Student prizes - FY13 only	$ 1,000.00	$ -	$ -		
Jessica Diebold travel expenses-FY13 only	$ 138.56	$ -	$ -		
One time support for Umass Amherst Student - FY14 only		$ 8,000.00	$ -		
One time support for Biomedical Intercampus Program - FY14 only	$ -	$ 25,000.00	$ -		
Total	***$ 1,138.56***	***$ 33,000.00***	***$ -***		
Total Expenditures	***$ 215,138.56***	***$ 332,500.00***	***$ 247,000.00***	***$ 252,500.00***	***$ -***
III. Totals					
I. Annual Budget	$ 297,000.00	$ 334,361.44	$ 252,500.00	$ 252,500.00	$ 239,875.00
II. Expenditures	$ 215,138.56	$ 332,500.00	$ 247,000.00	$ 252,500.00	$ 239,875.00
III. Annual Budget less Expenditures	$ 81,861.44	$ 1,861.44	$ (5,500.00)	$ -	$ -
IV. Carry forward FY 13 to FY14	*$ 81,861.44*				0
V. Balance	$ -	$ 1,861.44		$ -	$ -

The Intercampus Marine Science graduate program has received support directly from the UMass President's office since it was initially established in 2002 (then as the School of Marine Science). Over the past five years, the total amount of support has been reduced from $297,000 to ~$240,000 (Table 8). Much of this reduction has been targeted at programmatic support funds, while student stipend support has been held relatively constant through FY17. However, FY18 support is projected to be further reduced by 5%, which will result in a reduction in student support. Funds are allocated among the campuses based to some degree on enrollment and historical precedent.

Sources of Student Support

UMass Dartmouth student funding overview

Figure 5. UMass Dartmouth IMS Student Funding Profiles.



Total amounts of funding for IMS students at UMass Dartmouth has declined from Academic Year 12-13 to Academic Year 16-17 (Figure 5). This can largely be attributed to a decline in grant support. Much of this is related to the loss of a large NOAA earmark, which was last awarded in 2009 and gradually spent out through 2011. Grant support for students has remained fairly consistent over the last four years. Support from unrestricted funds has also declined as has fellowship funding. Direct support for students through the UMass President's office for the Intercampus Marine Science program has remained fairly consistent although projected to decline by 5% in FY18 and programmatic support for administration of the IMS program has been reduced consistently over the past five years (see IMS Budget).

The majority of IMS graduate students at UMass Dartmouth are supported through grant funding (40%) or are employed (19%) (Figure 6). IMS support and unrestricted funds account for 12% each of students and these funds are typically used to supplement other sources. A small percentage of students receive fellowship funds, with the remainder self-employed.

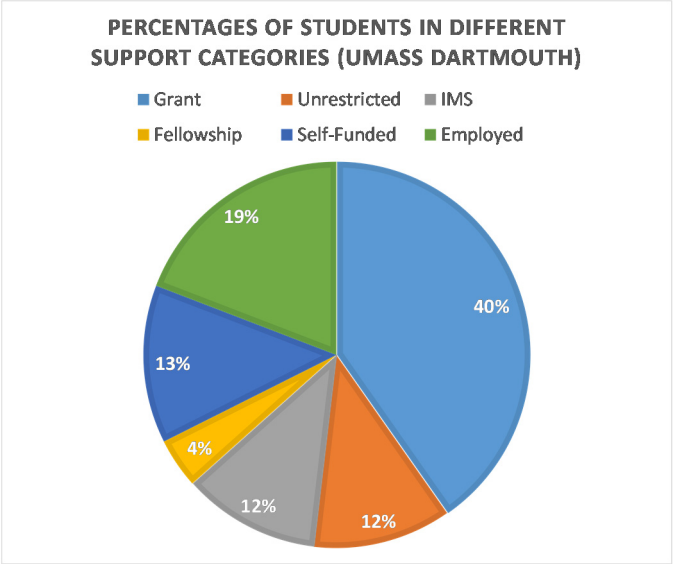


Figure 6. Percentages of student in different support categories.

UMass Boston student funding overview

The School for the Environment has created a holistic approach to undergraduate and graduate education by enlisting undergraduates in our faculty and graduate research and by employing our graduate students to support our undergraduate courses. We currently receive funding from UMass Boston's Office of Graduate Studies (OGS) to support sixteen teaching assistantships (TAs). The Intercampus Marine Sciences (IMS) program has provide funding for an additional three TAs. SFE views internal (OGS and IMS) funding as effective "investment", primarily designed to (i) bring in high quality graduate students into successful labs without sufficient current funding; (ii) support younger faculty to develop a successful research agenda; (iii) bridge funding for faculty between grants: and, (iv) encourage research in new and promising areas of science (natural and social). As a matter of policy, we have generally limited TA support for Ph.D. students to two or three years and for M.S. students to one to two years. This motivates our faculty and graduate students to find external funding and fellowships to support their research. We have continued to succeed with the strategies noted above despite the current budget challenges within the University and, more notably, the disproportionate federal defunding of SFEs core mission areas in Transdisciplinary Environmental Science, Environment/Ocean and Human Health, Environmental Policy, and Climate Change Science and Policy.

For AY 2017-18, approximately sixty percent of our internal (OGS + IMS) funding supports Ph.D. students with the remaining forty percent supporting M.S. students. In AY 2017-18, six of our nineteen current IMS students are being supported with internal funds for at least one semester (four Ph.D. and two M.S. students), with the rest supported by external funds or self-support.

Over the last five years in SFE, approximately sixty percent of all graduate students have been supported by external funds (grants, fellowships, scholarships). The table below is a breakdown of AY2017-18 support for SFE Ph.D. students (including IMS). This year, twenty-seven percent of our Ph.D. students are supported by internal funds, fifty-eight percent are supported with external funds (grants and fellowships), and fifteen percent are self-supported.

Table 9. UMass Boston IMS enrollment and funding profiles.

	No. of students	Internally supported	Externally supported	Self-supported
First Year	4	1	3	0
Second Year	6	1	4	1
Third Year	8	2	5	1
Fourth Year	5	3	2	0
Fifth & beyond	10	2	5	3

Plans for the Future

Key Issues for Program Development – UMass Dartmouth

Grow the enrollment – The SMAST and the IMS program continues to lead UMass Dartmouth in the production of Ph.D. graduates in STEM fields. Over the past five years, there have been 22 Ph.D. and 26 M.S. graduates of the IMS program at UMass Dartmouth. However, a critical issue for the IMS program at UMass Dartmouth is the need to grow its graduate enrollment. Enrollment has declined since FY10 from 65 to 49 graduate students in FY17. This can to some extent be attributed to a decline in the number of SMAST faculty (Figure 4), but is also a reflection of reduced funding both internally from University sources as well as externally from outside agencies. Several critical steps can be taken to grow the enrollment including:

1) Enhance student support through growth in external funding (including grant and private sources) to support scholarships and research/teaching assistantships;
2) Expand numbers of students who are either self-funded or employed;
3) Implement strategies for strengthening and expansion of international graduate degree; partnerships (e.g., program established between the University of São Paulo, Brazil, Institute of Oceanography (IOUSP) and the University of Massachusetts Dartmouth);
4) Continue to develop and expand the Professional Science Master's program;
5) Increase revenue and student opportunities through initiatives for undergraduate teaching, especially in collaboration with the College of Engineering and College of Arts and Sciences and on-line course development.

In contrast to UMass Dartmouth, UMass Boston and UMass Amherst campuses have seen a growth in enrollment. In the case of UMass Boston, this can largely be attributed to their partnership with the New England Aquarium, which has resulted in an increase in the number of research faculty and increased opportunities for students.

Addressing Quality of Core Curriculum and Variety of Elective Course Offerings –Results from the survey of UMass Dartmouth IMS students identified concerns about the quality of instruction for some core courses and this will need to be examined in more detail. Student comments highlighted a desire for more interactive and engaged learning activities. Efforts to expand the variety and number of course electives should also be a focus for future program development, including cross-campus course offerings.

Maintaining critical mass of faculty - The University must continue to recruit and retain high caliber faculty to maintain critical mass in key areas of marine science and technology and provide for succession as senior faculty retire. With the completed SMAST expansion, there are excellent opportunities to address multiple needs for new faculty (regular and research) through searches that target key areas. Different strategies can be employed to expand the impact of such hires. For example, "cluster" hires that attract multiple faculty with complementary expertise, may involve multiple units (e.g., SMAST and College of Engineering) and help to promote cross-unit collaboration. Hiring faculty that will contribute to undergraduate program development and delivery (see below) in addition to research and graduate advising will help to expand opportunities in marine science for undergraduate students while also helping to sustain the graduate and research enterprise.

Examples of potential areas for acquiring faculty include marine technology, marine renewable energy, ocean and environmental data science, and remote sensing and geospatial information systems. Other

potential areas that would address student demand and workforce needs include marine policy and socioeconomics, aquaculture, coastal restoration and water quality, and coastal sustainability.

Expand undergraduate programming - SMAST faculty have increased the number of undergraduate courses offered, and courses developed and taught have had good enrollment and positive student feedback. In addition, SMAST faculty are pursuing development of an undergraduate major in Environmental Science and Sustainability in partnership with the College of Engineering and College of Arts and Science. These efforts should be promoted and advanced to increase the revenue available to the program and provide a potential pathway for undergraduates to transition to the graduate program.

Current initiatives in Marine Sciences at UMass Boston

On-going efforts in the UMass Boston Marine Science and Technology program center on sustainable marine aquaculture. Specifically the faculty and students in the program have garnered significant external support from state and federal agencies and non-profits to engage in new research directions that extend the application of molecular techniques in support of sustainable shellfish farming. In addition a contingent of students and faculty in the program are working to engineer new hatchery designs that will support sustainable culture of organisms in developing nations where opportunities are limited. In addition our sensor group is tackling issues of shellfish and human health linking new molecular diagnostic tools to industry need. We launched our on-line sustainable aquaculture certificate program this spring in partnership with 5m Publishing and are leading, in conjunction with the Cape Cod Fisherman's Alliance, the Nature Conservancy, and the Massachusetts Aquaculture Association, the Massachusetts Shellfish Initiative which seeks to establish effective policies and regulatory structures in service to a growing marine aquaculture industry in the Commonwealth. Our partners at the Anderson Cabot Center for Ocean Life are continuing their leadership in by-catch monitoring as well as, in partnership with the Center for Coastal Studies, in-ongoing work on marine mammal conservation, specifically right whale population dynamics in the Gulf of Maine.

Key Issues for Program Development – UMass Boston

ISSUE 1. The total number of M.S. students in the Marine Sciences program is relatively low compared to our other M.S. programs. However, despite these lower enrollments the completion rate after 2-years is very low. What are the barriers to completing the degree?

ISSUE 2. The number of Ph.D. students in the Marine Sciences program is relatively low but have increased recently due to the MOU between the SFE and the New England Aquarium. Historically, the rate of completion of Marine Sciences Ph.D. students has been significantly longer than the Ph.D. in Environmental Sciences. We have made a concerted effort to move these students to completion and in AY2015-16, we conferred the first two PhDs in Marine Sciences and Technology at UMass Boston. We anticipate current and future IMS Ph.D. students will follow a similar track as Environmental Sciences Ph.D. students, graduating within five to six years of enrollment, on average.

ISSUE 3. There are marketing opportunities that would allow us to build enrollments in these programs. Moreover, the M.S. in Marine Science and Technology offers a Professional Science M.S. track as well (COAST). How can we distinguish ourselves through this program and increase enrollments leveraging the COAST M.S. track?

Key Issues for Program Development – All Campuses

Promote and strengthen cross-campus opportunities for faculty and students – The UMass President's office has identified as a priority building stronger relationships and collaborations across the campuses. The IMS program is an excellent example of an effort that leverages the strengths and capabilities of our different campuses. Yet, more effort is needed to streamline the ability for students to take advantage of the opportunities at different campuses. While there are numerous ongoing cross-campus collaborations centered on such issues as fisheries, ocean acidification, and offshore wind, further opportunities exist for synergies among the different campuses these should be promoted and enhanced.

Appendices

a. Application for Establishment of the IMS (originally IGS) Graduate Program
b. Faculty CVs
c. Faculty Assessment Procedures
d. UMass Dartmouth IMS Student Survey Results