UMCES Accreditation Self-Study Report

Institutional Self-Study, Presented to the Middle States Commission on Higher Education, October 2015

Acronyms

AAAC	Academic Affairs Advisory Council
AOS	Areas of Specialization
AL	Appalachian Laboratory
ARR	Accreditation Readiness Report
BEES	Behavior, Ecology, Evolution, and Systematics
BISI	The Biological Sciences Graduate Program
BoR	University System of Maryland Board of Regents
CBL	Chesapeake Biological Laboratory
ESC	Environmental Statistics Collaborative
ESCO	Environmental Safety Compliance Officer
FS	UMCES Faculty Senate
FSU	Frostburg State University
GEC	Graduate Education Committee
GFC	UMCES Graduate Faculty Council
GPILS	Graduate Program in Life Sciences
GSC	UMCES Graduate Student Council
HPL	Horn Point Laboratory
IAN	Integration and Application Network
IMET	Institute of Marine and Environmental Technology
IVN	Interactive Video Network
LMRCSC	Living Marine Resources Cooperative Science Center
MEES	Marine-Estuarine-Environmental Sciences Graduate Program
MFR	Managing for Results Report
MHEC	Maryland Higher Education Commission
MOODLE	Modular Object-Oriented Dynamic Learning Environment
MOU	Memorandum of Understanding
NOAA	National Oceanic and Atmospheric Administration
NT	Non-Tenure Track Faculty
REU	Research Experiences for Undergraduates; Maryland Sea Grant Program
SAC	Student Advisory Council to MHEC
SC	Steering Committee
SESYNC	National Socio-Environmental Synthesis Center
T-TT	Tenure-Tenure Track Faculty
UMB	University of Maryland, Baltimore
UMBC	University of Maryland, Baltimore County
UMCES	University of Maryland Center for Environmental Science
UMCP	University of Maryland, College Park
UMES	University of Maryland Eastern Shore
USM	University System of Maryland
USMAI	University System of Maryland and Affiliated Institutions, Library Consortium
WG	Working Group

UMCES

Globally eminent and locally relevant, the University of Maryland Center for Environmental Science is the University System of Maryland's premier environmental research institution.

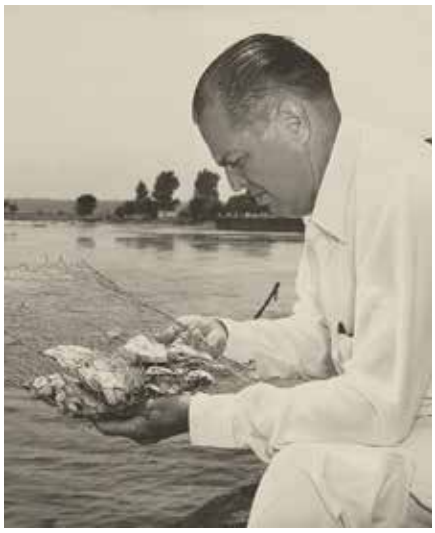
Innovation for a better future

University of Maryland
Center for Environmental Science

Executive summary

Innovation for a better future

University of Maryland
CENTER FOR ENVIRONMENTAL SCIENCE



In the summer of 1919, a brand new graduate student, Reginald Truitt, carried a borrowed microscope to a creek north of Solomons Island, MD, a knob of land near the meeting point of the Patuxent River and the Chesapeake Bay. In a cramped fisherman's shack, he set up a makeshift laboratory, installed his microscope, and began studying oyster biology. By 1929, he helped persuade the Maryland governor and legislature to approve the first marine lab in Maryland—today, Chesapeake Biological Laboratory, UMCES—that would conduct ongoing scientific research on oysters and blue crabs and finfish. It is now the oldest marine lab on the Bay and one of the leading centers in the country for fisheries research.

The University of Maryland Center for Environmental Science (UMCES) celebrates its 90th birthday in 2015. UMCES has achieved success and plays a leadership role as a preeminent institution engaged in research in the environmental sciences. Upon receiving authorization to become a degree-granting institution in the University System of Maryland (USM) in 2013, UMCES initiated the process to become accredited by the Middle States Commission on Higher Education (MSCHE). UMCES completed the Applicant Phase and became a Candidate for Accreditation in November 2013. The Self-Study, reported herein, and its evaluation by MSCHE represent the next steps in the evolution of UMCES and its aspiration to become an accredited institution in the USM.

Institutional history

UMCES is rooted in the establishment of the Chesapeake Biological Laboratory (CBL) in Solomons, MD in 1925. The addition of Laboratory Units in the 1960s and 1970s led to the establishment in 1973 of the Center for Estuarine and Environmental Science (CEES) as an institution within the USM. The institution's name was changed to UMCES in 1997 to formally recognize its connection to the USM. Over the years, UMCES and its founding Laboratory Units have earned a reputation for excellence and leadership in conducting research on the environment, especially investigations of coastal ecosystems and their watersheds. The newest component, the Institute of Marine and Environmental Technology (IMET), was added in 2010. The Maryland Sea Grant Program (MDSG) is administered by UMCES on behalf of the USM. The Integration and Application Network (IAN) is an UMCES resource that communicates science and its applications locally and globally. With its evolution, UMCES has made increasing commitments to graduate education. Particularly notable is the UMCES leadership in the inter-institutional Marine-Estuarine-Environmental Sciences (MEES) Graduate Program.

Seeking accreditation

Achieving accreditation will be an important milestone in the evolution of UMCES. UMCES began the accreditation process following authorization by the USM Board of Regents (BoR) in 2012 to award graduate degrees in marine and environmental sciences jointly with other USM institutions. Statutory authorization was granted by the Maryland General Assembly in 2013. The MSCHE approved the UMCES Accreditation Readiness Report (ARR) in November 2013 and UMCES advanced to Candidacy allowing UMCES to award its first joint graduate degrees in MEES with the University of Maryland College Park (UMCP) in May 2014. President Donald Boesch appointed Dr. Edward Houde and Ms. Erica Kropp as Self-Study Co-chairs. An UMCES Self-Study Design was approved by MSCHE in October 2014 and UMCES formally initiated its Self-Study in November 2014.

Anticipating the Self-Study, the Co-Chairs appointed members to five Working Groups (WG) and a Steering Committee (SC) in early summer 2014. The SC and WGs developed a Self-Study Design and then conducted the UMCES Self-Study, which was completed in August 2015. The Self-Study followed the MSCHE Comprehensive Model, addressing each of the Commission's Standards of Excellence, except Standard 12 (General Education), which applies only to undergraduate institutions.

Membership of WGs was broadly representative of the UMCES community and included students, staff, faculty, and administrators. Together, the SC and WGs conducted the Self-Study, following MSCHE guidelines and adhering to specific charges in the UMCES Self-Study Design.

On 22 July 2015, the draft Self-Study Report was provided to President Boesch and the senior executive leaders of UMCES for their review. It also was made available to the entire UMCES community for review and recommendations. The revised draft was provided to the Chancellor's Office of the USM on 18 August 2015 for review and

approval and then approval by the BoR. A draft of the Self-Study Report was sent to the MSCHE Evaluation Team Chair, Dr. Nancy Targett, on 17 August 2015 for review prior to her preliminary visit to UMCES on 2 September 2015.

Organization and content of the self-study

The Self-Study is presented in nine chapters that are organized thematically around specified MSCHE Standards. Each chapter cites evidence and provides examples of how UMCES complies with the MSCHE Standards.

Chapter 1: Introduction and institutional profile

The 90-year history and evolution of UMCES are described, including its emergence as a leading environmental research institution. UMCES has four major Laboratory Units that are located across the State of Maryland. Graduate education has always been a fundamental component of the UMCES mission but gained prominence with the 2012-13 actions by the USM BoR and the Maryland General Assembly that enabled UMCES to become degree-granting and authorized to grant graduate degrees jointly with other public institutions in Maryland, subject to gaining accreditation by the MSCHE. Achieving this milestone will position UMCES to maintain and improve its standing as a leader in the conduct of research and graduate education in environmental sciences.

Chapter 2: The UMCES mission and institutional goals

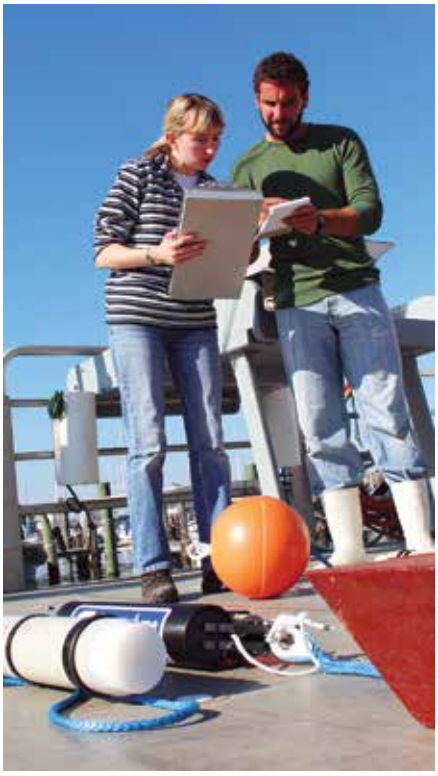
Addressing Standard 1 (Mission and Goals).

The mission and goals of UMCES are clearly stated, periodically assessed, and adjusted or revised to improve the institution's capabilities in research and education, while also fulfilling its legislative mandates. The Mission Statement emphasizes the institution's unique and broad charge, as defined by Legislative Statutes of Maryland, to "conduct a comprehensive program to develop and apply predictive ecology for Maryland to the improvement and preservation of the physical environment, through a program of research, public service, and education." UMCES contributes to meeting the USM's mission and strategic plan goals by 1) achieving national eminence as one of the world's premier research centers focused on ecosystem science; 2) uniquely integrating research, public service, and education related to the sustainability of the environment and natural resources with a focus on Maryland and the Chesapeake Bay region; 3) leading the USM's nationally ranked graduate program in marine and environmental science; 4) recruiting and retaining a nationally and internationally prominent faculty; 5) attaining research funding and private support in excess of its state support; 6) promoting economic development; 7) conducting outreach to state and federal agencies and other key constituencies; and 8) collaborating with other higher education institutions in Maryland in advanced research and graduate education. The Mission Statement includes the goal of strengthening capabilities to promote discoveries by sustaining and building on foundational research strengths along four strategic directions: 1) science to support ecosystem-based management; 2) multi-scale environmental restoration; 3) linking observing systems and forecasts from mountain to sea; and 4) regional consequences of climate change and variability. The most recent Mission Statement, approved by the BoR and the Maryland Higher Education Commission (MHEC) in 2014, and the Strategic Plan (2012) place great emphasis on insuring that UMCES continues its leadership of the inter-institutional MEES Graduate Program in environmental and marine sciences.

Chapter 3: Institutional planning to achieve mission and goals

Addressing Standard 2 (Planning, Resource Allocation, and Institutional Renewal) and Standard 3 (Institutional Resources).

UMCES is continuously engaged in policy planning and implementation, as well as seeking to improve its effectiveness as the primary institution within the USM charged with conducting research and graduate education in the environmental sciences. UMCES develops strategic plans periodically. It conducted self-study in 1993 and 2004 and



UMCES scientists test monitoring equipment to detect and survey whales and dolphins along the Mid-Atlantic coast and provide information that can minimize effects of offshore energy development.

was externally reviewed to obtain guidance on structure and processes to sustain and improve the institution's capabilities. Evidence presented in this Self-Study indicates that the effective planning, management and support structures of UMCES are inclusive, transparent, responsive and adaptive.

Oversight by the USM BoR also regulates the planning, allocation, and budgeting processes in UMCES. The Executive and Administrative Councils of UMCES meet in alternate months to address institutional planning and resource allocation. The faculty of UMCES participates in the planning and budgeting processes through its Faculty Senate (FS) and Graduate Faculty Council (GFC). Graduate students participate through the UMCES Graduate Student Council (GSC) and via student membership on the FS and GFC. UMCES understands that its sustainability depends on maintaining, renovating, and updating facilities to continue to attract and support the highest quality leadership, faculty, students and staff. Sound management of state appropriations, growth in sponsored projects, and development of diversity of facilities and programs contribute to the strengths of UMCES.

Chapter 4: Building upon an administration that is efficient, transparent, and founded on integrity

Addressing Standard 4 (Leadership and Governance), Standard 5 (Administration), and Standard 6 (Integrity).

The leadership and administrative structure of UMCES effectively guides the institution to conduct its mission successfully. UMCES is a small institution with a relatively flat administrative structure. A President, Chief of Staff, four Vice Presidents, and four Laboratory Directors constitute the core of administrative leadership. Offices of Business Administration, Facilities Administration, Human Resources, Institutional Advancement, and Research Administration and Advancement provide effective core support at the institutional and individual Laboratory levels. The existing leadership serves with the overall confidence of the faculty, staff, and students and has been resilient in adapting to changing political and economic realities that influence higher education institutions in Maryland and throughout the nation. The President, Vice Presidents, and Laboratory Directors are subject to comprehensive institutional review by faculty and staff on a five-year basis. The UMCES Administration, like those of other institutions in the USM, is guided by the broad policies of the USM. Policies and procedures within UMCES are consistent, transparent, and appropriate for the size and mission of the institution. Policies within the USM and in UMCES protect intellectual freedom and project an open and transparent organizational structure. Shared governance in UMCES is active and involves all constituencies. UMCES strives to be fair, equitable and ethical in all of its activities. This chapter describes procedures and policies that insure and reaffirm that UMCES conducts its business and prides itself by operating with integrity.

Chapter 5: Recruiting, retaining, and training outstanding students

Addressing Standard 8 (Student Admissions and Retention) and Standard 9 (Student Support Services).

UMCES faculty members participate, teach, and advise students in four USM graduate programs: the inter-institutional MEES Program, the Graduate Program in Life Sciences (GPILS) at the University of Maryland Baltimore (UMB), the Biological Sciences Graduate Program (BISI) at UMCP, and programs in Applied Ecology & Conservation Biology and Wildlife & Fisheries Biology at Frostburg State University (FSU). UMCES faculty members currently advise 85 graduate students, most of whom (>90%) are enrolled in the MEES Program. UMCES is the dominant institution within the inter-institutional MEES Program in terms of enrolled students and awarded degrees. Enrolled UMCES students have high retention and graduation success rates, and reasonable times to completion of degrees. Nearly all UMCES students are financially supported on fellowships or research assistantships. UMCES informs prospective students about opportunities for graduate study and graduate programs primarily through its online presence, including its "Education at-a-Glance" web pages.

Numerous student support services are provided at several levels (USM, UMCP, UMCES, and individual UMCES Laboratories). Many traditional services (e.g., counseling) are provided by larger partner institutions in the USM. While effective, many services would benefit from review and clarification. The GSC is meaningfully engaged in deliberations with the UMCES Administration, FS, and GFC to assure that support of graduate students is a high priority. The recently established and evolving Office of the UMCES Vice President for Education is becoming an important source of support for students and faculty, including fellowship programs and information management.

Chapter 6: A faculty committed to excellence

Addressing Standard 10 (Faculty).

In 2014, the UMCES faculty was comprised of 74 highly qualified Professors, Agents and Librarians. Except for the Librarians, all hold the PhD degree. Faculty lines are designated "tenure-tenure track (T-TT)" and "research (NT)," with teaching responsibilities mostly borne by the T-TT faculty. Both faculty lines in UMCES play strong mentoring roles, and thus both are important to the delivery of graduate education. All UMCES faculty members are expected to develop strong research programs in the environmental sciences. The scientific leadership and success of UMCES faculty members are evident across the diverse disciplines in environmental science. Numbers in faculty lines and ranks have shifted over the years. Retention of productive faculty members has resulted in a core of full Professors since the 1990s that constitute > 50% of the T-TT faculty numbers. During the past 25 years the numbers of NT research faculty increased from 6 (11%) in 1990 to 22 (31%) in 2015. An increasing number and percentage of the UMCES faculty are women [5 (9%) in 1990 to 22 (31%) in 2015].

Well-developed policies in the USM and in UMCES guide faculty appointment, promotion, and tenure. Annual evaluations of productivity are conducted from portfolios of performance in well-defined dimensions of scholarship: scientific discovery, integration, application, and education. UMCES faculty members have low teaching workloads; however, they have leadership responsibilities in student admissions, curriculum development, and thesis/dissertation supervision. UMCES can improve its practices for nurturing and mentoring performance by its young faculty members. There is a need to better define expectations for teaching responsibilities by faculty members.

Chapter 7: Delivering, evaluating, and assessing high-quality graduate education

Addressing Standard 11 (Educational Offerings), Standard 13 (Related Educational Activities), and Standard 14 (Assessment of Student Learning).

Graduate programs and education in UMCES are comprehensive in scope, providing content and rigor sufficient to enable students to complete degree programs in a timely fashion and to develop successful careers following graduation. The graduate programs are designed to provide in-depth training in: 1) the conduct of original scientific research that leads to discovery; 2) the integration or synthesis of scientific information; and 3) application of scientific knowledge to solve real-world problems. All UMCES graduate students must conduct independent thesis or dissertation research. The principal involvement of UMCES in graduate education is through the inter-institutional MEES Graduate Program. A new curriculum for MEES, one that addresses the need for breadth in modern environmental sciences, has been developed, with major contributions by the UMCES faculty, and is now proposed for implementation.

Graduate programs and courses are fully available to students at each of the four UMCES Laboratories. The institution has invested heavily in inter-active video (IVN) technology to provide students with a synchronous, distance education experience that overcomes the distributed nature of its Laboratories. Library resources at UMCES and USM-wide are equally available to all students. UMCES provides its students with opportunities for professional development, including opportunities to communicate and work with environmental professionals in government agencies, citizen scientists, and the public.

UMCES evaluates and assesses its educational programs at multiple levels and is committed to strengthening those practices while adhering to assessment protocols in place for the MEES Program and the Graduate School at UMCP. The new revisions to the MEES Curriculum serve as a prime example of an on-going commitment to ensure student learning outcomes are met. UMCES employs a range of formative student assessment tools in all education programs, including homework exercises, course projects, and formal written and oral examinations. UMCES also employs a range of summative assessment tools to ensure that course curricula have appropriate content and are effectively taught. With its new degree-granting authority, UMCES must increasingly be responsible for defining and maintaining UMCES-specific educational standards, particularly those that qualitatively and quantitatively integrate its internal assessment and evaluation procedures.

Chapter 8: An institution committed to excellence

Addressing Standard 7 (Institutional Assessment).

The success of UMCES is largely attributable to its dedication to planning, evaluation and assessments conducted in its administrative, research and academic programs. In this regard, the Mission Statement and Strategic Plan are reviewed regularly and renewed to seize opportunities and respond to identified needs. As an institution in the USM, UMCES adheres to the broad strategic plans and policies of the USM, while operating under its own specific plans and policies. The qualitative and quantitative procedures of assessments conducted at the USM and UMCES levels are described. In the planning and budgeting processes, assessments are conducted at both the UMCES and Laboratory Unit levels, insuring that programs are effective and equitable. Performances of administrators and faculty members are regularly reviewed and assessed. Assessment of institutional effectiveness is facilitated by the transparency of operations in UMCES and by the commitment to shared governance in which administrators, faculty, staff and students are included in planning and evaluation processes. Assessment of academic programs in which UMCES faculty members teach and mentor graduate students occurs at multiple levels because UMCES participates in inter-institutional graduate education within the USM. There is opportunity to enhance and improve assessment, especially the assessment of educational outcomes. In this regard, the Office of the VP- Education in UMCES plays an important role in development of policy on faculty involvement in teaching and in advocacy for new assessment approaches to aid evaluation of teaching, learning outcomes, and the overall success of graduate education.

Chapter 9: Conclusions, recommendations and path forward

The Self-Study confirmed that UMCES does what it says it will do in striving to achieve its mission and in implementing its strategic plan. UMCES is compliant with the Standards of Excellence of the MSCHE. It is an effective and efficient research institution with an important investment in graduate education. UMCES prides itself in being a transparent organization in which faculty, staff, and students participate openly in shared governance. The institution reviews and assesses its policies and procedures on a regular basis and revises its mission statement and strategic plan accordingly. Based on findings in the Self-Study, ten recommendations are brought forward that UMCES will seek to accomplish in the next one to five years. The UMCES Administration must be vigilant to assure that all Laboratory Units continue to be well supported, fiscally responsible and able to maintain facilities necessary to be preeminent in the environmental sciences. Already a leader of the MEES Graduate Program, UMCES must assert leadership in both the implementation and conduct of a newly restructured MEES Curriculum and will immediately work to institute and implement improved education delivery and assessment procedures.

CHE MSA **Middle States Commission on Higher Education**
3624 Market Street, Philadelphia, PA 19104-2680
Phone: 267-284-5000 Fax: 215-662-5501 www.msche.org

Certification Statement: Compliance with MSCHE Requirements of Affiliation and Federal Title IV Requirements

Effective October 19, 2012

University of Maryland Center for Environmental Science
(Name of Institution)

is seeking *(Check one)*:

_X_ Initial Accreditation
___ Reaffirmation of Accreditation through Self Study
___ Reaffirmation of Accreditation through Periodic Review

An institution seeking **initial accreditation** or **reaffirmation of accreditation** must affirm that it meets or continues to meet established MSCHE Requirements of Affiliation and federal requirements relating to Title IV program participation, including the following relevant requirements under the Higher Education Opportunity Act of 2008:

- Distance education and correspondence education (student identity verification)
- Transfer of credit
- Assignment of credit hours
- Title IV cohort default rate

This signed certification statement must be attached to the executive summary of the institution's self-study or periodic review report.

The undersigned hereby certify that the institution meets all established Requirements of Affiliation of the Middle States Commission on Higher Education and federal requirements relating to Title IV program participation as detailed on this certification statement. If it is not possible to certify compliance with all requirements specified herein, the institution must attach specific details in a separate memorandum.

___ Exceptions are noted in the attached memorandum *(Check if applicable)*

July 29, 2015 (Date)
Dr. Charles Caramello, Associate Provost for Academic Affairs & Dean of the Graduate School
University of Maryland, serving as the Graduate School and administrative home for the Joint Degree Program, on behalf of the
University of Maryland Center for Environmental Science

July 30, 2015 (Date)
Dr. Donald F. Boesch, President
University of Maryland Center for Environmental Science

Created in 2014, the UMCES seal is based on a bas relief stone sculpture that is over the doorway of Beaven Hall on UMCES' founding laboratory, the Chesapeake Biological Laboratory. It has the elements of water, seagrasses, crabs, oysters, fish, and oak leaf, representing all of the UMCES Laboratories and their areas of study.

Chapter 1 *An evolving institution*

Knowledge is our best natural resource

The University of Maryland Center for Environmental Science unleashes the power of science to change the way society understands and manages the environment. Our scientists conduct cutting-edge research to solve today's most pressing environmental problems and to train the next generation of scientists to guide our state, nation and world toward a more sustainable future.

History and overview

The University of Maryland Center for Environmental Science (UMCES) is 90 years old in 2015. UMCES traces its origin to the founding of the Chesapeake Biological Laboratory (CBL) in Solomons, MD in 1925. As such, CBL is the oldest permanent, state-supported marine laboratory on the east coast of the United States. The evolution of UMCES as an academic institution within the University System of Maryland (USM) is traced in the Milestones for UMCES table below. UMCES consists of four Laboratory Units dispersed across Maryland. However, it is administered as a single institution of the USM.

UMCES has evolved significantly since the 1970s. The Center for Environmental and Estuarine Studies (CEES) was established in 1973 and included CBL, the Appalachian Laboratory (AL) and the Horn Point Laboratory (HPL). The UMCES name was adopted by legislation in 1997. The Maryland Sea Grant College (MDSG) has been administered through UMCES since 2000. Recent expansion in 2010 added elements of the Institute of Marine and Environmental Technology (IMET) to UMCES. Each addition to UMCES has added diversity and depth. The diversity of disciplines and the presence of Laboratory Units across Maryland have allowed UMCES to gain regional recognition while conducting highly successful, inter-disciplinary research and education programs in environmental sciences that are globally eminent while responsive to the needs of the citizens of Maryland.

Milestones for UMCES

For the past 53 years, UMCES has operated as an institution within what is now the University System of Maryland (USM). UMCES has a rich tradition of conducting excellent research, education, and public outreach related to natural resources and the environment, fulfilling expectations expressed in its enabling legislation. The administrative structure of UMCES and

A brief synopsis of the evolution of UMCES.

1925	Chesapeake Biological Laboratory (CBL) estalbished (Solomons, MD).
1941	Department of Research and Education created as independent state agency (legislative act). CBL included in the Department.
1961	Natural Resources Institute (NRI) created to incorporate the previously independent Department of Research Education into the University of Maryland (legislative act). Appalachian Laboratory established (Frostburg, MD).
1973	Center for Environmental and Estuarine Studies (legislative act, 1975), Horn Point Laboratory established (Cambridge, MD). Two NRI Laboratories closed.
1997	University of Maryland Center for Environmental Science (legislative act to change name).
2000	Maryland Sea Grant College Program (College Park, MD), a partnership with the National Oceanic and Atmospheric Administration, placed under UMCES administration.
2010	Institute of Marine and Environmental Technology reorganized as partnership among UMCES, University of Maryland Baltimore County and University of Maryland, Baltimore (Baltimore, MD).
2013	UMCES authorized to award joint graduate degrees and post-baccalaureate certificates (legislative act). UMCES initiated actions to gain accreditation through the Middle States Commission on Higher Education (MSCHE) and was granted Candidate status in November 2013.
2014	UMCES awarded its first MS and PhD degrees, jointly with the University of Maryland College Park.
2015	UMCES celebrates its 90th anniversary.

its institutional connection to the USM are illustrated in Figure 1.1. UMCES operates under the laws of Maryland as codified in both the Natural Resources Article[1 2 3] and the Education Article[4 5] to "conduct a comprehensive program to develop and apply predictive ecology for Maryland to the improvement and preservation of the physical environment, through a program of research, public service, and education."

UMCES is the smallest of the twelve USM institutions in terms of faculty and staff and expenditures. In May 2015, UMCES included 48 tenured and tenure-track faculty members, 22 research faculty members, two agents, two librarians, and 13 research support faculty (doctoral level appointments, non-faculty). The total number of UMCES employees, excluding hourly employees and graduate students, was 265 in May 2015. The numbers of graduate students

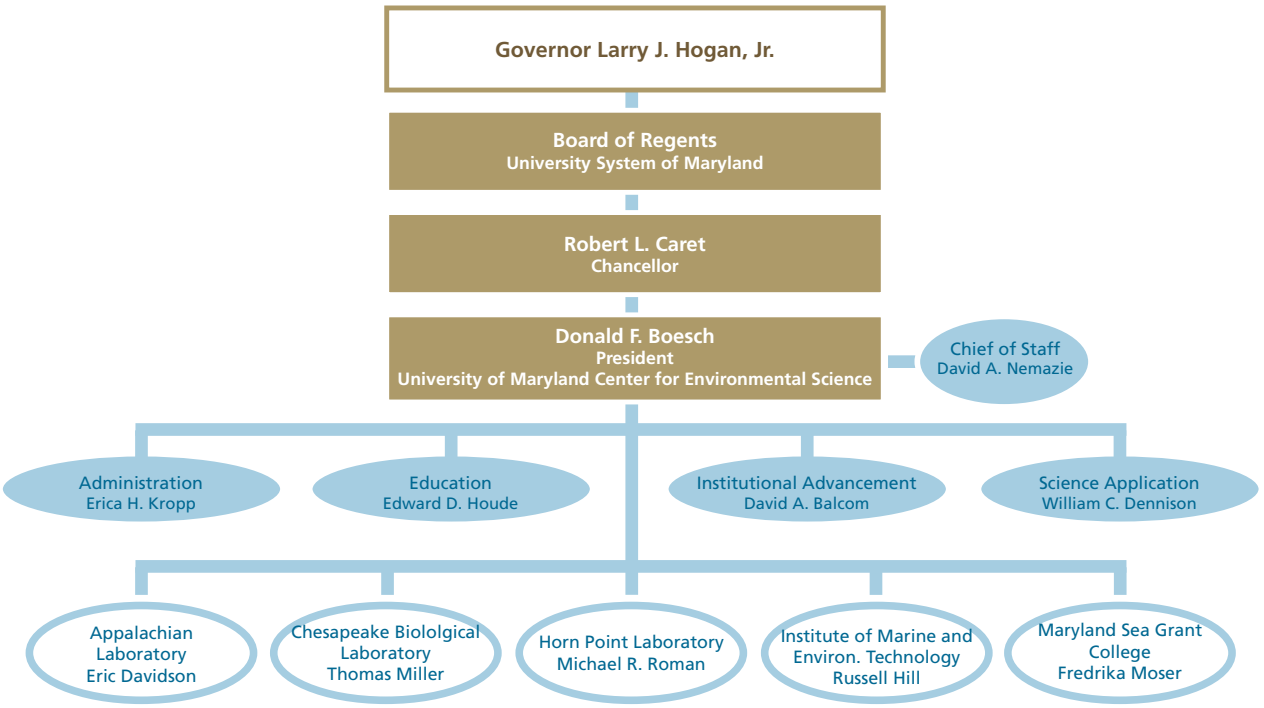


Figure 1.1. Administrative structure of UMCES within the University System of Maryland. The Administration includes four Vice Presidents (Administration, Institutional Advancement, Education, and Science Application). Four Laboratory Directors and the Director of Maryland Sea Grant College complete the administrative leadership.

(MS and PhD) in the Marine-Estuarine-Environmental Sciences (MEES)[6] Graduate Program, the primary home of UMCES graduate students, has ranged from 71 to 116 in the period 2002-2014, and numbered 79 at the beginning of academic year 2014-15. UMCES does not formally engage in undergraduate education although undergraduate mentoring and outreach activities are important activities at each of the Laboratories.

Although geographically distributed (Figure 1.2), UMCES is administered as a single institution of the USM. Each of its four Laboratories (Figure 1.1) has a Director who is responsible for faculty and scientific staff, facilities operations, and fiscal administration. The UMCES Center Administration is located primarily in Cambridge and operates under the President and Vice Presidents for Administration, Education, Institutional Advancement, and Science Applications. The Office of the Vice President for Education is located at CBL in Solomons. The Vice President for Institutional Advancement is located at the IMET site in Baltimore. The Maryland Sea Grant Program (MDSG) and Director are located in College Park. Additional project support offices are in Annapolis. The President, Vice Presidents and Laboratory Directors are responsible for oversight and coordination of the Laboratories, including graduate students, and representation to the USM. The UMCES President is a member of the Council of University System Presidents, with responsibilities delegated by the BoR and Chancellor that are equivalent to those of Presidents of the other USM institutions.

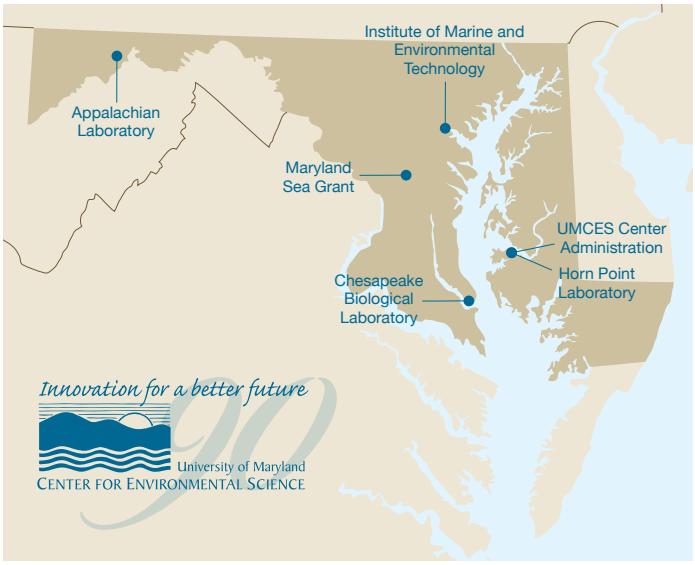


Figure 1.2. UMCES is a geographically distributed institution of the University System of Maryland. Its Laboratory Units and Offices are located across the state.

The UMCES vision and mission

UMCES is a research, education, and service institution of the USM and a world leader in the conduct of science in coastal environments and their watersheds. The vision of UMCES is to continually improve institutional capability as a leader in environmental science and graduate education. The Center's faculty advances knowledge through scientific discovery, integration, application, and teaching that promotes a comprehensive understanding of our environment and natural resources, helping to guide the State and world toward a more sustainable future. As the responsible institution for administration of the MDSG and collaborative programs with other institutions, UMCES leads, coordinates, and catalyzes environmental research and graduate education within the USM.

The UMCES Mission and institutional goals, elaborated in Chapter 2, are framed on a statutory mandate[1] [2] [3] to conduct a comprehensive scientific program to develop and apply predictive ecology for the improvement and preservation of Maryland's physical environment. This mission is accomplished through research, education, and public service.

UMCES faculty members advise, teach, and serve as mentors to graduate students enrolled in degree programs with USM institutions, particularly through the USM-wide graduate MEES Program, in which UMCES has a leading role. UMCES also delivers its services through 1) environmental science education programs for K-12 students and teachers, 2) pertinent and timely information to the general public and decision makers, 3) technology transfer to industries, and 4) collaboration with the MDSG.

Evolution

UMCES is committed to periodically undertake strategic planning to guide and improve its research and education programs. Four strategic plans were produced since 1993. Each of the Plans addressed emerging issues in environmental science and highlighted opportunities for UMCES to demonstrate scientific leadership while seeking solutions to problems in the Chesapeake Bay watershed and around the world, including the global ocean and polar regions. The 2004 Plan *From Vision to Reality*[7] was developed in conjunction with comprehensive and critical self-study, and was reviewed favorably by an External Examining Committee[8]. The 2012 Strategic Plan *Focus on the Future*[9] builds on the strengths of UMCES and includes five focus areas: 1) Genes to Ecosystems; 2) Human Welfare; 3) Energy Choices; 4) Water Security; and 5) Global Reach.

The addition of components of the Institute of Marine and Environmental Technology (IMET) to UMCES in 2010 was a significant step in the evolution of UMCES. IMET is a partnership among UMCES, University of Maryland, Baltimore County (UMBC) and University of Maryland, Baltimore (UMB). UMCES traditionally has excelled in collaborative, cross-disciplinary science. With the addition of IMET, the capability of UMCES to conduct research in molecular biology and biotechnology was enhanced and opportunities for collaboration have greatly expanded.

Graduate Education

UMCES has been involved in education for most of its 90-year history. In the institution's early days, efforts were focused entirely on residential summer programs aimed at undergraduate students who took courses taught by faculty visiting CBL. A brochure from 1932, only seven years after the institution's founding, lists courses in Invertebrates, Economic Zoology, Protozoology, Embryology, Animal Ecology, Paleontology and Zoological Problems, which were taught by faculty from CBL, UMCP, Goucher College and the Johns Hopkins University[10]. The courses did not represent a coherent graduate program; credit for the courses was arranged by the participating students and their home institutions. These summer courses continued until the 1970s.

For the first 53 years of its history, the involvement of UMCES in graduate education was informal. UMCES became formally involved with the implementation by the Maryland State Board for Higher Education of the MEES Program in October 1978[11]. The UMCES faculty now plays a major role in successful advising, teaching, and mentoring of graduate students, primarily in MEES. Although earlier students and graduates do not formally carry the UMCES institutional seal on their diplomas, they carry the imprimatur of the UMCES faculty in their training, their research activities, and ultimately in their professional careers.

Since the late 1970s, graduate students advised by UMCES faculty members have received MS and PhD degrees from one of the degree-granting institutions of the USM. In 2013, UMCES was granted authority by the Maryland General Assembly (House Bill 268)[12] to "award graduate degrees in marine and environmental sciences jointly with another public senior higher education institution and award post-baccalaureate certificates" [Md.Code Ann. Com. Law §3-403(a)(8)][13]. This milestone legislation followed several bilateral agreements between UMCES and UMCP[14]. The steps included authorization by the USM BoR for UMCES to seek accreditation through the Middle States Commission on Higher Education (MSCHE). An Agreement between UMCES and UMCP defines the joint degree program[15].

UMCES Laboratories and faculty advisors provided the academic home for 85 graduate students in the 2014-2015 academic year. Students advised by UMCES faculty members may be enrolled in four graduate programs in the USM: 1) the inter-institutional MEES Program[6] (Figure 1.3) administered through the Graduate School and College of Computer, Mathematical & Natural Sciences (CMNS) at UMCP[16] that presently includes 79 students from UMCES (46% of the total number of MEES students); 2) the Biological Sciences Graduate Program (BISI)[17] at UMCP with 1 UMCES student in 2014-2015; 3) the Graduate Program in Life Sciences (GPILS)[18], administered by the University of Maryland Baltimore that presently has 3 UMCES students; 4) the Applied Ecology and Conservation Biology, and Wildlife & Fisheries Management tracks leading to the MS degree in the Biology Department at Frostburg State University[19] that included 2 UMCES students in the 2014-2015 academic year.

The vast majority of graduate students supervised by the UMCES faculty have been enrolled in the MEES Program through which 98 PhD and 140 MS degrees under UMCES supervision have been conferred since 2002. In earlier years (1978-2001), 274

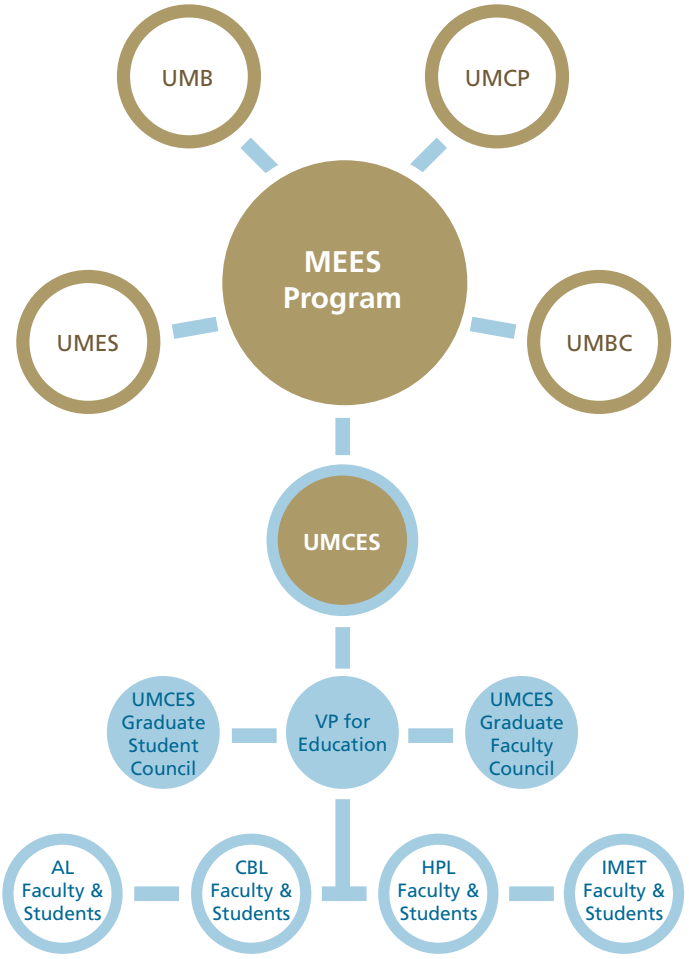


Figure 1.3. The structure and organization of education within UMCES and its four Laboratory Units. The Marine-Estuarine-Environmental Sciences (MEES) Program is a multi-institution graduate program centrally administered through the Graduate School at the University of Maryland, College Park (UMCP). Other institutions participating in MEES include the University of Maryland, Baltimore County (UMBC), the University of Maryland Center for Environmental Science (UMCES), the University of Maryland Eastern Shore (UMES), and the University of Maryland, Baltimore (UMB).

degrees (110 PhD and 159 MS) were awarded to MEES students supervised by UMCES faculty members. Historically, MEES degrees awarded to UMCES students were conferred through the Graduate School of UMCP[20].

As a Candidate for accreditation by MSCHE, UMCES may award degrees. UMCES awarded its first degrees, jointly with UMCP, in MEES in May 2014. In the period May 2014 through May 2015, UMCES awarded 9 PhD and 14 MS joint degrees to students who matriculated in the MEES Graduate Program and were advised by UMCES faculty members.

Seeking accreditation

With its recent authorization to grant degrees came the requirement that UMCES be accredited. Accordingly, the accreditation process was initiated with the MSCHE, UMCES has an opportunity to strengthen, expand, and improve its commitment to education. Over time, UMCES and its faculty have come to play an increasingly important role in graduate education within the USM. The Director of the highly regarded, system-wide MEES Program is a tenured UMCES faculty member. UMCES faculty members chair or co-chair all but one of the six Areas of Specialization (AOS) in MEES[21] and teach the majority of courses in MEES. In 2013, UMCES initiated the process to seek accreditation by MSCHE. Preparation of its Accreditation Readiness Report (ARR)[22] allowed UMCES to begin a critical evaluation and assessment of its compliance with MSCHE's 14 Standards of Institutional Excellence. Upon favorable review of the ARR, UMCES was advanced to Candidacy by MSCHE in November 2013. UMCES initiated the self-study process in 2014 and its Self-Study Design[23] was approved by MSCHE in October 2014. The Self-Study was completed in August 2015. It represents work and contributions by a large and representative segment of the UMCES community and a commitment by the institution to build on its strengths while demonstrating the constant improvements expected of an accredited institution.

Nature and scope of the self-study

As a Candidate institution seeking accreditation, UMCES was required to adopt the MSCHE Comprehensive Model for its Self-Study. All of the 14 Standards of Excellence, except Standard 12 (General Education), which applies to undergraduate institutions, are addressed to demonstrate how UMCES complies with the Standards and to confirm the institution's commitment to improvement of performance and continuance of excellence as UMCES moves forward as an accredited institution.

In spring 2014, President Donald Boesch appointed Edward Houde, Vice President for Education, and Erica Kropp, Vice President for Administration, as Co-Chairs of the UMCES Self-Study and Steering Committee. The Self-Study was conducted under the direction and oversight of a Steering Committee (SC)[24] appointed in summer 2014 by President Boesch and the SC Co-Chairs. The 17-member SC consisted of UMCES administrators and faculty, representatives of the USM BoR, USM Administration, and clients who benefit from research and education conducted by UMCES. They are leaders, strong contributors, and facilitators, who are committed to advancing the mission of UMCES. The SC met twice during the Self-Study design phase and contributed regularly in oversight and reviewing capacities throughout the Self-Study.

Five working groups (WGs)[25], broadly representative of the faculty, administration, and students in UMCES, conducted the Self-Study. The WGs were organized in thematic areas defined by selected MSCHE Standards of Excellence. The chair of each WG also sat on the SC to ensure accountability and provide effective communication among WGs and the broader UMCES community. The five WGs and thematic areas are:

- WG1. Institutional Planning and Resource Allocation (MSCHE Standards 1, 2, 3, and 7)
- WG2. Building Upon an Administration that is Efficient, Transparent, and Founded on Integrity (MSCHE Standards 4, 5, and 6)
- WG3. Recruiting, Retaining, and Training Outstanding Students (MSCHE Standards 8 and 9)
- WG4. A Faculty Committed to Excellence (MSCHE Standard 10)

- WG5. Delivering, Evaluating, and Assessing High-Quality Graduate Education (MSCHE Standards 11, 13, and 14).

Each WG consisted of 10-14 members who initiated their work in fall 2014. WG Chairs communicated by conference telephone and interactive video, and met regularly with the SC Co-Chairs throughout the Self-Study. The WG membership included a substantial fraction of the UMCES faculty, staff and students, insuring that all voices were heard. The WGs reported to the SC, submitting progress reports in February and April 2015. To facilitate connectivity, some WG members were assigned to more than one WG.

The draft Self-Study was compiled from individual WG reports in May-July 2015 that were submitted to the SC for its review, edits, and compilation. Throughout the Self-Study, the SC Co-Chairs reported regularly to UMCES faculty, administration, and students, seeking comments and recommendations. The draft Self-Study was posted to the UMCES website on 22 July 2015 for the entire UMCES community to read and submit comments for consideration and potential incorporation into the final report. The Self-Study was submitted to the USM Office of the Chancellor and to the BoR on 18 August 2015 for review and approval before submittal to MSCHE.

A Self-Study page[26] was installed on the UMCES website to facilitate document-sharing and to develop an electronic library of cited documents presented as supporting evidence in the Self-Study. The SC Co-Chairs and WG Chairs reported regularly on the Self-Study to the UMCES community at Laboratory Unit faculty meetings, town hall meetings, Executive Council meetings, Administrative Council meetings, and at annual Faculty Convocations held in May 2013 (initiating the accreditation process), May 2014 (Self-Study Planning) and May 2015 (completing the Self-Study).

Intended outcomes of the self-study

Beyond serving to demonstrate that UMCES is compliant and worthy of accreditation by MSCHE, the Self-Study provided a foundation upon which UMCES will maintain and strengthen its leadership role in 1) conducting environmental research, 2) applying science to solve environmental problems, and 3) delivering high-quality graduate education. The Self-Study presented an opportunity for in-depth self-evaluation and assessment of policies, procedures, and commitment to achieving excellence. Additionally, outcomes of the Self-Study have provided guidance for UMCES in setting aspirational goals.

Intended outcomes included:

1. Demonstration of compliance with the applicable MSCHE Standards of Excellence.
2. Engagement of the UMCES community and supporters in the review and assessment of policies, practices, and procedures employed to achieve excellence in research, applications of research, and graduate education.
3. Evaluation of institutional effectiveness and demonstration that UMCES is achieving its mission through successful implementation of its strategic plan.
4. Identification of actions to sustain and improve performance of the institution, including recommendations for additional or new assessment procedures.

Chapter 2 The UMCES mission and institutional goals

Addresses Standard 1

Standard 1: Mission and Goals. *The institution's mission clearly defines its purpose within the context of higher education and indicates who the institution serves and what it intends to accomplish. The institution's stated goals, consistent with the aspirations and expectations of higher education, clearly specify how the institution will fulfill its mission. The mission and goals are developed and recognized by the institution with the participation of its members and its governing body and are used to develop and shape its programs and practices and to evaluate its effectiveness.*

Analyses and findings

UMCES has strived to carry out its broad mission as defined by Legislative Statutes under the laws of Maryland as codified in both the Natural Resources Article (Md. Code Ann. Com. Law §§ 3-401 and 3-402 and 3-403)[1] [2] [3] and the Education Article (Md. Code Ann. Com. Law §§10-101 and 12-104)[4] [5] to "conduct a comprehensive program to develop and apply predictive ecology for Maryland to the improvement and preservation of the physical environment, through a program of research, public service, and education." UMCES contributes to meeting the legislative mandates of the USM in numerous ways[27] including: achieving national eminence as one of the world's premier research centers focused on ecosystem science; uniquely integrating research, public service, and education related to the sustainability of the environment and natural resources of Maryland and the Chesapeake Bay region; leading the USM's nationally ranked graduate program in marine and environmental science (i.e., MEES); recruiting and retaining a nationally and internationally prominent faculty; attaining research funding and private support in excess of its state support; promoting economic development; conducting outreach to state and federal agencies; and collaborating with other higher education institutions in Maryland in advanced research and graduate education. UMCES plays a key role in advancing knowledge in support of Maryland's international reputation for progressive environmental management and sustainable economic development. As an institution, UMCES has recognized the need to periodically reassess its mission and goals, consistent with the legislative charter and mandates. The Board of Regents approved the most recent mission statement in 2014[27].

The UMCES institutional Mission Statement requires and has received the approval of both the BoR and the Maryland Higher Education Commission (MHEC). Both the Mission and Goals Statement and underlying Strategic Plan incorporate the institutional expectations of the USM and the cognizant State authorities. In accord with its legislative mandate, the Maryland State Plan for Postsecondary Education[28], and the USM Strategic Plan[29], the UMCES Mission Statement outlines specific institutional objectives and outcomes.

The process of amending and updating the Mission Statement is initiated by the President of UMCES. Drafts are provided for review by the UMCES community through the established shared governance representation on the President's Executive Council and Administrative Council (as defined in Chapter 4) before the draft Mission Statement goes forward to the USM for review by the Chancellor and before being submitted to the USM BoR for its consideration and approval. Lastly, the MHEC reviews mission statements for consistency with the state plan. Updating of the mission statement is required by MHEC at least every four years.

Graduate education, while important in UMCES for more than three decades, is becoming an increasingly prominent part of the UMCES mission. Actions in 2012 by the Chancellor[30] and BoR[31], and by the Maryland Legislature in its 2013 session[12], have authorized UMCES to award graduate degrees in marine and environmental sciences jointly with other public universities in Maryland and to award post-baccalaureate certificates.

The Mission spells out five broad goals[27] and describes how UMCES will assess measures of progress. These broad goals relate to both external and internal contexts and constituencies:

- Continue to strengthen UMCES' capacity for scientific discovery;
- Continue the development of UMCES' capacity for integration and application through the Integration and Application Network (IAN)[32] and the National Socio-Environmental Synthesis (SESYNC)[33];
- Build on the UMCES' success in graduate education, including leadership of the MEES program;
- Expand the role of the UMCES and the Maryland Sea Grant College[34] in environmental education and awareness of Maryland's school children and citizens;
- Support the leadership of the UMCES faculty within the scientific community and advance environmental science and translational research within the University System of Maryland, the State, the Chesapeake Bay region, and the nation.

UMCES is working actively to address these broad goals. An example of how UMCES is addressing the graduate education goal is illustrative:

- *Build on UMCES' success in graduate education, including leadership of the MEES Program[6].* Working with other institutions participating in the USM-wide MEES

Program, UMCES has taken a leading role in updating and reforming the existing program and curriculum (see Chapter 7) to meet changing societal and scientific needs[35] [36], to compete more successfully for the most qualified students, and to provide expanded opportunities for continuing professional education. Progress, as defined in the Mission, will be measured by:

a. effectiveness in leading the reform of the MEES Program and improving its national ranking;

b. stronger qualifications of entering graduate students and greater professional success (awards, placement, etc.) of degree recipients; and

c. establishment of a successful program for continuing education for environmental science professionals.

The reform of the MEES Program is well underway (see Chapter 7). The USM-wide Curriculum Committee has developed proposed curriculum changes that are responsive to advances in environmental sciences, academic strengths within the USM, current and future societal and environmental challenges, and shifts in areas of interest of graduate students.

Refining and improving the mission and goals of UMCES are shared activities by administration and faculty (see Chapter 4). The faculty's input is insured through strong involvement of its Faculty Senate (FS)[37] [38] and Graduate Faculty Council (GFC)[39] [40] in shared governance and in planning for the future of UMCES. Student membership on the FS and GFC insure that graduate students have a strong voice in advising UMCES on its mission and goals.

Strategic planning accompanies the ongoing process of refining the Mission. UMCES recognizes the need to plan strategically and has produced three strategic plans in the past two decades (1993[41], 2004[7] and 2012[9]). The administration and faculty work together to develop strategic plans, implement them, and periodically evaluate success. Each of the three strategic plans in the past two decades has identified the critical and emerging needs for research in environmental sciences required to maintain the excellence and national eminence of UMCES. Consistent with the themes that are prominent in each of the strategic plans, the needs for investments in faculty, facilities, and resources are clearly expressed (see Chapter 3). In this regard, it is noted that the Mission of UMCES expanded in 2010 with the addition of IMET, an action that strengthened capabilities of UMCES in molecular biology and biotechnology.

The Mission's goals and objectives are most clearly defined and expressed in the Strategic Plan. The most recent Strategic Plan (2012)[9] places high priority on achieving goals and maintaining the institution's core values. By conducting cutting-edge research into today's most pressing environmental problems, UMCES is developing new ideas and solutions to help guide our state, nation, and world toward a more environmentally sustainable future while developing novel applications to enhance new commercial enterprises. Among the objectives in the Strategic Plan is the aspiration of UMCES to develop non-degree, professional training and certificate programs in the marine and environmental sciences. Training and inspiring the nation's next generation of environmental scientists is fundamental to the work of UMCES.

The Strategic Plan further states that UMCES executes its mission while holding these Core Values:

- Commitment to environmental discovery, integration, application, and education that epitomizes our institutional responsibility to serve society.
- Adherence to the highest standards of academic independence in the pursuit of discovery and knowledge.
- Engagement in translational science in partnership with scientific colleagues, other units in the USM, agencies and stakeholders.
- Responsiveness to the needs of colleagues, sponsors, governments, and stakeholders.
- Maintenance of an atmosphere of egalitarianism with no barriers based on status and authority, enhancing shared governance and a commitment to diversity.

Conclusions

The Mission of UMCES and goals contained in that mission are clearly stated, periodically evaluated, and adjusted or revised to improve the institution's capabilities in research and education, while also fulfilling its legislative mandates as an institution within the USM. The most recent Mission Statement and Strategic Plan place great emphasis on insuring that UMCES continues its leadership of the inter-institutional MEES Graduate Program in environmental and marine sciences. Nevertheless, the Mission Statement and Strategic Plan acknowledge the need for evaluation and possible restructuring of MEES to strengthen the program, recognizing the shifting demands for interdisciplinary education, new modes of education delivery, and development of new curricula to fulfill the UMCES mission.

Chapter 3 *Institutional planning and resource allocation*

Addresses Standards 2 and 3

Standard 2: Planning, Resource Allocation, and Institutional Renewal. *An institution conducts ongoing planning and resource allocation based on its mission and goals, develops objectives to achieve them, and utilizes the results of its assessment activities for institutional renewal. Implementation and subsequent evaluation of the success of the strategic plan and resource allocation support the development and change necessary to improve and to maintain institutional quality.*

Standard 3: Institutional Resources. *The human, financial, technical, facilities, and other resources necessary to achieve an institution's mission and goals are available and accessible. In the context of the institution's mission, the effective and efficient uses of the institution's resources are analyzed as part of ongoing outcomes assessment.*

Standard 2: Planning, Resource Allocation, and Institutional Renewal

UMCES is continuously engaged in planning and implementing policies and seeking to improve its effectiveness as the primary institution within the USM charged to conduct environmental research and graduate education in the environmental sciences. The administrative structure of UMCES and the institution's ongoing planning processes, development of periodic strategic plans, self-study, and external review provide guidance on needs and feedback on structure and processes that lead to success.

Oversight by the USM and its BoR[42] also serve to guide the planning, allocation, and budgeting processes in UMCES. The faculty of UMCES participates in the planning and budgeting processes through an engaged FS[38] and GFC[40]. Graduate students are participating through the UMCES GSC[43] and student membership on the FS and GFC. Annual Faculty Convocations[44] highlight critical issues facing UMCES and are a platform to initiate or implement needed changes in procedures or policies. The Executive and Administrative Councils (as defined in Chapter 4) of UMCES[45] meet bi-monthly on alternate months to address institutional planning and resource allocation[46] [47].

Focus on the future

UMCES seeks to achieve its mission[27] and goals through sound planning and the efficient and effective use of allocated resources. Strategic planning is an ongoing, important process. Development of strategic plans is initiated by the President but is developed with full involvement of the Executive Council, Administrative Council and FS. In 2004, UMCES conducted a Self-Study[48], hosted an External Review[8] and issued a Strategic Plan[7]. That plan, *From Vision to Reality*, served to direct UMCES for seven years. The updated Mission Statement of 2014[27] and the latest Strategic Plan (2012), *Focus on the Future*[9], provide a clear and concise plan for UMCES to not only continue its traditional role in conducting environmental research and education, but also commits itself to extend its reach to new and emerging areas. Five topics for Future Focus in support of scientific discovery, integration and application are identified in the new plan:

- Genes to Ecosystems: understand and apply genetic regulation of key ecological processes.
- Human Welfare: support resilient ecosystems and human health across the land-ocean continuum.
- Energy Choices: evaluate and communicate the environmental opportunities and consequences of energy production alternatives.
- Water Security: understand, evaluate and reduce the environmental consequences of the demand for water for agricultural, industrial and human use.
- Global Reach: enhance the capacity for international collaboration and training around the world to develop expertise in environmental research, application and management.

Over the past decade UMCES built upon its prominent reputation in marine and estuarine science and gained prominence in watershed science and ecosystem-based science to support resource management. Looking forward, UMCES will strive to become even more interdisciplinary and will increase capabilities and collaborate more effectively in the socio-economic disciplines to complement its strengths in the natural sciences.

The 2010 incorporation of the IMET partnership is one example of how UMCES has strategically strengthened its research and educational portfolio. The addition of IMET added a strong research element in the area of molecular biology and technology, but also strengthened UMCES with respect to impact on fostering economic development through research innovation[49]. A good case and example is the thriving entrepreneurial program for graduate students under an award from the Ratcliffe Foundation (also see Chapters 5 and 7)[50] [51].

Most recently, in response to both research and education demands, UMCES established an Environmental Statistics Collaborative (ESC)[52] at its Chesapeake Biological Laboratory. This new initiative offers state-of-the-art education in environmental statistics to UMCES graduate students and statistical expertise to faculty researchers and partners in the scientific and natural resources management community.

President Boesch noted "The new Environmental Statistics Collaborative reflects our commitment to provide our students, faculty and partners with the best possible tools to study and solve the world's pressing environmental challenges." The new ESC is responsive to the UMCES Mission and supports the Strategic Plan that charges UMCES to provide actionable science to the citizens of Maryland and to federal and other partners.

Authorization to seek accreditation through the MSCHE has stimulated efforts by UMCES to take a leading role in planning for revitalization of the MEES Graduate Program and for development of plans to restructure MEES and its curriculum (see Chapter 7)[53]. UMCES is now actively engaged in planning for an improved and expanded role in graduate education with its participation on the inter-institutional MEES Administrative Council[54], its leadership on the current Program Committee of MEES[55] and its strong presence on the MEES Curriculum Restructuring Committee[35].

Decision-making processes and authorization are referenced and documented in the UMCES Policies and Procedures[56] and specifically in the UMCES Policy on Organization[57]. These policies explicitly document the roles of the UMCES FS[38] and the UMCES GFC[40] in shared governance and in planning and decision-making.

UMCES places strong emphasis on facilities master planning. The UMCES current 10-year plan, 2012-2022[58], is in effect with a scheduled five-year review and update in 2017. Master planning is conducted by the UMCES Administration with input from the UMCES Executive and Administrative Councils. The process includes the involvement of the UMCES community at each Laboratory and administrative site, and includes obtaining feedback from faculty and staff, from Town Hall meetings, and annual Faculty Convocations. The overall vision of the Master Plan recognizes the extraordinary value of the diverse Laboratory Units and facilities that support research and education efforts in UMCES.

UMCES conducts an annual institutional assessment of key goals, objectives and performance measures in its Managing for Results report (MFR)[59] submitted to the USM for inclusion in the State Budget[60]. Completion of this report is another tool for ongoing internal assessment. Required by the Department of Management and Budget for all state agencies, the MFR categories used by UMCES include goals and measurements of extramural support, number of peer-reviewed publications produced by UMCES faculty, average GRE scores of incoming graduate students under the direction of UMCES faculty, K-12 teaching training, and percentile rank of UMCES expenditures per faculty member as compared to Carnegie I Research Universities. Completing the MFR report provides opportunity for the UMCES administration to evaluate reported data in a different context. It covers a period of four fiscal years that include the two most recent years of actual numbers and two out-years of estimates, which establish on-going goals.

When additional State funds above base budget were appropriated in FY 2014, the allocation required that USM institutions develop performance measures to assess the effective use of these enhancement funds toward fulfilling institutional missions. With the significant state budget cuts this past year and focus on developing new strategies for achieving and demonstrating improved cost efficiencies and effectiveness (discussed later in this Chapter), further study of the implementation of performance based funding appears to have been put on hold by the state. USM institutions must continue to report on accomplishments based on the FY14 enhancements and complete MFRs (cited above), which are reviewed and analyzed internally by the State of Maryland Executive Branch (Department of Budget and Management) and also by the Legislative Branch (Department of Legislative Services).

Standard 3: Institutional Resources

Analyses and findings

The UMCES business model is largely based on annual State Operating appropriations and restricted and unrestricted funds from grants and contracts. Annual appropriations from the State require constant evaluation and assessment of funded programs by institutions in the USM, including UMCES. While the sources of funding, in particular from sponsored projects, fluctuate from year to year, the overall budget of UMCES has generally increased over time. The UMCES capital budget is funded by the State and is based on the success of requests for capital investments to the USM BoR and ultimately the Governor and General Assembly. Facilities are state of the art and meet currently anticipated needs. As new buildings come on-line the State generally increases the operating budget according to the estimated utility and maintenance needs of the new facility. Currently, UMCES is replacing a research building with sea-water capabilities at CBL. Another facility (Information and Communications Services Building at CBL) is slated for appropriation of planning funds in FY 2017 within the Governor's Capital Improvement Program.

UMCES, as an institution within the USM, is an agency in the State of Maryland. State appropriations, other than salary, constitute less than half of the annual, direct funding support to UMCES. The Governor and the Maryland General Assembly annually determine the State's allocation, based on recommendation of the BoR. The State of Maryland Budget Book is made publicly available at the end of the calendar year and represents the Governor's proposed budget presented to the General Assembly, which convenes each year in mid-January. The UMCES budget, as part of the USM budget, is included. The FY 2016 budget, as it was proposed, can be found in the Budget Book, Volume III, pages 242-243[61]. The actual state appropriated budget is set by the General Assembly. By law, it may only be equal to or lower than the budget presented by the Governor. Actual operating revenues for FY 2015 (Figure 3.1) and most years are derived primarily from extramural contracts and grants (44%), State of Maryland appropriations (47%), and other sources (9%).

Administratively, UMCES is a relatively flat organization with a well-developed cooperative and collaborative relationship with other institutions within USM, particularly with UMCP, UMB and UMBC. UMCES has been effective and efficient in its budget processes and allocations, in part because of the flat structure of this relatively small institution that has no Schools, Deans, Departments, or Department Chairs.

UMCES has no separate Graduate School or Bursar's Office, but utilizes those offices at UMCP for support of graduate education in UMCES. Although UMCES does not directly generate tuition income from graduate courses its faculty teaches in the MEES Program, UMCES receives an 85% tuition return from UMCP for the course credits taught by UMCES faculty members. This

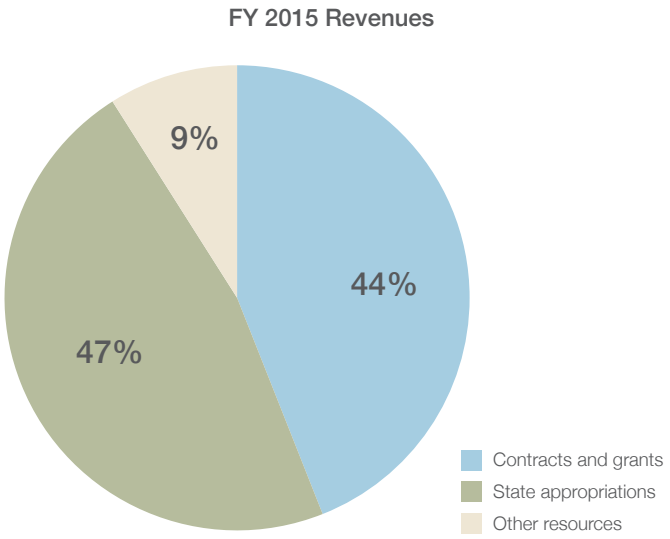


Figure 3.1. UMCES Operating Revenue for FY 2015. As depicted, more than half of the revenue is from sources other than State of Maryland appropriations.

allocation, made every year, is used by UMCES exclusively to enhance graduate education. Currently, a percentage of the tuition return (20%) is allocated to support operations of the Office of the Vice President for Education; the remainder (80%), based on course credits, is allocated to the Laboratory responsible for delivering those credits. The most current UMCES memorandum on the distribution of those funds is provided here[62]. Below is a chart of this source of income for the last ten years (Figure 3.2).

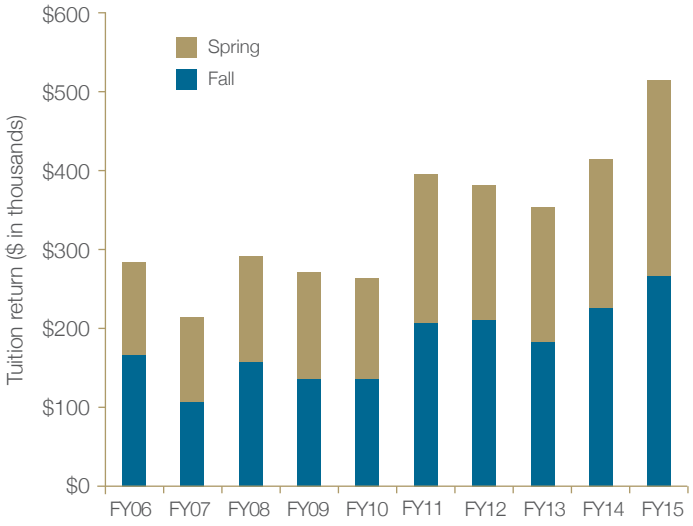


Figure 3.2. Ten-year chart of tuition return showing overall steady increases.

Shared resources

UMCES utilizes various levels of services from UMCP for payroll, time-keeping and human resources information and processing systems, bursar's office, on-line travel authorization and reimbursement, travel and procurement cards, procurement and accounts payable, and fixed asset and inventory systems. UMCES has MOUs in place with UMCP for its Institutional Review Board, with the University of Maryland Baltimore County for technology transfer and, for IMET, an MOU with UMB for both Institutional Animal Care and Use Committee (IACUC) and Environmental Health and Safety (EHS) at that particular site. Not only does this allow UMCES to operate with the most current and sophisticated technology support without replicating the cost, but it also minimizes the administrative structure and improves our compliance strength and access to expertise. And, these collaborations and partnerships are not stagnant; UMCES is currently collaborating with UMCP on implementation of a sophisticated contract and grant billing and accounts receivable system to replace the now outdated system. In other sections of this Self-Study (see Chapter 1), the MOU (June 2012)[14] and Agreement (December 2012)[15] in place between UMCES and UMCP addressing Graduate School and MEES Program support are described. The administrative structures in place and the agreements minimize duplication of services and costs in the MEES Program.

Sharing resources has aided UMCES in successfully maintaining high levels of institutional productivity, including increased efficiency and effectiveness, during the recent challenging times of reduced budgets. An effective institutional planning and assessment process is in place with the annual budget process, MFR, efficiency and effectiveness review and initiatives. UMCES also manages to support professional staff within the organization by the creative and effective arrangement of sharing positions between Center Administration and some of the Laboratories. In one example, the UMCES Chief Information Officer is also the Director of IT for HPL and other IT personnel also are shared. Another example is that of a Senior Research Administrator within the UMCES Office of Research Administration who is located at AL and has a role in its business office.

Allocating resources

UMCES is dedicated to continue the careful assessments and analysis that support effective use of resources. UMCES must continually assess needs to allocate resources in support of its four Laboratories located across the State of Maryland to insure that its mission is effectively carried out and initiatives in the Strategic Plan are implemented

Significant resources have been committed by UMCES in the past year to plan and implement its effort to seek and apply for accreditation through MSCHE, including the establishment of the Office of the Vice President for Education[63]. Budget planning and allocation of resources to support graduate education through the Office of the VP-Education are improving the conduct, support and management of graduate education within UMCES and its coordination with the MEES Program and Graduate School on the UMCP campus. The Office of the VP-Education also has played a key role in leading and managing the accreditation process.

A current initiative of the USM BoR is a formal Effectiveness and Efficiency 2.0 plan, known as "E&E 2.0"[64]. This is a critical new phase in the USM legacy of efforts to share resources and thus yield savings and cost avoidance while enhancing quality. Under the E&E 2.0 Initiative, the USM is exploring such practices as streamlining procurement policies and practices, expanding the use of analytics tools to improve student success, and supporting innovative and effective USM business practices. UMCES

participates in this initiative and has formed an "E&E" working group comprised of both business personnel and faculty members. The goal is to review not just the business office processes but also those processes that involve faculty and students.

UMCES operates facilities dispersed throughout the State and has embarked on several initiatives to become more efficient. Initiatives include the expansion and effective use of an interactive video network (IVN) system[65]; shared staff who work UMCES-wide; the extensive use of an electronic proposal routing system; and reduction in the total number of fleet vehicles.

Recruitment of outstanding faculty and staff

Faculty: Research areas for new faculty recruitment are guided by the Strategic Plan[9]. Faculty recruitment is initiated at each Laboratory by the Director and by faculty during faculty meetings and approved by the President. Faculty positions are advertised nationally and internationally. A search committee that includes faculty representatives from at least two UMCES Laboratories evaluates candidates and makes hiring recommendations (also see Chapter 6).

Recruitment of key administrators: In addition to members of the Administrative Council, the administrative staff within Center Administration and the Laboratory Business Offices have become increasingly professional over the last two decades. Vacancies in administrative positions involve search committees that, like faculty searches, often include representatives from other Laboratories.

Sponsored projects

Extramural funding through sponsored projects has always been an essential element of the UMCES budget. New awards of contracts and grants have been in the $20-24 million dollar range over the past 6 years (with a FY10 spike attributable to federal funding due the American Recovery and Reinvestment Act) and continue to hold steady in spite of the reduced federal budgets in grant programs and increased national competition for research grants. The majority of the research funding is from the federal government, but there is a significant fraction from state agencies and a growing amount from private sources. Figure 3.3 provides an 11-year picture of UMCES extramural funding.

As affirmed in Chapter 6, the UMCES faculty is strongly entrepreneurial in pursuing funding opportunities from dozens of agencies, and is adept to shifts in the funding landscape. A chart in Chapter 6 (Figure 6.5) shows the diversity of research sponsors that reflects the diverse capabilities of UMCES faculty members, a factor contributing to fiscal stability of UMCES.

The UMCES Facilities & Administrative Rate (F&A, a.k.a. indirect cost) for federal grants and contracts is 53% of Modified Total Direct Costs (MTDC), which recognizes the costs of operating our specialized facilities, e.g., research vessels, experimental hatcheries and seawater facilities. UMCES negotiates the rate agreement with the Department of Health & Human Services, its cognizant audit agency. UMCES has a policy of full cost recovery when budgeting for sponsored research or services, and procedures for exceptions, including a reduced rate of 39% MTDC for awards funded by the state of Maryland. The UMCES Laboratories are located in different regions of the state and each is responsible for its utilities, facilities

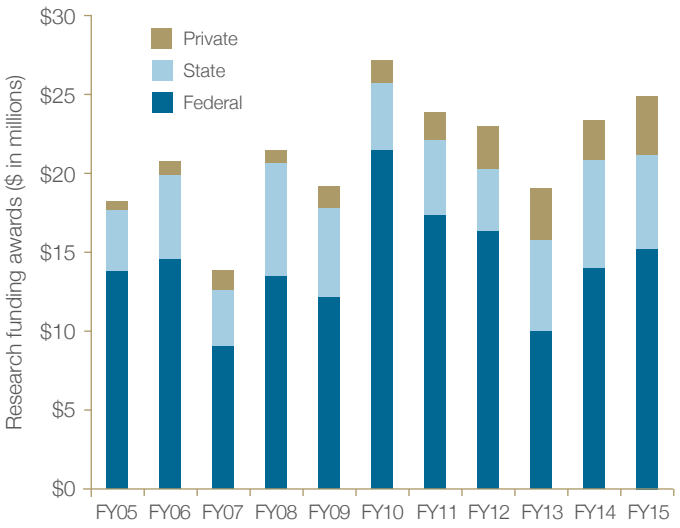


Figure 3.3. UMCES research funding awards, by source, FY 2005–FY 2015.

maintenance, and administrative costs. All of the F&A recoveries are allocated back to the Laboratories that generated the income. This provides major incentives as well as budgeting flexibility to each Laboratory.

Development

Along with other USM institutions, UMCES is participating in the next System-wide comprehensive campaign. Each institution will set its specific goals and programmatic points of focus for the campaign. UMCES is beginning the planning process for this campaign that will likely focus on research innovation and graduate education, particularly the generation of endowed and non-endowed resources for graduate student support. Such endowments have become key metrics in assessing the strength of universities. They are a factor in determining an institution's bond rating and general financial health. UMCES has an endowment of $2.1 million, which includes recently completed fundraising for the France-Merrick Foundation Endowed Professorship[66]. This endowment, now at $1.6 million, will provide start-up funding for a Center-wide faculty position in sustainable ecosystem restoration.

The scope and specific targets for the comprehensive campaign have not been fully vetted, but a reasonable projection of the UMCES goal for the seven-year campaign will be at or near $25 million. This level is three times that assigned to UMCES in the last campaign, which was a modest $8 million. A strong focus on support for graduate education dovetails nicely with the UMCES effort to obtain full accreditation status and will better position UMCES to attract the very best students. Moreover, a successful fundraising campaign will better prepare UMCES to address the uncertainties of state funding in light of shrinking extramural federal agency support for research.

Facilities planning and renewal

The University of Maryland Center for Environmental Science operates world-class research facilities at its four locations across the State. These include: specially-designed laboratories with advanced instrumentation to undertake chemistry and biology experiments and analyses, including DNA sequencing

and advanced molecular and isotopic measurements; seawater systems for maintenance of and experimentation with marine and aquatic organisms; extensive shellfish and finfish aquaculture facilities; greenhouses; computational and geographic information systems; the state-of-the-art research vessel *Rachel Carson*; and automated environmental observing systems.

UMCES plans and allocates carefully to insure that it has the critical resources and facilities to achieve its mission. A Master Plan has been implemented for the period 2012-2020[67]. A state-of-the-art replacement building for an UMCES seawater laboratory (Figure 3.4) is under construction and scheduled to be completed by winter 2015.

Figure 3.4. Architect's drawing of the Truitt Building. This building was under construction at the time the Self-Study Report was written.

The USM BoR capital budget plan for the next 10 years[68] includes funding for continued construction and growth of UMCES. The plan proposes capital projects that, through their program of spaces and strategic location on campuses, will better connect the research and teaching elements in UMCES. It places a premium on developing purpose-built spaces on the Laboratory campuses to help foster collaboration that is critical to cross-disciplinary research and training, a hallmark of UMCES. It is guided by overall sustainable designs, continued development and expansion of IT infrastructure, and is expected to strengthen public outreach and educational programs by providing the enhanced and improved facilities.

One of the stated priorities of the Chancellor and BoR of the USM is to maintain an adequate annual investment in the maintenance and renewal of capital assets. Current USM programs and policies are intended to reduce an existing backlog of deferred maintenance and help restore a manageable balance between the detrimental impact of time, weather and use on facilities and adequate spending to combat their deterioration. This fund, while not yet at the level set by the BoR due to budget constraints and cuts in recent years, is recognized as a priority to protect and maintain facilities and is a standard part of the UMCES budget request each year as a mandatory cost of services increase[69].

UMCES has facilities renewal funds to upgrade existing facilities available from both a growing operating budget line pursuant to the BoR policy referenced above and bond funds available through capital funds managed centrally by USM. Even in years with budget cuts, UMCES has managed to maintain a healthy facilities renewal fund and it is planned to provide upgrading of existing facilities.

These projects will also contribute to reduced energy use and are inherently supportive of a sustainable design approach in that they may include re-purposing of existing spaces to extend the useful life of existing materials and reduce overall greenhouse gas emissions. It is recognized that state-of-the-art facilities, that are also flexible, support UMCES in attracting and retaining excellent faculty and students.

Important resources—Special facilities and programs

Research fleet

UMCES operates a Research Fleet that is the backbone of the institution's coastal science research programs, providing scientists with access to the Chesapeake Bay, its tributaries, and the coastal ocean. Home-ported at CBL in Solomons, the research fleet consists of 16 boats and small vessels stationed at CBL and HPL. Christened in November 2008, the R/V *Rachel Carson* (Figure 3.5) is the flagship of the UMCES fleet[70]. This specially designed, state-of-the-art research vessel supports a wide variety of estuarine and coastal oceanographic research projects. The Carson's shallow draft, configuration, and versatility make her well suited for estuarine and near-coastal research.

Figure 3.5. The 81-ft Research Vessel *Rachel Carson*.

Integration & Application Network (IAN)

Creative ways of synthesizing data, communicating results and developing solutions are being pioneered at UMCES, using established and emerging technologies. In this regard, the Integration and Application Network (IAN), under the direction of the Vice President for Science Applications, is a unit within Center Administration that provides innovative ways of providing research information to decision makers and stakeholders[71]. IAN was instituted by UMCES in 2002 to bridge the gap between science and management. It presently has a professional staff of 25 persons. The expertise of the IAN resource includes science communication services[72], environmental report card production[73], and training and capacity building[74]. The combination of science integration with science application is a powerful approach to address environmental problems, allowing scientists to move beyond identifying and documenting problems, and providing opportunities to solve them.

Maryland Sea Grant

Maryland Sea Grant College (MDSG)[34], which is administered by UMCES for the USM, is committed to scientific synthesis and translating research to multiple audiences. Funded by the National Oceanic and Atmospheric Administration (NOAA) and the State of Maryland, MDSG is part of a network of 33 university-based Sea Grant programs nationwide[75].

The MDSG provides funding in support of marine and environmental research conducted by scientists at Maryland institutions. For 26 years, it has conducted an NSF-funded Research Experience for Undergraduates (REU) program with UMCES Laboratories and faculty members serving as hosts and mentors, respectively. Maryland Sea Grant has produced a series of videos and books that serve to synthesize and communicate scientific results on issues related to Chesapeake Bay. In addition, its *Chesapeake Quarterly*[76] publication and dynamic web site provide regular updates to the broader community. Sea Grant extension agents work at the interface of science and the community and they have been instrumental in promoting understanding and a more scientific approach to resource management.

Library resources

The first library in UMCES was instituted at CBL in 1934, mainly with donations from Director Reginald Truitt and staff. In addition to the CBL Library, which is the primary library resource in UMCES[77], there is a library at HPL and there are smaller collections of library resources at the other Laboratories. Library facilities in UMCES also are described in Chapters 5 and 7 of this Self-Study. The advent of partnering with other USM institutions has removed the imbalance of availability of library resources among Laboratories. Now, all UMCES personnel have access to the same traditional and electronic holdings through partnerships with other USM institutions[78]. As part of the USMAI Library Consortium[79] UMCES Faculty/Students/Staff have access to over 6 million titles and nearly 10 million items through a shared catalog and hold/recall process. The revolution in electronic journal subscriptions over the last quarter century has further enhanced access to library resources. UMCES now has direct access to over 24,000 journal titles. A typical month shows usage at 7,507 look-ups and 5,472 clicks through to full text. A proposed UMCES facility, an Information Commons Building to be sited at CBL, is slated for planning funds in FY 2017 should it be approved within the State's Capital Budget.

The Alliance for Coastal Technologies (ACT)

Located at CBL, this is a NOAA-funded partnership of research institutions, resource managers, and private sector companies dedicated to fostering the development and adoption of effective and reliable sensors and platforms[80]. ACT is committed to providing the information required to select the most appropriate tools for studying and monitoring coastal environments. Priorities include supporting transition of emerging technologies to operational use; maintaining a dialogue among technology users, developers, and providers; identifying technology needs and novel technologies; documenting technology performance and potential; and providing the Integrated Ocean Observing System (IOOS) with information required for the deployment of reliable and cost-effective networks.

The National Socio-Environmental Synthesis Center (SESYNC)

UMCP, in collaboration with UMCES and Resources for the Future, competed successfully with some of the nation's most prestigious universities for the NSF's national center for synthesis in environmental sciences. SESYNC[33] is now well established in Annapolis, co-located with an UMCES office. SESYNC programs support the synthesis of natural and social science in addressing problems of the environment. Promoting fundamental, discovery-driven synthesis research that contributes to actionable science is central to SESYNC's mission. SESYNC presents opportunities for UMCES to expand its own synthetic activities, ranging from the regional to the international scale.

Aquaculture Research Center

The Aquaculture Research Center (ARC) is an extensive culture and holding facility at the Columbus Center in Baltimore[81] where the IMET Laboratory is located. ARC is an 1,800-square-meter, state-of-the-art, environmentally responsible facility that provides excellent experimental capacity for research with marine organisms. It is a completely contained, recirculating system with sophisticated biological filtration and life support systems that enable safe and efficient re-use of water.

Oyster Cultivation and Research Facility

The largest culture facilities in the world for the Eastern Oyster are located at HPL[82]. The Jones Oyster Culture facility produces larval oysters for use in research, restoration and educational programs. It and an extensive setting facility on the waterfront at HPL provide sound science for use by resource managers and have been instrumental in improving oyster culture methodology. UMCES has become a leader in hatchery-based oyster production and restoration. Researchers work cooperatively with partners, the Oyster Recovery Partnership[83] and Maryland Department of Natural Resources, Federal sponsors, and others to improve production methods and learn how to restore the oyster resource to Chesapeake Bay.

Analytical services

The BioAnalytical Services Laboratory (BASLab)[84] at IMET provides services that include DNA sequencing, plasmid purification, and genotyping. The BASLab serves primarily scientists at IMET, but also offers its services to investigators working at other USM institutions and outside entities. Analytical services, including nutrient analysis and other water quality services are available from facilities housed at CBL and HPL[85] [86]. These facilities house state-of-the-art instrumentation and provide services for UMCES faculty, other USM faculty, and outside entities.

Lean state budget

The USM and UMCES received budget increases for cost of living and merit adjustments in FY 2013 and FY 2014, although the funding climate has been lean in the past decade. The USM experienced a modest budget cut in mid-year FY 2015 that has been carried forward into the FY 2016 budget. Even with those cuts, UMCES was able to protect a portion of the enhancement to

its budget that was provided in FY 2014, in particular a substantial part that was allocated to a graduate fellowship program.

The USM requests that UMCES allocate 2% of its total budget to its fund balance each year. The fund balance is reserved for major initiatives or significant, unexpected expenditures. Fund balances are used to support faculty start-up packages, major initiatives, and emergencies. With only a few exceptions over the last 20 years, UMCES has generally met or exceeded its fund-balance goal.

Communications and the budget process

After the Maryland General Assembly has approved the annual budget and the Department of Budget Management makes appropriations available to USM, funds are then distributed to the institutions. The UMCES Vice President for Administration, with the Comptroller and Manager of Budget Operations, develops a distribution plan for the Laboratories that is shared and discussed with the Administrative Council. All Laboratories must maintain a fund balance that, beginning in FY 2016, must be a budgeted item. The budgetary status of UMCES is reviewed each month, at either the Executive Council or Administrative Council meetings. Agendas and minutes of those meetings are maintained in the President's office and are distributed when completed.

UMCES finance/administrative staff routinely conducts analyses based on specific budget scenarios provided by the USM, using information from the State of Maryland Department of Budget Management. Much of the analysis is based on the state's periodic tax revenue projection and whether actual revenues will fall short, meet, or exceed budgets.

Stretching resources

UMCES operates facilities dispersed throughout the State and has embarked on several initiatives to become more efficient. Initiatives include the expansion and effective use of an IVN system[65]; shared staff who work UMCES-wide; the extensive use of an electronic proposal routing system; and reduction in the total number of fleet vehicles. UMCES is dedicated to continue the careful assessments and analyses that support effective use of resources. The institution must continually assess needs to allocate resources in support of its four Laboratories located across the State of Maryland to insure that its mission is effectively carried out and initiatives in the Strategic Plan are implemented.

UMCES strives to be an example of a sustainable institution that effectively and efficiently utilizes its resources. It is a signatory to the American College & University Presidents' Climate Commitment[87] and has launched and evaluated programs aimed at reducing the UMCES environmental footprint with the goal of achieving climate neutrality.

Conclusions and recommendations

UMCES has sustained itself and grown responsibly for 90 years. Its strong tradition of planning and carefully considered resource allocation has served it well through difficult economic times and its future seems secure. UMCES understands that its sustainability is dependent on maintaining, renovating, and updating facilities to continue to attract and support the highest quality leadership, faculty, students and staff. Evidence gathered and presented in the Self-Study indicates that the management and support structure of UMCES is inclusive, transparent, responsive and adaptive.

UMCES should continue to conduct its budgeting and resource allocations in an open, participatory and transparent process. The Center Administration works closely with the Laboratory business offices. Operating in this way will ensure that UMCES has the flexibility to respond to short-term needs or longer term changes in either the research or education elements of its mission.

Recommendations

1) Beginning in Fiscal Year 2016, UMCES will develop a five-year budget for planning purposes.

Projections will be based on a number of factors, including: recent sponsored project trends and recovered overhead; information on changing operating funds provided via the USM on State General Funds; merit and COLA increases, and costs associated with fringe benefits; philanthropic support; faculty and staff turnover and new buildings and changes in utilities. The budgeting projections will assist UMCES in planning for implementation of its current strategic plan as well as establishing budget priorities. The process will be directed by the UMCES Vice President for Administration and will include the involvement of the Executive and Administrative Councils.

Chapter 4 *Building upon an institution that is efficient, transparent and founded on integrity*

Addresses Standards 4, 5 and 6

Standard 4: Leadership and Governance. *The institution's system of governance clearly defines the roles of institutional constituencies in policy development and decision-making. The governance structure includes an active governing body with sufficient autonomy to assure institutional integrity and to fulfill its responsibilities of policy and resource development, consistent with the mission of the institution.*

Standard 5: Administration. *The institution's administrative structure and services facilitate learning and research/scholarship, foster quality improvement, and support the institution's organization and governance.*

Standard 6: Integrity. *In the conduct of its programs and activities involving the public and the constituencies it serves, the institution demonstrates adherence to ethical standards and its own stated policies, providing support for academic and intellectual freedom.*

Standard 4: Leadership and Governance

The USM and its BoR[88] [42] constitute a mature higher educational structure with clear governance guidelines and ethical standards as evidenced by the accreditation of the 11 institutions of the USM that have sought it from the MSCHE, as well as accreditation by other bodies (e.g., medical school accreditation). The BoR is an independent body, whose members are appointed by the Governor, with review and consent of the Maryland State Senate. It develops, reviews, and approves policies that are adhered to by all USM institutions. The Chancellor of the USM is appointed by the BoR. Individual institutional policies must not be in conflict with BoR policies. Shared governance is practiced within the USM and UMCES and is inclusive of faculty, staff, and students. For example, within UMCES the faculty is represented by the long-standing FS[38], administrative staff by a Staff Council[57] [89] [90], students by a GSC[43], and the academic interests of faculty by the GFC[40]. The FS and the three Councils have representation on the UMCES Administrative Council[45].

Board of Regents: An independent governing body

As noted, UMCES is governed by the USM BoR as are all institutions within the USM. The BoR has well-developed and comprehensive bylaws[91]. The 17 members of the BoR[92] are appointed by the Governor to five-year terms, with the exception of the Student Regent, who is appointed by the Governor to a one-year term. By statute, the Maryland State Secretary of Agriculture is a member of the BoR. All appointments, except for the Secretary of Agriculture, must receive consent of the Maryland State Senate. A current BoR members list, including biographies, is publicly posted[92]. A new Governor of Maryland took office in early 2015 and made seven new appointments or reappointments to the BoR, which all received Senate confirmation during the Legislative Session. USM Presidents and the Chancellor of the USM are specifically excluded from membership on the BoR[93]. Moreover, BoR members must adhere to State Ethics laws and policies[94] that require disclosure of potential or perceived conflicts of interest. The BoR assists USM institutions, including UMCES, in the provision of resources needed to sustain and improve the institutions by regularly testifying before the Maryland General Assembly on behalf of USM[95]. Additionally, many Regents actively assist USM institutions in philanthropic fund raising. The USM and decisions of its BoR are public and under the scrutiny of the Governor, General Assembly, the press, and the public in recognition of the importance of the USM to higher education and the economy of Maryland.

President, appointment and review

The President of UMCES is appointed by the BoR and reports to the Chancellor of the USM (see Figure 1.1), who in turn reports to the BoR. The President has specific oversight authority as described in Section V of its Bylaws[91]. Annually, the Chancellor reviews the President's performance in consultation with the BoR based on accountability measures developed for each institution[59]. The President is comprehensively reviewed every five years, with significant and substantial input from the UMCES faculty, staff, and students[96]. President Donald Boesch was last reviewed in 2013.

UMCES mission and authority to become accredited

The BoR regularly reviews and approves mission statements of USM institutions, as required by State law. In the review and approval of its 2014 Mission Statement[27] the Board specifically requested that sections concerning the UMCES role in graduate education be strengthened. UMCES and other USM institutions regularly report to the BoR on their operations and achievement of mission as directed in Article IX of its Bylaws[91].

UMCES received authorization from the BoR to seek accreditation from the MSCHE, as documented in the following actions: a) BoR approval to seek accreditation at its 22 June 2012 Public Session meeting[31], after considering the recommendation of its Education Policy Subcommittee; b) Support from the Chancellor of USM to apply for MSCHE accreditation[30]; c) Legislative authorization to grant joint degrees (MS and PhD) and award post baccalaureate certificates[12] and d) Signing of a Memorandum of Understanding (MOU) between UMCES and the UMCP (which has MSCHE accreditation)[14].

UMCES relies upon shared governance

The USM requires institutions to have well defined shared (collegial) governance policies in which all members of the campus community have representation. UMCES has a shared governance policy and organizational structure approved by the BoR[57] [45]. The UMCES Executive Council, which meets bi-monthly, consists of the President, Chief of Staff, four Vice Presidents and four Laboratory Directors. The UMCES Administrative Council, chaired by the President, is a broadly representative body (Table 4.1) that meets bi-monthly and is charged with reviewing new policies and procedures, and bringing its recommendations forward to the President.

UMCES has an active FS that is elected by the faculty. In addition to tenured and tenure-track faculty, the FS includes representation from non-tenured faculty and graduate research assistants[38]. FS members are elected by vote of faculty members within their Laboratory to three-year terms. The Chair of the FS must be a tenured faculty member and is elected at large by the UMCES faculty. The Vice Chair, who must be a tenured faculty member, and Secretary of the FS are elected annually by members of the FS. The Chair of the FS is a regular member of the Administrative Council (Table 4.1).

Table 4.1. UMCES Administrative and Executive Council membership.

President*
Vice President for Administration*
VP for Science Application*
VP for Education*
VP for Institutional Advancement*
Unit Laboratory Directors (5)*
Associate VP for External Affairs
Chief of Staff*
Associate Unit Laboratory Director (5)
Director of Human Resources
Director of Research Administration
Director of Public Relations
Comptroller
Faculty Senate (FS), Chair
Staff Council, President
Graduate Student Council, Chair (GSC)**

** also serve on Executive Council*
*** invited to one meeting each year plus the annual Faculty Convocation*

The GFC[43] was re-constituted and provided a specific charge in 2013. It is an active body that participates regularly in the shared governance of UMCES and is chaired by the Vice President-Education. Graduate students are represented on the GFC by representative of the UMCES GSC that consists of two students from each UMCES Laboratory[97]. The Chair and Vice Chair of the GSC participate in at least one meeting of the UMCES Administrative Council each year and participate in the annual UMCES Faculty Convocation. The Chair and Vice-Chair of the UMCES GSC serve as members, with voting privileges, on the UMCES GFC[40]. A representative of the UMCES GSC serves on the FS but does not have voting privileges. Additionally, regular faculty meetings at each Laboratory include a graduate student representative.

The Chair of the UMCES Staff Council is elected by members of the "exempt" and "non-exempt" staff[57]. Each Laboratory has at least one staff member serving as its representative. Since collective bargaining was enacted and instituted at UMCES[98] in 2014 (for a small class of non-exempt employees), the Staff Council has met infrequently due to questions regarding representation. The Chair of the Staff Council participates as a member of the Administrative Council and regularly reports to the Staff Council on relevant issues.

Standard 5: Administration

UMCES policies[56] and the UMCES organizational chart (Figure 1.1) demonstrate the depth of professional leadership and the administrative leanness of the leadership core of UMCES. The President of UMCES is a leader with qualifications that serve UMCES effectively within the University System and as a representative of UMCES to the national science, education, and policy communities. The administrative structure and leadership, together with active shared governance policies and practices, indicate that UMCES is in compliance with this MSCHE standard.

All UMCES administrators undergo an annual review by the UMCES President who in turn is reviewed annually by the Chancellor and Board of Regents of the USM[99]. Additionally, the UMCES President, Vice Presidents, and Laboratory Directors undergo a comprehensive five-year review that includes evaluation by UMCES faculty, students, and staff. The Vice President for Science Application underwent such a review in 2015. The four Laboratory Directors, who are appointees of the President, play a prominent role in guiding both research and education at their respective Laboratory Units. The Maryland Sea Grant College is administered by UMCES for the USM, with its Director reporting to the UMCES President.

The UMCES faculty interacts regularly with the Administration to support the UMCES mission and goals, participating actively in the UMCES Administrative Council (Table 4.1). The FS[38] is the primary faculty vehicle to foster interaction and the newly strengthened GFC[40] is becoming increasingly important in representing the academic interests of faculty and graduate students to the Administration.

Qualified leadership

The UMCES President has primary responsibility to lead the institution toward accomplishing its mission and achieving its goals and is responsible for administration of the institution[100]. Leaders in UMCES, including members of the Executive Council, have the appropriate educational background and professional experience to provide leadership in the institution[101] [102] [103]. The UMCES administration staff is of appropriate size and structure to ensure accomplishment of the goals of the institution[104].

Over the 25 years of President Boesch's tenure, UMCES has grown significantly and has achieved numerous notable accomplishments in key areas including facilities, achievement of strategic initiatives, research growth, development and administration, formalization of graduate education, and expansion of shared governance. UMCES facilities have grown and modernized with at least one new, significant facility at three of its Laboratories plus a new modern research vessel[105]. UMCES assumed the administration of the Maryland Sea Grant in 2000[34]. Strategic planning processes have led to several new and significant initiatives including the Integration and Application Network (IAN)[71], formalization of the role of UMCES in graduate education through accreditation, and several new research programs through hiring of new faculty with relevant expertise. Significant growth in UMCES faculty was achieved in marine biotechnology as part of the establishment of the joint research facility (IMET) with UMBC and UMB.

Additionally, while serving as UMCES President, Dr. Boesch also has served as the Interim Vice Chancellor for Academic Affairs (2002-2003)[106] and is the Vice Chancellor for Environmental Sustainability (2008-present)[107]. In recognition of the important role that UMCES plays in the environmental affairs of the state of Maryland, the UMCES President is specifically included as a member of the Governor's Council on the Chesapeake Bay (a subcabinet maintained under the past six governors) and of the Maryland Commission on Climate Change (by statute).

Table 4.2. UMCES serves on system-wide coordinating bodies.

Chancellor's Council (President, monthly)
Administration and Finance Meeting (VP for Administration, monthly)
Academic Affairs Advisory Council (VP for Education, monthly)
Meeting of Vice Presidents for Development (VP for Institutional Advancement, every two months)
State Relations Committee (Associate VP for External Affairs, weekly during the legislative session)
Human Resources Committee (Director of Human Resources, quarterly)
Council of University System Faculty (Faculty Senate President, quarterly)
Council of University System Staff (Staff Council President, quarterly)
University Relations Committee (Director of Public Relations, quarterly)
Meeting of Budget Directors (Comptroller and Budget Manager, quarterly)
System Research Administrators Group (Director of Research Administration and Comptroller, quarterly)
Information Technology Coordinating Council (CIO/Director of Information Technology, 2-3 times a year)

UMCES leadership fully participates with colleagues on key Councils and Committees of USM-wide coordinating bodies (Table 4.2). UMCES has equal representation with other USM institutions on those bodies.

Organizational structure

UMCES has clearly documented lines of organization and authority within the USM and within its own organization[108] [109](Figure 1.1). Periodically, UMCES reviews its organizational structure[45].

Leadership succession

Article V of the Bylaws of the BoR specifies that power is vested in the BoR under Maryland law which, in consultation with the Chancellor and after a thorough search, charges the BoR to appoint a qualified person as President of each constituent institution of the USM[100]. The BoR, in consultation with the Chancellor, is authorized to appoint a successor to the UMCES President, on a permanent or interim basis, under any circumstances.

The President has authority to appoint members of the UMCES Executive Council[45]. For appointments, UMCES must follow State and federal laws as well as USM and UMCES policies when conducting open external searches[110]. Regular transitions are expected and on-going. For example, a new Director of the UMCES Appalachian Laboratory was appointed in January 2015. And, the UMCES Vice President for Administration has announced her retirement, effective in the Fall of 2015. A search for the VP of Administration is underway.

After 13 years of service, Chancellor William Kirwan stepped down as the chief administrator of the USM, effective 30 June 2015. The newly appointed Chancellor, Robert Caret, was announced by the BoR in December 2014 and took office on 1 July 2015. Chancellor Caret, most recently President of the University of Massachusetts System, previously was President of Towson University (a USM institution) and knows UMCES and its leadership well. A new Maryland Governor, Larry Hogan, Jr., took office in 2015 and has made seven appointments or reappointments to the 17-member BoR. These transitions and cycles are usual. Both the USM and UMCES expect no disruptions from these transitions and anticipate continued success under the new leadership.

Standard 6: Integrity

The consolidated UMCES and USM policies, and UMCES practices, address a broad range of legal, ethical and research compliance matters[56]. The policies broadly cover all the Laboratories and Units, employees, and practices of UMCES. Specific policies protect student rights and include grievance policies. Academic freedom and protection of intellectual properties are addressed for all UMCES staff and students. Although there is no explicit, prescribed periodic assessment of integrity and its policies in UMCES, dialog is encouraged on questions of ethics and integrity, leading to revisions or creation of new policies and procedures as needed. The integrity of the institution is a frequent topic of discussion at UMCES Administrative and Executive Councils and at annual Faculty Convocations.

The leadership of UMCES strives to maintain a collegial environment that encourages professional behavior consistent with the expectations and responsibilities of academic freedom. In policy and practice, professional misconduct on the part of faculty, students, or staff that threatens the integrity of the institution is not tolerated. Frivolous allegations of professional misconduct also are not tolerated. The consolidated policies of USM and UMCES set forth rigorous procedures for investigating allegations and provide administrative measures to address them[111] [112]. The policies are also clear in establishing the rights of accused individuals[113] [114] [115].

UMCES strives to be an open and transparent institution. Information on policy, procedures, and organizational changes is made available in a timely fashion to UMCES staff and students and to its constituents. Websites, printed materials, strategic plans, annual reports, newsletters and stakeholder reports are widely distributed via the UMCES website[116] and often in printed copies. In the UMCES accreditation process with the MSCHE, the Chancellor and BoR of the USM have affirmed with the MSCHE that the University System, its Regents, and UMCES will share all relevant information on UMCES, its policies, and practices.

UMCES is vigilant in guarding its integrity. A graduate course in Responsible Conduct in Research is offered to MEES students every other year and is currently co-taught by two UMCES Laboratory Directors[117]. Policies and practices in UMCES and in the MEES Graduate Program[118] [40] are open and transparent. Information and data on graduate education (applications, enrollment, retention, graduation) are readily available for prospective students or others who may be interested[119]. In its Self-Study, UMCES reviewed the consolidated USM and UMCP policies related to integrity and ethics in graduate education[120] [111] to determine if additional policies are needed. None were identified, although a policy governing visiting students or researchers not affiliated with UMCES should be considered for general security purposes and to protect UMCES intellectual property.

Ethical standards to protect academic freedom and intellectual property

The UMCES Mission Statement supports the climate of inquiry and engagement[27]. The USM Policy on Classified and Proprietary Work[121] protects faculty and student academic freedoms. UMCES has sound ethical practices and respect for individuals through its teaching, scholarship/research, service, and administrative practice, including the avoidance of conflict of interest or the appearance of such conflicts in all of its activities. In this regard, USM and UMCES have policies on Rights and Responsibilities for Academic Integrity[120] [111]. UMCES also has clear policies and procedures for ethical behavior in research and scholarship involving animal and human subjects [122] [123]. The consolidated USM and UMCES policies and procedures support the equitable and consistent treatment of all faculty, staff and students[56].

The USM and UMCES are committed to principles protecting intellectual property rights[124]. Due to its small size and primary focus on basic research, UMCES does not have its own office of technology development, but has a formal MOU with UMBC to provide those services to UMCES faculty, students and staff[125] [126]. Intellectual property is protected from misuse, including plagiarism, by the UMCES policy on scholarly misconduct [111] [127].

Graduate student fair treatment

UMCES has specific policies related to the fair treatment graduate students[43].The UMCP Graduate Policy and Procedures for Review of Alleged Arbitrary and Capricious Grading[128] apply to UMCES graduate students who are enrolled in the UMCP-administered MEES Program[6]. Like many academic institutions nation-wide, the USM and UMCES are actively updating and developing sexual misconduct policies to comply with new federal laws and regulations[129].

Courses available on a regular schedule

UMCES currently does not issue its own course catalog but relies on the programs and catalogs available at UMCP and other institutions within the USM where UMCES students jointly matriculate. The UMCP Graduate School website is extensive and archives its electronic catalogs[130]. Courses and course schedules for offerings in the MEES Program by UMCES faculty members are included in the UMCP Graduate Catalog. Information on UMCES student enrollments, retention, and graduation, now submitted annually by UMCES to MSCHE in its Institutional Profile, is available on the UMCES website and labeled Education At-A-Glance[119]. This information and other statistical data on education in UMCES are now readily available[131] in addition to the broader data on the MEES Program and Graduate School on UMCP websites[6] [20].

UMCES is transparent

UMCES relies upon shared governance policies as well as the practice of open meetings[56]. The review process of the UMCES President and other members of the Executive Council serve as a good example[132]. Newsworthy information is regularly shared electronically with the UMCES community. The institutional website is comprehensive, making available UMCES Strategic Plans, Annual Reports, Policies, Mission Statements, and minutes of meetings[116]. Recruitment for any position within UMCES is posted on the website regardless of where else it may be advertised[133]. The Office of the VP-Administration notifies all UMCES personnel of approved policies and revisions, as well as important announcements, via email and the UMCES website.

MSCHE accreditation process

With authorizations from the USM BoR[31] and Maryland General Assembly[13], UMCES is seeking first-time accreditation from the MSCHE and this is its first Self-Study conducted for the Commission. UMCES compiled an Accreditation Readiness Report (ARR)[22], itself a small self-study, that was submitted to MSCHE in August 2013 for evaluation and which supported the decision by MSCHE to advance UMCES to Candidacy in November 2013. UMCES has affirmed that it intends to fully comply with all policies and requirements of the MSCHE.

Conclusions and recommendations

The existing leadership and structure of UMCES is adequate, appropriate, and effective in guiding the institution to carry out its mission. The longevity of administrative personnel is noteworthy, but does not imply complacency as a research institution or an inability to adapt to the changing higher education environment.

Rather, the existing leadership serves with the overall confidence of the faculty, staff, and students and has shown resilience in adapting to changing political and economic realities that influence higher education institutions in Maryland and throughout the country. Communication mechanisms are effective and flow freely within UMCES.

Institutional controls and procedures also appear rigorous, consistent, transparent, and in most cases appropriate for the size and mission of UMCES. Existing procedures within the USM and in UMCES adequately protect intellectual freedom and project an open and transparent organizational structure. Shared governance in UMCES is active and formally involves all constituencies within the institution. Some communities within UMCES have been reinvigorated by the accreditation process and are now more engaged in shared governance, for example the GFC and GSC.

Recommendations

1) Within the next year, the reinvigorated UMCES Staff Council should initiate holding regularly scheduled meetings as well as coordinate and schedule all-staff meetings on at least an annual basis. (Addressing Standard 4).

The UMCES Staff Council had been inactive for many years. Active once again, the Council needs to develop a plan for action and participation in UMCES shared governance. The elected Chair of the Staff Council, with representatives from each of the UMCES Laboratories, should develop and formalize its plans to participate in and contribute to UMCES and USM-wide staff governance actions.

2) Within the next year, UMCES should better define the Vice President for Education position, its responsibilities and scope for development and management of education programs within UMCES. (Addressing Standard 5).

UMCES appointed its first Vice President for Education in 2012 in anticipation of the authorization to become degree-granting and the opportunity to seek accreditation from MSCHE. Currently, the VP-Education holds a 50% administrative appointment and a 50% faculty line. UMCES should engage its Executive Council, FS and GFC in a broad discussion to define the scope of activities and responsibilities of the VP-Education position and Office.

Chapter 5 *Recruiting, retaining, and training outstanding students*

Addresses Standards 8 and 9

Standard 8: Student Admissions and Retention. *The institution seeks to admit students whose interests, goals, and abilities are congruent with its mission and seeks to retain them through the pursuit of the students' educational goals.*

Standard 9: Student Support Services. *The institution provides student support services reasonably necessary to enable each student to achieve the institution's goals for students.*

Here, the admissions, retention and student support services available to UMCES graduate students are described and assessed. As noted in earlier chapters, the UMCES Mission[27] and Strategic Plan[9] are explicit in committing UMCES to achievement of its education aspirations and goals. Historically, much of the education mission has been accomplished by partnering with degree-granting institutions of the USM, particularly in the MEES Program administered through UMCP (see Chapter 1). As a degree-granting institution seeking accreditation, policies and procedures for conduct of graduate education in UMCES will become increasingly formalized and managed internally. But, the application and enrollment procedures of graduate students in MEES and other graduate programs in which UMCES students enroll will continue to be administered by our partner institutions in the USM. Nonetheless, it is clear that the USM and its constituent institutions all have student success as a central goal and a focus for accountability across the system.

Standard 8: Student Admissions and Retention

Admissions

UMCES faculty members currently advise students in four USM graduate programs: MEES; Graduate Program in Life Sciences (GPILS) at UMB); Biological Sciences Graduate Program (BISI) at UMCP; and programs in Applied Ecology & Conservation Biology and in Wildlife & Fisheries Biology at FSU. Applicants are considered at both the MS and PhD levels for MEES, GPILS and BISI. Only MS students are enrolled at FSU. The admissions procedures for these graduate programs differ. Admissions requirements are described on the websites of each of the programs: MEES[134], GPILS[135], BISI[136], and FSU[137]. In recent years, most (>90%) of UMCES graduate students are admitted and enrolled in the inter-institutional MEES Program, in which UMCES has the leading role for course delivery and student mentoring.

Within MEES, applicants are considered for admission and advising at all of the participating institutions (Figure 1.3) by faculty members associated with an appropriate Area of Specialization (AOS)[21], based on the applicant's interests and requested affiliation. The current six AOS are: Ecology, Environmental Chemistry, Environmental Molecular Biology and Biotechnology, Environmental Science, Fisheries Science, and Oceanography. Applications to MEES are received through the UMB, UMBC, UMCP and UMES graduate school application processes. The admission process is centralized such that all applicants are reviewed by the same inter-institutional AOS committees. The graduate schools of all participating institutions abide by decisions administered through the central MEES Office at UMCP. The centralized admission process promotes equity among admissions decisions across institutions.

Once an application is complete, the admissions committee of participating faculty members from each AOS evaluates applications of prospective students based on the following criteria:

1. The applicant's statement of research interests;
2. The academic preparation of the applicant relative to their stated interests and AOS requirements;
3. The applicant's undergraduate GPA, which must be at least 3.0, although some students with a GPA below 3.0 may be provisionally accepted based on relevant research or work experience;
4. Graduate Records Exam (GRE) scores;
5. For international applicants, Test of English as Foreign Language (TOEFL) scores;
6. Letters of recommendation; and, importantly,
7. Agreement by an appropriate faculty member to advise the student. UMCES faculty members currently chair five of the six AOS in MEES and thus have a major responsibility for decisions and recommendations on admittance.

Each of the six AOS has specific course prerequisites[138] in addition to the common prerequisites for admission into MEES. The prerequisites are rigorous and include two semesters of physics, two semesters of biology, two semesters of calculus, and two to four semesters of chemistry (depending on the AOS). Students missing one or two of the prerequisite courses, if provisionally admitted, are expected to successfully complete them during their first year after matriculation in MEES. If a student is found to meet all acceptance criteria, and has a faculty advisor

secured, an acceptance for admission letter is issued by the UMCP Graduate School[139]. The Director of MEES is responsible for final admissions decisions as well as subsequent recommendations to the UMCP Graduate School regarding student advancement, changes in status, or termination[140].

Admission statistics

Application statistics specific to UMCES are not available because students apply to the multi-institutional MEES program and not specifically to a participating institution. Accordingly, only aggregate MEES statistics are available for the application process. Once accepted, a student becomes associated with an institution through her/his advisor, and UMCES statistics are then available for accepted students. It should be noted that many, perhaps most, prospective students communicate with UMCES faculty members who they believe could serve as advisors and to ascertain possible interest before initiating the MEES application process.

For the MEES program as a whole, the number of applications has declined from about 215 per year in the 2002 to 2006 period to 165 per year in 2009 to 2013 (Table 5.1). Approximately 30% of students who apply to MEES are accepted and 70% of students who are accepted subsequently enroll. Faculty advisors in UMCES usually will accept a new graduate student only if assistantship or fellowship support is available. Student applicants not accepted into the MEES Program fall into three categories. In the period 2002 to 2013, 37% were rejected based on evaluation by the AOS faculty panel; 25% were rejected because the student did not find an advisor, and the remainder (38%) withdrew their applications. The initial rejection rate has declined in recent years from about 50% in 2002 to 20% in 2013. In that period, mean undergraduate GPA of applicants averaged 3.3, while the mean for accepted students was 3.4. The average verbal and quantitative GRE scores of MEES applicants and accepted students are similar - in the low 60th percentiles. Of the accepted students, 62% enrolled into MEES. Further breakdowns by cohort are provided in Table 5.1.

In UMCES, 120 MS and 107 PhD students have enrolled since 2002 in the MEES Program (Table 5.1). In those years, the number of incoming MEES students in UMCES was, on average, 45% of all enrolling MEES students, making UMCES the dominant institution at which MEES students reside. On average, there have been 15 domestic graduate student enrollments and 2.5 international graduate student enrollments (14.5%) annually. There is no significant trend in enrollment from 2002 to 2013 for either domestic or international MEES students at UMCES. Undergraduate GPA scores for UMCES students are similar to GPAs of students accepted to the MEES Program as a whole, but GRE scores are slightly higher in UMCES (64.4 MEES as a whole vs. 68.4 UMCES for verbal, and 63.8 MEES as a whole versus 64.1 UMCES for quantitative). Among the enrolled students with UMCES advisors, 63% were female and 37% male. Sample sizes are relatively small but there is no observable trend in the female:male ratio of UMCES graduate students in MEES in the 2002 to 2013 period. Also, the percentage of UMCES MEES students enrolling in the PhD program (47%) has not trended over the 2002 to 2013 period. A small number of UMCES students enter the MEES Program as MS students, but switch to a PhD program without completing a MS degree. In UMCES, student numbers have been fairly evenly distributed across the disciplinary AOS, with highest numbers in the Oceanography, Fisheries, and Environmental Science AOS (Figure 5.1). In 2014, the numbers of UMCES students in each AOS were: CHEM (6); ECOL (9); ENMB (13); ENVSCI (16); FISH (19); OCEAN (26).

In 2014, the number of graduate students advised by UMCES faculty members was 85. An aspirational goal is to increase that number to 100. The increases will be primarily students in the MEES Program. The goal is to increase enrollments by 3-4 students annually.

Recruiting and supporting students

Recruitment packages offered to prospective students are similar among the UMCES Laboratories. Most students are offered support that is derived from external grant and contract funding and includes a stipend plus tuition support (for up to 10 credits per semester)[141] and State of Maryland health insurance coverage[43]. Graduate student stipends are adjusted when State of Maryland employee salaries increase with cost-of-living adjustments. Student

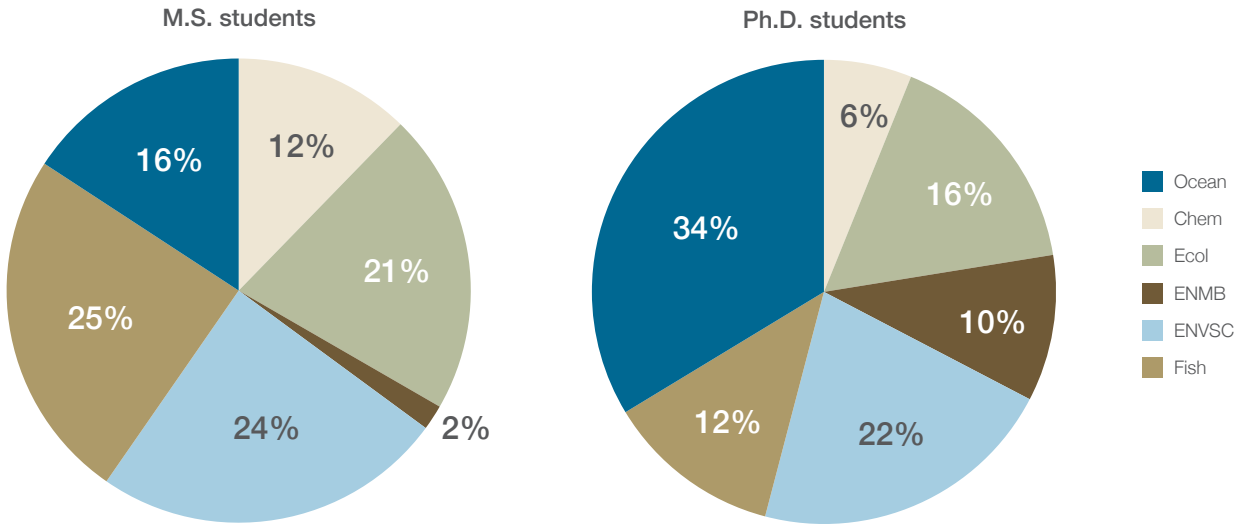


Figure 5.1. Percentage of UMCES students enrolled in the MEES program by degree sought and Area of Specialization (AOS) from 2002 to 2014. OCEAN=Oceanography; CHEM=Environmental Chemistry; ECOL=Ecology; ENMB=Environmental Molecular Biology and Biotechnology; ENVSC=Environmental Science; FISH=Fisheries Science.

Table 5.1. Number of applications received, applicants accepted, and student enrollments by the MEES Program, and breakdown of MEES students enrolled and supervised by UMCES faculty members, provided by degree sought, gender, and international status from 2002-2014. Records on applications, acceptance, enrollment, and other information are maintained by the MEES Office at UMCP and were provided to the UMCES Office of the VP-Education.

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
MEES												
# Applications	236	237	217	199	187	188	148	138	178	140	179	164
# Accepted (% of applications)	76 (32%)	70 (30%)	69 (32%)	64 (32%)	67 (36%)	69 (37%)	54 (36%)	47 (34%)	56 (31%)	52 (37%)	55 (31%)	61 (37%)
# Enrolled (% of admitted)	59 (78%)	48 (69%)	44 (64%)	41 (64%)	42 (63%)	44 (64%)	42 (78%)	37 (79%)	42 (75%)	38 (73%)	36 (65%)	36 (59%)
GPA apply	3.3	3.29	3.23	3.3	3.3	3.32	3.33	3.31	3.36	3.33	3.33	3.35
VGRE apply (%)	61.5	62.9	60.4	60.3	55.5	60.1	57.5	56.5	61.9	63	63	61.7
QGRE apply (%)	66.9	67.7	64.9	60.3	61.7	62.4	61	60.5	61.7	61.4	64.2	62.1
GPA accept	3.46	3.41	3.26	3.39	3.43	3.42	3.4	3.4	3.42	3.46	3.43	3.4
VGRE accept (%)	68.9	61.4	65.5	70.8	64.1	68	59.4	57	64.8	62.2	66.6	65.1
QGRE accept (%)	69.3	61.9	68.8	63.4	67.2	63.3	55.7	62	61.3	60.5	68.1	59.6
UMCES												
Total	23	19	22	14	18	17	17	11	26	15	15	15
Ph.D	13	4	11	6	9	7	9	3	15	8	6	9
M.S.	10	15	11	8	9	10	8	8	11	7	9	6
Male	10	8	11	5	9	0	6	6	8	4	5	7
Female	13	11	11	9	9	17	11	5	18	11	10	8
International	4	3	1	1	5	1	2	0	5	4	2	2
GPA enroll	3.5	3.4	3.3	3.46	3.49	3.53	3.55	3.28	3.46	3.47	3.3	3.3
VGRE enroll (%)	66.8	72.5	71.9	67.7	57.6	69	67.2	67.5	69	62.8	80.2	69.2
QGRE enroll (%)	75.4	57.6	64.8	55.1	69.6	60.4	59.4	71.7	59.6	61.6	70.1	56.1

stipends in UMCES currently are in the range $22,000 to $26,000 per year, the range reflecting step increases for advanced graduate students and a higher stipend for students at the downtown Baltimore, IMET Laboratory[142].

UMCES annually awards up to three Presidential Fellowships to support incoming PhD students[143]. The Presidential Fellowships are merit-based and designed to support recruitment of outstanding students into the UMCES graduate programs. They provide two or three years of stipend, health benefits, and tuition. Several additional recruitment packages are offered. CBL offers two, two-year fellowships each year to support PhD or MS students[144]. Similarly, HPL offers from one to four fellowships each year, providing one-year fellowships to MS students and two-year fellowships to PhD students[145]. At present, the two smaller Laboratories, AL and IMET, do not offer such recruitment packages, but IMET is presently halfway toward establishing endowment funding for a graduate fellowship. In IMET, the NOAA-supported Living Marine Resources Cooperative Science Center (LMRCSC)[146] supports 3-4 graduate students for two years of study. The LMRCSC recruitment package is directed to minorities and underrepresented groups in marine science.

Retention and student success

Graduate students advised by UMCES faculty members have enjoyed high rates of retention, graduation, and job placement, going on to employment in a wide variety of professional and technical positions in federal, state, academic, NGOs, and private industry (see Chapter 7, Figure 7.3) that address environmental issues[147]. Since 2002, the retention rate of UMCES students (defined as the number of students enrolled who continue to be enrolled in their second year) has ranged from 89 to 100% for each annual cohort and is without trend. On average, more than 96% of enrolled students continued their graduate study after the first year. The average time to degree was 5.0 years for a PhD and 3.3 years for a MS student for the 2002-2007 enrollment years[119]. The national median time for PhD completion in the Life Sciences, as reported by the U.S. National Science Foundation, is 6.9 years[148]. During these same enrollment years, 88% of MS students completed their degrees and 80% of PhD students completed their degrees. Compared to a recent study by the Council of Graduate Schools, the UMCES PhD completion rates are above the medians for life sciences and the mathematics and physical science fields, which are 62.9% and 54.7%, respectively[149].

Retention

Retention of graduate students is high in UMCES because 1) students are highly motivated to achieve academic and career goals; 2) financial support is usually provided (see above Recruitment Packages); and 3) students receive a high degree of individual attention from their advisor, graduate advisory committee, and individual instructors. Admitted students often are selected by their UMCES advisor not only because they are well qualified academically but because they typically pursued research experiences as undergraduates. Accordingly, students being advised by UMCES faculty members are already experienced and highly motivated for graduate study and completion of their degree. An additional factor in retention is the requirement that students, during their first year, prepare a program of study for approval by the student's graduate advisory committee and the MEES Program Office[150]. During annual or more frequent committee meetings, students report progress and receive guidance from the committee. Because the thesis or dissertation is such an important part of graduate education in UMCES (see Chapter 7), students meet regularly with their major advisor and with individual committee members to plan and discuss their research.

Standard 9: Student Support Services

Comprehensive policies and procedures are in place to provide student support services to UMCES students. The UMCES Graduate and Faculty Handbook[151], the UMCP Graduate School Ombudsman Office[152], and the UMCES Policy on Evaluation of Performance of Faculty[153] describe student services that address many of the Fundamental Elements that MSCHE identifies as indicating compliance with Standard 9, such as qualified professionals to provide student support, procedures to address the spectrum of student needs, student advisement procedures and processes, and procedures for addressing student grievances. The UMCES Policy also provides guidelines for assessing success of faculty members in supporting their students.

The primary student support services available to UMCES students are described in the UMCES Graduate and Faculty Handbook[151]. The Handbook contains detailed information on graduate student milestones including admissions and prerequisites, annual committee reviews, course requirements, comprehensive examinations, and the dissertation proposal and defense. A list of important procedures for students is also included in the Handbook. Information is provided on program structure and annual graduate student events (e.g., MEES Graduate Student Organization and the MEES Colloquium). The Handbook also includes a summary of student services provided at each UMCES Laboratory. Additionally, each Laboratory Unit in UMCES has a Graduate Education Committee (GEC) that provides oversight and guidance to education activities at the individual Laboratories. The annual UMCES Faculty Convocation[154] frequently is a forum that addresses topics of student support, as well as student quality, enrollments, graduation success and outcomes of graduate education[155].

Orientation of new students

Upon arrival, graduate students in UMCES are provided orientation opportunities. At the individual Laboratory level, the Laboratory Director meets with graduate students and introduces them to UMCES and Laboratory policies and practices. Students also meet with the Laboratory safety officer for a mandatory safety introduction. Students are provided the links to the Graduate Student Handbook which, in addition to degree requirements, directs students to sources of additional information on academic and practical needs, informs them of opportunities such as travel grants, and provides links to policies such as sexual misconduct and research ethics, and animal care and use. Additionally, the MEES Program Office hosts an orientation session for all new students that is held at UMCP. For international students, the International Student and Scholar Services Office of UMCP[156] provides additional orientation sessions. Welcome receptions and social activities are arranged for new students, both by the MEES Program Office and at the individual UMCES Laboratories.

Academic advising

Academic advising and mentoring are important student support services provided by UMCES faculty members. As a research institution, these services are critical to supporting students, as well as assessing and evaluating their progress. Typically, UMCES tenure-track faculty members advise only a small number of graduate students, generally one to three, and thus are able to provide intensive individual attention to each student. The roles of faculty advisors and graduate advisory committees in UMCES are explained and discussed in Chapters 6 and 7.

Professional development

In support of professional development (see also Chapter 7), each UMCES Laboratory hosts a weekly seminar series[157] [158] [159] [160]. The wide diversity of expert speakers in these seminar programs provides students with broad scientific training and networking opportunities. All MEES graduate students attend the annual MEES Colloquium[161], a two-day event at which students present their research findings, engage in informal discussions, network, and listen to presentations by MEES alumni who have successful careers in the environmental sciences.

The UMCES GSC represents graduate students in UMCES[162] and actively participates in shared governance (see Chapter 4). The GSC includes representatives from each UMCES Laboratory and participates fully in activities of the UMCES FS and GFC. To support student interests, an UMCES graduate student serves on the Student Advisory Council (SAC) to the MHEC)[163], the body responsible for setting policies and allocating state-based funding to Maryland public institutions of higher education. A graduate student representative attends monthly faculty meetings at each of the Laboratories.

Each UMCES Laboratory provides material support for graduate students through independent GECs[151]. The GECs make decisions on allocation of funds, as well as setting policies and reviewing applications for student support, for example student travel, student publishing, conference attendance, and bridging gaps in funding from other traditional sources. For Laboratories that have graduate student assistantships (mostly research assistantships) or fellowships, the GEC has a role in recommending allocations of those opportunities. UMCES provides support to graduate teaching assistants (TAs) for highly-subscribed courses at HPL and AL. The modest support for TAs in FY 2015 consisted of 3.5 TAs. Funding support for graduate students is obtained from many sources, including tuition remission return (through agreements with institutions in the USM)[15], government agencies, foundations, and private donations. UMCES has employed two development staff (located at HPL and IMET) and has recently employed two additional staff (at CBL and AL) whose tasks include acquisition of funds for student support.

UMCES students work side by side with faculty. In 1981, the first of many UMCES MS and PhD graduates received degrees from the inter-institutional Marine-Estuarine-Environmental Sciences Graduate Program.

Individual faculty advisors and each of the UMCES Laboratories provide funds to enable graduate students to attend national and international conferences. Attendance at conferences provides valuable opportunities for UMCES students to present research, develop individual networks, and explore career options.

UMCES is increasingly providing opportunities for graduate students to receive training in entrepreneurship and leadership. The Ratcliffe Environmental Entrepreneurs Fellowship (REEF) Program at IMET[164] trains six to eight IMET students each year in entrepreneurship and business skills, in addition to their regular graduate education (also see Chapters 3 and 7). Additionally, IMET hosts an Entrepreneurs' Office Hours[165] providing opportunity for graduate students to meet with investors, funding agencies, and successful entrepreneurs. The IMET Business Incubator Program[166] provides a business incubator for young companies working to promote development of products and services that have a positive impact on the environment and human health, including companies founded by UMCES graduates.

The MEES Program is cognizant of the need to provide instruction promoting professional development. A required course in environmental management or policy must be taken by its graduate students. Other examples of the curriculum promoting and supporting professional development in MEES include courses in scientific writing and communication. Additionally, the UMCES IAN[71] offers training to UMCES graduate students in scientific communication and applications of science to stakeholder communities.

Supporting at-risk/special needs students

As an institution offering only graduate education, UMCES has few at-risk students relative to typical undergraduate institutions. However, a range of services is provided for at-risk and special needs students through programs available to MEES students at the UMCP Counseling Center[167]. These include disability support services (DSS)[168], counseling[169], learning assistance[170], and testing assistance[171].

UMCES participates in a NOAA-EPP supported Cooperative Science Centers at Minority Serving Institutions to advance training and collaborative research for underrepresented, minority students. In this regard, UMCES has participated in the LMRCSC since its founding in 2001[146]. The roles of UMCES in the LMRCSC are to provide 1) training for MS and PhD students; 2) training for undergraduate interns; 3) co-mentoring of graduate students from LMRCSC partner institutions; and 4) capacity building in molecular

biotechnology to LMRCSC partner institutions. The UMCES-IMET LMRCSC program[172] [173] provides financial support for underrepresented, minority graduate students.

Library

Each USM institution must provide suitable library facilities to support its academic programs[174]. UMCES has two comprehensive libraries, two small libraries, and a circulation-only site (see also Chapters 3 and 7). Additionally, as part of USMAI[79], UMCES Faculty/Students/Staff have easy access to over 6 million titles and nearly 10 million items through shared catalog, ILL, and hold/recall processes. In UMCES, the largest libraries are at CBL[77], and HPL[175], the Laboratories where most UMCES graduate students reside. Included in UMCES holdings are 466 student theses and dissertations in addition to extensive journal and book holdings in the environmental sciences. To support students and faculty, the CBL Library has a full time librarian and four to six docent volunteers; HPL has a half-time librarian.

Safety

Unlike larger institutions in the USM, UMCES lacks a police force and on-site emergency response systems to serve and support students, faculty and staff. Instead, individual UMCES Laboratories rely on local police, fire department, and medical technicians for emergency response. The AL facility, being in close proximity to FSU, utilizes the FSU campus police. Protocols for emergencies are in place and available to all students. All protocols are posted on the UMCES website[176]. Incoming students must subscribe to the "e2campus" emergency alert system[177] that is operated by Laboratory facilities managers and instantly informs UMCES personnel of any imminent and ongoing emergencies or threats via direct e-mail and text messages.

Student safety in UMCES research laboratories is coordinated by an Environmental Safety Compliance Officer (ESCO)[178]. Radiation safety falls under the purview of ESCO, with compliance at the individual Laboratories monitored by the UMCES faculty. IMET and HPL both have biohazard laboratories, whose safety compliance is managed by UMB[179] and by UMCP[180], respectively. All incoming students receive mandatory Hazard Communication & Right-to-Know training, conducted by the ESCO (for CBL and HPL), by UMB (for IMET) or conducted in-house (AL).

Student safety in the field (terrestrial and aquatic circumstances) is the immediate responsibility of faculty advisors, who must provide relevant safety information, equipment, and training. Safety on the UMCES Research Vessel *Rachel Carson*[105] and other research vessels falls under jurisdiction of the US Coast Guard and is coordinated by the UMCES vessel captain and Research Fleet Office[70]. For operation of small vessels, graduate students are required to complete training, including State of Maryland Boating Safety Certification[181]. To operate state vehicles, graduate students must have a valid driver's license and complete basic driver competency and safety training[182] [183].

Some UMCES graduate students use SCUBA in their research. To promote safety, these students must have PADI or NAUI certification and must hold membership in the Divers Alert Network[184]. Safety training is coordinated by an approved UMCES faculty member who is a diver and authorized by the UMCES Dive Safety Officer[185] under auspices of the American Academy of Underwater Sciences[186].

Table 5.2. Grievance information policies and procedures available for UMCES graduate students.

General information on grievance procedures

USM Graduate School Office of the Ombudsperson[152]
USM Graduate Catalog[187]

Specific guidelines

Academic Affairs
UMCES Policy on Misconduct in Scholarly Work (III-1.10)[111]
UMCP Policy for Review of Alleged Arbitrary and Capricious Grading (III-1.20)[188]

Sexual Misconduct
UMCES Graduate and Faculty Handbook[151]
University of Maryland System VI-1.60 Policy on Sexual Misconduct[189]
VI-1.60-UMCES Policy on Sexual Misconduct[129]

Non-discrimination
USM Policy on Affirmative Action and Equal Opportunity (VI-1.00)[190]
USM Policy of Non-Discrimination on the Basis of Sexual Orientation (VI-1.05)[191]
UMCP Policy on Equity, Diversity, and Inclusion[192]
UMCES Affirmative Action Plan for Minorities and Women[193]
UMCES Affirmative Action Plan for Veterans and Individuals with Disabilities[194]

Laboratory Safety
Original UMCES Policies[195]
UMCES Safety Information[176]

Grievance procedures

Ensuring that students at UMCES have access to processes and policies that address grievances is important in the academic and work environments of the USM and UMCES. Because UMCES participates in a UMCP academic program (MEES), there is no single process or policy within UMCES for resolving grievances, although multiple avenues exist to seek relief. The UMCP Graduate School, the MEES Program, and UMCES have comprehensive policies and procedures in place to file and address grievances (Table 5.2), as well as qualified professionals to implement measures whenever a grievance may arise. Students are informed of their rights and responsibilities at all levels.

Policies pertaining to grievances related to academic affairs, sexual misconduct, non-discrimination, and laboratory safety are referenced in Table 5.2. Appointment letters for graduate research assistantships in UMCES must provide contact information for graduate assistants should they need to obtain advice concerning grievance rights and procedures[43]. Both formal and informal avenues of resolution are available under the policy related to Due Process Protections[43].

Conclusions and recommendations

UMCES meets expectations of compliance with the Fundamental Elements that MSCHE lists for its Standards 8 and 9. UMCES has developed a compendium of student support services at both

the UMCES level and at each of its Laboratories that complement those provided by USM and UMCP. The GSC is meaningfully engaged in deliberations with the UMCES Administration, FS, and GFC to assure that support of graduate students is a high priority in UMCES. The evolving Office of the UMCES VP-Education is becoming an important source of support for students and faculty, including fellowship programs and information management. UMCES provides extensive support for student advising, safety, and professional development activities.

Evidence that UMCES complies with expectations in MSCHE Standard 8:

- The UMCES faculty presently advises 85 graduate students. UMCES, through internal agreement among administrators and faculty, has set an aspirational admissions goal to increase the number of graduate students to 100. The increased numbers will primarily be in the MEES Program.
- The admission process to the MEES program is coordinated among participating USM institutions. UMCES faculty members, through participation in the MEES AOS, have played a leading role in evaluating student applications and making recommendations on acceptance.
- Retention and graduation rates of UMCES MS and PhD students are high. A percentage of UMCES graduate students higher than the U.S. average complete their degrees; 88% of MS students and 80% of PhD students in the most recent decade.
- The UMCES website and its links to the MEES and GPILS graduate program websites, serve as resources for describing and marketing the educational opportunities provided by UMCES. Information and statistics are provided on academic programs, admissions requirements, application procedures, and fellowship opportunities.
- UMCES has recently initiated an institution-wide Presidential Fellowship program, which is administered by the UMCES Office of the VP- Education to recruit outstanding PhD students in environmental sciences.

Evidence that UMCES meets the MSCHE Standard 9:

- A range of student support services is provided to UMCES graduate students. Support is available from UMCES and its Laboratories and also from UMCP and MEES.
- Student support services at each Laboratory unit are conducted by a GEC.
- With partner institutions, UMCES has a long-standing involvement in the LMRCSC[146] whose goal is to train minority students underrepresented in NOAA-relevant marine sciences.
- Procedures and student support services for UMCES graduate students are documented and available to all students in the UMCES Graduate and Faculty Handbook.
- Compliant with USM policy, UMCES has procedures to address student complaints and grievances. Records of student complaints and grievances are maintained by the MEES office and UMCP Graduate School and will be maintained by the recently instituted UMCES Office of the VP-Education in cooperation with UMCES Laboratory Directors.
- UMCES provides a wide range of protocols, information, access to emergency services, and training, to assure the personal safety of its graduate students.

Recommendations

1) Over the next three years, UMCES should improve its system for maintaining student and alumnae records and rely less on the MEES Program and UMCP Graduate School.

Currently, there is no single, centralized database in UMCES for its graduate students covering all programs in which UMCES students participate. A Data Flow and Management Committee of the UMCES GFC is addressing this need, under direction of the Office of the VP-Education. UMCES will develop a plan to collect and maintain data.

2) In FY 2016-17, UMCES should review and, if necessary, develop plans for improvement and/or clarification of student support services.

There is a wide spectrum of student support services within the USM available to UMCES graduate students. Within UMCES, student support services are often handled in an ad hoc manner and the services available may vary among the Laboratory Units. The GFC and the GSC, working with the UMCES Administration, should determine if current support services meet the needs of UMCES students and, if not, develop a plan to provide the necessary services.

Chapter 6 *A faculty committed to excellence in teaching and mentoring*

Addresses Standard 10

Standard 10: Faculty. *The institution's instructional, research, and service programs are devised, developed, monitored, and supported by qualified professionals.*

Standard 10: Faculty

As a research institution within the USM, the success of UMCES in achieving its mission is clearly dependent on a faculty comprised of PhD-level scientists with expertise in the diverse disciplines of environmental science. In addition to conducting cutting-edge research, the faculty is committed to teaching graduate-level courses and takes pride in its responsibility for mentoring graduate students seeking MS and PhD degrees. The UMCES faculty is appropriately trained, highly qualified, and productive[196] [197]. Faculty members are engaged meaningfully in the education enterprise, which is being strengthened as a consequence of seeking accreditation through MSCHE and by recent activity directed at restructuring and improving the curriculum of the MEES Graduate Program (see Chapter 7). The UMCES faculty, though small compared to other institutions within the USM, is recognized for its noteworthy achievements, as reflected, for example, in the number of Regents Faculty Awards[198] [199] that far exceed expectations based on the size of its faculty.

Faculty numbers, ranks, and trends

The UMCES faculty consists of individuals in tenure-track and research lines[200]. There also is a research scientist line that is primarily occupied by individuals holding recently awarded PhDs (i.e., post-docs) who are not in the faculty ranks. The total number of tenured and tenure-track (TT-T) faculty members in 2014, including administrators holding faculty rank, was 48 without including 2 Agents (specialists in aquaculture and science extension) and 2 Librarians (Table 6.1). The research faculty (NT) and research scientists (non-faculty rank) numbered 22 and 13, respectively, in 2014. The full Professor rank, which includes seven high-level UMCES administrators, dominates TT-T faculty, but not NT faculty (Figure 6.1). Young, talented faculty members have been recruited at a fast pace during the past 15 years, particularly women, who comprised 38% (15/39) of new hires since 2001. It is anticipated that seven new faculty members will join UMCES in FY 2016.

Faculty growth is attributable to the addition of 15 NT faculty members since 2002 (Figure 6.1). For comparison, in 1994, there were only six NT faculty members in UMCES. Tenure-track and tenured appointments have varied relatively little from 2002 to 2014 and the number of T-TT faculty has remained nearly constant. A shift in types of appointments began about15 years ago when research faculty appointments trended upward in response to the need to aggressively address the many emerging issues in environmental science and to fulfill the evolving UMCES mission. Total faculty numbered 59 to 66 from 2002-2008, when 14 T-TT and 9 NT rank faculty members were recruited. In the 2009-2015 period, while total faculty size rose only from 72 to 74, 10 T-TT and 8 NT faculty members were hired. A substantial turnover, partly through retirements, occurred in that six-year period. Since 2002, average faculty attrition is 3% per year, requiring approximately two new faculty hires per year to maintain numbers.

An impressive breadth of disciplinary expertise is represented in UMCES faculty appointments, as is evident in the distribution of disciplines among the four Laboratories. Although faculty members conduct research across environmental science disciplines and collaborations are frequent, individual Laboratories have unique areas of expertise within UMCES. CBL (25 faculty) has a long legacy in fisheries and estuarine ecology, but since 1990 has developed programs in marine chemistry, ecotoxicology, and arctic science[201]. HPL (25 faculty) is home to highly regarded

Table 6.1. UMCES faculty numbers for Professor, Agent, and Librarian ranks in 2014. Research Scientists (13 PhD post-doctoral appointees) are not included in these faculty data.

	FEMALE	MALE	TOTAL
Assistant Professor	3	8	11
Associate Professor	4	8	12
Full Professor	3	22*	25
Research Assistant Professor	3	2	5
Research Associate Professor	4	5	9
Full Research Professor	3	5	8
Agent	1	1	2
Librarian	2	0	2
TOTAL	**23**	**51**	**74**

** Full Professor Male category includes 7 administrators (4 Directors, 2 Vice Presidents, and President Boesch).*

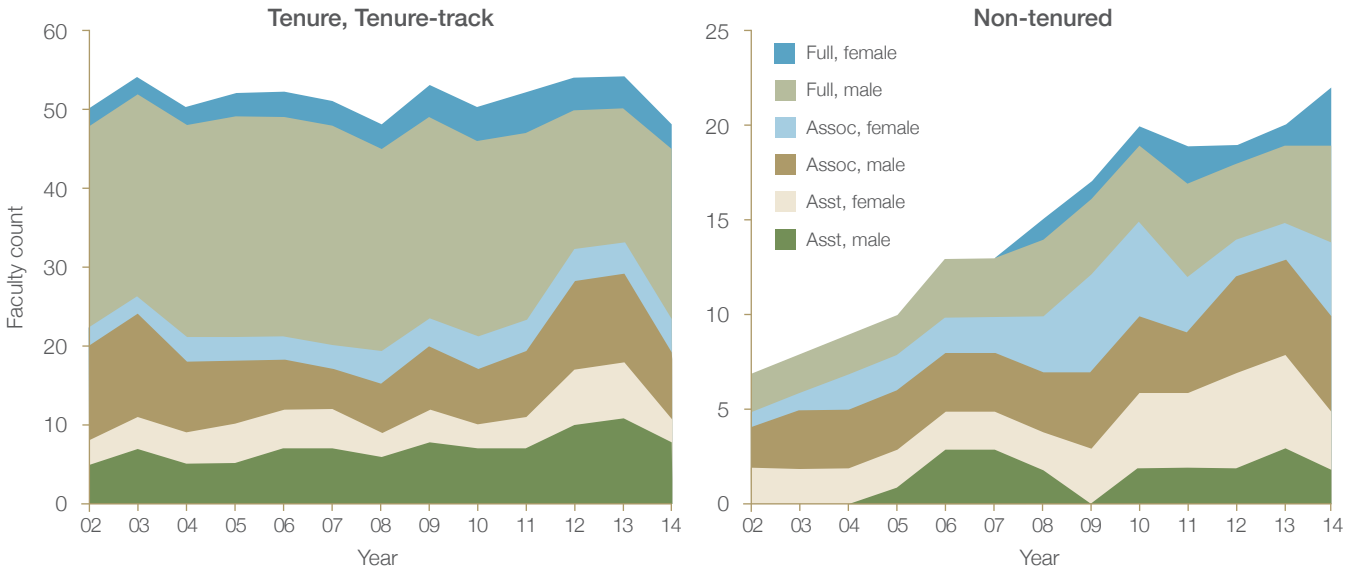


Figure 6.1. Trends in UMCES faculty professorial rank for Tenure-Tenure Track (T-TT) and Non-Tenure Track (NT) appointments, 2002-2014.

oceanography and estuarine ecology research programs[202]. The AL[203] (12 faculty) conducts research on watershed hydrology and biogeochemistry, and landscape and conservation ecology. IMET[49] (8 faculty) brings molecular biology and marine biotechnology disciplinary strengths to issues of ecosystem restoration, aquaculture, and human health. Two UMCES administrators are tenured Full Professors; President Donald Boesch and Vice President for Science Applications William Dennison. At this time, a single UMCES faculty member holds an inter-institutional appointment within the USM (67% UMCES and 33% UMB). More such appointments are planned.

The UMCES faculty plays a key leadership role in coursework and graduate student mentorship in all AOS in the MEES Graduate Program[204]. Faculty members self-nominate themselves to an AOS for approval by the MEES Program Committee[55]. The numbers of UMCES faculty members in each MEES AOS are summarized in Table 6.2. In accord with the interdisciplinary nature of UMCES science and programs, 55% of faculty members assign themselves to multiple AOS. The Oceanography, Ecology, Fisheries Science, and Environmental Chemistry AOS are most strongly rooted within UMCES in terms of the relative proportion of AOS membership. For comparison purposes, percentages of UMCES student enrollments by AOS (Figure 5.1) indicate that highest enrollments in the 2002-2013 period were in the Oceanography, Environmental Science, and Fisheries AOS.

UMCES does not have an adjunct faculty specifically employed or contracted as instructors to teach courses. Typically, adjunct and visiting faculty appointments in UMCES are made[200] to broaden research collaborations between UMCES faculty members and outside experts, and also to encourage those experts to serve as advisors and mentors to UMCES graduate students.

Table 6.2. UMCES faculty membership across MEES Areas of Specialization (AOS). Some faculty members participate in more than one AOS. 1 AOS (36), 2 AOS (28), or 3 AOS (4); some faculty members have not yet assigned themselves to an AOS (4). "Total MEES" refers to total number of faculty in the inter-institutional MEES Program. Faculty outside of UMCES also occasionally assign themselves to multiple AOS.

MEES area of specialization	UMCES FACULTY	UMCES / TOTAL MEES FACULTY (%)
Ecology	27	50%
Oceanography	26	81%
Environmental Science	14	28%
Environmental Chemistry	15	48%
Environmental Molecular Biology and Biotechnology	12	30%
Fisheries Science	10	50%

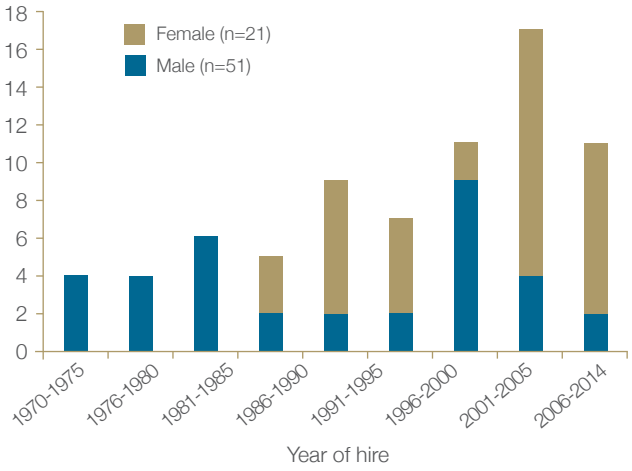


Figure 6.2. UMCES faculty members in 2014 by year of hire and gender.

Gender of faculty

The representation of women on the UMCES faculty has increased over the past three decades (Figure 6.2), although the percentage of women faculty members (31%) remains relatively low. Representation of women increased substantially (presently 23 faculty) since 1990 when only four women held faculty appointments. UMCES is keenly aware of the need and actively seeks to improve the representation of women and minorities, and to provide equal opportunities for under-represented ranks[190]. As documented in Chapter 5, the percentage of women graduate students in UMCES now greatly exceeds the percentage of men. The difference in representation of women on the faculty and in student ranks is noteworthy. As retirements of long-employed male faculty members in UMCES occurs, it is probable that the faculty female:male ratio will shift-up as new hires fill the ranks.

Faculty responsibilities

UMCES expects that its tenured and tenure-track faculty members will teach and mentor graduate students[205]. Workload is evaluated on an institutional basis according to the following expected ranges: instruction, 5-15%; research/scholarship: 75-85%; and service, 15-25%. Instructional workload is measured as equivalent course units (ecu) where 1 ecu is equivalent to one three-credit course, 13 MS thesis credits or 10 PhD thesis credits. The annual expectation for the UMCES faculty is 0.5-1.5 ecu. Annual merit evaluations conducted by the faculty member's Laboratory Director and institutional promotion and tenure decisions include careful evaluation of a faculty member's contribution to education[153]. Reappointment to the UMCES Graduate Faculty, after a five-year review, continues the conferred privilege of teaching and advising graduate students and is contingent on demonstrated successful engagement in education programs that are clearly described in UMCES policies[40].

Although not required to teach or mentor students, most NT faculty members in UMCES do in fact participate in teaching and advising graduate students, usually with less total involvement than tenure-track faculty[200]. The research faculty (NT) may hold Graduate Faculty appointments as either Regular members or Associate members, depending on their degree of involvement and contributions, as described in UMCES policies[40]. Research scientists (post-docs) generally are not involved in graduate education in UMCES, but there are exceptions and UMCES recognizes substantial participation by affording Associate Graduate Faculty status to those research scientists with defined educational contributions[40].

Assessing and cultivating faculty performance

Criteria for appointment, promotion and tenure of faculty derive directly from goals expressed in the mission of UMCES, with four identified performance categories: scientific discovery, integration, application, and teaching-student advisement. The USM and UMCES policies [206] [200] describe ranks and standards for appointment, promotion and tenure of all faculty and other professionals. UMCES also conducts annual reviews of faculty members in all ranks and comprehensive reviews of all tenured faculty members at five-year intervals[207], including Directors, Vice Presidents, and the President. This policy encourages sustained excellence in the performance of all faculty members. Procedures for evaluating faculty are fully compliant with USM policies[208] [209] [196]. These procedures are periodically reviewed and updated at the USM level and within UMCES through its administrative and shared governance policies[57] (see Chapter 4).

An important annual activity that allows the UMCES faculty to reflect and take stock of itself and to express itself on issues of need is the annual UMCES Faculty Convocation. Agendas developed by the UMCES FS typically center on issues of shared governance, fiscal health, new research initiatives, and education (e.g., student recruitment, curriculum development). The Convocation also features opportunities to celebrate new faculty arrivals and faculty promotions and achievements[210] [211].

The four categories of faculty achievement are assessed as part of "professional portfolios"[7]. They are assessed on an annual basis by Laboratory Directors. In annual reviews, faculty members submit curriculum vitae and a self-evaluation that documents research, teaching and mentoring performance. Additionally, each faculty member participates in a face-to-face discussion of performance and goals with the Laboratory Director. Laboratory Directors provide a written evaluation of performance by each faculty member, which is transmitted to the President of UMCES for further evaluation[153]. The process is rigorous and allows flexibility in assessing diverse portfolios of faculty performances. Nevertheless, there is potential for inequities in how teaching and mentorship activities are allocated across Laboratories and among faculty ranks, given the range specified in faculty workloads (see Faculty Responsibilities above). Accordingly, UMCES should seek to implement institution-wide standards for evaluation of faculty performance in teaching and mentorship. This recommendation also was made by the MSCHE Evaluation Team who reviewed the UMCES ARR and its section on Faculty (Standard 10)[22] [212].

Procedures for handling grievances[114], discipline and dismissal[213] of faculty members are clearly articulated within UMCES and USM policies. Professional misconduct on the part of faculty, students, or staff constitutes a threat to the integrity of UMCES and is not tolerated (see Chapter 4). Frivolous allegations of professional misconduct are no less a threat to that integrity. The UMCES Policy and Procedures on Misconduct in Scholarly Work[111] articulates the process for investigating grievances related to academic freedom and professional misconduct. During the past ten years, no such grievances have been filed, evidence of the high ethical standards UMCES places on academic and intellectual freedom (see Chapter 4).

UMCES recognizes that new faculty members face ever-increasing challenges as they approach tenure and promotion, with increased demands for research productivity and professional service as well as graduate student mentorship and teaching. UMCES provides generous start-up funds and laboratory resources to newly appointed faculty members. The UMCES promotion process is rigorous, particularly in granting initial tenure and Associate Professor rank (Table 6.3). During the period 2002-2012, 20% of Assistant Professors were denied tenure. Pre-tenure and annual review processes provide regular guidance and feedback on faculty progress and goals. The emphasis on individuals allows the cultivation of a diverse faculty who may have variable strengths in teaching, applied research, theoretical approaches, and fundamental science. Laboratory Directors play a key role in

Table 6.3. Promotions and denials of faculty promotions at UMCES, 2002–2014, by gender.

	Promotions		Denials	
Rank sought	Female	Male	Female	Male
Associate Professor	5	7	1	2
Full Professor	1	6	1	1
Research Associate Professor	1	1		
Research Professor	4	1		
Principal Agent		1		
Senior Agent	1			

mentoring young faculty members. However, it is recognized that the current system of distributed and informal mentorship of young faculty members may be under-serving them and that UMCES would benefit from a formal mentorship program.

Leaders in environmental science

A strength of UMCES has been its success in maintaining a faculty adept in conducting cutting-edge and interdisciplinary environmental science that is aligned with aspirations in its mission and strategic plan[27] [9]. The faculty constitutes a community of scientists seeking opportunities to conduct integrative and synthetic research, and is committed to involving both MS and PhD students in research initiatives. An awareness that there is need to balance numbers of junior and senior faculty (Table 6.1, Figures 6.1 and 6.2) assures that UMCES will continue to foster growth while maintaining its traditional strengths. Faculty enterprises cover a broad range and blend of disciplinary skills, with research and teaching emphases on oceanography and estuarine science; global climate change; biogeochemistry; fisheries science; microbial and molecular ecology; landscape and watershed ecology; conservation biology; numerical modeling and biostatistics; and environmental economics[204].

Excellence in research, advisory, and outreach efforts in recent years has earned high honors, with faculty recognized by the USM Board of Regents Awards[198] [199], UMCES President Service Awards[210], and Governor's Admiral Awards[214]. Recent career awards to UMCES faculty members include the Odum Lifetime Achievement Award (Drs. Walter Boynton and J. Michael Kemp; Coastal and Estuarine Research Federation), the Cronin Early Career Award (Dr. Elizabeth North; Coastal and Estuarine Research Federation), the Sloan Foundation's Simons Award (Dr. Alyson Santoro; Sloan Foundation), the Ketchum Career Award (Dr. William Boicourt; Woods Hole Oceanographic Institution), The International Arctic Science Committee Medal (Dr. Jacqueline Grebmeier), the American Fisheries Society Oscar Sette Award (Dr. Edward Houde), Fellow of the Ecological Society of America (Dr. Margaret Palmer), and the Maryland Governor's Admiral of the Chesapeake Bay (Drs. Donald Boesch and Walter Boynton). Within the USM, the receipt of 11 Regents Awards since 2000 by the small UMCES faculty is unparalleled[198] [199]. Six faculty members [E. Davidson, E. Houde, R. Gardner (Emeritus), P. Glibert, M. Palmer, D. Stoecker] are Fellows of the American Association for the Advancement of Science. Many others populate leadership posts in national and international advisory organizations[215].

Recruitment of faculty members to maintain and improve leadership potential by UMCES occurs through periodic strategic plan development that has been responsive to new challenges and opportunities [41] [7] [9] [53]. Over the past 15 years, UMCES has successfully recruited faculty members in targeted disciplines including 1) fisheries and chemical oceanography; 2) watershed and landscape ecology; 3) estuarine systems ecology, and 4) environmental molecular biology, genomics and biotechnology[41] [7]. The 2012 Strategic Plan *Focus on the Future*[9] is designed to leverage existing faculty talent and faculty recruitment (e.g., molecular ecology), and thus be responsive to forecasted research opportunities and societal needs. The UMCES strategic plan and strategic themes were developed with full faculty engagement. Examples of faculty achievements within these themes are highlighted in Box 6.1.

The UMCES faculty and graduate students publish their research findings regularly in highly regarded, peer-reviewed journals at a rate comparable to peer institutions (Table 6.4). Published works are well cited and have measurable impact. Most senior faculty members devote, or have devoted, efforts as editors for peer-reviewed journals. Many faculty members have undertaken synthetic book projects[224]. Most publications are co-authored with graduate students (Table 7.3).

Table 6.4. Summary of number of publications, citations, and impact factors for UMCES faculty members compared with those of institutions of comparable size and mission, 2005-2014. Librarians and any publications by them are not included in the tallies. Data source is Web of Science Citation Index, http://apps.webofknowledge.com/UA_GeneralSearch_input.do?product=UA&search_mSearch&SID=2FkPxJK7rrj2cF6a13a&preferencesSaved=

Institution	Faculty size (2014)	Publ/yr (publ/faculty/yr)	Citation per item	H-index
UMCES	72	148 (2.1)	21	80
Virginia Inst. Marine Sci [225]	61	147 (2.4)	20	70
Marine Biol Laboratory [226]	50	208 (4.2)	22	94
Carey Inst. Eco Studies [227]	15	90 (6.0)	26	75

Box 6.1. Examples of faculty leadership in research addressing themes highlighted in the UMCES Strategic Plan, *Focus on the Future.* [9]

Genes to Ecosystems: Understand and apply genetic regulation of key ecological processes

Genetic adaptation of temperate forests to climate change. Highlighting early career leadership and collaboration, younger faculty members at the AL (Drs. Elmore, Fitzpatrick, Nelson, and Stylinski) are undertaking an NSF-supported study utilizing ecological genomics to investigate how climate has changed the seasonality of forest canopy development by the balsam poplar[216]. The project seeks to understand the genetic basis for climate adaptation in a ubiquitous tree in temperate North America that is rapidly undergoing a range shift in response to warming. The five-member team, including a faculty member at the University of Vermont, includes experts in ecological genetics, forest and landscape ecology, remote sensing, and public outreach.

Human Welfare: Support resilient ecosystems and human health across the land-ocean continuum

University-state-industry partnership to reduce invasive species in ship ballast water. Dr. Mario Tamburri at CBL directs a unique partnership, The Maritime Environmental Resource Center (MERC), which includes UMCES, the Maryland Department of Natural Resources and the Maryland Port Administration. He and his team have built a unique mobile test bed to evaluate ballast water treatment measures designed to mitigate unintended introduction of invasive species[217]. The MERC also develops "Green Ship" solutions to address vessel biofouling, alternative fuels, and approaches to reduce air emissions. For his pioneering leadership of this program, Dr. Tamburri received the 2015 UMCES President's Award for Science Application[218].

Energy Choices: Evaluate and communicate the environmental opportunities and consequences of energy production alternatives

Proactive research on the effects of offshore wind energy on marine mammals and fishes. Dr. Helen Bailey, a conservation biologist engaged in research on whales and marine turtles at CBL, conducts her research in the coastal ocean off Maryland[219]. Collaborating with colleague Dr. David Secor (CBL), the Maryland Ocean Energy Administration, Maryland Department of Natural Resources, and the Bureau of Energy Management, she is investigating patterns of marine mammal and fish movements in the designated Maryland Offshore Wind Energy Area. Utilizing the UMCES vessel R/V Rachel Carson, acoustic receivers demarcate seasonal occurrences of whales, dolphins, sturgeons and striped bass. The project has uncovered novel winter migrations in these species that commonly occur in the Maryland Wind Energy Area.

Water Security: Understand, evaluate and reduce the environmental consequences of the demand for water for agricultural, industrial and human use

Critical research addressing watershed export and nutrient pollution. In addressing the strategic focus Water Security, Dr. Thomas Fisher at HPL seeks to broaden investigation of linked issues of water conservation (agricultural usage) and nutrient pollution within the Chesapeake Bay. His long-term and continuing research program leverages his expertise and that of colleagues at HPL in nutrient modeling, soil ecology, GIS, and watershed hydrology[220 221]. For his career-long commitment to improved understanding of the Chesapeake Bay's eutrophication problem, Dr. Fisher was presented the 2006 UMCES President's Award for Science Application.

Global Reach: Enhance the capacity for international collaboration and training around the world to develop expertise in environmental research, application and management

Cooperative research on harmful algal blooms in China. Dr. Patricia Glibert at HPL has called attention to the link between excess nutrients (fertilizer use) and the incidence of harmful algal blooms not only within the Chesapeake Bay, but worldwide[222]. Dr. Glibert has teamed with Chinese scientists to demonstrate that ever-increasing blooms of harmful algae in lakes and the South China Sea are strongly correlated with patterns of fertilizer use[223]. For her international leadership in understanding algal blooms, Dr. Glibert has received two distinctions: China's 1000 Talent Scholars and an honorary doctorate from Linnaeus University, Sweden. Additionally, she is a recipient of a prestigious USM Regent's Faculty Award.

Graduate student mentorship in environmental science

The unique structure and function of UMCES within USM as a research institution whose mission is to undertake predictive ecology and graduate student training have supported the strong emphasis by faculty on mentorship of graduate student thesis and dissertation research. The UMCES education program consists of both formal teaching and faculty-intensive, individual mentoring of independent research conducted by graduate students (Chapter 7). Faculty members are responsible for only modest teaching loads (~1 course per year), allowing intensive advising of student research and problem-solving. UMCES faculty members provide effective mentorship through 1) responsive development of a curriculum structure that is rigorous but adaptive (Chapter 7); 2) research achievements that couple scientific discovery, synthesis, and application with teaching and learning; and 3) an academic culture that integrates disciplinary knowledge with cross-disciplinary communication as essential elements to solve complex environmental problems.

Teaching and graduate-student mentoring in UMCES are conducted by faculty members who have Graduate Faculty status within UMCES[40]. UMCES faculty members who participate in the MEES Program also are granted graduate faculty status at UMCP after review and endorsement by the MEES Program Committee and MEES Director, and approval by the Dean of the Graduate School at UMCP[55]. Graduate Faculty appointments in UMCES are based on nominations by Laboratory Directors, review and endorsement by the GFC, and approval by the UMCES VP-Education. Appointments are for five-year terms and are subject to reappointment after recommendation by Laboratory Directors and approval by the UMCES GFC and VP-Education.

Graduate student advisors come from all faculty ranks, but the majority of students, 46% of MS and 73% of PhD, are advised and mentored by tenured full Professors (Table 6.5). Expressed as number of students advised per faculty member, there is a more equitable distribution of students among professorial ranks (Table 6.5). From 2002-2014, faculty members mentored an average of 1.8 and 1.2 students for MS and PhD students, respectively (Figure 6.3).

Teaching

Most of the core MEES courses (Chapter 7) are taught by tenured UMCES faculty members[204]. These courses (see Figure 7.1) also draw graduate students from outside the MEES Program (33% of course enrollments) from more than 70 departments within the USM. Because most core class sizes enroll less than 20 students, UMCES faculty instructors are able to tailor course offerings to student needs. For the MEES core courses taught by UMCES faculty members (some team-taught), Full, Associate, and Assistant Professors assumed 56%, 39%, and 4% of the teaching load (2007-2014 statistics). UMCES Administrators make a clear effort to reduce teaching burdens on junior faculty who are seeking to establish research programs. Junior faculty members do have substantial commitment to teaching specialized courses outside the core MEES Curriculum.

Table 6.5. Distribution of graduated UMCES MS and PhD students by rank of faculty advisor, 2002-2014. Numbers of faculty in 2014 are presented to show the distribution of faculty across ranks. Numbers in parentheses are the mean number of students per faculty member. Tallies do not include librarians.

Faculty rank	NUMBER OF FACULTY (2014)	MS NUMBER	PHD NUMBER
Assistant Professor	11	29 (2.6)	5 (0.5)
Associate Professor	12	23 (1.9)	12 (1.0)
Full Professor	25	61 (2.4)	65 (2.6)
Research Assistant Professor	5	1 (0.2)	1 (0.2)
Research Associate Professor	9	13 (1.4)	3 (0.3)
Research Professor	8	3 (0.4)	3 (0.4)
Principal and Senior Agent	2	3 (1.5)	0 (0)
SUM	72	133 (1.8)	89 (1.2)

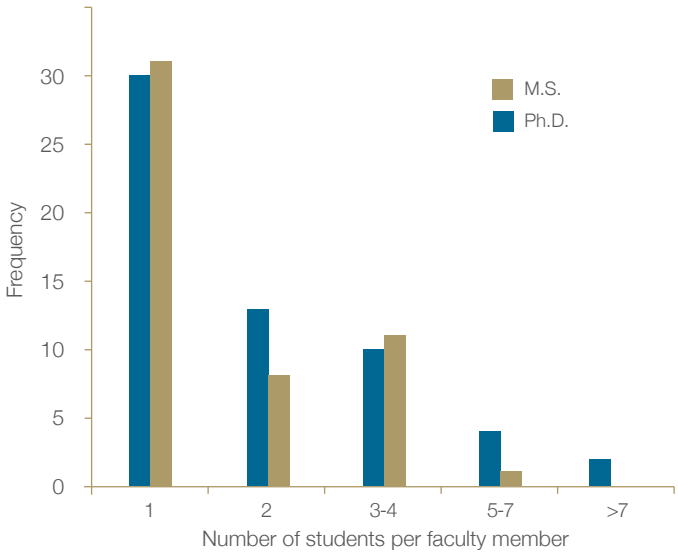


Figure 6.3. Frequencies of total number of graduate students advised per UMCES faculty member during the period 2002-2014.

Because of its distributed locations, MSCHE defines UMCES as a Distance Learning institution. The faculty at UMCES has long experience (since the early 1990s) in delivering education via its Interactive Video Network (IVN)[65] and relies on the highly qualified IT staff members at each Laboratory who are instrumental in maintaining this infrastructure[228]. The IT staff offers regular instruction sessions for faculty. At a broader scale, UMCES faculty members have access to USM resources such as the Kirwan Center for Academic Innovation[229] and the UMCP Teaching and

Learning Transformation Center[230] to stay abreast of new and improved instructional practices. Many UMCES instructors have, however, recognized that they are not taking full advantage of IVN capabilities, nor are they fully compensating for limitations associated with real-time distance instruction. Expertise and new developments in video network learning are less utilized than they could be to improve delivery of instructional material, create teaching efficiencies, and improve student outcomes. UMCES should explore the potential to contract expert instructional training in use of IVN to most effectively use evolving IVN capabilities.

Leadership within the MEES Program

The UMCES Faculty provides core leadership and participation in MEES graduate education through 1) development of the existing AOS structure[21]; 2) dedicated service on the MEES Program Committee; 3) responsiveness to new distance education technologies; and 4) recognition of emerging disciplines within environmental science (see Chapter 7). The current MEES Program Director holds a faculty appointment in UMCES. MEES is largely reliant on individual motivation of faculty members to participate, contribute courses, advise students, and work to implement changes in admissions, matriculation requirements, and curriculum. Over the past two decades, most MEES Program Committee members have come from UMCES faculty ranks[204]. A recent example of faculty initiative was action prompted by the loss of high-quality biostatistics courses on the UMCP campus that had routinely served UMCES graduate students. Recognition of the problem and action taken in 2014 by the CBL Laboratory Director resulted in a reinstituted, rigorous biometrics program, the Environmental Statistics Collaborative (ESC) that is fully embedded in UMCES with two new faculty members located at CBL[52].

Outreach and technology transfer

UMCES faculty members contribute advisory leadership and technology transfer on critical environmental management and restoration issues[231] [232], and actively support STEM outreach for the general public and for K-12 educators and administrators. UMCES faculty members play key roles in addressing local, regional, and global environmental issues including climate change, Chesapeake Bay restoration, sustainability of fisheries, mining and hydraulic fracturing, coastal pollution, and marine products and aquaculture[233]. As highlighted above (Box 6.1), the UMCES faculty is heavily engaged in making science applicable to societal issues. A noteworthy example of effective advisory work was the recent landmark report on best management practices for unconventional natural gas extraction (i.e., hydraulic fracturing) in Maryland by AL faculty members Drs. Keith Eshleman and Andrew Elmore. For their leadership in providing rigorous and unbiased analysis on this controversial issue, Drs. Eshleman and Elmore were recognized for public service and received prestigious USM BoR Faculty Awards[234].

Public service by faculty members is mandated by the UMCES Charter [1] [2] [3] [4] [5], while protecting academic and intellectual freedom. UMCES subscribes to the USM Policy on Classified and Proprietary Work[121], which specifies conditions of academic freedom for faculty and students[235]. Most UMCES faculty members perform advisory work and science applications on local, state, national and international levels[215]. President Boesch is strongly supportive of such work and sets the example for these contributions. Such service is expected and is duly recognized by UMCES and by the individual Laboratories through support of costs associated with such service (e.g., faculty time, travel, IT service, other office support), and by the emphasis placed on this component of faculty performance in annual evaluations and promotions (see Faculty Responsibilities above). Similarly, there is strong institutional support for faculty engaged in public and K-12 outreach programs. Indeed, specialized faculty and staff are placed in the UMCES Administration and at each of the Laboratories to assist faculty communication of science to public audiences[236] [237].

The recent addition to UMCES of the state-of-the-art biotechnology capabilities of IMET has enhanced opportunities for UMCES to effectively engage in marine technology development and transfer[238]. A recent example is research by IMET Professor Feng Chen who, with the biotech firm Hytek-Bio, utilizes an isolated Chesapeake Bay strain of microalgae to develop bioreactors capable of scrubbing carbon dioxide emissions from powerplants and converting them into biodiesel fuel and food additives[239].

Some UMCES faculty members and agents have developed and emphasized programs of K-12 environmental education[240] [241]; teacher professional development[242]; and public outreach and docent programs[243] (see also Chapter 7). Many faculty members participate as mentors in the Maryland Sea Grant REU Program[244].

The faculty enterprise

The faculty is responsible for developing and sustaining research activities that are essential to the fiscal health and educational vitality of UMCES (Figure 6.4, 6.5). Sponsored research awards are in excess of state support of research and education (see Chapter 3). The sponsored research supports student stipends and tuition, thesis and faculty research, and outreach programs. During the period 2000-2015, annual research award totals ranged from $13.9 million (2007; 145 awards) to $27.2 million (2010; 168 awards, the high funding level resulting from American Recovery and Reinvestment Act grants), but in most years tallied $19-24 million (average $21.0 million per year). In FY 2015, grant revenues totaled $24.9 million (203 awards). On average, a faculty member was awarded 2.5 grants per year, valued at $322,000. Research awards from state (average 25%) and federal (average 67%) sources have fluctuated without trend during the past 15 years, but private funds ("other" category in Figures 6.4, 6.5) have increased their contribution from 3-8% in the FY 2000-2011 period to 11-17% in FY 2012-2015.

The UMCES faculty is strongly entrepreneurial in pursuing funding opportunities from dozens of agencies, adapting to a changing funding landscape. As evidence, funding portfolios by classes of sponsors are shown for years FY 2010 and FY 2015 (Figure 6.5). Note that the same agencies and sources persist across years. Although funding levels were somewhat lower in FY 2015 ($24.9 million) due to federal stimulus spending in 2010 ($27.1 million), the lower support levels in FY 2015 from NOAA and NSF were in part compensated through increased support from private organizations, MD DNR, and NASA. The diversity of research sponsors reflects the diverse capabilities of UMCES faculty members, which contributes to fiscal stability of UMCES.

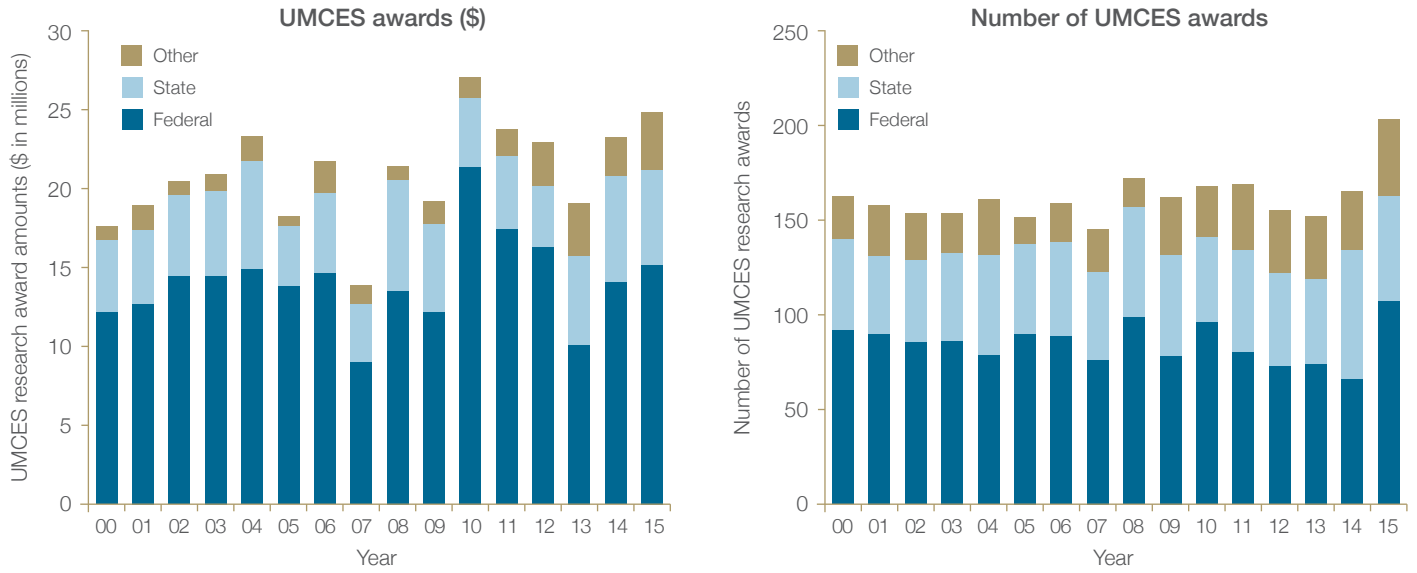


Figure 6.4. Total UMCES research award amounts and numbers by state, federal, or other (principally private) categories for the period 2000-2015.

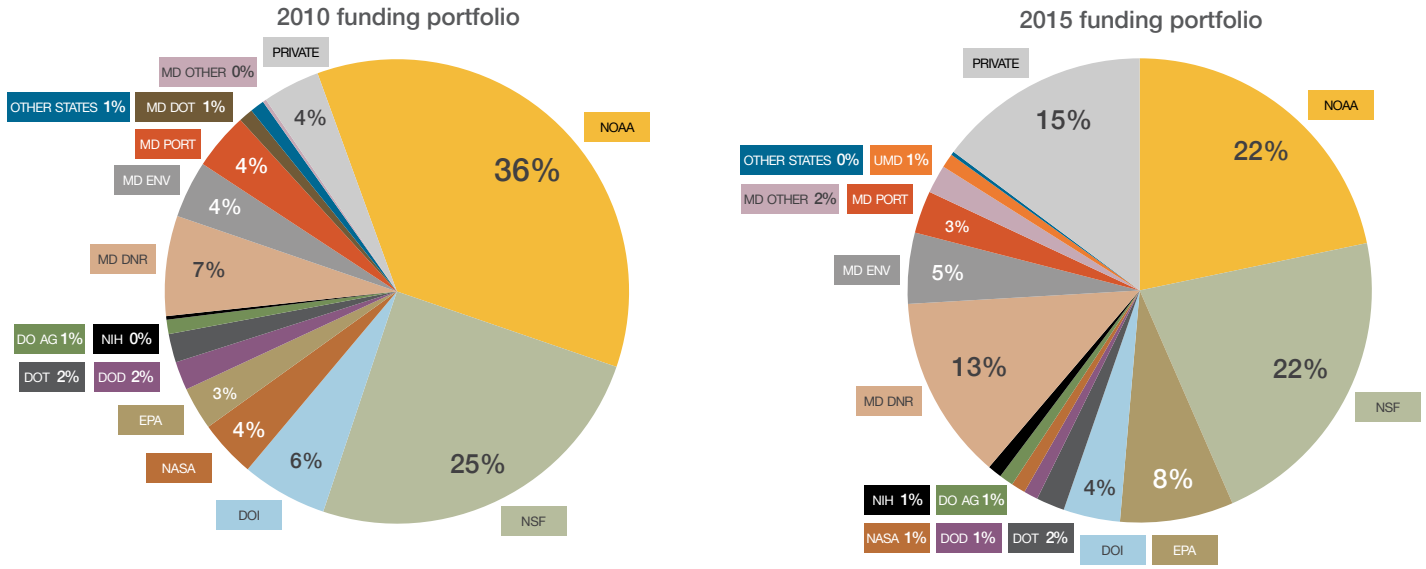


Figure 6.5. Distribution of UMCES research awards by granting agencies in FY 2010 and FY 2015. NOAA=National Oceanic and Atmospheric Agency, NSF-National Science Foundation, DOI=Department of Interior (USGS, USFWS, NPS), DOT=Department of Transportation, NIH=National Institute of Health, DOD=Department of Defense, MD_DNR=MD Department of Natural Resources, MD_ENV=MD Department of the Environment, MD_Port=MD Port Authority, DOAgr=Department of Agriculture.

The UMCES faculty has been quite successful in competing for prestigious National Science Foundation support. UMCES has consistently attracted significant NSF funding, despite increased competition in the past 15 years. Among Maryland institutions, UMCES ranked fourth in National Science Foundation support in 2014 ($6.3 million), following UMCP ($60.3 million), Johns Hopkins University ($42.3 million), and UMBC ($8.6 million), all of which have substantially higher faculty numbers than UMCES. Within Maryland institutions of higher education, UMCES and its faculty enjoyed the highest NSF funding success rate (32%; state average was 26%). UMCES compares favorably in NSF support with peer institutions such as the Virginia Institute of Marine Science (faculty size 61), the Institute of Ecosystem Studies (faculty size 15), and the Marine Biological Laboratory (faculty size 50) (Figure 6.6). In 2014, NSF funding success rates for peer institutions were 8% (VIMS), 14% (IES), and 36% (MBL).

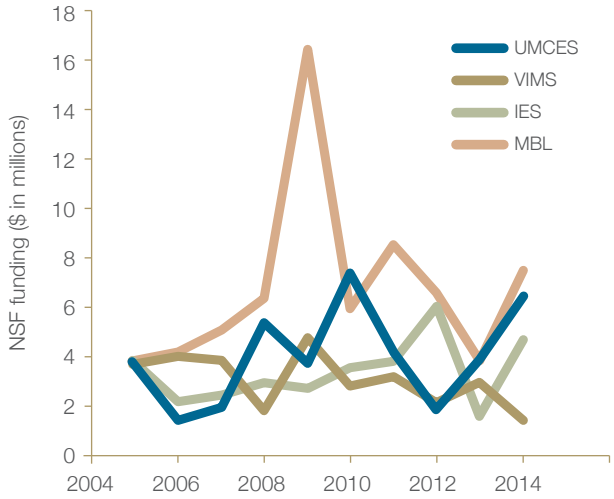


Figure 6.6. Trends in NSF funding by year for UMCES and for three institutions of comparable size and mission. VIMS =Virginia Institute of Marine Sciences[379]. IES = Cary Institute of Ecosystem Studies[380]. MBL = Marine Biological Laboratory[381].

Institutional support of faculty

The UMCES faculty is supported by a wide-range of institutional resources constituting a tight cross-disciplinary research network that encourages collaboration among its four Laboratories (Chapter 3) and a dedicated science communications center[32]. An efficient and skilled grants administration staff guides proposals through local review and submission and maintains an ever-improving web-based proposal and grant submission tool[245]. UMCES has invested substantial resources and support in its library facilities and expert library staff (see Chapters 3, 5 and 7) to facilitate research and scholarly enterprises that link unique historical holdings in UMCES to the vast repositories within the USM[79].

As a graduate research institution competing for grant support and the best students, the faculty requires substantial provisions of analytical equipment, seawater systems, greenhouses, research vessels, and IT resources to sustain the faculty enterprise (also see Chapter 3). The UMCES faculty is meaningfully engaged in the facilities planning process[58] (see Chapter 3). At individual Laboratories, Directors make strategic decisions on major equipment and instrument purchases, placing priority on insuring competitive start-up packages for new faculty and on purchase of key multi-use instruments.

Conclusions and recommendations

The UMCES faculty has evolved in recent decades, modestly increasing its number and diversity, while embracing ever greater disciplinary breadth and elevating emphasis on its education mission. Procedures of shared governance, policy amendment and revision, strategic planning, and curriculum development all actively engage the faculty. The faculty is enthusiastic in pursuing research opportunities and engaging in advisory service. Challenges remain in cultivating and elevating performance by young faculty members. There is a need for more consistent and defined expectations for teaching responsibilities. While effective in delivering education over the IVN, approaches to improve faculty use of distance instruction technologies should be explored.

Evidence that UMCES complies with expectations in MSCHE Standard 10:

- The UMCES faculty is appointed and promoted according to rigorous criteria to fulfill education, research, and advisory roles as prescribed by USM and UMCES policies and to fulfill the UMCES mission. The diversity of expertise, demographic structure, and distribution of faculty members among the individual Laboratories support the strategic research directions of UMCES and its graduate education program.
- The UMCES faculty is governed by a set of well communicated policies at UMCES that fully comply with those of USM. Review and promotion procedures are specified based on faculty portfolios of performance: scientific discovery, integration, application, and teaching-advising. Policies protect academic freedom and address grievances and dismissals.
- The UMCES faculty participates in a system that values shared governance through the UMCES FS, the UMCES GFC, and direct interactions with Laboratory Directors and other administrators. Faculty members are engaged in strategic planning and periodic review of all administrative staff.
- The UMCES faculty provides core leadership and instruction within the MEES Program including curriculum development and delivery of core courses. Core courses are principally taught by senior UMCES faculty members. Teaching loads remain light to accommodate the strong research and advisory missions of UMCES.
- The UMCES faculty enterprise is essential to the fiscal health of research, education and advisory programs at UMCES. The faculty has been effective in attracting diverse and competitive sources of funding, while maintaining strong levels of research scholarship, student mentorship, and advisory capability.
- Public service and technology transfer are mandated by the UMCES Charter and are pursued according to individual faculty motivation, with encouragement from the UMCES Administration. A large number of faculty serves on regional, national, and international advisory bodies and many have received prestigious career awards for their service.
- The faculty enterprise is strongly supported in UMCES through an effective Office of Sponsored Research, IT services, outreach and science communications centers, library services, research vessels, and master facility planning. Laboratory Directors provide competitive start-up packages for new faculty members, strategically invest in education (e.g., IVN and IT resources) and research (e.g., equipment), and support faculty advisory work.

Recommendations

Three recommendations are put forward that can improve performance of the UMCES faculty.

1) UMCES should develop and implement institution-wide standards for evaluation of faculty performance in teaching and mentorship. This recommendation also was made by the MSCHE Evaluation Team who reviewed the UMCES ARR[212].

The policy for UMCES faculty workload and performance has not been reviewed for over two decades and merits re-evaluation with increased emphasis on graduate education within the UMCES mission. Criteria for evaluation and assessment of faculty involvement and success in these endeavors are not clearly defined. In July 2015, President Boesch directed the Executive Council and FS to assist him in developing new faculty standards, which are to be consistently applied across UMCES. Note: This recommendation also was made by the MSCHE Evaluation Team who reviewed the UMCES Accreditation Readiness Report.

2) Within the next two years, UMCES should develop and initiate a mentorship program for junior faculty that is instituted across its Laboratories.

Currently, faculty mentorship is performed at the individual Laboratories on an ad hoc basis. Over the next two years the UMCES FS will work with the Executive Council, Laboratory Directors, and GFC to develop a program of faculty mentorship to improve teaching, research, and advisory performance by young faculty.

3) Over the next five years, UMCES should improve training of its faculty in distance instruction, especially the effective use of the Interactive Video Network (IVN) and evolving technologies.

Utilization of IVN technology by UMCES faculty members is universal and apparently highly successful. Still, training in use of this teaching medium and other emerging technologies will improve course delivery, leading to better learning outcomes. As a small institution, UMCES cannot develop fully the capacity to provide instructional training internally. The Office of the Vice President-Education, working with the GFC, will seek out and develop faculty training programs for improved use of the IVN and other evolving distance-learning technologies.

Chapter 7 *Delivering, evaluating, and assessing high quality graduate education*

Addresses Standards 11, 13, and 14

Standard 11: Educational Offerings. Delivering High-Quality Graduate Education. *The institution's educational offerings display academic content, rigor, and coherence appropriate to its higher education mission. The institution identifies student learning goals and objectives, including knowledge and skills, for its educational offerings.*

Standard 13: Related Educational Activities. *The institution's programs or activities that are characterized by particular content, focus, location, mode of delivery, or sponsorship meet appropriate standards.*

Standard 14: Assessment of Student Learning. *Assessment of student learning demonstrates that, at graduation, or other appropriate points, the institution's students have knowledge, skills, and competencies consistent with institutional and appropriate higher education goals.*

UMCES is committed to education. The institution has an educational tradition that reaches back to its founding in 1925. Today, UMCES offers high-quality graduate and related educational programs that are responsive to achieving its mission and meeting needs for STEM training of students, environmental professionals, teachers and citizens. Graduate education is at the heart of educational programs (Chapter 1) in UMCES. UMCES regularly and routinely assesses the effectiveness of its education programs through direct assessment of student performance and critical evaluation of curricula and programs to ensure that its programs meet the needs for academic training in the environmental sciences. UMCES strives for, and is committed to, continual improvements across the full spectrum of its educational programs to ensure that students receive world-class instruction that maximizes effectiveness of instruction and contributes to success of its graduates.

The commitment to education is exemplified by the direct involvement of the UMCES President, both academic Vice Presidents, and all Laboratory Directors as instructors in full graduate-level courses[6] and as graduate student advisors. Educational activities are conducted by faculty members from all four Laboratories. It is common for faculty members from different Laboratories to co-teach courses to ensure students are exposed to inter-disciplinary approaches in environmental science. In short, UMCES is committed from bottom to top to accomplish its mission by training the next generation of leaders in environmental sciences.

Standard 11: Educational Offerings

UMCES graduate education programs are congruent with its mission

Graduate programs in UMCES are designed to advance knowledge through scientific discovery, integration, and application, and through educational courses that result in a comprehensive understanding of the environment and natural resources. Support of these central elements of the UMCES mission[27] is facilitated by the UMCES requirement that all students conduct independent and original graduate research under the guidance of faculty mentors and with the oversight of a graduate advisory committee. Indeed, conducting original research is, arguably, the most important learning opportunity that UMCES offers to its students. Graduate theses and dissertations require: 1) in-depth study of relevant scientific literature; 2) independent thinking and problem solving in field work, laboratory work, and/or simulation modeling; 3) effective scientific writing; and 4) effective scientific communication. These learning objectives are formally captured in statements of expected graduate outcomes for the MS[246] and PhD[247] degrees. A sample of titles of 10 MS theses and 10 PhD dissertations by UMCES students over the last five years is indicative of the broad scope and diversity of areas in which UMCES students conduct research (Table 7.1). Students in UMCES conduct their research from the mountains to the sea, focusing on scales ranging from genes to ecosystems and using approaches that support both fundamental discovery and the application of science to solving environmental challenges.

Graduate research within UMCES is integrated with formal coursework. The graduate programs in which UMCES participates support the conduct of independent graduate research and provide a foundation for professional careers by offering courses that provide in-depth training in: 1) conduct of original scientific research that leads to discovery; 2) the integration or synthesis of scientific information across disciplines, across topic areas within a discipline, or across time; and 3) application of scientific knowledge to solve real-world problems. Courses taught by UMCES faculty members are listed in the joint UMCES-UMCP MEES program[6]. It is notable that these courses serve both MEES and non-MEES students. Graduate programs and education in UMCES are complete and comprehensive in scope, providing content and rigor sufficient to enable students to complete their degree programs in a timely fashion (see Chapter 5) and

Table 7.1. Titles of 10 representative MS and 10 PhD research projects completed by UMCES students (2010-2015) by degree and program. Educational programs in UMCES have led to 48 MS degrees and 37 PhD degrees over this time period. Students with underlined names elected to receive the joint UMCES-UMCP MEES degree which became available in 2014.

Degree	NAME	YEAR	SEX	PROGRAM	RESEARCH TITLE
M.S.	Ghorpade, Sarah	2010	f	MEES (CHEM)	Interactions Between Natural Organic Matter Composition And Mercury Transport In A Boreal Watershed
	McChesney, Lauren	2010	f	MEES (ECOL)	Competition Between Hydrilla verticillata And Vallisneria americana In An Observational Field Study And Greenhouse Experiment.
	Shearin, Charlotte	2010	f	MEES (ENVSC)	Using Dredged Material To Restore The Chesapeake Marshlands Complex: Preliminary Application Of A Risk-Based Optimization Model For Comparing Placement Options
	Malpezzi, Michael	2010	m	MEES (OCEAN)	The Abundance And Distribution Of Transparent Exopolymer Particles In The Turbidity Maximum Region Of Chesapeake Bay
	Colton, Amanda	2011	f	MEES (FISH)	An Evaluation Of The Synchronization In The Dynamics Of Blue Crab (Callinectes sapidus) Populations In The Western Atlantic
	Lozano, Carlos	2011	m	MEES (FISH)	Dynamics Of Ingress, Hatch Dates, Growth, And Feeding Of Atlantic Menhaden, Brevoortia tyrannus, Larvae At The Chesapeake Bay Mouth
	Hanif, Ammar	2012	m	MEES (ENMB)	Development, Validation, And Application Of A Quantitative Polymerase Chain Reaction Assay To Assess Hematodinium perezi Prevalence In Environmental Samples
	Johnston, Miriam	2014	f	MEES (ECOL)	Field-Measured Versus Derived: What Are The Most Effective Predictor Variables In Stream Biodiversity Models?
	Forsyth, Melinda	2014	f	MEES (ENVSC)	Investigations Of The Effects Of Oyster Allometry And Reef Morphology On Filtration Rate And Particle Capture Using Numerical Models
	Gelesh, Lauren	2015	f	MEES (CHEM)	Methane Dynamics In Marine Systems
Ph.D.	Utz, Ryan	2010	m	MEES (ECOL)	Interregional Differences In Stream Ecosystem Responses To Urbanization: Causes And Consequences
	Yost, Denise	2010	f	MEES (ENMB)	Dimethysulfoniopropionate (Dmsp) And Dmsp-Lyase In Cnidarian Algal Symbioses
	Peer, Adam	2012	m	MEES (FISH)	The Importance Of Female Phenotype In Determining Reproductive Potential And Recruitment In Atlantic Coast Striped Bass (Morone saxatilis)
	Li,Yun	2012	f	MEES (OCEAN)	Impacts Of Winds And River Flow On Estuarine Dynamics And Hypoxia In Chesapeake Bay
	Testa, Jeremy	2013	m	MEES (OCEAN)	Dissolved Oxygen And Nutrient Cycling In Chesapeake Bay: An Examination Of Controls And Biogeochemical Impacts Using Retrospective Analysis And Numerical Models
	Bosch, Jennifer	2014	f	MEES (ENVSC)	Polychaetes, Hypoxia, And Nitrogen Cycling In The Mesohaline Chesapeake Bay
	Pie, Hannah	2014	f	GPILS (TOX)	Assessing The Exposure To And Impacts Of Oil Constituents And Chemical Dispersants In Marine Invertebrates
	Powell, Ryan	2015	m	MEES (ENMB)	Rapid Harvest Of Algae For Biofuel Production With The Aggregating Bacterium Bacillus sp. Strain Rp1137
	Vest, Kimberly	2015	f	MEES (ENVSC)	Interactions Between Chemical, Physical, And Biological Processes During Desertification Of Groundwater-Dependent Semi-Arid Grasslands
	Kazyak, David	2015	m	MEES (FISH)	Management And Conservation Of Brook Trout In Western Maryland

to develop successful careers following graduation. Table 7.2 provides an annotated list of the current UMCES-taught MEES courses organized under the discovery, integration and application categories of the UMCES mission. A synopsis of each course is available[248]. All courses are currently approved by the Program and Curriculum Committee of the College of Computer, Mathematics and Natural Sciences at UMCP[16].

The appropriateness, appeal, and quality of UMCES educational offerings are emphasized by data on enrollment of non-MEES students in MEES courses taught by UMCES faculty members. As depicted in Figure 7.1, 17 of the 20 MEES courses with highest enrollments are taught by UMCES faculty members. Many non-UMCES students, and also non-MEES students, regularly take UMCES-taught courses, an indication of the perceived high quality, rigor, and relevance of these courses, as viewed by colleagues and students within the USM.

Table 7.2. Elective courses taught by the UMCES faculty within MEES. The three categories address elements of the UMCES mission.

DISCOVERY	APPLICATION	INTEGRATION
MEES 432/632 Physiological Ecology of Animals	MEES 604 Environmental Statistics	MEES 610 Land Margins Interactions
MEES 606 Cell and Molecular Biology: A Mechanics View	MEES 607 Quantitative Methods in Environmental Sciences	MEES 617 Hydrological Effects of Land Use Change
MEES 608L Marine Microbial Ecology	MEES 608D Scientific Writing and Communication	MEES 682 Fisheries Science and Management
MEES 611 Estuarine Systems Ecology	MEES 608T Applications of State-of-the-Art Analytical Techniques in the Environmental Sciences	MEES 698Y Science for Environmental Management
MEES 614 Landscape Ecology	MEES 671 Remote Sensing for Environmental Management	MEES 743 Aquatic Toxicology
MEES 616 Fisheries Oceanography	MEES 688A Scientific Communications	
MEES 621 Biological Oceanography	MEES 708C Mixing and Transport in Coastal Water	
MEES 626 Environmental Geochemistry I	MEES 712 Advanced Population Dynamics and Assessment	
MEES 627 Environmental Geochemistry II		
MEES 631 Fisheries Ecology		
MEES 637 Zooplankton Ecology		
MEES 661 Physics of Estuarine and Marine Environments		
MEES 698A Aquatic Microbial Ecology		
MEES 698C Chemical Oceanography		
MEES 698Q Biogeochemistry		
MEES 698Q Stream Ecology		
MEES 721 Plankton Dynamics		

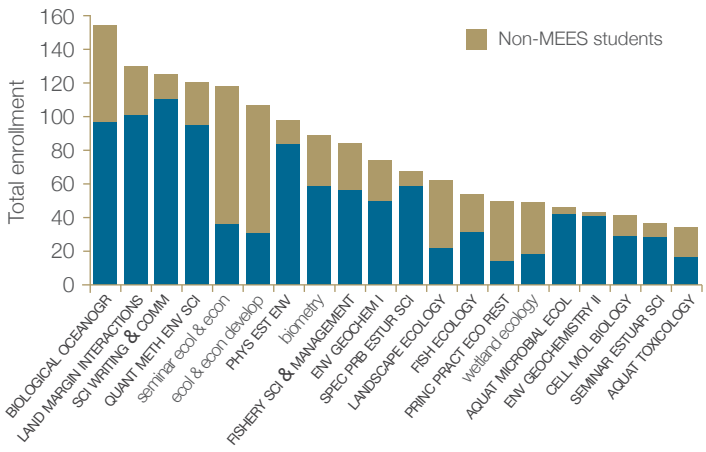


Figure 7.1. Cumulative enrollment in the 20 most subscribed MEES courses 2002-2013. Seventeen of the top 20 were taught by UMCES faculty members. Courses taught by UMCES faculty members are shown in upper case and those taught by other MEES faculty in lower case.

In addition to rigorous academic course offerings, each student shortly after matriculation must complete a plan of study appropriate to their field. For example, coursework in the MEES program has requirements specific to each of six Areas of Specialization (AOS)[21] into which students matriculate that seek to balance breadth and depth. Depth is provided by the requirement to take several courses from the AOS. Breadth is provided by the requirement that all students take one or more courses from outside their AOS, in addition to a management course, a statistics course, and a writing course.

All graduate students in UMCES must have a graduate advisory committee consisting of qualified faculty members, which is chaired by the student's advisor. A description of the committee structure is provided in Chapter 6. The requirement to include a committee member external to UMCES for all PhD students ensures rigor and accountability. This requirement helps to ensure that research by students meets or exceeds national norms for each field of study. The membership of the student's graduate advisory committee must be reviewed and approved by the MEES Director.

For PhD students, the advisory committee administers the comprehensive written and oral examinations required for all PhD students[249]. The comprehensive exams, tailored to each individual student's research interests, are typically administered at the end of the second year of a student's program. The primary objective of the exam is to ensure that the student has a sufficiently strong background to undertake PhD-level research.

Approval of the research proposal by the advisory committee is an important landmark in each graduate student's progress. Approval occurs through reviews by committee members for MS students, but requires a formal oral proposal defense at the PhD level [249] [250]. Developing a logical, cogently-argued proposal is a skill that will be useful to many in their subsequent careers, as is learning to incorporate constructive feedback and criticism, which typically accompany the oral defense of the proposal.

Upon completion of research and academic programs, each student must defend the completed thesis or dissertation in a public seminar followed by a formal oral examination of the student

by his/her advisory committee[250] [249]. The oral examination is open to the entire UMCES Graduate Faculty. The advisory committee votes to pass or fail the student, and to approve the thesis or dissertation.

Perhaps the ultimate assessment of the quality of research by UMCES graduate students is its translation to the primary literature. The MS theses and PhD dissertations of UMCES students frequently result in award-winning presentations at scientific conferences and publications in highly regarded peer-reviewed journals. Students commonly publish with their advisor and other members of their advisory committees (Table 7.3). UMCES students publish high-quality articles in highly recognized, peer-reviewed research journals. Recognition of quality frequently occurs. For example, UMCES PhD alumnus Adam Peer was awarded the Best Paper of the Year in 2014 by the North American Journal of Fisheries Management for his dissertation research on the effects of climate change on the ecology and management of striped bass[251].

Table 7.3. Authorship by UMCES students in scientific publications (2010-2014). The table shows the number of peer-reviewed scientific papers and book chapters with UMCES Contribution numbers that were authored or co-authored by faculty, staff and students.

Unit	Total	Faculty/staff auth only	Student auth, or with student co-auth	% Student auth
AL	96	14	82	85.4
CBL	196	54	142	72.5
HPL	142	18	124	87.3
IMET	141	93	48	34.0
IAN	5	0	5	100
TOTAL	580	179	401	69.1

Evolution of the MEES Program

The institutional partners in MEES within the USM committed to revise the MEES curriculum in response to an external review[252] and internal USM deliberations[140]. A central part of this commitment was the establishment of the MEES Administrative Council[253]. The Council is chaired by the Vice-Chancellor for Academic Affairs for USM. Each of the five institutional partners in MEES is represented on the Administrative Council by a Provost and Graduate Dean. The MEES Director also serves on the Administrative Council in an ex officio capacity. The Administrative Council provides guidance and support to the MEES Program, ensuring its excellence, its evolution in response to changing needs, its academic integrity and compliance with the policies of the Graduate Schools of the participating institutions .

The MEES Administrative Council empaneled a MEES Curriculum Committee in 2013. UMCES faculty members played a prominent role on the Curriculum Committee that was chaired by the UMCES CBL Director. Of the 24 members on the Curriculum Committee, 13 were UMCES faculty members. The Curriculum Committee has delivered a plan and recommendations for changes in the MEES curriculum[53]. The new curriculum structure recommended by the Curriculum Committee is on the agenda for approval by the MEES Administrative Council at its Fall 2015 meeting. Moreover, anticipating approval of the curriculum by the MEES Administrative Council, the Chair of the Curriculum Committee has prepared a formal proposal to change the MEES curriculum for submittal to the Program and Curriculum Committee at UMCP[254]. This proposal is currently under review by the Office of the Associate Provost at UMCP. It is anticipated that the new curriculum will be instituted in Fall 2016.

The MEES Curriculum Committee recognized that the new curriculum will exist within a changing education landscape. Three important drivers of change were recognized: 1) the evolving definition and scope of the environmental sciences;[255] 2) the increasing need for scientific knowledge to shape policy for existing and emerging environmental challenges by integrating understanding of human and natural systems; and 3) the national need to train students in STEM fields to supply the future workforce. In addressing these three challenges the MEES Curriculum Committee recognized that the fundamental strength of MEES is that it was established to, and continues to, break down barriers between disciplines to promote inter- and transdisciplinary research. The new curriculum (Figure 7.2) was designed to emphasize and continue this tradition. The Committee also sought to develop a curriculum that would contribute to training a generation of scientists who are able to conduct science that can 1) inform policy debates; 2) lead to social change; and 3) be translated into technologies to help meet current and future environmental challenges. Finally, the Committee recognized that a strong quantitative training provides a foundation for a diverse range of careers.

The new curriculum identifies four core Foundation areas “Foundation A - Environment and Society”, “Foundation B - Earth and Ocean Science”, “Foundation C - Ecological Systems” and “Foundation D - Environmental Molecular Science and Technology” that are directly responsive to the UMCES mission (Figure 7.2). These Foundation areas will replace the existing MEES curriculum with its six AOS[21]. MEES and UMCES are not abandoning traditional strengths in oceanography, fisheries science, and environmental chemistry. UMCES is committed to maintaining strong capabilities in these areas. Rather, the new curriculum is designed to expand the relevance of these traditional disciplines by providing a broader context. The Foundation areas and courses are designed to provide a foundation of knowledge that equips UMCES students for their graduate coursework, independent research and future careers. The courses are intentionally interdisciplinary, providing context within which students can understand their more specialized studies. Beyond the new Foundation courses, the new MEES curriculum offers diverse pathways for students with different career aspirations (Table 7.4).

Standard 13: Related Educational Activities

Educational programs in UMCES focus on ensuring broad access for students to a wide range of educational opportunities and ensure that the wider implications of graduate research are communicated to policy makers, stakeholders, and the society at large.

Figure 7.2. The new curriculum developed by the MEES Curriculum Committee and proposed in 2015.

Table 7.4. Example curricula for four UMCES students with differing career goals in the proposed new MEES curriculum. ISG = Issue Study Group seminars. RCR = Responsible Conduct for Research seminar. Number of credits in parentheses.

Semester	MS student with career goal of an environmental NGO	PhD student with career goal of an academic appointment in oceanography	MS student with career goal of PhD position in ecology	PhD student with career goal of a biotech start-up
Year 1: Autumn	Foundation A (3) Applied Sci. (3) Env. Stat. (3)	Foundation B (3) Applied Sci. (3) Env. Stat. (3)	Foundation C (3) Applied Sci. (3) Env. Stat. (3)	Foundation D (3) Applied Sci. (3)
Year 1: Spring	Env. Anthro. (3) Scient. Comm. (2)	Chemical Oce. (3) Global change (3) RCR (2)	Env Stat. II (3) Model. Biol. Sys. (3)	Princ. Mol. Ecol. (3) Model. Biol. Sys. (3) RCR (2)
Year 2: Autumn	Fish. Sci. (3) ISG (1) Data Visualize. (1)	Bio. Oce. (3) Remote Sens. (3) ISG (1)	Remote Sens. (3) Env. Stat. III (3) Data Visualize. (1) ISG (1)	Data Visualize. (1)
Year 2: Spring	Env. Manag. (3) ISG II (1) RCR (2)	Coastal Dyn. (3)	Cons. Biol. (3) ISG II (1) RCR (2)	Marine & Env. Tech. (3)
Year 3: Autumn		PhD Research		PhD Research
Year 3: Spring		PhD Research		PhD Research

Educational opportunities

UMCES educational programs are available to all students

MSCHE has recognized UMCES as a Distance-Learning institution because of the geographic distribution of its four Laboratories and the committed use of an interactive video network (IVN) to provide instruction. Accordingly, UMCES students at all Laboratory Units are equally able to access and participate in UMCES graduate programs. Indeed, the newly proposed MEES curriculum includes as one of its seven guiding principles that MEES will be "a leader in the delivery of high quality courses to students via integrated high quality video technology, emerging communication technologies,

and flexible class scheduling and siting"[53]. The IVN is managed in the USM by MDREN, the Maryland Research and Education Network[65]. IVN is supported at the four UMCES Laboratories by 13 IVN sites, with each Laboratory having at least two IVN-capable rooms [256] [257] [258].

Ensuring that all courses are equally available to all students does not mean that enrollments are equally distributed among Laboratories. For example, all UMCES students in the spring 2015 offering of MEES 698T Marine and Environmental Biotechnology were at IMET. Notably, there were more students enrolled in this course from non-UMCES institutions and locations (UMCP and UMES) than there were UMCES students, indicating that a remote location posed no barrier to enrollment and participation of MEES students or students from other graduate programs.

UMCES educational resources are available to all students

In addition to our commitment to use state-of-the-art communication technologies to ensure all students can access courses, UMCES is also committed to ensure other educational resources, such as library facilities and software, are broadly available. Ensuring equitable access to library services historically was a challenge for UMCES but this impediment has been removed in the last quarter century with broad availability of electronic and online access. Because it was the founding Laboratory, CBL has the most comprehensive holdings[77]. Library resources in UMCES are described in more detail in Chapters 3 and 5. An Information and Communication Services Building at CBL is presently in the USM's capital budget planning stage. This facility will serve as a coordinating hub for literature and information resources for access and use throughout UMCES, a virtual "research and learning commons."

UMCES students apply their learning outside of the classroom

In many cases, individual graduate students have opportunities to work directly with, or alongside, state and federal biologists, chemists, oceanographers, and resource managers. These experiences provide UMCES students with exceptional opportunities to understand the needs of the broader environmental management community and to assess whether this may be a career path of interest. It is not uncommon for state and federal agency staff to serve on graduate advisory committees as adjunct faculty. Additionally, graduate students frequently make presentations to resource management groups, outside audiences and community organizations, and to K-12 teacher education programs.

Seminars by external speakers and interactions by these speakers with graduate students are a crucial part of graduate education. Each UMCES Laboratory has a weekly seminar series that hosts outside speakers[157] [158] [159] [160]. The IVN system has capability to make selected seminars broadly available to students and faculty at all Laboratory Units.

UMCES graduate students are encouraged to present their research findings at national and international conferences (e.g., American Society of Limnology and Oceanography, American Geophysical Union, Coastal and Estuarine Research Federation, American Fisheries Society), where they not only gain experience communicating their work to scientists in the field, but they are informed about research being conducted by others. Each Laboratory, and also individual faculty members, support students with funds to attend national and international conferences, providing opportunities for students to network and identify future employment opportunities. Importantly, encouraging students to present at national and international conferences has proven to be a good recruiting tool for UMCES. Colleagues observe the high quality of research conducted by UMCES students and recommend potential students.

As another example of learning outside the classroom, graduate students at IMET recently completed the first year of an entrepreneurial boot camp focused on basic business principles, leadership and entrepreneurism. The Ratcliffe Environmental Entrepreneurs Fellowship (REEF) Program[50] helps young scientists cultivate the leadership and business skills necessary to bring their research into commercial markets. REEF informs students of potential business implications of their research - both for those wishing to start their own business and those interested in careers with established businesses or in public policy (also see Chapters 3 and 5). One Fellow, Ryan Powell, was awarded seed funding[259] and subsequently raised more than $800,000 in grant funding for a new startup company with technology licensed from UMCES. Additionally, IMET hosts an Entrepreneurs' Office Hours[165] providing opportunity for graduate students to meet with investors, funding agencies, and successful entrepreneurs.

Opportunities are available for UMCES students to communicate and work with broader audiences

UMCES faculty and staff often involve graduate students in their externally-funded projects that target K-12 and public audiences. For example, UMCES graduate students participated in developing curricular materials for the HPL, NSF-funded COSEE Coastal Trends Center [260] [261]. As a part of the Coastal Trends Center, UMCES graduate students mentored middle and high school teachers immersed in science research through an eight-year, UMCES-wide fellowship program supported by NOAA[262]. Likewise, UMCES graduate students often serve as junior mentors in Maryland Sea Grant's NSF-funded Research Experience for Undergraduate (REU) Program[244] which attracts 15-20 of the nation's top science undergraduates to the coastal UMCES Laboratories (CBL and HPL) for an intensive 12-week research experience. Additionally, UMCES attracts K-12 teachers who participate in NSF Research Experiences for Teachers (RET) at all four UMCES Laboratories[242]. A recent effort by HPL faculty and graduate students focused on teacher training within geosciences[263]. This NSF-funded project is the Research Experiences for Science, Technology, Engineering and Mathematics Students (RE STEM) pilot program that trains teachers to meet next generation science standards and then provides opportunities for them to trial classroom implementation of student research. Paralleling these efforts, UMCES is also a lead institution within the NSF-funded project MADE CLEAR – the Maryland and Delaware Climate Change Education and Research program – in which faculty, staff, and graduate students in USM and Delaware institutions seek to provide curricula and instructional tools to assist K-12 teachers in implementing concepts of adaptation and mitigation to climate change in their lessons[264].

Increasingly, UMCES faculty members, with participation of graduate students, engage public and K-12 participants directly in

research through "citizen science." Some examples at the UMCES AL Laboratory are PopClock[265], Citizen Restoring American Chestnut[266] and Watershed Research Investigations: A Student-Teacher-Scientist Partnership to Support Healthy Streams[267] projects. All four UMCES Laboratories host open-house events, on-site presentations to schools and community groups, and other community events that depend on graduate students to share their research experiences and passion with learners of all ages. In summary, UMCES has an extensive and ongoing non-credit educational program that provides opportunities for faculty, students and staff to be engaged in community outreach and education[268].

Standard 14: Assessment of Student Learning

UMCES is committed to assessment of student learning outcomes to ensure that its educational programs are relevant, rigorous and comprehensive. Since being granted degree-granting authority by the Maryland General Assembly, these efforts are increasingly coordinated by the Office of the UMCES VP-Education. This office is evaluating policies for membership and appointment to the Graduate Faculty, coordinating student support at the UMCES level, and promoting faculty activity reporting. Leadership in the accreditation process and Self-Study came from the VP-Education Office. Ultimately the Office of the UMCES VP-Education may take on many of the functions of a provost's office in the comprehensive institutions within USM.

UMCES has consistently re-evaluated and refined its educational programs

The MEES Program was initiated in 1978 and underwent a rigorous evaluation in 1992[269]. That evaluation resulted in implementation of the current structure with AOS in Environmental Science, Ecology, Environmental Chemistry, Oceanography and Fisheries. UMCES conducted an assessment of MEES in 1996 to determine the effectiveness of the AOS structure[270]. In response, a sixth AOS – Environmental Molecular Ecology and Biotechnology was added.

MEES External Review 2008

The MEES Program conducted a self-study and underwent external programmatic review in 2008[140] [252]. The team of reviewers concluded that MEES was an excellent graduate program and an important asset to the mission of the USM. The external reviewers did recommend efforts to restructure the curriculum to leverage additional expertise across the USM[252]. A committee of high-level administrators was established in 2009 to recommend what actions USM should take in response to the external review[271] [252]. The newly proposed MEES curriculum, described above, responds to the recommendations and aims at both improving learning outcomes and their assessment[53].

Administration of UMCES educational programs

UMCES re-evaluated and refined its administration (see Chapter 4) to support its new authority to jointly grant degrees with other public institutions in Maryland (see Chapter 1). UMCES is now working diligently to improve its institutional capacity to evaluate and assess its educational offerings. A significant indication of this commitment was the establishment of the Office of the Vice President for Education in 2012. The UMCES VP-Education is responsible for implementation of graduate education policies and coordination of teaching activities[40]. The UMCES VP-Education represents UMCES on the Academic Affairs Advisory Council (AAAC) of the USM[272] and serves on the inter-institutional MEES Administrative Council described above. The UMCES VP-Education is well placed to oversee UMCES educational offerings and to ensure they are well integrated within the USM and, in particular, with MEES Program partner institutions.

Following establishment of the Office of the VP-Education was the re-activation of the UMCES GFC[40] in 2013. The GFC, which is chaired by the VP-Education, has two representatives from each Laboratory. By policy, one GFC member is Chair of the GEC at each Laboratory, who is appointed by the Laboratory Director[40]. The second Laboratory representative on the GFC is elected from each Laboratory by faculty ballot. The UMCES GFC, with direction from the VP-Education, has authority to design and implement graduate education activities[40], including assessment procedures. Primary among these responsibilities has been the revision of policies on appointment of faculty members to the UMCES Graduate Faculty[40]. Rigorous assessment and reappointment policies require faculty members to meet two of five conditions every 5 years: (i) major responsibility for teaching at least one course, (ii) significant participation in three graduate courses, (iii) supervision as major professor of at least one graduate student, (iv) membership on at least three graduate student committees, and (v) service on the UMCES GFC or Laboratory GEC.

Curriculum approval processes

Currently, UMCES partners with other fully accredited institutions within USM to ensure that educational and course curricula are thoroughly reviewed. For example, the UMCES MEES course curricula are reviewed and approved by the Program and Curriculum Committee (PCC)[273] at UMCP and, additionally, internally within the MEES Program by its Program Committee. UMCES seeks approval from partner institutions for core graduate courses taught by the UMCES faculty because, until the recent establishment of the UMCES Office of the VP-Education, it had lacked the institutional capacity to conduct these evaluations. UMCES will develop policies and structures that permit the UMCES GFC to serve as a course and curriculum approval body that parallels the Program and Curricula Committees on MEES partner campuses. The GFC has yet to fill this role, but capacity to achieve it is demonstrated by the leadership UMCES faculty displayed in the recent restructuring and revision of the MEES curriculum[53].

Evaluating rigor and effectiveness

UMCES is committed to evaluating the effectiveness of its graduate course offerings. Currently, evaluation occurs primarily through a common "MEES Course Evaluation" form[274] completed by students at the end of each course. The 12-question evaluation form includes questions on the instructor's ability to convey concepts clearly and concisely, the rigor of course content, the organization of course lectures and exams, and the conditions of the physical space (i.e. could students hear and see over the IVN system). Evaluations are anonymous. They include scores and written comments from the students. The forms are sent directly to the MEES Office where scores are collated and then returned to the

instructors, Laboratory Directors, and the UMCES VP-Education. Response rates vary among courses and from year to year but, on average, only 45% of students have responded by evaluating MEES courses. Results of the evaluations are considered by Laboratory Directors in their annual review of individual faculty members. To increase response rate and the scope of evaluation, the UMCP recently implemented a new, online course evaluation procedure that replaces the existing MEES forms[275].The new process provides a broader spectrum of information and allows statistical summaries and assessments of student responses.

The current and newly instituted approaches to course and teaching evaluation and assessment are improvements over past approaches. They gauge perceived satisfaction by students in the course but do not assess student performance against specific learning outcomes identified in the course syllabi, nor do they formally assess development of new skills by the students. Accordingly, UMCES faculty members are being encouraged by the VP-Education to develop or revise syllabi[52] to more explicitly specify student learning outcomes in the syllabus and to judge how well those outcomes were achieved in new summative assessments[276]. This evaluation process will help instructors to determine how effective they were at conveying the course material.

Quantifying student learning outcomes

UMCES currently utilizes traditional formative and summative assessments of students in graduate courses taught in the MEES Program. Among the formative assessments are assigned problem sets, term papers, formal examinations and project presentations (Table 7.5). Increasingly, and particularly since UMCES has initiated the accreditation process, these formative assessments are tied to evaluating specific student learning outcomes identified in each course syllabus. Building on these assessments, UMCES seeks to improve record-keeping of data collected through the assessment process to develop a longitudinal record of student performance.

UMCES uses a MOODLE online learning site and its content and learning management system[277]. Currently, UMCES uses MOODLE only as a content management system, but it has potential to serve as a learner analytic system. UMCES will develop a plan to evaluate its utility to model student performance and to provide data on procedures to improve educational programs in a more targeted fashion. UMCES also recognizes that it should more consistently track students over the course of their careers to provide longitudinal information on scientific productivity, application of their UMCES training, social networking, and career outcomes (Table 7.5).

Paralleling improvements in evaluation and assessment of coursework, UMCES is also improving evaluation and assessment of the student research endeavor. Students have always met at least annually with their graduate advisory committee to evaluate progress. The student has submitted a report and the committee completes an annual assessment of progress. This assessment report includes a list of requirements that the student must meet. Recently, these reports were improved and now require each committee member to assign progress by the student to one of five categories: unsatisfactory, marginal, satisfactory, good, and excellent[278]. The endorsed form is submitted to the UMCES VP-Education for transmittal to the MEES Program Office, thus strengthening a process by which UMCES tracks progress of its students.

UMCES will explore the use of its MOODLE content management system[278] to provide learner analytics to help in identifying approaches that will improve instruction and assessment of learning outcomes. There are plug-ins for MOODLE, such as SMARTKLASS[279], that provide a range of tools and dashboards to assist faculty in identifying students who may be experiencing problems with course content, and to compare student behavior and performance across students in a course, or across courses. If

Table 7.5. Matrix of educational assessment and evaluation in UMCES. The table shows a spectrum of formative and summative assessments together with more synthetic tools to evaluate the effectiveness of UMCES graduate programs. The table shows the state of development of each assessment and evaluation tool.

	METHOD			
Target	FORMATIVE ASSESSMENTS	SUMMATIVE ASSESSMENTS	LEARNER ANALYTICS	TRACKING
Student	Course problem sets, term papers and exams	Course evaluations	MOODLE site activity	Career outcomes and interviews
(Progress)	Existing	Existing	Planned	Existing and developing
Faculty	Student performance	Course evaluations	Faculty participation	Annual faculty evaluation
(Progress)	Existing	Existing	Planned	Existing and Developing
UMCES		Program evaluation	Modeling of student performance	Student retention, graduation, and career outcomes
(Progress)		MEES Curriculum Proposal completed in 2015	Planned	Existing and developing

successful, the implementation of learner analytics within MOODLE will allow modeling of the behavior and performance of successful students. Such information can be effective for informing incoming graduate students of expectations and behaviors that lead to success.

Quantifying faculty and mentor outcomes

Quantitative data on student learning outcomes can be analyzed also to infer performance of faculty, particularly when data are available longitudinally. Inclusion of teaching evaluations already is a part of annual faculty performance evaluations (Table 7.5). However, the broader vision is to catalyze change in faculty by showcasing academic transformation in how students are engaged, how material is taught, and how student performance is assessed. UMCES already does this to an extent by showcasing novel approaches to teaching using its IVN and incorporating innovations such as the flipped classroom format now used in MEES 698Y Science for Environmental Management, and the institution of student panel evaluations of research proposals used in MEES 631 Fish Ecology.

Educational offerings prepare students for professional life

Much of the training received by UMCES graduate students comes directly from formal coursework and the independent research that every student must conduct. However, students also are offered a range of professional development or application courses to add to their skill sets (see also Chapter 5). Students have numerous opportunities for professional development and networking through interactions with visiting speakers and scientists from academia, government and industry in weekly seminar series, special symposia, and workshops offered at each UMCES Laboratory. All Laboratories offer informal seminars or "brown bag" discussions that focus on professional development. For example, CBL periodically offers "brown-bag" seminars that focus on rotating themes related to career advancement or research ethics[280]. At HPL, a bi-annual scholar in residence program[281] invites distinguished scientists to lecture, discuss their research, and provide advice on career advancement through meetings with students and workshops. UMCES students participate in the annual MEES Colloquium that brings together MEES students from all partner institutions and features research seminars by students and prominent alumnae, and workshops and break-out sessions to address career advancement topics[161].

The clearest evidence that demonstrates both the quality of our graduates and the effectiveness of professional and career development resources available at UMCES is the successful and diverse record of job placement for UMCES graduates. After graduation, UMCES students generally find employment in academia, state or Federal Agencies, environmental non-profits, and industry. Of 237 students who graduated from UMCES from 2002-2014 (Figure 7.3), data on careers were available for 136. A substantial fraction (30%) is employed by academic institutions. However, fully 70% of the students moved on to non-academic careers, with most working in federal (19%) and state (11%) government. A substantial number moved on to careers in industries (18%) that are as varied as industrial chemists to CEOs of small start-up companies.

One measure of the success of UMCES students of which the institution is particularly proud is the success of its students in receiving prestigious NOAA/Sea Grant, Knauss Fellowships[282], which place highly qualified graduate students (or recent graduates) within either the legislative or executive branches of the US government in environmental and natural resource policy positions in Washington D.C. The current class of Knauss Fellows includes two from UMCES (Jeanette Davis, PhD 2015 and Jessica Foley, MS 2015). Other recent Fellows have included Jennifer Bosch (2013 – PhD received 2014, now full time at NOAA), Nicole Mehaffie (2013 – MS candidate, now at Pew Foundation), and Rebecca Holyoke (2010 –PhD received 2008, now full time at NOAA). As this Self-Study was being completed, two additional Knauss awards to UMCES students were announced; one to Alexandra Atkinson and one to Katherine Liu.

Compelling stories of success are seen in the diverse career paths of UMCES students[147]. Dr. Holly Bamford (MS 1998 MEES, PhD 2002 MEES) received her academic training at UMCES in environmental chemistry. She rose rapidly within NOAA to be the Acting Assistant Secretary for Conservation and Management. In her address to the UMCES 2015 graduating class, Dr. Bamford attributed her success to the interdisciplinary focus of education she received while at UMCES. Likewise, Dr. Debbie Bronk achieved prominence within the federal government as NSF Division Director for Ocean Sciences. Dr. Bronk (PhD, 1992 MEES) is now Professor of marine science at the Virginia Institute of Marine Science. UMCES students also find success outside government service and academia. For example, Veronica Caceres (MS 2001, MEES) investigated the role of small-scale turbulence on feeding success of fish larvae. Today, she is Secretary of the Inter-American Convention for the Protection and Conservation of Sea Turtles. Veronica is one of the many foreign students who come to UMCES, further emphasizing the appeal and impact of UMCES educational programs.

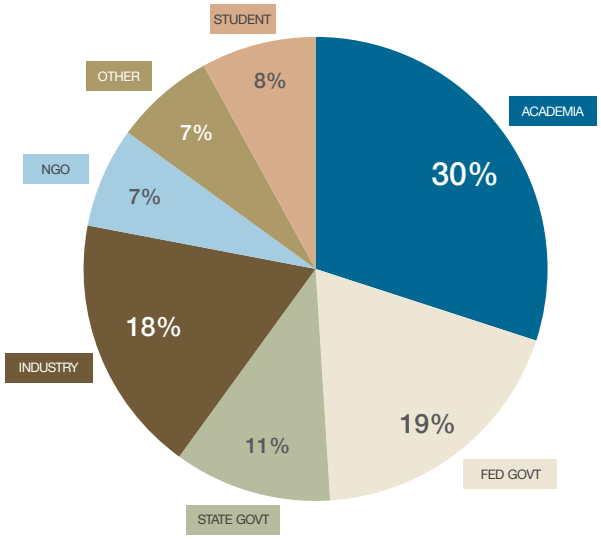


Figure 7.3. Career paths of UMCES MS and PhD students based on data from 2002-2014.

Conclusions and recommendations

UMCES generally meets expectations identified by the MSCHE in its Standards 11, 13 and 14 for an accredited institution. However, with its new degree-granting authority, UMCES must increasingly be responsible for defining and maintaining its educational standards, in addition to being compliant with assessment protocols now in place for the MEES Program and the Graduate School at UMCP. Success in the effort will require development of both reporting methods and data management standards that are UMCES-specific. UMCES will target graduate student, faculty, and institutional outcomes that will be measured by both qualitative and quantitative indices. Four recommendations are made.

Evidence that UMCES complies with expectations in MSCHE Standard 11

- UMCES provides leadership within the inter-institutional MEES Program in terms of faculty involvement, courses offered and number of graduate students enrolled. This leadership extends to driving curriculum revision and advancing student learning outcomes to meet the goals, interests and aspirations of students.
- UMCES has consistently evaluated its educational offerings. The newly proposed MEES curriculum seeks to strengthen student acquisition of scientific knowledge to enable graduates to shape policy for existing and emerging environmental challenges by integrating understanding of human and natural systems in line with the UMCES mission.
- Students who are trained in UMCES graduate programs possess skills sought by employers in academic, governmental, non-governmental and commercial enterprises.

Evidence that UMCES complies with expectations in MSCHE Standard 13

- UMCES offers graduate students a broad spectrum of professional development training. Much of this training is derived from mentoring by faculty advisors, but increasingly UMCES is utilizing seminar and formal courses to provide training in communication, ethics and quantitative methods.
- Students are encouraged and are offered opportunities to engage stakeholders, clients, and the public on a range of environmental issues in professional fora and public engagement.
- Although graduate study is the primary emphasis of education in UMCES, the institution nevertheless has substantial and successful involvement in K-12 education, undergraduate intern programs, teacher training, and citizen-based science.

Evidence that UMCES complies with expectations in MSCHE Standard 14

- Graduate education programs in UMCES have clear student learning outcomes that result in graduated professionals who are well qualified to enter the academic, governmental, non-governmental and industrial job markets.
- Formative and summative assessments are applied in UMCES to measure student learning outcomes. The results of these assessments, via traditional coursework evaluations and assessments, and via intensive mentoring by a student's graduate advisory committee, are regularly communicated to students, providing them opportunities to address gaps in knowledge or abilities.
- UMCES faculty members are assessed annually by Laboratory Directors with respect to involvement and effectiveness in teaching and graduate student mentorship. This assessment in part is based on results from summative course evaluations completed anonymously by students. New and improved evaluation tools are being developed.
- The recent establishment of the Office of the Vice President for Education in UMCES is fostering the culture of assessment. With the recent award of degree-granting status comes the responsibility to both improve internal management and improve assessment of graduate education and outcomes.

Recommendations

1. Within two years, UMCES should develop policies and structures that permit its Graduate Faculty Council to serve as a course and curriculum approval body that parallels the Program and Curricula Committees on MEES partner campuses.

UMCES has relied on its partner institutions for formal curriculum and program review. In its preparation for accreditation, UMCES established an Office of the Vice President for Education and restructured the UMCES GFC. UMCES should develop policies that ascribe responsibilities for course and program review, evaluation, and recommendations to its GFC with formal approvals by the VP-Education. The GFC has yet to fulfill this role, but capacity to achieve the goal was demonstrated by the leadership of the UMCES faculty in the recent restructuring and revision of the MEES Curriculum.

2. Within five years, UMCES should standardize and unify evaluation of student learning outcomes in ways that are compatible and complementary to existing assessment procedures.

UMCES uses a shareware content management system (MOODLE) to support instruction. This platform has existing, but unused, capacities that provide enhanced formative and summative assessment and evaluation tools. Led by the VP-Education and GFC, UMCES will explore and initiate adoption of learning analytics within its course content management system that will provide dynamic information to students and instructors while a course is being offered, and longitudinal data to faculty and administrators over time. There already is progress on these tasks as exemplified by the new summative assessment survey that has been employed recently by several UMCES-led MEES courses.

Chapter 8 *An institution committed to excellence*

Addresses Standard 7

Standard 7: Institutional Assessment. *The institution has developed and implemented an assessment process that evaluates its overall effectiveness in achieving its mission and goals and its compliance with accreditation standards.*

This year, UMCES celebrates a 90-year history of discovery, education, and public service in the environmental sciences. As an institution within the USM, UMCES benefits from the rigorous policies, constant oversight and critical review by the USM, by its BoR, the MHEC, and the Maryland General Assembly. Although a relatively new entity within the USM, UMCES has evolved as a unique "research institution" and is recognized as such by its contributions and service to the citizens of Maryland. In 2012-13, the BoR and General Assembly granted UMCES the authority to be degree-granting, pursuant to gaining accreditation from MSCHE. While highly regarded as a research institution, the substantial achievements of UMCES in graduate education had mostly been assessed and evaluated within the broader context of the USM graduate programs in which UMCES offers courses. The accreditation process and this Self-Study have highlighted the responsibility of UMCES to continuously assess all aspects of the institution's resources, planning processes, and activities to ascertain if UMCES is effective in conducting its mission, achieving its goals, and is true to its core values[27] [9].

The UMCES Self-Study was conducted after the approval of its ARR by MSCHE in November 2013. Approval of the ARR advanced UMCES to Candidacy for accreditation. The ARR itself constituted a broad evaluation by UMCES to assess its compliance with the MSCHE Standards of Excellence. The Self-Study is more detailed and comprehensive, incorporating both quantitative and qualitative measures into analysis and assessment of the structure and operations of UMCES.

UMCES has time-proven management procedures in place. Many policies and procedures are responsive to requirements of all USM institutions and therefore have the oversight of the USM. All policies and procedures are documented, reported at Executive and Administrative Council meetings, and are transparent to the UMCES community and its stakeholders, clients, and reviewers. As dictated by the USM and its BoR, UMCES revisits its mission statement[27] and institutional goals regularly. The latest review and approval of the UMCES Mission Statement by the BoR occurred in April 2014[283] [284]. It is important to note that UMCES has long recognized the need for self-examination and planning, which it has done periodically by developing new strategic plans, most recently in 2012[9]. The UMCES Facilities Master Plan[58], most recently implemented for 2012-22 is updated every five years and includes information consistent with the structure, function and mission of UMCES[27].

UMCES has been successful in steering research toward its key strategic themes. To address foundation themes of the Strategic Plan, UMCES is reinvigorating its faculty ranks through strategic recruitment. Faculty recruitment is guided strongly by the Strategic Plan and its research and educational initiatives aimed at dominant and emerging areas in environmental sciences while maintaining its success in addressing the broader objectives of the UMCES mission. Examples of success in strategic hires since 2012 are: Tsvetan Bachvaroff (Genes to Ecosystems)[285], Eric Davidson (Water Security, Human Welfare, Global Reach)[286], Michael Gonsior (Energy Choices, Human Welfare)[287], Laura Lapham (Water Security)[288], Yantao Li (Energy Choices)[289], Dong Liang (Human Welfare)[290], Viacheslav Lyubchich (Human Welfare, Global Reach)[291], Louis Plough (Genes to Ecosystems)[292], and Ryan Woodland (Human Welfare, Global Reach)[293].

The success of UMCES in carrying out its mission is in part attributable to the broad collaborative ethic that is pervasive throughout the institution despite geographic separation of individual Laboratory Units. UMCES is a small institution, without discipline-focused departmental structure, and its faculty members (and graduate students) are successful in developing and engaging in multi- and interdisciplinary research. Another measure of an institution's effectiveness and health is the degree to which shared governance is practiced. Shared governance and the structure to support it is the rule in UMCES. The structures to support involvement, reported in chapters 3-5 of this Self-Study, are in place, e.g., FS, GSC, Administrative Council, Executive Council, GFC, and the UMCES Staff Council.

Within UMCES, the establishment of the Office of the VP-Education in 2012 already has focused attention on amending policies, and on the kinds and quality of education delivered by the UMCES faculty. Working with the VP-Education, the re-established GFC is conducting critical evaluations and assessments of graduate faculty appointment policies, management and flow of educational data, and selection criteria for prestigious fellowships. As recognized in the overall institutional assessment conducted annually by the BoR and Maryland General Assembly[59], the graduate program in UMCES has 1) increased in stature; 2) UMCES is now awarding joint degrees in the MEES Program; 3) the MEES curriculum has been revised[53] and is being evaluated for implementation in 2016; and 4) a new MEES Program Framework Agreement[54] was drafted for approval by institutions that participate in MEES. All of these activities and actions have depended on collaborative, shared workloads at many levels in UMCES and the USM.

Implementing a culture of assessment

UMCES, independently and in response to USM directives, is continuously engaged in planning, evaluation and assessment of

its resources, facilities and subsequent successful implementation of programs (Chapter 3, Standards 2 and 3). Because UMCES is geographically dispersed, it is particularly important that the institution's planning processes and assessment of them are efficient, effective, and inclusive. Strategic planning has played a major role in the evolution of UMCES over the past three decades. In the 2004 Strategic Plan[7], the strategic planning process was accompanied by Self-Study[48] and external review[8]. The latest UMCES strategic plan[9] and revised mission statement (Chapter 2) have placed new emphasis on the human dimensions of environmental science, e.g., Human Welfare, Energy Choices, Water Security. The new emphasis in part reflects the addition of the newest unit to UMCES, the Institute of Marine and Environmental Technology, but also attests to the close link between ecosystem and societal health, and their prominence in the mission of UMCES. Emerging from this perspective is the addition of foundation courses in the socio-environmental disciplines within the newly proposed MEES curriculum[53]. The new curriculum and its inclusion of courses emphasizing human dimensions responds to an external review and assessment of the MEES Program[252], followed by internal review[140], and actions by the MEES Curriculum Committee and MEES Administrative Council.

Institutional assessment is closely linked to assessment of student learning and learning outcomes (Chapter 7), which themselves depend on availability of resources and institutional support of academic activities. UMCES is cognizant of this dependency and addresses it in its strategic planning and in its annual and periodic assessments of institutional effectiveness. In UMCES, graduate education, its conduct, and its support, are topics addressed at virtually all UMCES Executive Council and Administrative Council meetings.

A system that values assessment

UMCES is regularly reviewed and audited by the USM, the BoR, the MHEC, and the State of Maryland executive and legislative branches to ensure that it is meeting its mission while complying with federal and state laws, policies, and procedures. In this regard, UMCES is a partner in the USM, with its broad mission, system-wide strategic plan, and policies that are common to all 12 institutions[88]. UMCES also derives services from the USM, and especially from UMCP, allowing it to be a relatively flat institution with modest administrative overhead. Each of the 11 other USM institutions is accredited by MSCHE, providing models for UMCES to follow, while ensuring that interactions by UMCES with, and services derived from, those institutions are held to a high standard. The assessment processes being followed system-wide clearly benefit UMCES. Monthly meetings of the Academic Affairs Advisory Council[294] of provosts from the USM institutions, on which the UMCES VP-Education serves, are directed toward maintaining and improving the rigor and effectiveness of policies and procedures, for example, the new effectiveness and efficiency initiative[295], that are under continual review. Many system-wide policies and procedures are reviewed annually to evaluate how each of the USM institutions complies with academic standards, and meets expectations of enrollments, retention, and support of students[296].

UMCES is aware that it must review not only its institutional assessment procedures, but how those procedures are documented and supported. Effective assessment procedures and policies for the USM are in place. They broadly guide and benchmark standards to which each institution, including UMCES, must subscribe. Examples of annual data assessments include the Managing for Results Report[59] and the Dashboard Indicators Report[296] that are reviewed by the Legislature and BoR, respectively. As a small and unique institution in the USM, UMCES has developed compatible, approved policies and procedures that adhere to USM policies while meeting its needs to assess programs and activities[56]. UMCES provides leadership to the USM in its development of policies and procedures related to environmental sustainability[107] [297]. President Boesch serves as the USM Vice-Chancellor for Environmental Sustainability in addition to serving as President of UMCES.

Institutional commitment to assessment

UMCES engages in continuous and productive assessments and evaluation of performance. Many of these assessments are conducted in the spirit of shared governance common to UMCES. In these instances, internal and external assessments and strategic planning are conducted collaboratively by faculty and administration. The UMCES Administration is responsive to faculty agendas emerging through strategic planning by the FS and GFC, and via faculty reviews of UMCES administrative leadership. A good example is the current five-year review policy for Laboratory Directors[298] that now is also applied to Vice Presidents. The review policy was largely developed by the FS in collaboration with the Administrative Council. These reviews, in fact, also serve as assessments of institutional functions of the responsible administrators and, in this way, allow UMCES faculty, students, and staff to periodically express their views and levels of satisfaction of institutional function.

Laboratory Directors have substantial management and budget responsibility and independence. The Directors serve as a conduit of information between their Laboratory community's concerns and goals and the UMCES Central Administration. The Directors hold regular town hall meetings[299] to engage the entire Laboratory community on assessments of Laboratory and UMCES functions such as institutional budgets, salary and benefits, fiscal and facilities planning, new hires, new research and equipment initiatives and, importantly, to celebrate achievements of individual performance by staff, students, and faculty. Directors are well informed and in touch with the faculty, students, and staff at their Laboratory and they are the most efficient mode for conveyance of information and assurance of transparency across the broader UMCES community.

Sustainability of the UMCES enterprise

UMCES, through its Center Administration and Laboratories, historically has committed substantial resources to facilities and resources, even in difficult economic periods. These support activities and funds result from planning and resource allocation after deliberative evaluation and consideration at: the Laboratory levels (by Directors, GECs, and faculty) and at the Central Administration level (through Executive and Administrative Councils, FS, and GFC).

The UMCES business model is largely based on annual State Operating Appropriations and restricted and unrestricted funds from grants and contracts. The reality of annual appropriations from the State requires constant evaluation and assessment of funded programs by institutions in the USM, including UMCES. While the sources of funding fluctuate from year to year, the overall budget of UMCES has generally increased over time. Throughout each funding cycle the review and discussion of the budget and its possible effects on the UMCES mission and strategic plan are part of the overall assessment.

The capital budget is funded by the State and is based on the success of requests by UMCES to the USM BoR and ultimately the Governor and General Assembly. Facilities are high-quality and currently adequate to support the needs of UMCES. As new buildings come on-line the State generally increases the operating budget in accord with estimated utility and maintenance needs of new facilities. Currently, UMCES is replacing a research building with sea-water capabilities at CBL. Another facility (Information Commons Building at CBL) is slated for planning funds in FY 2017 should it be approved within the State's Capital Budget. During the working budget meetings with both the BoR and subsequently the State, UMCES carefully assesses its plans since the institution must defend requested allocations.

The USM BoR has recently instituted a new round of Efficiency and Effectiveness[64] in which each institution must develop plans to reduce operating costs through new practices and shared services within or between institutions. These plans are reviewed by the USM and BoR and calculated savings are computed and assessed. UMCES already has a strong record of shared services with other institutions such as payroll, purchasing, facilities planning and engineering, and tech transfer. The USM encourages shared services between institutions as much as practical and UMCES is constantly seeking new possibilities for shared services while evaluating services now in place. Assessing procedures is a key element as UMCES develops plans to reduce operating costs and/or create new efficiencies.

UMCES maintains strong Executive and Administrative teams, which deliberate and make numerous strategic funding decisions based on internal and USM-wide strategic planning and assessment. Fiscal management planning and outcomes constitute a major part of every bimonthly Administrative and bimonthly Executive Council meeting [300] [301]. These meetings are chaired by the President of UMCES who encourages open dialog and discussion on budget issues by members who represent all segments of the UMCES community.

New dimensions: Assessment and the accreditation process

As an institution not yet accredited, the ARR[22] and Self-Study processes themselves have instilled an awareness of the need for continuing assessment in UMCES. The Self-Study was an impetus to analyze, enumerate, and evaluate a broad range of institutional policies and procedures that has yielded statistics and baseline data on facilities, personnel and students that will carry forward in continuing assessments. In UMCES, much of the burden of enhanced assessment is likely to be borne by the Offices of the VP-Administration and VP-Education together with the Laboratory Directors. UMCES already is aware that the assessments and documentation in its ARR and this Self-Study Report must be maintained and expanded. Further improvements are recommended (see Chapter 9), especially in educational assessment.

In that regard, the Office of the VP-Education was instituted with commitment of institutional resources to support the accreditation process. The VP-Education has responsibilities to institute, improve, and assess education programs in UMCES. The VP-Education and UMCES GFC[40] [63] have been active in assessing UMCES Policies and Procedures[56] and have worked recently to 1) institute amended policies on graduate faculty appointments; 2) assess needs for and management of data in the education programs in which UMCES participates; and 3) develop protocols for evaluating Presidential Fellowship applicants[302]. To insure oversight and accountability, the VP-Education reports monthly to the UMCES Administrative and Executive Councils. Semi-annual reports by the VP Education to the faculty and administration are submitted and available on the UMCES website[63].

The prospect of accreditation was an impetus for UMCES to move forward in defining and assessing its role in graduate education. With the authorization to become degree-granting in 2013, UMCES formed a Curriculum Committee[35] to assess the current MEES Program, its curriculum, and, in particular, the involvement of UMCES faculty members in it. That action and assessments by the Committee played a key role in the subsequent appointment of the MEES Curriculum Committee[303] by the partner institutions in MEES and the proposal to restructure the MEES curriculum[53]. Accreditation of UMCES and degree-granting authority will bring greater scrutiny by oversight bodies (e.g., Maryland General Assembly, Maryland Department of Budget and Management) who will provide their own assessments of the benefits of UMCES to Maryland and the nation.

Assessment of faculty commitment and success

The UMCES faculty, its appointment protocols, credentials, productivity, and periodic review and assessment are strengths of the institution. UMCES continues to strengthen faculty review procedures that are conducted regularly. For example, all faculty members undergo a regular annual review. Junior faculty members in the tenure-track undergo a comprehensive and inclusive review for promotion five years after appointment. Additionally, periodic five-year comprehensive reviews of tenured Associate and Full Professors have been implemented[207]. As a primarily research institution, the commitment of UMCES faculty is heavily focused on research. Accordingly, evaluation of faculty members is weighted on the research side of their productivity. Evaluation and assessment of teaching expectations and workload will benefit from clarification. Developing a plan to evaluate and assess workload and commitment of UMCES faculty members to education and teaching is a recommendation of the Self-Study (see Chapter 9).

Effective education programs

The formal role of UMCES in education began with its involvement in the inter-institutional MEES Program[6] leading to research-based MS and PhD degrees. As documented in earlier chapters of the

Self-Study, the UMCES faculty has played a leading role in MEES since its inception in 1978. For example, UMCES faculty led the 1992 restructuring of MEES[269] that resulted in its current structure involving 6 AOS. As leaders of the current AOS in MEES, UMCES faculty members play a decisive role in formulating and evaluating programmatic criteria for 1) faculty participation in MEES; 2) acceptance of students into MEES; and 3) developing evaluation criteria at milestones and benchmarks of a student's tenure. This role and the involved processes effectively serve as evaluation and assessment tools for MEES and UMCES. At a broader level, graduate education in UMCES is integrated into and guided by the protocols and assessments of the accredited USM institutions with which UMCES partners in delivering graduate education.

Assessment of education outcomes within MEES occurs at several levels. Programmatically, learning outcomes of graduates in MEES are reasonably well specified. Each of the AOS[21] has its expectations and requirements that mesh with the broader expectation of learning outcomes in MEES[304]. At the course level, most graduate courses employ formative assessments to assess student mastery. UMCES faculty members involved in MEES have employed a range of creative approaches to ensure that MEES students attain mastery of concepts and professional skills (see Chapter 7). Faculty members also use summative assessment of their courses to determine the extent to which student learning outcomes are achieved. Assessment at the program level (MEES) is conducted in accord with the rigorous standards of UMCP and other USM institutions offering graduate degrees. UMCES accepts and adopts those protocols and strives to maintain or exceed the level of expectations of MEES and its partner institutions.

Independent research projects, required for MS and PhD degrees, are a core feature of UMCES graduate education programs. Rigorous and comprehensive procedures and milestones are in place in the MEES Program and in USM in general to assess student performance relative to expectations and benchmarks established programmatically in MEES and other graduate programs in which UMCES faculty teach and mentor students[6] [17] [18] [19]. At the institutional level, assessment of success is tied to evaluation of student performance, qualifications, retention rates, degree success rates, job success rates, journal publications, and success of its graduates, all of which are positive indicators of success in UMCES.

The Graduate School[20] and MEES Program[6] at UMCP undertake detailed application, admission and learning outcomes assessments for the MEES Program as a whole. As an accredited institution, UMCES must build an internal capability to track those students who apply, are accepted, and who are mentored, supervised, and instructed by UMCES faculty members. This capability must be developed by the Office of the VP-Education with strong involvement of the Laboratory Directors and the UMCES GFC. To the extent possible, UMCES should not duplicate administrative aspects of MEES that are already effectively performed by UMCP, but UMCES should independently evaluate the progress of its students and their learning outcomes. Doing this will not only better serve UMCES students and plans to improve graduate education in UMCES but will also contribute to improved ability to plan and assess learning outcomes throughout MEES.

Responding to assessment: A new MEES curriculum emerges

MEES is highly ranked nationally in external reviews and assessments[6] [252]. However, a changing educational landscape in environmental sciences indicated a need to consider change. MEES underwent a critical internal and external evaluation of the Program that was completed in 2013. The transformation recommended USM-wide commitment to cooperation and significant restructuring. UMCES took a leadership role in this overhaul, beginning in 2013. The restructuring was planned to support the commitment of UMCES to increase its role in graduate education, to award degrees, and to obtain accreditation from MSCHE. As a result, and with strong UMCES participation and initiative, the MEES Program is being improved and transformed into a program with broader appeal to graduate students in the environmental sciences[303] [53]. It is imperative that UMCES be aggressive yet vigilant in guiding, improving, and assessing this program in which >90% of UMCES graduate students matriculate and receive degrees (including the joint UMCES-UMCP degree). We anticipate that the new MEES curriculum[303] [53] will likely be implemented by Autumn 2016, and will fall under the oversight of the MEES Administrative Council, a USM-wide council of provosts and deans of institutions that participate in MEES. The Council has drafted a new Framework Agreement[54] that affirms the principles of MEES and commits participating institutions to excellence in administration and conduct of the program.

UMCES as a distance education institution

UMCES was a leader in the USM during the 1990s in instituting its interactive video network (IVN)[65] that supports real-time instruction and interaction between professors and graduate students at multiple campus sites. In UMCES, the USM IVN is supported by a MOODLE-based content learning system[26]. MSCHE defines UMCES as a distance-learning institution because more than 50% of its courses are delivered over a remote-access (IVN) medium. While no formal assessment of the IVN instructional modality has been conducted, it is perceived to be remarkably successful as a solution to the problem of delivering high-quality graduate courses to students at MEES institutions across the State of Maryland. The adoption of IVN technology has greatly reduced travel time of students and faculty who were previously required to travel to a central location for formal instruction. The IVN technology has also greatly increased availability of courses to students because all MEES courses must be taught and made available over this network. Modes of delivery by individual faculty members are evolving; for example, flipped classrooms, and enhanced video technologies (e.g., Camtasia). There is a need for assessment of the use and effectiveness of IVN and other distance-learning approaches, and the need for training of faculty in the pedagogy and delivery of graduate education via remote technologies.

Looking forward

UMCES is committed to employing institutional and educational assessment policies and procedures comprehensively, consistently and constructively. Efforts aimed at restructuring the MEES Program over the past two years[53], combined with work dedicated to the accreditation process, have prepared UMCES to strengthen its conduct and assessment of graduate education. This will require the continued evolution of the scope, role and responsibilities of senior administrators including the VP-Education, Laboratory Directors, and the faculty. Within UMCES, responsibility for evaluation, assessment, and improvement of graduate education will be borne increasingly by the recently established Office of the VP-Education that also represents UMCES in matters of academic interest to the broader USM community.

It is anticipated that an accredited UMCES will chart a course of excellence in graduate education for its students that exceeds expectations of the broader MEES Program. It is anticipated that new policies and new assessment tools will need to be developed. The early shoots of these innovations are evident in the explicit student learning outcomes now included in syllabi of the newest curricula and in faculty evaluation forms being used by some UMCES faculty members[305]. Importantly, the new tools should not be viewed as a single investment, but rather the first indications of an institutional investment and recurring commitment to excellence in graduate education. Although these new tools must be compatible with those used by our partners in MEES, UMCES must chart its own course to excellence within MEES.

Conclusions

Overall, UMCES succeeds in accomplishing what its mission statement says it will do. It has procedures in place to assess and evaluate institutional and learning outcomes. It is successful in scientific discovery and integration, and in the promotion of science applications. The evolving education programs are assessed at many levels, primarily in concert with partner institutions in the USM, but increasingly by internal UMCES assessments and assessment plans. UMCES is addressing thematic elements of its strategic plan effectively and has mechanisms in place to review and assess effectiveness. As such, UMCES is in compliance with the MSCHE Standards of Excellence. There is room for improvement. Some assessment approaches that are now qualitative and deliberative, particularly for education outcomes, can be transformed into quantitative metrics to provide better assessments. UMCES will work to institute such improvements over the next five years, led by efforts of the VP-Education and the reconstituted GFC. Some assessment procedures already have been developed, improved or revised. A culture of assessment is developing. That culture has been promoted by the involvement of UMCES faculty and staff in this Self-Study. It has instilled a new appreciation of how assessment contributes to continued excellence.

Chapter 9 *Conclusions, recommendations and path forward*

The Self-Study provided UMCES with an opportunity to broadly evaluate the institution and its structures and functions. The outcome confirmed that UMCES is accomplishing its mission and implementing its strategic plan. Administratively, UMCES is an effective and efficient institution, with a relatively small administration that is able to draw on resources of the USM to support its academic and research endeavors. UMCES prides itself in being a transparent organization in which faculty, staff, and students participate in shared governance. UMCES weathered difficult economic conditions in the past decade and continues as a vibrant research institution with faculty and students who aspire to preeminence in the environmental sciences.

Graduate education in UMCES is strong, and evolving. A new curriculum for the MEES Program, the inter-institutional USM program within which UMCES offers courses and advises students, was recently developed and is likely to be implemented in 2016. UMCES will continue its leadership in MEES. As an institution, UMCES must take greater administrative responsibility for its education programs that historically have been evaluated and assessed by the degree-granting institutions that are partners in MEES.

MSCHE designated UMCES as a Candidate for Accreditation in 2013. Subsequent to that designation UMCES has conferred more than 25 joint MS and PhD degrees (with UMCP) at the time this Self-Study Report was submitted to MSCHE. Although UMCES has achieved high standards in its educational programs, improvements in education delivery and assessment are possible and recommended. Administration and management of graduate education within UMCES falls under the recently instituted Office of the Vice President for Education. The VP-Education, with support of the faculty and UMCES Administration, is instituting plans and procedures to support graduate education, manage the collection and flow of student and course data, develop and amend policies on graduate faculty appointments, and improve the evaluation and assessment of student learning outcomes.

Recommendations

Institutional and administrative

Chapter 3 (Standards 2 and 3)

1: Beginning in FY 2016, UMCES will develop a five-year budget for planning purposes. (Addressing Standard 2).

Projections will be based on a number of factors, including: recent sponsored project trends and recovered overhead; information on changing operating funds provided via the USM on State General Funds; merit and COLA increases, and costs associated with fringe benefits; philanthropic support; faculty and staff turnover and new buildings and changes in utilities. The budgeting projections will assist UMCES in planning for implementation of its current strategic plan as well as establishing budget priorities. The process will be directed by the UMCES Vice President for Administration and will include the involvement of the Executive and Administrative Councils.

Chapter 4 (Standards 4, 5, and 6)

1: Within the next year, the reinvigorated UMCES Staff Council should initiate holding regularly scheduled meetings as well as coordinate and schedule all-staff meetings on at least an annual basis. (Addressing Standard 4).

The UMCES Staff Council had been inactive for many years. Active once again, the Council needs to develop a plan for action and participation in UMCES shared governance. The elected Chair of the Staff Council, with representatives from each of the UMCES Laboratories, should develop and formalize its plans to participate in and contribute to UMCES and USM-wide staff governance actions.

2: Within the next year, UMCES should better define the Vice President for Education position, its responsibilities and scope for development and management of education programs within UMCES. (Addressing Standard 5).

UMCES appointed its first Vice President for Education in 2012 in anticipation of the authorization to become degree-granting and the opportunity to seek accreditation from MSCHE. Currently, the VP-Education holds a 50% administrative appointment and a 50% faculty line. UMCES should engage its Executive Council, Faculty Senate and Graduate Faculty Council in a broad discussion to define the scope of activities and responsibilities of the VP-Education position and Office.

Faculty

Chapter 6 (Standard 10)

1: Within the next two years, UMCES should develop and implement institution-wide standards for evaluation of faculty performance in teaching and student mentorship.

The policy for UMCES faculty workload and performance has not been reviewed for over two decades and merits re-evaluation with increased emphasis on graduate education within the UMCES mission. Criteria for evaluation and assessment of faculty involvement and success in these endeavors are not clearly defined. In July 2015, President Boesch directed the Executive Council and Faculty Senate to assist him in developing new faculty standards, which are to be consistently applied across UMCES. Note: This recommendation also was made by the MSCHE Evaluation Team who reviewed the UMCES Accreditation Readiness Report.

2: Within the next two years, UMCES should develop and initiate a mentorship program for junior faculty that is instituted across its Laboratories.

Currently, faculty mentorship is performed at the individual Laboratories on an ad hoc basis. Over the next two years the UMCES Faculty Senate will work with the Executive Council,

Laboratory Directors, and GFC to develop a program of faculty mentorship to improve teaching, research, and advisory performance by young faculty.

3: Over the next five years, UMCES should improve training of its faculty in distance instruction, especially the effective use of the Interactive Video Network (IVN) and evolving technologies.

Utilization of IVN technology by UMCES faculty members is universal and apparently highly successful. Still, training in use of this teaching medium and other emerging technologies will improve course delivery, leading to better learning outcomes. As a small institution, UMCES cannot develop fully the capacity to provide instructional training internally. The Office of the Vice President for Education, working with the GFC, will seek out and develop faculty training programs for improved use of the IVN and other evolving distance learning technologies.

Education programs

Chapter 5 (Standards 8 and 9)

1: Over the next three years, UMCES should improve its system for maintaining student and alumnae records and rely less on the MEES Program and UMCP Graduate School. (Addressing Standard 8).

Currently, there is no single, centralized database in UMCES for its graduate students covering all programs in which UMCES students participate. A Data Flow and Management Committee of the UMCES GFC is addressing this need, under direction of the Office of the VP-Education. UMCES will develop a plan to collect and maintain data.

2: In FY 2016-17, UMCES should review and, if necessary, develop plans for improvement and/or clarification of student support services. (Addressing Standard 9).

There is a wide spectrum of student support services within the USM available to UMCES graduate students. Within UMCES, student support services are often handled in an ad hoc manner and the services available may vary among the Laboratory Units. The GFC and the GSC, working with the UMCES Administration, should determine if current support services meet the needs of UMCES students and, if not, develop a plan to provide the necessary services.

Chapter 7 (Standards 11, 13, and 14)

1: Within two years, UMCES should develop policies and structures that permit its Graduate Faculty Council to serve as a course and curriculum approval body that parallels the Program and Curricula Committees on MEES partner campuses. (Addressing Standard 11).

UMCES has relied on its partner institutions for formal curriculum and program review. In its preparation for accreditation, UMCES established an Office of the Vice President for Education and restructured the UMCES GFC. UMCES should develop policies that ascribe responsibilities for course and program review, evaluation, and recommendations to its GFC with formal approvals by the VP-Education. The GFC has yet to fulfill this role, but capacity to achieve the goal was demonstrated by the leadership of the UMCES faculty in the recent restructuring and revision of the MEES Curriculum.

2: Within five years UMCES should standardize and unify evaluation of student learning outcomes in ways that are compatible and complementary to existing assessment procedures. (Addressing Standard 14).

UMCES uses a shareware content management system (MOODLE) to support instruction. This platform has existing, but unused, capacities that provide enhanced formative and summative assessment and evaluation tools. Led by the VP-Education and GFC, UMCES will explore and initiate adoption of learning analytics within its course content management system that will provide dynamic information to students and instructors while a course is being offered, and longitudinal data to faculty and administrators over time. There already is progress on these tasks as exemplified by the new summative assessment survey that has been employed recently by several UMCES-led MEES courses.

Path forward

UMCES is committed to remain strong and responsive to its mission, strategic plan, and core values. With accreditation comes the expectation that the institution will not only be compliant with MSCHE Standards, but will continually strive to improve all aspects of its educational programs. UMCES willingly accepts that responsibility. Because UMCES is geographically dispersed across the State of Maryland, the Administration will remain vigilant to assure that all Laboratory Units are well supported, fiscally responsible, and able to maintain the facilities necessary to be preeminent in the environmental sciences. Already a leader of the MEES Graduate Program, UMCES must assert leadership in both the implementation and conduct of the newly restructured MEES curriculum. It is the aspiration of UMCES to grow its graduate student population from the present number of 85 to 100 in the next five years. Additionally, UMCES aspires to develop and implement professional certificate programs in the marine and environmental sciences over the next five years. UMCES and its partnering institutions have evaluation and assessment procedures in place to assure excellence in the MEES Program, but the need for certain improvements was identified in this Self-Study. UMCES will immediately work to institute and implement improved education delivery and assessment processes that are highlighted in Recommendations of the Self-Study.

UMCES scientists adopt and implement the newest technologies, including the ocean glider instrument depicted here that autonomously surveys the ocean environment.

Source Documents

1. Natural Resources Article (Md. Code Ann. Com. Law §§ 3-401)
2. Natural Resources Article (Md. Code Ann. Com. Law §§3-402)
3. Natural Resources Article (Md. Code Ann. Com. Law §§3-403)
4. Education Article (Md. Code Ann. Com. Law §§10-101)
5. Education Article (Md. Code Ann. Com. Law §§ 12-104)
6. MEES Program
7. UMCES 2004 Strategic Plan From Vision to Reality
8. UMCES External Review 2004
9. UMCES 2012 Strategic Plan Focus on the Future
10. Brochure of educational offerings at the UMCES Chesapeake Biological Laboratory for the Summer of 1932
11. MEES History
12. Maryland General Assembly (House Bill 268)
13. Md. Code Ann. Com. Law §3-403(a)(8)
14. MOU between UMCES and the University of Maryland College Park (UMCP), 2012
15. Agreement (December 2012) in place between UMCES and UMCP
16. UMCP College of Computer, Mathematical, and Natural Sciences
17. BISI program
18. UMB - Graduate Program in Life Sciences
19. FSU - Biology Department at Frostburg State University - Ecology
20. UMCP Graduate School
21. MEES AOS Overview
22. UMCES Self-Study Design
23. Steering Committee Membership
24. Working Group Membership
25. MOODLE: Electronic Distribution of Teaching Material
26. UMCES Mission Statement
27. Maryland State Plan for Postsecondary Education
28. USM Strategic Plan
29. Chancellors Accreditation Support
30. USM Board of Regents Minutes (6/22/2012)
31. IAN
32. SESYNC
33. Maryland Sea Grant College
34. UMCES Task Force on MEES
35. Draft Framework Document for the USM-wide MEES Administrative Council
36. UMCES Faculty Senate
37. UMCES Policy on Faculty Senate (II-3.00)
38. UMCES Graduate Faculty Council
39. UMCES Policy and Procedures on Graduate Education (III-7.10)
40. UMCES 1993 Strategic Plan
41. USM Board of Regents
42. UMCES Policy on the Graduate Assistantships (III-7.11)
43. UMCES Annual Faculty Convocations
44. UMCES Policy on Organization of UMCES (I-6.00.1)
45. UMCES Administrative Council Agendas
46. UMCES Executive Council Agendas
47. UMCES 2004 Self-Study
48. Institute of Marine and Environmental Technology
49. Ratcliffe Foundation Grant Supporting Entrepreneurial Leadership

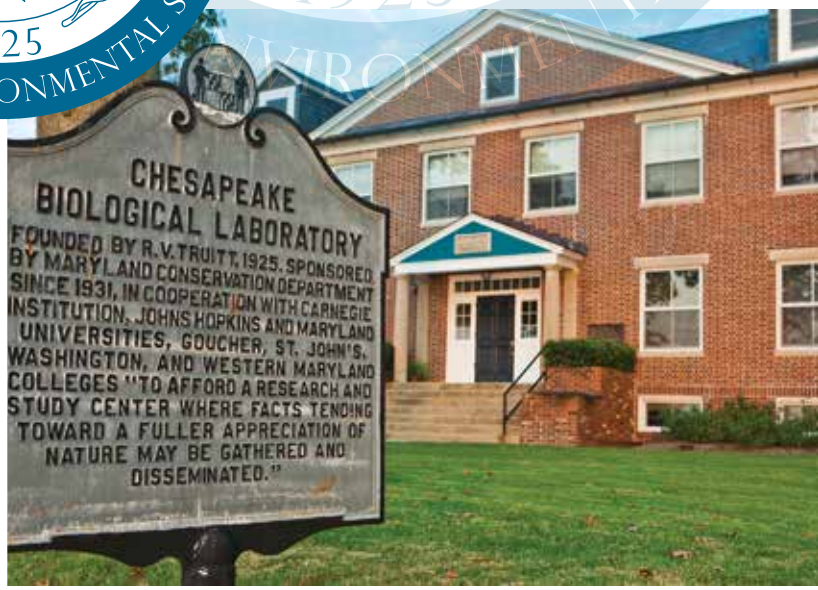
51. Entrepreneurship Programs at IMET
52. UMCES Environmental Statistics Collaborative
53. A Vision for the Marine, Estuarine and Environmental Science Program
54. MEES Administrative Framework Agreement
55. MEES Program Committees
56. USM and UMCES Consolidated Policies
57. UMCES Policy on Shared Governance (I-6.00)
58. UMCES Facilities Master Plan Full Report
59. Maryland State Budget Book – USM (pages III-243-246)
60. 2014 UMCES from MD Budget Book
61. UMCES Memorandum on Tuition Return from MEES
62. Office of the Vice President for Education
63. E&E 2.0 Plan
64. IVN
65. The France-Merrick Professorship in Sustainable Ecosystem Restoration
66. UMCES 2012 Master Plan
67. USM Board of Regents Capital Budget Plan for the Next 10 Years (see pages 5 & 6)
68. USM Policy on Facilities Renewal for Auxiliary and Non-Auxiliary Capital Assets (VIII-10.10)
69. UMCES Research Fleet
70. IAN
71. IAN Science Communication Services
72. IAN environmental report card production
73. IAN Training and capacity building
74. Nationwide Sea Grant Programs
75. Chesapeake Quarterly
76. UMCES CBL Library
77. UMCP Research Port
78. USMAI
79. Alliance for Coastal Technologies
80. Aquaculture Resource Center at Columbus Center
81. HPL Oyster Hatchery
82. Oyster Recovery Partnership
83. BASLab
84. CBL Nutrient Analytical Services Laboratory
85. HPL Analytical Services
86. American College & University Presidents' Climate Commitment
87. USM
88. USM Council of University System Staff
89. USM Policy on the Council of University System Staff (I-3.50)
90. USM Board of Regents Bylaws
91. USM Board of Regents Members
92. USM Board of Regents Bylaws, Article II
93. Maryland State Ethics
94. USM 2015 Legislative Testimony
95. USM Policy on Performance Evaluation of the Chancellor and the Institution Presidents/Center Directors of the University of Maryland System
96. UMCES Policy on Graduate Assistantships (III-7.11) (Section VI)
97. MOU between UMCES and The Maryland Classified Employees Association
98. UMCES Presidential Review by the Chancellor and Board of Regents
99. USM Board of Regents Bylaws Document, Article V
100. UMCES Presidential Profile

103. UMCES Administration
104. R/V Rachel Carson
105. UMCES President as Interim Vice Chancellor of Academic Affairs
106. UMCES President Don Boesch Appointed USM Vice Chancellor of Environmental Sustainability
107. UMCES System Organizational Chart
108. UMCES Administration Organizational Chart
109. USM and UMCES Policies on Personnel (Section VII)
110. UMCES Policy on Misconduct in Scholarly Work (III-1.10)
111. USM Policy on Faculty, Student and Institutional Rights and Responsibilities for Academic Integrity
112. UMCES Formal Request, Problem, Complaint, or Grievance
113. UMCES Policy on Faculty Grievances (II-4.0)
114. USM Policy on Grievances for Exempt and Non-Exempt Staff Employees (VII-8.00)
115. UMCES Website
116. UMCES Course on Responsible Conduct in Research
117. MEES Orientation Guide 2014
118. UMCES Consumer Information Webpage
119. USM Policy on Academic Integrity (III-1.00)
121. USM Policy on Classified and Proprietary Work (IV-2.20)
122. UMCES Policy on Human Subjects in Research (IV-2.10)
123. UMCES Policy on Care and Use of Vertebrate Animals in Research and Graduate Studies
124. USM Policy on Intellectual Property (IV-3.20)
125. USM and UMCES Policies Sections III-7 and IV-3
126. UMCES MOU with UMBC
127. UMCES Policy on Faculty, Student And Institutional Rights and Responsibilities for Academic Integrity (III-1.0)
128. UMCP Graduate Catalog Academic Policies (Section F)
129. UMCES Policy on Sexual Misconduct (VI-1.60)
130. UMCP Graduate Catalog
131. UMCES Graduate Education
132. UMCES 2012 Presidential Review
133. UMCES Employment
134. MEES Admissions
135. GPILS Admissions
136. BISI Admissions
137. FSU Admissions
138. MEES AOS Prerequisites
139. UMCP Graduate School Acceptance Letter
140. MEES Self-Study 2008
141. UMCES Tuition Remission
142. UMCES Graduate Assistant Stipends
143. UMCES Presidential Fellowship
144. CBL Fellowship
145. HPL Assistantships
146. Living Marine Resources Cooperative Science Center
147. UMCES Alumni Profiles
148. NSF Time to Degree of U.S. Research Doctorate Recipients
149. Council of the Graduate Schools - PhD Completion Rate
150. MEES Approved Program Form
151. UMCES Graduate and Faculty Handbook
152. UMCP Graduate School Office of the Ombudsperson
153. UMCES Policy on Evaluation and Performance of Faculty (II-1.20)
154. UMCES Faculty Convocation 2015

155. UMCES Faculty Senate Agendas and Meeting Summaries
156. UMCP International Student and Scholar Services Office
157. HPL Seminar Series
158. CBL Distinguished Scholar Seminar Series
159. AL Seminar Series
160. IMET Event Schedule
161. MEES Colloquium
162. UMCES Graduate Student Council
163. Maryland Higher Education Commission
164. Ratcliffe Environmental Entrepreneurs Fellowship (REEF) Program at IMET
165. IMET Entrepreneurs' Office Hours
166. IMET Business Incubator Program
167. UMCP Counseling Center
168. UMCP DSS
169. UMCP Counseling
170. UMCP Learning Assistance
171. UMCP Testing Assistance
172. UMCES-IMET LMRCSC program
173. COMAR Policy on Library/Learning Resource Center
174. UMCES HPL Library
175. UMCES Safety Information
176. UMCES e2 Campus Alert System
177. UMCES Environmental Safety Compliance Officer
178. UM Environmental Health and Safety
179. UMCP Biosafety
180. State of Maryland Boating Safety Certification
181. UMCES State Vehicle Usage Form
182. UMCES Travel Policy (VII-11.00)
183. Divers Alert Network (DAN)
184. UMCES Dive Safety Officer
185. American Academy of Underwater Sciences
186. UMCP Graduate School Policies
187. UMCP Policy for Review of Alleged Arbitrary and Capricious Grading (III-1.20)
188. USM Policy on Sexual Misconduct (IV-1.60)
189. USM Policy on Affirmative Action and Equal Opportunity (VI-1.00)
190. USM Policy of Non-Discrimination on the Basis of Sexual Orientation (VI-1.05)
191. UMCP Policy on Equity, Diversity, and Inclusion
192. UMCES Affirmative Action Plan for Minorities and Women
193. UMCES Affirmative Action Plan for Veterans and Individuals with Disabilities
194. UMCES Original Policies
195. UMCES Policy on Verification of Professional Credentials (II-1.02)
196. USM Regent's Faculty Awards
197. USM Regent's Award Recipients at UMCES
198. UMCES Policy on Appointment, Rank, and Tenure of Faculty (II-1.00)
199. Chesapeake Biological Laboratory
200. Horn Point Laboratory
201. Appalachian Laboratory
202. MEES Faculty
203. UMCES Policy on Faculty Workload (II-1.25)
204. USM Policy on Appointment, Rank, and Tenure of Faculty (II-1.00)

207. UMCES Policy on Comprehensive Review of Tenured Faculty Members (II-1.19)
208. USM Policy on Verification of Professional Credentials (II-1.02)
209. USM Policy on Concurrent Faculty and Administrative Appointments (II-1.03)
210. UMCES President's Award for Excellence in Application of Science
211. UMCES ARR Evaluation Team Report
212. Procedures for Appeals to the University System of Maryland (USM) Board of Regents of Decisions to Terminate Tenured or Tenure-Track Faculty Members (II-1.04)
213. UMCES Faculty Members Named Admiral of the Chesapeake Bay
214. Supplemental Table on Advisory Posts
215. UMCES NSF Grant Award
216. Maritime Environmental Resource Center
217. UMCES Presidential Award for Science Application
218. Baltimore Sun Article: Study Aims to Shield Marine Mammals from Offshore Wind Projects
219. Dr. Fisher as recipient of NSF Grant
220. NSF Grant to Dr. Fisher
221. UMCES Study on Chesapeake Bay Algae Blooms
222. UMCES Research Paper on blooms in the East China Sea
223. Supplementary Table of Faculty Book Publications
224. Virginia Institute of Marine Science
225. Marine Biological Laboratory
226. Cary Institute of Ecosystem Studies
227. CBL Faculty Handbook
228. USM Center for Academic Innovation
229. UMCP Teaching and Learning Transformation Center
230. UMCES Annual Report 2014
231. UMCES Environmental Insights Newsletter
232. Advisory and Technology Transfer Activities Conducted by UMCES Faculty
233. Dr. Eshleman UMCES President's Award
234. USM Policy on Intellectual Property (IV-3.20)
235. UMCES News and Events
236. IAN Ecocheck
237. Technically Baltimore Article on IMET's Marine Research
238. UMCES News Article on Algae and Greenhouse Gases
239. Appalachian Laboratory Environmental Science Education
240. Horn Point Laboratory STEM Center
241. UMCES Teacher Research Fellowship Program
242. UMCES Visitors Center and Outreach
243. Maryland Sea Grant Research Experiences for Undergraduates
244. UMCES Office of Research Administration and Advancement
245. MEES M.S. Graduate Degree Outcomes
246. MEES PhD Graduate Degree Outcomes
247. MEES Courses
248. MEES Doctoral Requirements
249. MEES Master's Requirements
250. North American Journal of Fisheries Management - Best Paper 2014
251. MEES External Review 2008
252. MEES Administrative Council Framework Agreement
253. A New Biology for the 21st Century
254. AL IVN Information
255. CBL Computer Services

258. HPL IVN Information
259. Algal Biofuel Research
260. COSEE Coastal Trends Center
261. Teach Ocean Science
262. COSEE Teacher Research Experience
263. UMCES RE STEM Program
264. MADE CLEAR
265. PopClock
266. Citizen Restoring American Chestnut
267. Watershed Research Investigations: A Student-Teacher-Scientist Partnership to Support Healthy Streams
268. UMCES Non-Credit Educational and Outreach Activities
269. 1992 Reorganization of the Graduate Program in MEES
270. MEES and CEES Review 1996
271. USM Committee on MEES Report
272. USM Origins and Functions
273. UMCP Programs, Curricula & Courses (PCC)
274. MEES Course Evaluation Form
275. UMCP Course Evaluations
276. UMCES Course Syllabus: Environmental Statistics I
277. MOODLE Content Manager System
278. MEES Student Progress Report
279. SMARTKLASS
280. CBL Brown Bag Seminars
281. HPL Scholar-in-Residence Program
282. UMCES NOAA/Sea Grant Knauss Fellows
283. USM BoR Committee on Education Policy and Student Life Meeting Agenda, 30 April 2014
284. USM BoR Meeting, 27 June 2014 (approvol of 30 April 2014 Meeting Minutes)
285. USM Academic Affairs Advisory Council
286. USM E&E Initiative
287. USM Dashboard Indicator 2014
288. USM Environmental Sustainability and Climate Change Initiative
289. Five Year Review Policy of VPs and Directors
290. UMCES Presidential Fellowship Criteria
291. MEES Curriculum Committee
292. MEES Guide for Prospective Students



Laboratories of the University of Maryland Center for Environmental Science: Horn Point Laboratory (upper left); Chesapeake Biological Laboratory (upper right); Institute of Marine and Environmental Technology (lower left); Appalachian Laboratory (lower right).