School of Marine Science

Graduate Catalog 2002-2003

The College of William and Mary

August 2002

NOTE: This catalog provides announcements for the 2002-2003 academic year. It is current until August 2003. The College reserves the right to make changes in the regulations, charges, and curricula listed herein at any time.

Catalogs are issued for College programs as follows:

Undergraduate
School of Business Administration
School of Education
Graduate Studies in Arts and Sciences
School of Marine Science
Marshall-Wythe School of Law
Summer Sessions
Special Programs

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(757) 221-2615

The policies in this catalog apply to students who matriculate into the School of Marine Science graduate program in the academic year 2002-2003.

School of Marine Science

Graduate Catalog 2002 - 2003

www.vims.edu

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Contents

Calendar

Fall Semester 2002

August

26	Mon.	Tuition and Fees for 2002 Fall Semester Due
26-27	Mon.-Tues.	Orientation Period
26-27	Mon.-Tues.	General Registration & Registration for Incoming SMS Students
28	Wed.	FIRST DAY OF CLASSES: 8:00 am Beginning of Add/Drop Period for 2002 Fall Semester

September

6	Fri.	Last Day to Add/Drop a Class for Fall 2002 Semester
6	Fri.	NOTICE OF CANDIDACY FOR GRADUATION Forms due to SMS Registrar for December 2002 candidates
9	Mon.	Beginning of Period for Withdrawal from a Class with Grade "W"

October

4	Fri.	Last day to file for May or August 2003 Graduation
11	Fri.	Mid-Semester (for grading purposes only)
12-15	Sat.-Tues.	Fall Break
28–Nov. 1	Mon.-Fri.	Graduate Student Registration Period for Spring 2003

November

1	Fri.	Last Day to Withdraw from a Class with a Grade of "W" for 2002 Fall Semester
15	Fri.	NOTICE OF CANDIDACY FOR GRADUATION Forms due to SMS Registrar for May 2003 candidates
27	Wed.	Beginning of Thanksgiving Holiday: 8:00 am

December

2	Mon.	End of Thanksgiving Holiday: 8:00 am
6	Fri.	END OF CLASSES: 5 pm
7-8	Sat.-Sun.	Reading Period
9-10	Mon.-Tues.	Examinations
10	Tues.	LAST DAY TO SUBMIT THESES AND DISSERTATIONS FOR DECEMBER 2002 CONFERRAL OF DEGREES
11	Wed.	Reading Period
12-13	Thurs.-Fri.	Examinations
14-15	Sat.-Sun.	Reading Period
16-19	Mon.-Thurs.	Examinations
23	Mon.	OFFICIAL DECEMBER GRADUATION DATE

Spring Semester 2003

January

13	Mon.	Tuition and Fees for 2003 Spring Semester Due to SMS/VIMS Cashier
15	Wed.	FIRST DAY OF CLASSES: 8 a.m. General SMS Graduate Student Registration Beginning of Add/Drop Period for 2003 Spring Semester
24	Fri.	Last Day to Add/Drop a Class for 2003 Spring Semester
27	Mon.	Beginning of Period for Withdrawal from Course with Grade of "W."

March

1-9	Sat.-Sun.	Spring Break
7	Fri.	Mid-Semester (for grading purposes only)
21	Fri.	Last Day to Withdraw from Course with Grade "W" for 2003 Spring Semester
24-28	Mon.-Fri.	GRADUATE STUDENT REGISTRATION PERIOD FOR FALL 2003

April

14-16	Mon.-Wed.	Open Drop/Add for 2003 Fall Semester
25	Fri.	END OF CLASSES: 5 pm
26-27	Sat.-Sun.	Reading Period
28	Mon.	LAST DAY TO SUBMIT THESES AND DISSERTATIONS FOR MAY 2003 CONFERRAL OF DEGREES
28-May 2	Mon.-Fri.	Examinations

May

3-4	Sat.-Sun.	Reading Period
5-7	Mon.-Wed.	Examinations
11	Sun.	COMMENCEMENT

Summer Sessions 2003

SESSION I: May 27-June 27 (Tues.-Fri.)
SESSION II: June 30-August 1 (Mon.-Fri.)

May 23	Fri.	NOTICE OF CANDIDACY FOR GRADUATION Forms due to SMS Registrar for AUGUST 2003 Candidates
July 25	Fri.	LAST DAY TO SUBMIT THESES AND DISSERTATIONS FOR AUGUST 2003 CONFERRAL OF DEGREES
August 4	Mon.	AUGUST 2003 GRADUATION DATE

The College of William and Mary

The College of William and Mary in Virginia, founded in 1693, is the nation's second oldest institution of higher education. During its 305-year history, the College has built an eminent reputation for excellence in education. The College's commitment to a thorough, well rounded education through exploration, innovation and involvement is the source of institutional coherence. Today the College is national and international in its character and contributions. Students and faculty from diverse backgrounds are attracted to both the undergraduate programs and the various schools offering graduate studies.

The College of William and Mary is a small, residential university currently enrolling approximately 5,400 undergraduate and 2,300 graduate students. The School of Arts and Sciences offers Masters and Doctorate degrees in several departments. Graduate degrees may be pursued in four professional schools: Marshall-Wythe School of Law, the School of Business Administration, the School of Education and the School of Marine Science.

The College is accredited by the Southern Association of Colleges and Schools. In keeping with the College's mission as a state institution, a wide range of courses, seminars and programs both for credit and non-credit are offered on all campuses.

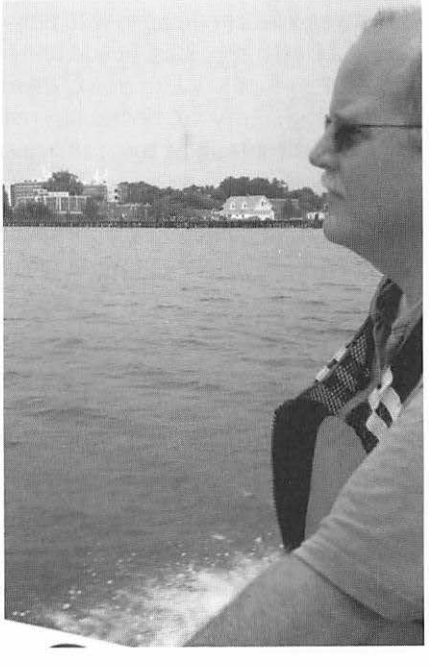
School of Marine Science/ Virginia Institute of Marine Science

Since it's founding more than 60 years ago, the Virginia Institute of Marine Science has functioned under a tripartite mission: to conduct independent research, to provide advisory services, and to provide education in the marine sciences. The School of Marine Science is the academic program within the Virginia Institute of Marine Science. It is one of four graduate schools of the College of William and Mary. The School of Marine Science awarded its first Masters degree in 1943 and inaugurated a Doctoral program in 1964. Over the past 58 years more than 500 marine scientists have earned graduate degrees from the School of Marine Science.

At present the School of Marine Science has 130 graduate students; about one-half are working on their Masters theses and one-half are working on Doctoral dissertations. The School receives approximately 200 applications per year from prospective students. Approximately 25 enter the program each academic year.

Statement of Purpose for the School of Marine Science

The purpose of the School of Marine Science is to provide quality education and opportunities in scholarly research to students pursuing advanced degrees in marine science. The objective of the program is to provide a fertile and stimulating learning environment in which students can pursue their studies. This is accomplished by providing a comprehensive program in the basic principles of marine science and marine resource management, and close interaction with faculty actively involved in research and management issues.



Facilities

School of Marine Science students participate in graduate studies at an active, year round research facility with approximately 350 scientists, support technicians and staff. The 35-acre main campus of the School of Marine Science/Virginia Institute of Marine Science (SMS/VIMS) is located in Gloucester Point at the mouth of the York River, a major tributary and natural passageway to the Chesapeake Bay and Atlantic Ocean.

The Eastern Shore Laboratory offers access to embayments, salt marshes, barrier beaches and coastal waters. Located in Wachapreague, about 2 hours from Gloucester Point, this facility is an important center for research in bivalve aquaculture and houses a hatchery, a nursery facility and nearby bivalve grow-out sites. A seawater flume laboratory is also located on the campus. The Aquaculture Genetics and Breeding Technology Center (ABC) operates an experimental shellfish hatchery for genetics and breeding studies of hard clams, oysters, soft-shell clams, scallops and other species.

Various service centers and special programs at the SMS/VIMS complement and enhance the student's experience.

Library: Current holdings include more than 530 journal subscriptions, 61,869 volumes and 29,114 titles in addition to topographic maps, nautical charts and scientific archives. Online networks provide access to marine science literature, and a wealth of electronic databases offered by the Commonwealth of Virginia. Students in the SMS/VIMS library have access to on-line catalogs at Swem Library on the main campus of William & Mary. In addition VIMS has a Web interface to an on-site search engine, which enables it to present local bibliographies.

Vessels: The SMS/VIMS maintains and operates a fleet of 40 vessels for research. Larger vessels are equipped with flow-through seawater, sample collection-analysis labs and electronics labs. In addition to the 65-foot R/V *Bay Eagle*, 44-foot R/V *Langley*, and 29-foot R/V *Fish Hawk*, there is a sizable trailerable fleet. State-of-the-art electronic systems can be transferred among the smaller boats. The diving facility includes a diver training room and classroom to support the 40-member dive team.

Information Technology and Networking Services Unit: ITNS provides technical support for all computer platforms used on campus, in addition to maintaining a campus-wide backbone network linked to Internet and several local area networks (LANs).

Aquaculture Breeding Center: The Gloucester Point Hatchery is utilized by the Aquaculture Genetics and Breeding Technology Center and maintains varieties and stocks of native and non-native oysters. The Marine Advisory Program recently established a new greenhouse complex for fish culture.

Analytical Service Center: The Analytical Service Center (ASC) provides nutrient, physical and sediment analyses to students, scientists and governmental agencies managing and developing diversified environmental programs as well as thesis projects. The ASC has researched, refined and developed methodologies for analysis in a wide spectrum of environmental matrices. The quality of data is the result of thorough

statistical controls, documentation, and training. ASC instrumentation is state-of-the-art, with computer control interfacing, background correction and optimization for saline matrix.

Nunnally Hall: Completed in 1992, Nunnally houses the extensive fisheries collection that includes approximately 85,000 specimens representing 247 families.

Chesapeake Bay Hall: Completed in spring 1997, this facility provides 60,000 sq. feet of research facilities, including labs for advanced research in chemistry, geochemistry, toxicology, pathobiology, microbiology, genetics, physiology, planktology, nutrient cycling and parasitology.

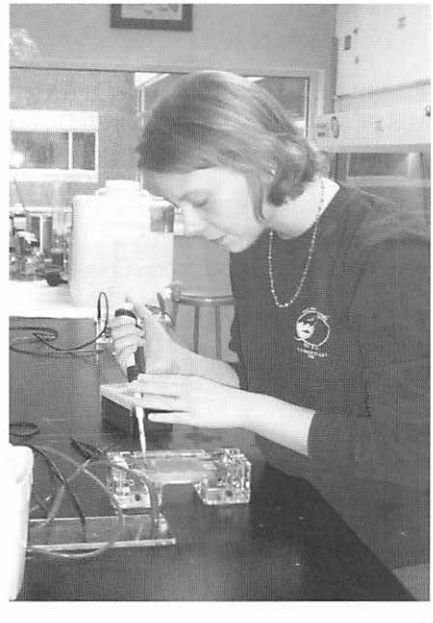
Programs

Marine Advisory Service/Virginia Sea Grant Program: Serves as a liaison between commercial and recreational marine related industries, providing them with access to the Virginia university system.

Chesapeake Bay National Estuarine Research Reserve System: VIMS is the lead agency in Virginia, with four designated sites preserved for estuarine research, monitoring, education, and conservation of key resources.

Center for Coastal Resources Management: Focuses on applied research, advisory service, and outreach activities in support of government agencies and nongovernmental organizations involved in resource management. Continuing work is conducted in tidal and non-tidal wetlands, estuarine and coastal shorelines, geographic and living resource inventories, and watershed management. The Center engages in a wide variety of interdisciplinary projects and provides a forum for multi-investigator and multi-institutional applied research.

Cooperative Marine Education and Research Program (CMER). The CMER Program is a formal agreement between the College of William and Mary and the National Marine Fisheries Service (NMFS) that stations a senior NMFS scientist as a faculty member at VIMS. The program also includes direct research funding that supports three graduate students, and offers students a variety of opportunities to participate in NMFS research. Dr. Richard Brill, a noted fish physiologist, serves as director of the VIMS CMER Program.



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Graduate Study Programs

Research at SMS/VIMS emphasizes the study of coastal and marine environments from estuaries to the continental slope. Interdisciplinary programs are encouraged. In addition to teaching and conducting basic research, many of the faculty is engaged in applied research of concern to industry and management agencies. Students often find that their assistantship duties and/or research activities offer opportunities that bring them in close contact with other departments at SMS and William and Mary, marine related industries, and state, regional, and federal management agencies.

Based on the primary academic and research disciplines represented at SMS/VIMS, graduate studies are offered in five major areas.

Biological Sciences

The Department of Biological Sciences includes a diverse group of biologists and ecologists working in a variety of disciplines from microbiology and taxonomy to ecosystem modeling. Scientists in the department are engaged in research aimed at elucidating the temporal and spatial patterns and processes controlling benthic, nektonic, and planktonic systems in estuarine, coastal and open ocean regimes.

Major Programs

Benthic Ecology: Studies focus on the major processes governing the structure and function of benthic systems. Component processes are addressed using a variety of approaches, ranging from molecular genetic studies of evolutionary relationships among species to interdisciplinary studies of organisms or communities interacting with their environment. In most cases research is focused on benthic systems of the land-sea margins, including tidal freshwater, estuarine and coastal regions. On-going research programs include studies of processes influencing recruitment, growth and production of benthic organisms; linkages between benthic and pelagic systems through processes such as nutrient cycling and trophic transfer; functional role of benthic communities in the transport and fate of materials such as sediments, organic matter and contaminants.

Ecosystem Modeling: The program develops and uses digital computer simulation models as an integrative and synthetic tool in ecosystem analysis. Current programs include modeling studies of both temperate and tropical seagrasses, the dynamics of littoral zones in estuaries, estuarine plankton-nutrient interactions, and watershed nutrient cycling processes with an emphasis on spatial heterogeneity. Working with

hydrodynamic and water quality modelers, a general goal of the program is to develop linked models that address both basic and applied ecological management questions.

Macrophyte Ecology: Studies concentrate on submerged and emergent macrophyte species that dominate shallow subtidal and intertidal marine, brackish, and freshwater areas. Current research includes studies on plant distribution and abundance, restoration ecology, plant dispersal mechanisms, plant response to environmental variability, plant growth and productivity, carbon and nitrogen cycling and ecosystem simulation modeling. The program encourages multi-investigator and multi-institutional collaborative efforts.

Nutrient Cycling: Studies focus on the fate of nutrients in benthic and pelagic ecosytems and on the role they play in regulating primary and secondary production. Nutrient cycling is studied in habitats ranging from intertidal marshes and mudflats to shallow subtidal, littoral zone systems, coastal embayments, riverine systems, large estuaries such as Chesapeake Bay, and to the coastal ocean including that adjacent to Antarctica.

Physical Biology: Interdisciplinary studies utilize methods from fluid and solid mechanics, and heat and mass transfer theory, to investigate food capture, bioenergetics, primary and secondary production, and allometry in invertebrates and algae. Ongoing projects include the effects of internal waves on secondary production at seamounts (Gulf of Maine), flow modulation of coral bleaching (Caribbean), organism- sediment-flow interactions (Chesapeake Bay), and impact of sponges on water column processes (Lake Baikal).

Plankton Processes: Plankton research addresses processes of primary production by phytoplankton and secondary consumption by bacteria, protozoans and zooplankton in estuarine, coastal, shelf and open ocean systems. System-wide and both short- and long-term responses to cultural eutrophication are addressed. Collaborative research aimed at understanding the links between plankton dynamics and recruitment of economically important fisheries populations are also pursued. The ecology of harmful algal blooms is of particular interest.

Research Facilities

The department is well equipped with modern laboratory and field instrumentation in support of Biological Sciences. Various laboratories are equipped with running salt water. Major equipment includes an instrument tripod with acoustic Doppler velocimeters, underwater video cameras, suspended sediment sensors for *in situ* studies of organism-sediment interactions in the aquatic environment, gas chromatographs fitted with various detectors, 15N-emission spectrometer, an Alpkem auto-analyzer for ten water chemistries, computer-assisted image analysis hardware, a remote sensing imaging processor, underwater spectral radiometer, Li Cor light sensors and data loggers, spectrophotometer, sediment profile cameras, box corer and benthic grabs, underwater video, hydrolabs, radioisotope modules, an autonomous underwater vehicle, Coulter Altra flow cytometer, and a seawater flume. A programmable light- and temperature-controlled walk-in chamber and greenhouse are available for photosynthesis-related studies.

Preparatory Studies

A solid background in modern biology and basic science courses is required. This background should include mathematics through calculus, a year of statistics, physics and chemistry including organic and biochemistry, as well as contemporary biology courses. A foreign language such as German, French, Russian or Spanish is recommended. The present facilities and equipment available in the department are described in more detail on the departmental web site (www.vims.edu/bio/).

Typical Course of Study

Students in the Biological Sciences area must include in their programs the required core courses as well as MS 526. Additionally, courses related to the student's area of specialization should be included as appropriate, e.g., plankton and microbiology for specialization related to small planktonic organisms; marine benthos and secondary production of invertebrates for those interested in benthic specializations. Theoretical ecology, ecological modeling and computer applications should be included in any biological program that relies on modeling or theoretical mathematical formulations.

Coastal and Ocean Policy

The Department of Coastal and Ocean Policy (DCOP) is an interdisciplinary department in which faculty emphasize graduate education and research on the science and management of the marine and coastal environment and associated resources. Faculty conduct collaborative research and education with faculty from Biological Sciences, Physical Sciences, Department of Environmental and Aquatic Animal Health, Fisheries Sciences, the Thomas Jefferson School of Public Policy, the William and Mary Law School, the School of Business Administration, and the William and Mary Environmental Science and Policy Cluster.

Research by departmental faculty is both theoretical and applied, and seeks to offer innovative and practical scientific solutions to problems affecting marine and coastal resources, the marine environment, and society. Areas of interest are distributed within four major program areas (coastal ecosystem processes, ocean and coastal law, coastal zone planning and marine resource management, and coastal wetlands) that allow for both theoretical treatments as well as sound practical scientific advice and information. Emphasis is placed on relating theory to practice in all cases, and students are given significant opportunities to work in a real world context.

Graduate education within the department provides students with a broad, but balanced, interdisciplinary understanding of coastal and ocean policy. Students can be expected to be involved in a wide array of on-going projects such as the preparation of

resource management plans for coastal parks and sanctuaries; assessment of the social and economic impacts of proposed coastal environmental regulations; determination of the optimum allocation of resources among competing user groups; and assessments of the laws and policies that govern the utilization of marine and coastal resources. Students completing their graduate education should be able to synthesize knowledge from the core science disciplines, law, economics, government, sociology, anthropology, mathematics, and statistics. Students will learn to tackle environmental problems using a holistic approach that integrates the natural sciences and the human dimensions of the coastal and ocean environment.

Major Programs

Departmental faculty will provide guidance to individual students and help formulate specific academic programs that capture their personal interests and match their future career goals, generally within four major areas.

Coastal Ecosystem Processes: Conducts applied and state-of-the-art research on detection and characterization of changes in the coastal environment. The program emphasizes the development of models and algorithms necessary to assess coastal ecological phenomena. Major components of this program involve: monitoring environmental stress and ecological long-term changes in dune/beach and tidal and non-tidal wetlands; the relationship of long term changes to changes in environmental parameters within a watershed; and determining the role of environmental conservation and sustainable development in the mid-Atlantic United States and several developing nations. The program has a variety of instruments for field and lab studies such as field and lab spectroradiometers, fluorescence spectrophotometers, and digital multi-spectral video.

Coastal and Marine Resource Management: Emphasizes determining policies and management strategies to promote the optimum or best use of estuaries, coastal and open oceans, and related marine environments and resources consistent with constraints imposed by physical and biological conditions, existing laws, and the needs of society. Research interests include sustainable resource utilization, optimum resource use, mitigating environmental degradation, coastal development and land use, rights based regimes to control common-property problems, fisheries management and regulation, design and implementation of marine protected areas, protecting essential fish habitat, community-based management, social and community impact assessment, valuation of non-market goods and services, aquaculture, marine-based recreation and eco-tourism, marine resource economics, and international trade.

Ocean and Coastal Law: Provides graduate education; advisory support to local, state, regional, national, and international agencies; and conducts research on the legal and governmental aspects of resource management. Two major research activities of this program involve determining the role of government in public decision-making, and assessing the feasibility of using various property-rights regimes to manage marine and coastal resources and the environment. Faculty often engage in collaborative research with faculty from the William and Mary Law School, the School of Business Administration, the School of Arts and Sciences and the William and Mary Environmental Science and Policy Cluster.

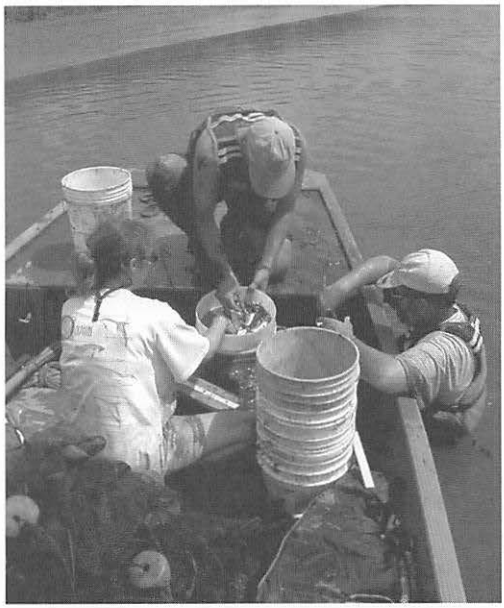
Coastal Wetlands Program: Provides graduate education and conducts extensive research on the structure, function, and optimum utilization of wetlands and optimum use of coastal lands. This highly applied world recognized program emphasizes a broad interdisciplinary approach to utilizing wetlands and coastal land areas. Research and education within the program typically involve the application of rigorous scientific principles to the formulation of policies governing the use of wetlands and coastal areas.

Research Facilities

By virtue of its interdisciplinary nature, the Department of Coastal and Ocean Policy works closely with numerous other departments of the Virginia Institute of Marine Science, the School of Marine Science, and Departments and Schools at the main William and Mary Campus in Williamsburg. This collaborative work affords students the opportunity to receive education and conduct research on a wide array of subjects and to emphasize a particular scientific discipline. Collaborative research is also conducted with faculty from the Law School, the School of Business Administration, the School of Arts and Sciences, the Thomas Jefferson School of Public Policy, the Department of Environmental and Aquatic Animal Health Cluster, various universities around the world, and numerous local, state, national, and international agencies. Faculty and students closely cooperate with the Center for Coastal Resources Management, which operates the Comprehensive Inventory Laboratory that is a computer-based facility using Geographic Information System (GIS) and image processing software. A wide array of scientific instruments, equipment, research material, and technical services are available through the various collaborative facilities and programs.

Preparatory Studies

Students interested in pursuing a career in coastal and ocean policy will benefit by having a strong background in mathematics, statistics, and the basic sciences, which include physics, chemistry, biology, and geology. Additional studies or courses in economics, sociology, public policy, anthropology, law and government, ecology, and computer science will be beneficial. Students should have strong writing and verbal communication skills. The present facilities and equipment available in the department are described in more detail on the departmental web site (www.vims.edu/cop).



Typical Course of Study

The typical curriculum for students in the Department of Coastal and Ocean Policy includes the School of Marine Science (SMS) core courses (MS 501 and 502). In addition, all DCOP students are required to complete the Departmental Seminar (two semesters each MS 590 and MS 591), Principles of Environmental and Natural Resource Policy (MS 542), and Quantitative Methods for Coastal and Ocean Policy Analysis (MS549). Substitution of MS549 with other quantitative courses is permissible, or additional quantitative courses may be required, as recommended by the student's major professor. Students should consult with their major professor prior to selecting a particular quantitative or advanced science course. Additional related graduate courses in public policy, law, government, economics, sociology, anthropology, applied mathematics, and business are available through the Williamsburg campus and may be used as part of the DCOP curriculum.

Environmental and Aquatic Animal Health

Research in the Department of Environmental and Aquatic Animal Health focuses on the health of aquatic systems from the molecular to the ecosystem level. Efforts are often multidisciplinary and include the identification of emerging pollutants and disease-causing pathogens and investigation of their fate and effects on estuarine and marine organisms. We are also active in efforts aimed at gaining a better understanding of immune defense mechanisms and nutritional requirements of organisms, interactions of multiple stressors, host-parasite interactions, and evaluating the environmental risks arising from human activities. A diverse faculty of environmental chemists, toxicologists, ecotoxicologists, biochemists, immunologists, microbiologists, and pathobiologists collaborate to achieve these goals.

Some current projects exemplify this theme:

- Effects of carcinogenic contaminants in sediments on population genetics and adaptation
- The interaction of contaminants, nutrition and pathogens in the disease process
- The role of *Pfiesteria*, other harmful algae, and emerging pathogens on animal and human health
- The role of emerging chemicals in endocrine disruption and reproduction
- Development of molecular probes to study immune defense mechanisms and to identify sources of pathogens

Major Programs

Environmental Chemistry: Research addresses the sources, transport, fate, bioavailability and impacts of contaminants in marine and estuarine systems. Some recent efforts include the behavior of anti-foulants, use of geographic information systems (GIS) for modeling spatial distribution of environmental data and development of environmentally friendly analytical procedures. Emerging contaminants are a

particular interest. The faculty collaborates with international researchers, federal and state agencies (e.g. EPA, NOAA, DOE, VA Dept of Environmental Quality, VA Dept. of Health) and private industry.

Recent student research has examined the binding of pesticides to natural organic matter and subsequent impact on bioavailability and toxicity; bioremediation of tributyltin-contaminated sediment in a created wetland; factors influencing the degradation rate of crop protectants in natural waters; the utility of supercritical fluid extraction for the determination of flame retardants in fish.

Environmental Microbiology: This program studies indicator or pathogenic microorganisms in waters used for recreation, aquaculture, and shellfish industries. Research includes development and validation of methods for detection of microorganisms of human health significance in marine environments, and studies to understand processes that contribute to eutrophication and microbial contamination of receiving waters. A particular strength of the department is multidisciplinary, collaborative research on *Aphanomyces* spp. and *Mycobacterium* spp. that are pathogenic to fish.

Toxicology: Effects of toxic chemicals in water and sediment are measured at the molecular to population levels. Endpoints include 1) uptake and elimination of pollutants by individual organisms, 2) vital processes (mortality, growth, reproduction), and 3) mechanisms of internal distribution, biotransformation, and clearance of hazardous chemicals. Molecular, cellular, and whole organism responses are being evaluated as a basis for predicting population effects at sublethal concentrations.

Pathobiology: Research in this field 1) focuses on infectious and non-infectious diseases of fish and shellfish, 2) determines the mechanism(s) by which pathogens cause disease in the host organisms, 3) examines pathological consequences of exposures of estuarine animals to contaminants, 4) studies etiology and epidemiology of pathogens in estuarine and marine organisms, 5) investigates host defense mechanisms in order

to develop diagnostics, therapeutics and vaccines for use in aquaculture, and 6) seeks to understand the impact of toxic materials on disease processes. The pathobiology group has developed an Aquatic Animal Disease Diagnostic Laboratory using traditional histological, microbiological, immunological, and molecular techniques to identify diseases in shellfish and fish.

Environmental Risk Assessment: Risk assessment tools are applied to evaluate the risk associated with exposure to hazardous chemicals, pathogens, bacterial agents, both individually and collectively in complex mixtures. The goal is to provide a conceptual framework that will improve environmental management by allowing resource agencies to focus their limited resources on those issues of greatest importance.

Research Facilities

Laboratories of the Department of Department of Environmental and Aquatic Animal Health are located in Chesapeake Bay, Watermen's and Byrd Halls. The Department laboratories in Chesapeake Bay Hall are equipped with state-of-the-art instrumentation for studies on environmental chemistry, toxicology, immunology, electron microscopy, pathobiology, and microbiology.

Analytical instrumentation is available to identify and quantify a wide range of organic and inorganic contaminants in water, sediment and biota. This allows faculty and students to develop new analytical methodologies, detect emerging contaminants and track pollutants in the environment at trace levels. For example, an atomic absorption spectrophotometer is available for measuring heavy metals at low ambient concentrations. GCs, HPLCs, mass spectrometers and enhanced solvent extractors are maintained for the determination of organic pollutants.

Genetic analyses of pathogenic organisms are performed using an automated DNA sequencer, polymerase chain reactor (PCR), and associated electrophoretic and imaging equipment. State-of-the-art electron microscopes allow identification of microorganisms (e.g. *Pfiesteria*) and ultrastructural analysis of diseased organisms, supplementing traditional light microscopy.

Instrumentation is available for sophisticated research on enzyme systems that play a role in detoxification of chemicals and lipids that are involved in accumulation of hydrophobic chemicals and in resistance to some disease organisms. The immunology laboratory has the capability to produce monoclonal antibodies for a variety of antigens.

A flowing saltwater laboratory facility in Byrd Hall allows exposure of animals to contaminants and pathogens. Colonies of several species of fish and invertebrates are maintained to provide test animals for various studies. Equipment is available to maintain additional species as needed for particular studies. The facility also houses exposure tanks especially adapted for toxicology. A freshwater laboratory devoted to study of coldwater fish is available in Chesapeake Bay Hall. A separate BSL3 laboratory is available for assaying the biotoxicity of *Pfiesteria* and other hazardous organisms to fish.

The present facilities and equipment available in the department are described in more detail on the departmental web site (www.vims.edu/env).

Preparatory Studies

Students entering the Department of Environmental and Aquatic Animal Health program should possess a degree in an applicable natural science (e.g. biology, chemistry, or a related subdiscipline), ideally with some course work in all natural sciences including physics and geology. Competency in calculus, statistics, computer experience and strong written communication skills are highly desirable. Students applying to the Department are strongly encouraged to discuss their previous academic background and experience with prospective mentors listed under the major program of interest before applying.

Typical Course of Study

The educational program prepares students for careers as environmental scientists, educators and managers. Since departmental research and educational programs are interdisciplinary, incoming students are expected to have strong backgrounds in biology and chemistry. Following satisfactory completion of the institutional core curriculum, students may pursue courses and research in any of the major program areas (environmental chemistry, toxicology, environmental risk assessment, environmental microbiology or pathobiology). The department offers a number of pertinent courses including Environmental Chemistry (MS563), Aquatic Toxicology (MS 564), Principles of Pathobiology (MS 565), Diseases of Marine Organisms (MS 566), Environmental Microbiology (MS 573), Fish Histology and Histopathology (MS 638), Quantitative Ecotoxicology (MS 640) and Environmental Risk Assessment (MS 641). Students pursuing the Masters degree typically select a minimum of two departmental offerings, while PhD students will generally be expected to choose four of these courses. Students may complement this curriculum, in consultation with their mentor and research committees, with appropriate courses offered by other SMS departments and departments at the Williamsburg campus.

Fisheries Science

The Department of Fisheries Science makes substantial contributions to the Institute's research, education, and advisory service missions. Research programs at the local, national and international levels focus on investigations and assessments of fish, crab and mollusk species of commercial, recreational and ecological importance. Also included within the research framework of the department is the Aquaculture Genetics and Breeding Technology Center. Collaborative research and teaching efforts are common among department faculty. In addition to furthering knowledge through publication, members of the department are expected to advise local, regional, and national management agencies, providing opportunities for students to become directly involved in fisheries management. Also available to students are highly equipped laboratories and many opportunities for fieldwork in estuarine and marine environments, especially the Chesapeake Bay.

Major Programs

Anadromous Fishes Program: Research and monitoring of the abundance, reproductive ecology, life history and exploitation of important migratory species such as striped bass and American shad that spawn in Virginia's tidal fresh waters. Studies include monitoring commercial and recreational landings, developing novel approaches to stock assessment, conducting surveys of juvenile abundance, and mark/recapture methods for estimation of fishing rates.

Aquaculture Genetics and Breeding Technology Center: Research includes development of brood stocks in shellfish species of interest to Virginia and the region, including selective breeding (especially for disease resistance), chromosome set manipulation, and evaluation of non-native species.

Bivalve Ecology: Studies focus on recruitment of bivalves, particularly oysters, and the effects of the environment on physiology and behavior of larval oysters and other bivalves, oyster population assessments, and the development of disease-resistant hybrids.

Commercial Fisheries Development: Research includes gear selectivity and bycatch as well as management and regulatory strategies for seafood production, processing and utilization.

Crustacean Ecology: Investigations of the ecology, population dynamics, and conservation of the blue crab in Chesapeake Bay and spiny lobster in the Caribbean.

Finfish Ecology: Studies of the dynamics, recruitment, stock structure and life history of marine, estuarine and anadromous fishes based on sampling fisheries landings, surveys and tagging studies. Data generated by this program is directly applied to stock assessment and fisheries management by state and regional agencies.

Fisheries Genetics: Examines the application of molecular genetic techniques to address problems in fisheries science. Studies focus on analysis of stock structure, use of molecular characters to identify early life history stages of marine organisms, and the evaluation of taxonomic and biogeographic hypotheses with molecular genetic information.

Fisheries Oceanography: Focus on the effects of environmental variables (weather and climate) on the survival, recruitment, and distribution of fishes and other marine organisms.

Marine Conservation Biology: Ecology and conservation of the blue crab, Caribbean spiny lobster, queen conch, Nassau grouper, and marine bivalves. Emphasis on metapopulation and source-sink dynamics, marine reserves and dispersal corridors, habitat fragmentation and loss effects on marine invertebrates, recruitment processes, and predator-prey interactions.

Marine Vertebrate Ecology: Continuing studies into the comparative morphology, reproduction, and population dynamics of sharks; long term research on the distribution, migration, abundance, ecology and energetics of sea turtles; and investigations of the life history of finfish taxa.

Stock Assessment Methodology: Program involves the systematic evaluation of stock assessment procedures and the development of new mathematical models and statistical methods for studying populations and their responses to exploitation. Tagging, survey, and landings data are used to estimate population size, mortality rates, components of mortality, yield, spawning potential, and effects of changes in fishery regulations. Applications include invertebrates and vertebrates in temperate and tropical sport and commercial fisheries.

Systematics and Taxonomy: Taxonomically diverse studies that focus on the morphology, evolution, taxonomy and zoogeography of various vertebrate and invertebrate groups. The program promotes a total evidence approach to phylogenetic research, including molecular techniques and morphological studies of larval, juvenile and adult forms

Research Facilities

The Department of Fisheries Science comprises several programs, each with a fully equipped laboratory, a variety of collection and sampling equipment, and extensive computer facilities.

The Fisheries Science Laboratory has available an image analysis system, computerized scale projectors and Biosonics digitizing system to provide automated morphometric measurements, rapid analysis of hard structures for age determination, and automated counting procedures. Automated fish measuring boards and a variety of collections are also available.

The Crustacean Ecology Program maintains the GEM Lab with two large (1800 gal) benthic mesocosm tanks monitored by IR-sensitive, computer-controlled cameras with time-lapse image recorders.

The Bivalve Ecology Program's laboratory is well equipped for physiological and ecological studies with a UV-VIS spectrophotometer, centrifuges, a fluorescence microscope, compound and dissecting microscopes, and an image analysis system.

The Fisheries Genetics Program maintains a large laboratory with a walk-in cold room and is fully equipped to undertake a variety of genetic analyses. Major equipment includes an automated DNA sequencer, five thermal cyclers, refrigerated centrifuges, ultracentrifuges, a vacuum concentrator, a digital imaging system, and several ultracold freezers.

Nunnally Hall contains a fish collection with approximately 85,000 species representing 247 families. This research and teaching collection incorporates extensive holdings from Chesapeake Bay, the Middle Atlantic Bight, Appalachian freshwater habitats, and an internationally recognized collection of deep-sea fishes. The Larval Fish Laboratory houses a reference collection containing early life history stages of over 120 families of marine, estuarine and freshwater fishes. The program also has considerable plankton collection equipment, an *in situ* silhouette plankton camera and 1.5 m diameter mesocosms for *in vivo* experiments of larval fish trophic dynamics and mortality.

Two wet lab facilities are available to department faculty and students. The general wet lab contains a flow-through system with several wet tables and tanks. In addition, a special greenhouse/wet lab houses the large sea turtle holding tanks, which are supplied with recirculated filtered seawater. Adjacent to the sea turtle greenhouse is a 7,560 gallon tank used for research.

Monthly surveys of juvenile fishes and crabs are conducted throughout the Bay and on three major rivers. Plankton studies, larval fish research, and reproductive studies of recreational fishes are conducted in the Bay as well as offshore.

Preparatory Studies

Students interested in graduate study in Fisheries Science should have a solid undergraduate background in biology including: physiology, biochemistry, comparative morphology or developmental biology, genetics, ecology and related topics, and evolutionary biology. College physics, chemistry (through organic) and math through calculus are required. Courses in statistics, marine biology and fishery biology may be helpful but are not prerequisites.

The present facilities and equipment available in the department are described in more detail on the departmental web site (www.fisheries.vims.edu).

Typical Course of Study

In addition to the core courses required of all SMS graduate students, Fisheries students are required to take Marine Fisheries Science (MS 528) and an additional quantitative course such as Experimental and Quantitative Ecology (MS 667), Multivariate Analysis and Time Series (MS 625); Applied Regression and Forecasting (MS 672); or Stock Assessment Methods (MS 670). Among the courses offered by the Fisheries faculty are Fisheries Climatology (MS 665), Ichthyology (MS 666), Diseases of Marine Organisms (MS 566), Malacology (MS 668), Marine Fisheries Science (MS 528), Culture and Physiology of Marine Organisms (MS 571), Early Life History of Marine Fishes (MS 657), Fisheries Population Dynamics (MS 671) and Marine Molecular Genetics (MS 673).

Physical Sciences

The objective of the Department of Physical Sciences is to generate, communicate and apply knowledge concerning the physical, chemical and geological processes that operate in the coastal ocean and estuaries. The emphasis of the physical oceanography group is the study of water properties and water movement in estuarine, coastal and continental shelf environments. Geological oceanography includes the study of the processes of sediment erosion, transport and accumulation as well as the resulting stratigraphy. Marine chemistry emphasizes the study of marine biogeochemical processes, and environmental fate and transport of natural and anthropogenic substances. Interdisciplinary studies are strongly emphasized in this department.

Major Programs

The Chemical Oceanography/Marine Geochemistry Program: Comprises a diverse faculty with numerous cross-disciplinary interests. Work is currently being conducted across groundwater, riverine, estuarine, continental margin and open ocean environments on a variety of projects intended to help better understand the cycling of organic materials (both natural and anthropogenic) and both major and trace elements.

Individual faculty and students in this program collaborate actively not only with other programs in Physical Sciences, but also with the departments of Biology, Department of Environmental and Aquatic Animal Health, Fisheries Science and Coastal and Ocean Policy. There is also increasing interaction with several of the departments and with the newly established Department of Environmental and Aquatic Animal Health and Policy cluster on the main campus of the College of William and Mary. Examples of current and on-going projects within the Chemical Oceanography/Geochemistry group include: cycling and diagenesis of dissolved and particulate organic matter in estuaries and open ocean settings; physio-chemical exchanges of organic contaminants across various aqueous and particle interfaces in groundwaters and estuaries; and sorptive/

desorptive processes controlling the movement and availability of trace metals and organic contaminants in sediment matrices.

The Geological Oceanography Program: Conducts local and international research on a variety of both disciplinary and interdisciplinary topics. Research sites span the full range of marine/nearshore environments from the coastal plain and river floodplains, through the estuaries and across the margin to the base of the continental rise. Although much of our effort addresses questions in Chesapeake Bay and surrounding areas, federal funding supports research in many other areas in the U.S. and around the world (including China, Bangladesh, and New Guinea), which generates generic knowledge about geological phenomena in the coastal ocean. Some of the major focal areas include: sediment transport and boundary layer processes; sediment flux and fate; seabed dynamics; shoreline erosion/sand resource issues; and Quaternary stratigraphic development. Interdisciplinary research efforts involve faculty from the departments of Biological Sciences, Department of Environmental and Aquatic Animal Health and Coastal and Ocean Policy, as well as colleagues from other institutions worldwide.

The Physical Oceanography Program: Focuses on water motion in estuaries and on the continental shelf along with the associated transport of buoyancy, suspended particles, nutrients and pollutants. Physical Oceanography at VIMS is extremely interdisciplinary, with ongoing collaboration with chemists and geologists within our department, biologists and resource managers elsewhere at VIMS, and scientists from various disciplines through the country and around the world. We have ongoing field projects in the Chesapeake Bay and its tributaries as well as on the shelves of the east and west coasts of the U.S., and we are applying three-dimensional numerical models to study circulation and associated dissolved and particulate transport in estuarine and shelf environments. Cooperative research projects are underway with scientists from countries including Korea, The Netherlands, Taiwan, and the U.K. Some of the major focal areas of scientists in our group include: wind- and buoyancy driven circulation on the inner shelf; effects of stratification on the bottom boundary layer; the dynamics of estuarine fronts; three-dimensional modeling of estuarine sediment transport and water quality; the association of characteristic density- and tidally-driven estuarine

circulation patterns with the fate and transport of pollutants; wind wave evolution in estuaries and on shelves; and the physics governing sediment transport on shelves and in the surf zone.

Research Facilities

The department maintains state-of-the-art equipment for conducting high-quality field and laboratory research. Major field equipment includes: Laser In-Situ Scattering and Transmissiometry (LISST); sea-bed hydraulic flume; a meteorological station with a precipitation collector for low-level organic contaminants; high-volume air samplers; a rotating drum surface microlayer sampler; and bottom boundary layer instrumental tetrapod systems for measuring bed stress, wave and currents, sediment resuspension, and bed-level changes. A variety of instrumentation including tide gauges, current meters, conductivity-temperature-depth (CTD) profilers, fluorometers, dissolved oxygen (DO) meters, fathometers, dual-frequency side-scan sonars, variable frequency seismic profiling systems, directional wave gauges, turbidity sensors, acoustic Doppler current profilers (ADCP), and Kasten and box corers are available for field studies. Microwave and GPS navigation systems are maintained by the department for accurate positioning of research vessels.

The department houses extensive laboratory instrumentation, including: microwave-assisted solvent extraction system; large-capacity, refrigerated, programmable centrifuge; ultra-cold (-80 deg. C) freezers; Fisons EA1108 CHNS-O analyzer; UV/Vis spectrophotometer; gas chromatographs with flame ionization and electron capture detectors; two quadrupole mass spectrometers; Inductively Coupled Plasma Atomic Emission Spectrophotometer (ICP/AES); EDS system with full SEM imaging capabilities; powder x-ray diffractometer; nitrogen adsorption surface area and porosity analyzer; CHNSO elemental analyzer; high performance liquid chromatograph with UV absorbance and liquid scintillation detectors; two laboratory flumes (recirculating and annular); five intrinsic germanium gamma spectrometers; eight channel alpha spectroscopy system; X-ray radiography unit; sedigraph automatic particle analyzer; rapid sediment analyzer. Computer facilities range from laptop units for field use to work stations supporting LANs (local area networks) to the institute-wide network. Computer users have ready access to external networks. Pentium-PC, UNIX and MacIntosh systems are supported by departmental staff and by the Institute's computer center.

Preparatory Studies

In all aspects of the Department of Physical Sciences' education and research programs, there is a heavy reliance on quantitative skills, and our incoming students therefore are expected to have a strong background in the appropriate sciences. Undergraduate majors providing preparation for graduate study in physical sciences include physics, applied mathematics, engineering, chemistry and geology. Biological science majors interested in pursuing graduate work in physical sciences are encouraged to include introductory physics and calculus through ordinary differential equations in their backgrounds.

The present facilities and equipment available in the department are described in more detail on the departmental web site (www.vims.edu/physical).

Typical Course of Study

For students majoring in physical oceanography, required courses include Principles of Coastal and Estuarine Physical Oceanography (MS 520). Advanced courses address estuarine hydrodynamics and water quality, providing an in-depth focus on estuarine physics and its influence on biogeochemical processes. Additional courses address other advanced topics in ocean dynamics and apply three dimensional numerical modeling to estuarine and coastal issues.

Students interested in geological oceanography may pursue tracks emphasizing sedimentary environments and stratigraphy, sediment geochemistry, or physical transport/morphodynamic processes. Courses include marine sedimentation, coastal morphodynamics, benthic boundary layers, multivariate and time-series analysis, and isotope geochronology.

Students are required to take the Geological Oceanography (MS 522) course. In addition, depending on a student's particular emphasis, geological students may be required to take advanced courses in physical, chemical or biological oceanography.

Graduate students in marine chemistry may specialize in any of the various aspects of marine and environmental chemistry. Required courses include Advanced Aquatic Chemistry (MS 555) and Principles of Chemical Oceanography (MS 524). Specialized course work in other aspects of marine and environmental chemistry can be selected through recommendation of the student's thesis committee.

Course Descriptions

Graduate Courses

The courses presented below may be offered in a different format than listed under the course description if the number of students registering for the course is such that the listed format is inappropriate. For example, if only one student registers for a course listed as being taught in a lecture format, the instructor may decide that the content is better presented through directed readings and one-on-one discussion. MS 691 to MS 696 are cross listed courses taught by staff of the College of William and Mary's School of Law on the Williamsburg campus. Students wishing to take any of these courses must contact the School of Law instructor to gain permission.

501 - Fundamentals of Marine Science. Fall (6) Mr. Smith, Mr. Brubaker, Mr. Bauer, Mr. Kuehl
An interdisciplinary overview of marine science with emphasis on processes of open ocean systems. Topics include the physics of ocean circulation, processes influencing the vertical and horizontal distributions of properties, the chemistry of aqueous species (inorganic and organic), the influence of past and present processes on the ocean's sediments and basins, and the structure and function of pelagic communities. The course is divided into modules emphasizing physical, geological, chemical and biological aspects, with interdisciplinary aspects of a wide variety of oceanic systems, such as upwelling regions, polar systems, hydrothermal vents, and oceanic gyres, highlighted at the course's end. *Required of all students unless an exemption from a module has been obtained by taking a written exam administered by the responsible faculty member prior to the beginning of class.*

501L - Fundamentals of Marine Science Lab. Fall (1) Ms. Canuel, Staff
A hands-on introduction to lab and field methods commonly used in marine science. The course will include exercises from the fields of biological, chemical, geological and physical oceanography. Lab exercises will be designed to complement lectures in MS 501. Sample collection and analysis will be emphasized with additional focus on data analysis and interpretation. *Required of all students unless exemption is approved by the Dean of Graduate Studies upon recommendation by the course coordinator.*

502 - Coastal and Estuarine Processes, Issues and Investigations. Spring (5) Mr. Friedrichs, Mr. Haas, Ms. Schaffner
An interdisciplinary classroom and field-based introduction to the science and management issues in the coastal ocean, including estuaries and continental shelves. The course is organized around four major themes: the unique nature of coastal and estuarine environments; sediment transport and coastal change; eutrophication and habitat quality issues; and living resources and fisheries. Students will explore these themes in depth by developing and conducting a field-based project centered around class cruises in the estuary, with particular emphasis on spatial and temporal patterns of biotic and abiotic processes and their interactions. *Required of all students.*

504 - Fundamentals of Statistical Methods and Data Analysis. Fall (2) Mr. Evans
Stochastic model of observational data; introduction to probability, probability distributions, discrete and continuous; parameter estimation, confidence intervals, hypothesis testing; linear regression and analysis of variance methods, including multiple regression and dummy variables; data transformations; propagation of errors; distribution fitting; non-parametric tests. *Required of all students unless justification for exemption is approved by the Dean of Graduate Studies upon recommendation of the course coordinator.*

505 - Fundamentals of Experimental Design and Sampling. Spring (1) Mr. Diaz
This course is an introduction to sampling and experimental design. Basics of the scientific methods will be reviewed and design principles explained relative to the scientific method. Selection of appropriate statistical tests for various sampling and design strategies will be covered. Probability-based and exact statistical methods will be presented. *Required of all students unless justification for exemption is approved by the Dean of Graduate Studies upon recommendation of the course coordinator.*

506 - Scientific Communication Skills. Spring (2) Mr. Milliman
Review of the important elements of oral and written presentation skills for communicating scientific research. Critical evaluation of literature, development of scientific questions and rationale for research, formulation of conceptual models for developing high-quality scientific research projects. Oral and written presentation skills are emphasized through written exercises and class presentations, with peer review.

520 - Principles of Coastal and Estuarine Physical Oceanography. Spring (3) Mr. Friedrichs, Mr. Brubaker
Following a review of the governing equations, lectures and discussions will focus on dynamics of currents and waves on continental shelves and in estuaries. Topics to be covered include fundamentals of wind and density-driven flow; aspects of fronts, mixing and secondary circulation; and time-dependent motion such as surface gravity waves, internal waves, coastally-trapped waves and tides.

522 - Principles of Geological Oceanography. Fall, even years (3) Mr. Kuehl, Staff
A brief review of the tectonic history of the oceans followed by detailed study of the ocean margins including sea-level history and near shore geological processes in the coastal zone and continental shelf regions. The geological effects of bottom currents on oceanic sediments will be examined along with ocean basin sediment history and approaches to pale oceanography.

524 - Principles of Chemical Oceanography. Spring (3) Mr. Bauer, Ms. Canuel. Prerequisite: Instructor's consent
This course covers in a comprehensive and integrated manner the important factors controlling the chemical composition of seawater. Basic principles of chemical thermodynamics will be applied to the seawater medium and will serve to introduce contemporary, global-scale chemical processes such as the role of the oceans in global

climate change. Selected topics include distributions of the bio limiting elements; chemistry of marine sediments; trace metal chemistry; marine organic chemistry; and ocean-atmosphere interactions.

526 - Principles of Biological Oceanography. Spring even years (4) Mr. Ducklow, Mr. Duffy
Lecture and discussion of the fundamental processes underlying primary and secondary production in marine ecosystems. Emphasis on physical processes supporting primary production, plankton dynamics, biotic interactions structuring communities, vertical and horizontal distributions, food web structure, ecological role of higher and lower trophic levels, and benthic-pelagic coupling. The course concludes with a survey of the major marine ecosystems.

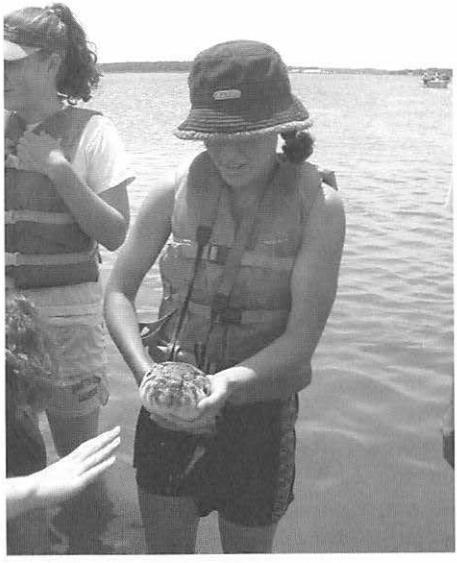
527 - Coastal Botany. Fall (3) Mr. Perry
A general survey of maritime vascular plant communities. Marshes, swamps, beaches, dunes, maritime forests and submerged aquatic communities of the coastal region. Field trips, laboratory and lectures.

528 - Marine Fisheries Science. Fall, even years (3) Mr. Olney, Mr. Austin, Mr. Latour
Principles and techniques, including the theory of fishing, age and growth, definition of stocks, catch statistics, description of world fisheries, goals and problems in managing a common property resource. Lectures, laboratory hours and field trips.

529 - Economic Principles of Fisheries Management. Fall (3) Mr. Kirkley
An introduction to economic theories and principles that determine the exploitation, utilization, and management of marine fisheries. Theories and principles are presented in a graphical format, but the interpretation and understanding of policies and solutions are emphasized. The course provides a balanced understanding of the underlying economics of conflicting user groups. Methods of fisheries management and regulation are emphasized with respect to economic and social concerns.

542 - Principles of Environmental and Natural Resource Policy. Fall (3) Mr. Kirkley, Mr. Taylor, Staff
An introduction to the principles necessary for understanding and formulating policy that governs the environment and natural resources. Topics covered include the classification of environmental and natural resources; reasons why management is necessary; the ethics of science in policy formation; and types of policy instruments used in management and regulation. Emphasis is placed on the legal, social and economic aspects of management and the role of science in policy formulation. Management institutions, instruments and regulatory strategies are reviewed and critiqued. Command and control type management is discussed and contrasted to community-based management and various types of property regimes. Domestic, foreign and global policies for governing the environment and natural resources are discussed and compared. Concepts are developed by case study methodologies for air, water, land, forests, minerals and fisheries.

543 - Law and Resource Management. Fall (3) Mr. Taylor



A course designed to introduce scientists, resource managers and environmentalists to the legal principles and tools used to address the causes of environmental degradation and resource depletion. The argument is not for more or less environmental law, but better environmental law. The approach reflects the view that law governs activities not the environment. Rather than using a traditional approach to teaching the law, environmental and resource law is explained as it relates to human and societal activities from the time resources are allocated to their manufacture and disposal. Activities are examined from resources to recovery within three major domains: harvesting, energy and feedstocks. Geographic scope and history, the laws governing the activity, and an evaluation of goals and effectiveness are provided in case studies. Attention is given to the role of law in altering human and societal behaviors in favor of a better environment and resource conservation.

544 - Pests and Diseases in Resource Management. Spring (3) Mr. Shields

This course gives students a basic background in the principles and practices of pest and disease management in aquatic systems. It focuses on aquaculture and fisheries problems, but also draws on case histories in the control of human diseases and agricultural pests for comparisons. It presents the basic tenets in resource management, integrated pest management, and certain ecological principles that apply to introductions of pests and epizootics of parasite diseases. The efficacy of various control measures, practices, and regulations are also explored.

545 - Marine Sedimentation. Spring, even years (3) Mr. Milliman, Staff

Introduction to continental margin sedimentary environments with emphasis on physical, biological and chemical controls on the development of sedimentary strata over a range of spatial and temporal scales. Case studies from modern settings will be used to illustrate concepts of strata formation. Laboratory exercises include petrographic, textural and mineralogical analysis.

546 - Environmental Law and Science. Fall (2) Mr. Bookbinder

A weekly two-hour seminar focusing on how science is used (or misused) in drafting environmental legislation and regulations, and in environmental enforcement efforts. The course will cover portions of the Clean Water Act, the Clean Air Act, the Resource Conservation and Recovery Act (RCRA), the Marine Mammal Protection Act, and the Endangered Species Act. We will examine the science behind EPA's particulate matter standards, the basis for National Marine Fisheries Service quotas on North Atlantic

Flounder, the Corps of Engineers creative use of demographics, cancer risk assessment at Superfund sites, and how to prove standing in Clean Water Act citizen suits.

547 - Environmental Policy: Science and Law. Fall (2) Staff
Sources of environmental policy are examined and reviewed to evaluate which ones are most effective to protect land, air and water resources. Federal and State Constitutions, statutes, regulations, and case law will be discussed and analyzed in relation to the scientific principles and findings that support the various sources of environmental policy.

548 - Technical and Continuing Education in Marine Science. Fall, Spring and Summer (1-3) Staff. Prerequisite: Instructor's consent
Graduate-level instruction to public school teachers and other professionals who require postgraduate certification or special training. Courses are offered on an occasional basis as demand warrants. Instructors or teams of faculty identify a client group and formulate a course description that serves individual professional needs. Courses may include lecture laboratory components, field trips and demonstrations. An example of a course offered recently is experimental design in the marine science laboratory, a lecture and laboratory course for science teachers that addressed standards of learning in Virginia.

549 - Quantitative Methods for Coastal and Ocean Policy Analysis. Fall (3) Mr. Kirkley, Staff
An introduction to mathematical and statistical methods commonly used to formulate and assess environmental and natural resource policy. Instruction is focused on the application of quantitative methods to environmental and resource policy problems. The student will become familiar with the use of quantitative methods to promote policy goals and management efforts. Topics covered include regression analysis, risk assessment, cluster analysis, non-parametric analysis and regression, time series analysis, forecasting and prediction, simulation, and mathematical analysis and optimization in a policy context. Students will also be introduced to social, economic and scientific principles necessary for quantitative policy analysis. Each topic will be introduced and discussed with reference to case studies. Students will learn to frame problems analytically and to use software packages in numerical analysis for practical policy advice.

550 - Rivers: Processes and Management. Spring, odd years (3) Mr. Milliman
Rivers form the main link between land and the sea, discharging 40 thousand km3 of water and more than 20 billion tons of suspended and dissolved solids annually. Three central themes stressed are: 1) How rivers work: the hydrologic cycle and water balance, basin character, erosion, 2) River management: land use and the impact of anthropogenic activities including river diversions, and 3) Policy: historical perspectives; legal problems. Includes several field trips.

551 - Integrated Coastal Zone Management. Fall (3) Ms. Chuenpagdee, Mr. Kirkley
A course designed to examine the methodologies for applying an integrated approach to coastal zone management to improve the understanding of the interactions between

various ecosystems in coastal environments and their close connection to society and human communities in the coastal zone. Emphasis is placed on incorporating social, cultural and economic values into coastal management. Theory and case studies are used to develop a practical knowledge of this approach.

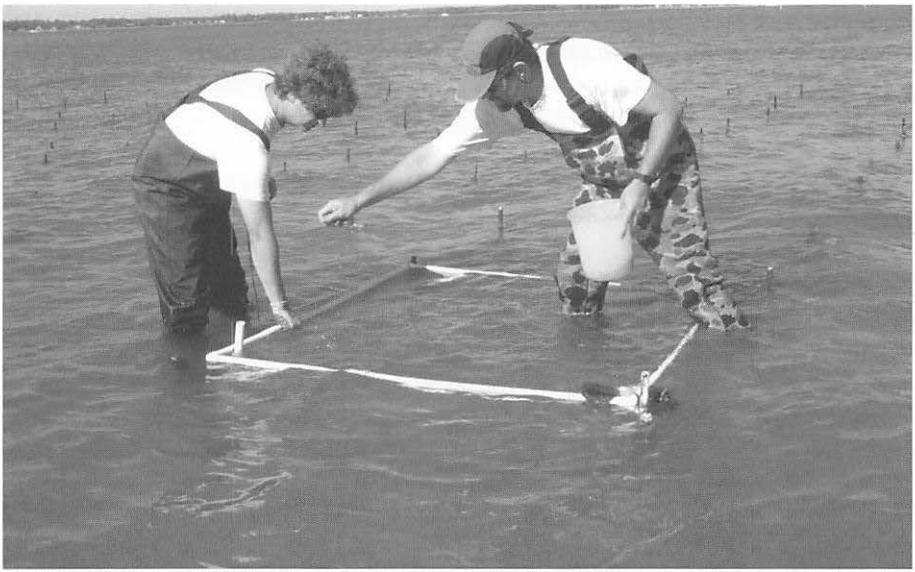
552 - Coastal Sedimentary Environments. Fall (3). Mr. McNinch
This course examines the depositional systems of coastal sedimentary environments such as sand-dominated (barrier islands), mixed (modern deltas), and mud-dominated (wetlands, tidal flats). Modern and ancient examples will be explored in field trips and lectures. Controlling physical and sedimentary processes will be emphasized. Depositional environmental parameters, particularly hydrodynamics, will be interpreted from geomorphology and sedimentary structures. Observational techniques, such as satellite imagery, near-bottom current measurements, seismic profiles, and vibracores will be discussed in lecture and utilized during field trip exercises.

553 - Introduction to Benthic Boundary Layers and Sediment Transport. Fall, even years (3) Mr. Wright
Physical and geological aspects of coastal and estuarine benthic boundary layers, their dynamic forcings and the associated suspension and transport of sediments. Principles of waves, tides and currents are introduced with emphasis on shallow-water processes. Boundary layer structure and shear stress on the seabed, wave boundary layers and turbulence are considered in relation to the coastal environment. Forces on sediment particles, initiation of sediment movement and principles of sediment transport are treated at an intermediate level.

554 - Principles of Numerical Computing. Fall (3) Mr. Wang, Ms. Harris
An introduction to computer methods for mathematical computations. Topics include principles of floating-point computation, linear systems of equations, interpolation, numerical integration, ordinary differential equations, least square method, optimization and the fundamentals for partial differential equations. Two lecture hours and one hour of computer laboratory with assigned problems using MATLAB.

555 - Advanced Aquatic Chemistry. Fall (3) Staff. Prerequisite: Instructor's consent
Discussion of the principles of chemistry focusing on the chemistry of natural water systems. Quantitative problem solving and application of computer codes will be emphasized. Topics will include: principles of chemical kinetics and thermodynamics, structure and properties of liquid water, electrolyte and polyelectrolyte solution chemistry, acid-base chemistry, carbonate equilibria, precipitation-dissolution reactions, basic coordination chemistry, and redox reactions with reference to the physical chemistry of biochemical and aquatic systems. Quantum chemistry as necessary for understanding marine phenomena, e.g. photosynthesis, hydrogen bonding, also will be presented.

556 - Biogeochemical Modeling. Spring (3). Ms. Dickhut
This course will focus on developing mathematical descriptions for biogeochemical processes, as well as on using mathematical models to design experiments to verify



specific biogeochemical mechanisms in a system. Equations describing biogeochemical processes will be derived. Discussion will include descriptions of the conditions and assumptions of the models, as well as situations where specific models apply. The course will emphasize mathematical derivations, graphical visualization and use of model fitting software.

557 - Stable Isotope Geochemistry. Fall (3) Ms. Bronk
An introduction to the principles and the use of stable isotope techniques. A survey of applications using stable isotopes to define elemental flow through experimental and natural systems. Topics include tracer theory; natural abundance techniques; quantifying biological processes; and defining trophic relationships using multiple tracers. Lectures and readings in the peer-reviewed literature.

558 - Biochemistry and Molecular Biology of Marine Organisms. Fall (3) Ms. Reece, Mr. Van Veld
This course will examine the molecular processes involved in the cellular biochemistry and genetics of marine organisms. Topics include the structure and function of nucleic acids and proteins, cellular organization and cell interactions and the application of recombinant DNA technologies to marine research. Comparative analysis of a variety of animals, plants, and microbial organisms in the marine environment will be undertaken.

561 - Analytical Approaches in Environmental and Biogeochemical Studies. Spring (3) Mr. Hale
Modern techniques to identify and quantify trace organic and inorganic compounds in the marine environment. Principles of extraction, purification, identification and quantification. Techniques include SFE, TLC, open column chromatography, HPLC, GC, trace metal spectroscopy and mass spectrometry. Sampling, quality assurance/ control, detection limits and other concerns will be covered.

563 - Environmental Chemistry. Fall (3) Mr. Unger
Overview of the major classes of environmental toxicants. Fundamentals of aquatic, atmospheric, and geo/soil chemistry. Emphasis on the environmental significance of chemical processes. Fate and transport of contaminants and how this affects Bioavailability will be stressed.

564 - Aquatic Toxicology. Fall (3) Mr. Van Veld
Factors influencing the fate and behavior of major environmental toxicants in aquatic organisms. Mechanisms involved in their uptake, distribution, bio-transformation and clearance. Effects of toxicants on aquatic organisms ranging from effects at the biochemical and cellular level to effects on individuals, populations and communities. Current methods of laboratory and field toxicity testing.

565 - Principles of Pathobiology. Spring (3) Mr. Kaattari, Staff
This is a course focused on the molecular and cellular mechanisms of pathogenesis in important, emerging diseases in the medical, veterinary, and aquacultural fields. Students will learn how current molecular and cellular techniques are being applied to the resolution of a variety of infectious and non-infectious diseases. Primary focus will be on the application of these techniques to the diseases of fish and shellfish, although mammalian models will be explored to provide a more global point of view.

566 - Diseases of Marine Organisms. Fall, odd years (4) Mr. Burreson, Mr. Vogelbein
Identification, life histories, host defense mechanisms, pathology and control of non-infectious and infectious disease agents including viruses, bacteria, protozoa, helminthes and arthropods in marine fishes and shellfishes. Three lecture and three laboratory hours.

567 - Comparative Immunology. Spring, odd years (3) Mr. Kaattari. Prerequisites: Genetics and biochemistry, and permission of instructor. Recommended: An introductory immunology course
Current theories and applications of molecular and cellular immunology. A comparative approach to the understanding of immune function throughout the animal kingdom. Topics include antibody and antigen structure and function, immune cell networks, major histocompatability complex and disease resistance, mechanisms of pathogen recognition and elimination, general principles of vaccine design and modification. Three hours of lecture.

568 - Tissue Culture and Virus Diagnosis. Spring, odd years (3) Staff
Overview on the general aspects of culturing cells of aquatic animals including their biology, derivation and characterization. Discussion of the practical application for the use of tissue culture in marine science research. Special emphasis will be given to the use of tissue culture in the isolation and diagnosis of viruses. The course will provide students with an opportunity to practice culturing, maintaining and characterizing cells from marine organisms including invertebrates. Two hours of lecture and two hours of laboratory.

569 - Molluscan Immunology and Pathology. Fall, odd years (3) Ms. Chu. Prerequisite: Instructor's consent
Concept of invertebrate internal defense; structure and function of molluscan blood cells (hemocytes and phagocytes); role of humoral factors in molluscan defense; models of non-self recognition; specificity and memory. Evasion mechanisms of the parasites. Case studies in host-parasite interactions including seasonal, environmental and toxic effects. Lecture and laboratory.

570 - Nutrition and Energy Reserve in Marine Organisms. Fall, even years (3-4) Ms. Chu. Prerequisite: Instructor's consent
Biochemistry of food source; feeding strategies; energy requirements and factors affecting energy requirements; energy reserve and metabolism, including digestion, absorption, transport, deposition, and mobilization; nutritional effects on reproduction and larval ecology. Lecture and laboratory.

571 - Culture and Physiology of Aquatic Organisms. Spring (3) Mr. Mann
History and principles of culture of aquatic organisms. Physical and biological system requirements, water quality, feeding and nutrition, manipulation of reproductive biology, selection of cultured species, quarantine and disease control, current practices in finfish and shellfish culture, physiological and biochemical methods to assess condition of cultured organisms.

572 - Estuarine Benthic Processes. Fall, odd years (3) Ms. Schaffner, Mr. Moore
This course examines current concepts in estuarine benthic processes, especially the major factors governing productivity and biodiversity. It is organized around the theme of major habitats from the upper to lower estuary and open bay, and the coastal bay mouth region. Lectures and readings will draw on examples from the Chesapeake Bay and other estuarine systems. The format consists of lectures and discussions of the primary literature.

573 - Environmental Microbiology. Fall, even years (3) Mr. Kator, Ms. Anderson
The study of microorganisms and their activities in natural environments. Specific topics include water-borne pathogens; microbial processes in wastewaters; aquaculture, created marshes, subsurface groundwater and sediments; and methodologies for detecting microorganisms and measuring processes in a variety of environments. Attention will be focused on interactions and transformations of microbial communities and pollutants (organic and inorganic) and will include discussion of biodegradation and bioremediation processes, biological nutrient reduction, and public health microbiology.

575 - Aquatic Microbial Ecology. Fall, odd years (3) Ms. Anderson, Mr. Kator. Recommended: Organic chemistry or biochemistry
An introduction to the role that microorganisms play in the biogeochemical cycling and production of dissolved and particulate inorganic and organic matter in freshwater and marine ecosystems. The approach will be ecological, relating environmental physiochemical properties to regulation of microbial processes, distributions, and

biodiversity. Topics will include state of the art methods for detecting distributions, biomass, and activities of microorganisms in the natural environment, the energetics regulating microbial processes, microbial biochemical pathways, biodegradation, microbial interactions, and the role that microorganisms play in the food webs of various ecosystems. Although emphasis will be placed on marine systems, also discussed will be processes in lacustrine, riverine, and groundwater ecosystems. Readings will draw heavily on the primary literature.

576 - Evolutionary Ecology. Fall, even years (3) Mr. Duffy. Prerequisites: General ecology; preferably, evolutionary biology
A theoretical and empirical exploration of the interaction between environment and evolution of organism structure, function, and behavior. Topics will include the evolution of life history strategies; natural selection and adaptation; sexual selection and mate choice; kin selection and sociobiology; speciation and adaptive radiation; coevolution; the paleohistory of biotic interactions; and the practical implications of evolutionary biology. Readings draw heavily from primary literature, concentrating on examples involving marine organisms.

577 - Physical Biology of Marine Organisms. Spring, even years (3) Mr. Patterson
Principles from the physical sciences (fluid and solid mechanics, mass and heat transfer theory) applied to the analysis of form, function, and evolution of marine organisms. Engineering methods and measurement techniques appropriate for investigations in physical biology will be presented.

579 - Wetlands Ecology. Spring (3) Mr. Hershner, Mr. Perry. Prerequisite: Instructor's consent
Structural and functional attributes of tidal and non-tidal wetlands. Emphasis on analysis of wetland systems at the landscape and community level. Introduction and practical experience in common research techniques including wetland classification, vegetation mapping, functional assessment models, and field sampling techniques. Individual research projects and/or paper expected. Lectures and field trips.

582 - Applied Methods of Fisheries. Fall (3-4) Mr. Chittenden
Practice, principles, and theory of applied methods in fisheries. Sampling and data collection tools, practice, and theory. Principles and theory of age determination, estimation of abundance, reproductive biology, marking and tagging, and mark-recapture. Special topics as necessary.

590 – Departmental Seminar in Resource Management and Policy. Fall and Spring (1) Staff
Required of all first-year students in the Department of Coastal and Ocean Policy, both Fall and Spring. Guided readings of the literature with the objective of synthesizing scientific, legal, economic and management aspects of resource management. Fall, faculty and invited speakers. Spring, student papers and presentations.

591 – Departmental Seminar in Resource Management and Policy. Fall and Spring (1) Staff
Required of all second-year students in the Department of Coastal and Ocean Policy, both Fall and Spring. Guided readings of the literature with the objective of synthesizing scientific, legal, economic and management aspects of resource management. Fall, faculty and invited speakers. Spring, student papers and presentations.

599 - Thesis. Fall, Spring, and Summer (hours to be arranged)
Original research in biological, physical, chemical or geological oceanography, environmental science, marine fisheries science and marine resource management. Project to be chosen in consultation with the student's major professor and the Dean of the School.

601 - Marine Science Seminar. Fall and Spring (1-3) Staff
Multidisciplinary review of significant areas of marine science. The topic will vary each semester. Guest speakers will present a variety of views. Course participants will organize and present talks related to the seminar theme. Credit will be determined by the level of participation. One credit hour (pass/fail only) for attendance and participation at seminars; two credits (pass/fail or grade option) for additional participation by contribution to discussions and presentation of seminar; three credits (pass/fail or grade option) for additional submission of written critical literature review/synthesis.

611 - Estuarine Hydrodynamics I. Spring, even years (3) Mr. Wang. Prerequisite: MS 520
Classification of estuaries, time scales of motions, tidal dynamics in estuaries, nontidal circulation, mechanism of arrested salt wedge, gravitational circulation, diffusion induced circulation, turbulence in stably stratified flows.

612 - Estuarine Hydrodynamics II. Fall, even years (3) Mr. Wang. Prerequisite: MS 611
Zero-, one- and two-dimensional descriptions of estuaries, salt intrusion, pollutant flushing, sediment transport through estuaries, field experience in estuaries, model laws for estuarine models.

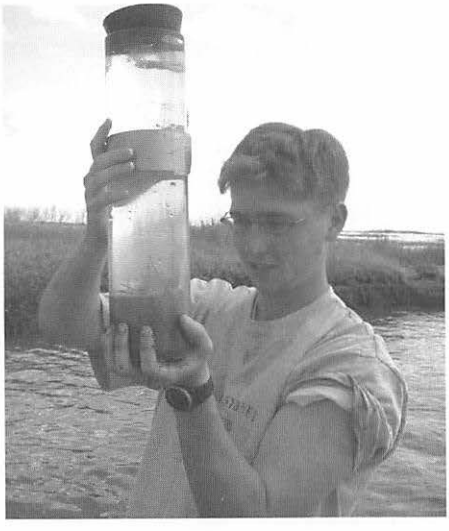
613 - Ocean Dynamics. Fall (3) Mr. Brubaker, Mr. Friedrichs. Prerequisite: MS 520 or Instructor's consent
Development of illustrative conceptual and analytical models to elucidate the effects of the rotation of the earth, stratification, and friction on the dynamics of oceanic motion at various scales. Topics include: wind-driven gyre circulation, coastal upwelling, turbulence in stratified flows, large-scale waves, and internal waves with and without rotational influence.

615 - Hydrodynamic Modeling of Estuarine and Coastal Waters. Spring (3) Mr. Wang. Prerequisite: MS 613 or Instructor's consent
This course will survey numerical methods for the solution of partial differential equations describing the estuarine and coastal water motion and transport. Topics include

stability, accuracy, consistency and convergence analysis of numerical scheme, formulation of primitive and scalar transport equations, and the pre- and post-processing for numerical computational models. The course will involve classroom lectures, seminar readings, application of models for operational environmental prediction.

617 - Estuarine Water Quality Models. Fall, odd years (3) Staff. Prerequisite: MS 611
Principles of mass balance, physical transport processes, diffusion and dispersion in estuarine environments. Water quality processes, representation of biochemical transformations, dissolved oxygen modeling, survey of available models.

621 - Coastal Morphodynamic Processes. Fall, odd years (3) Mr. Wright
Emphasis is on the mutual adjustments between coastal depositional and erosional morphologies and the hydrodynamic processes that cause sediment transport and transport gradients. Continental shelf, surf-zone, beach, and estuarine processes will be examined. The course involves a mix of classroom lectures, seminar discussion of readings, application of computer models and analysis of field data.



623 - Isotope Geochronology. Fall, odd years (3) Mr. Kuehl
Principles of radioisotope dating techniques with emphasis on those applicable to marine settings. Equations of radioisotope decay and ingrowth will be detailed along with the geochemical systematics of each technique.

624 - Ocean Waves: Theory, Measurement and Analysis. Fall, even years (3) Mr. Maa. Prerequisite: Instructor's consent
Introduction to linear water wave theory and its applications. Topics include mechanisms of wave generation (wind waves and tides), the governing equations, wave properties, wave transformation, special cases for tidal wave propagation (e.g., Kelvin waves), wave bottom boundary layer, nonlinear properties (i.e., radiation stress). Practical applications of numerical models for wind wave generation, wave transformation, the spectrum analysis for wave measurements, and harmonic analysis for tides will be introduced and demonstrated.

625 - Multivariate Analysis and Time Series. Spring (3) Mr. Evans
Eigenvector methods, principal component analysis and factor analysis; regression methods; Fourier and stochastic models applied to geophysical and other time series data sets. Two lecture hours and one hour of computer laboratory with assigned problems.

626 - Advanced Quantitative Methods for Marine Scientists. Spring (3) Mr. Evans
Introduction to matrices. Advanced topics in regression including multiple regression, sensitivity analysis, non-linear function-fitting techniques. Empirical eigen function methods with applications. Complex notation as applied to the description of sinusoidal variations. Fourier transforms, spectra and filtering.

627 - Marine Organic Geochemistry. Spring, even years (3) Ms. Canuel, Mr. Bauer. Prerequisite: Organic Chemistry
Characterization of organic carbon, nitrogen, phosphorus and sulfur in marine water column and sediments. Modern methods of organic analysis that enhance our understanding of how organic materials cycles through the oceans will be discussed. Topics include the role of organic matter in the C, N, S, and P cycles; chemical composition of marine organic matter; diagenetic transformations of organic materials; organic matter degradation and preservation; and petroleum geochemistry.

628 - Chemistry of Surfaces and Interfaces. Spring, odd years (3)
Chemical properties and reactions at surfaces and interfaces, focusing on aquatic surface chemistry relevant to natural systems. Topics include structure and reactivity of surfaces; properties of bulk and interfacial water; chemical reactions at surfaces and interfaces; bonding mechanisms at the water/solid interface; and relevant experimental and spectroscopic methods.

629 - Environmental Organic Chemistry. Fall, odd years (3) Ms. Dickhut
Overview of partitioning, transport, and transformational processes controlling the environmental fate of organic contaminants. Fundamentals of thermodynamics and chemical kinetics relevant to organic chemical fate and transport mechanisms. Elementary mass transfer equations and application to chemical transport in the environment.

635 - Immunotoxicology. Spring, even years (3) Staff
Mechanisms through which several classes of toxic chemicals compromise the function and phenotype of immunocompetent cells. Methods of data interpretation and extrapolation of conclusions at the organismal and population levels. Topics include principles of immunotoxicology, chemical immunomodulators or environmental concern, effects of toxic chemicals on the ontogeny of immune functions and hemopoietic organs, tiered approach to evaluate toxic insult on the immune system, and molecular mechanisms of immunotoxicology, correlation between immunotoxicity, carcinogenicity, and susceptibility to disease. Two hours of lecture and two hours of laboratory.

638 - Fish Histology and Histopathology. Spring, even years (4) Mr. Vogelbein
Detailed examination of the normal microscopic structure and function of tissues and organs in fishes and the morphological and functional changes that occur in tissues during disease. Infectious and non-infectious diseases, including pathological changes elicited by chemical toxicants and environmental factors will be evaluated. Lab will consist of in-depth training in routine methods of paraffin histology and histochemistry. Three lecture and 3 laboratory hours. Restricted to 6 students.

640 - Quantitative Ecotoxicology. Spring (4) Mr. Newman
Essential ecotoxicology principles and quantitative methods for the analysis of ecotoxicological data. Laboratory exercises will include method applications with PC-based software. Emphasis will be placed on the scientific and statistical soundness of techniques.

641 - Environmental Risk Assessment. Fall (3) Mr. Newman
Basic structure and methods for environmental risk assessment are presented for retrospective and predictive assessments. Concepts associated with ecological and human hazard and risk assessments are covered. Discussions of associated logic and methods are framed around NRC Paradigm of Problem Formulation/Hazard Identification, Effects Characterization, Exposure Characterization, and Risk Characterization.

650 - Analysis of Discrete Data. Spring (3) Mr. Diaz. Prerequisite: Instructor's consent
Design, analysis and interpretation of field and laboratory studies that rely on discrete or count data, including rates and proportions. Models based on Chi-squared and other nonparametric distributions for uni-, bi-, and multi-variate data will be covered. Topics include sample size experimental design, single and cross classification, covariate inference, and numerical classification techniques. Lecture and computer laboratory.

651 - Ecological Modeling and Simulation Analysis. Fall (3) Mr. Wetzel. Prerequisite: Instructor's consent
Theoretical and practical aspects of conceptualizing, simulating and analyzing digital computer models of estuarine and marine ecosystems. Systems theory and control is presented in terms of ecological processes. Computer modeling project required.

652 - Marine Plankton Ecology. Fall, odd years (3) Mr. Ducklow, Ms. Steinberg. Prerequisite: MS 524 or 526 or consent of the instructors
Contemporary topics in cellular, population, community and ecosystem level dynamics of plankton systems, including nutrients and organic matter, viruses, bacteria, phytoplankton, protists and zooplankton. Lectures and student-led discussions.

653 - Marine Benthos. Spring (3) Mr. Diaz, Staff. Prerequisite: MS 526
Ecology of marine and estuarine benthos. Emphasis is placed on determining how ecological processes effect function and structure of benthic communities. Consideration is given to interactions among autotrophs, microheterotrophs and larger metazoans and interactions between these organisms and their physical-chemical environments.

654 - Secondary Production of Invertebrates. Fall (3) Mr. Diaz
Principles and theories of secondary production. Physical and biological factors influencing production, role of habitat complexity, implications for community structure, estimation of trophic resources and techniques of measuring secondary production.

655 - Methods in Aquatic Microbial Ecology. Spring, odd years (3) Ms. Anderson, Mr. Kator. Prerequisite: MS 575 or equivalent
An advanced laboratory-oriented course covering methods used to measure microbial numbers and biomass, activity, primary production, secondary production, community metabolism, specific biogeochemical cycling, and degradation of pollutants. Methods include gas chromatography, emission spectrometry, epifluorescence microscopy, and application of stable and radioactive isotopes. Each student will design, prepare and perform a field-project utilizing methods described in the course.

656 - Seagrass Ecosystems. Spring, odd years (1-2) Mr. Orth, Mr. Moore
A lecture-seminar course covering topics related to seagrass ecosystems. Emphasis on the structure and function of seagrass communities, submerged angiosperm physiology, primary and secondary production, and integration of seagrass communities to the marine environment. Students will be assigned projects to complete. Credit, which must be arranged in advance of registration, will depend upon difficulty of the assignments.

657 - The Early Life History of Marine Fishes. Fall, odd years (3) Mr. Olney. Prerequisite: MS 666 or consent of instructor
Ontogeny, systematics, physiology, behavior and ecology of egg, larval and juvenile stages of fishes with special reference to adaptations for survival. Population dynamics and the importance of early life history in the recruitment process are emphasized. Ichthyoplankton sampling methods are outlined. In the laboratory, eggs and/or larvae of 100+ families of teleostean fishes are examined, and characters useful in identification are presented. Two lecture and two laboratory hours.

658 - Ecology of Marine Invertebrate Larvae. Spring, alternate years (3) Mr. Mann. Prerequisite: Instructor's consent
A broad discussion within the marine invertebrates of the following topics: the concept of the larval form, spawning and developmental patterns, limitations on the fertilization process and embryology, the Reynolds number environment at typical larval size, feeding and nutrition in the larval size range, larval size and parental investment, larval dispersal and supply in maintaining community structure, roles of physical versus biological processes in inducing metamorphosis, early post-metamorphic survival, and larval ecology in extreme environments.

659 - Phytoplankton Ecology. Fall, odd years (3) Mr. Smith. Prerequisites: MS 501 (may be taken concurrently with Instructor's consent.)
This course will examine the factors which influence the growth, losses and distributions of phytoplankton in marine systems. Topics include photosynthesis, pigmentation, productivity, biochemical fractionation, grazing, and nutrient uptake and interactions. A laboratory will introduce students to modern methods used in the study of phy-

toplankton such as isotopic measurements, HPLC analysis of pigments, fluorometry, and image analysis. Samples from the local estuaries will be used in the laboratories to illustrate the principles discussed in class.

660 - Zooplankton Ecology. Spring (4) Ms. Steinberg
This course will examine the ecology, natural history, basic cell or body design features, physiology, and life-histories of all the major groups of zooplankton. Food webs, specialized habitats, physical-biological coupling, and behavior are also discussed. Laboratories will concentrate on the groups or topics that are being discussed that week in lecture. The laboratories will be devoted to studying freshly collected (live local net tows), laboratory cultured, and occasionally museum specimens of the various taxa, and to introducing students to methods of study of zooplankton ecology (microscopy, biomass measurement, grazing experiments). There will also be field trips (e.g. night plankton tow to catch vertical migrators).

664 - Marine Conservation Biology. Fall (3). Mr. Lipcius
Study and application of multidisciplinary scientific principles to the protection, enhancement and restoration of marine biodiversity (genetic, species, community and ecosystem). Ecological emphasis on the conservation of biodiversity threatened by habitat degradation and loss, overexploitation, invasive species, and global change. Discussion of social, legal, economic and political influences. Practical application through case studies and training in population viability analysis. Lectures and Laboratory.

665 - Fisheries Climatology. Fall, odd years (3) Mr. Austin. Prerequisite: MS 528
Effects of natural environmental variability on the recruitment, availability (yield), abundance and behavior of living marine resources. Application to real-time fishing operations and climate scale analysis of fishery fluctuations. Instruction in basic meteorology and climatology with application to the ocean. Two lecture hours and one laboratory hour.

666 - Ichthyology. Spring (3 - 5) Mr. Musick
Functional morphology, behavior, ecology, zoogeography and evolution of fishes. Seven lecture, laboratory and field hours. Three credits without laboratory; five credits with laboratory.

667 - Experimental and Quantitative Ecology. Spring (3) Mr. Lipcius
The design, conduct, analysis and interpretation of field and laboratory experiments in ecology. Includes lectures, discussion and supervised field and laboratory projects designed to illustrate the diversity of experimental and quantitative approaches in use by ecologists. Topics include the scientific method, experimental design, the use and abuse of statistical techniques, modeling and manuscript preparation, with emphasis on topical ecological issues such as those dealing with predator-prey interactions, recruitment phenomena, environmental science (e.g., dose-response assays) and metapopulation dynamics. Lecture and laboratory.

668 - Malacology. Spring, even years (3) Mr. Mann
The fossil record and the ancestral mollusc. Structure and function of the molluscan shell. Review of molluscan taxonomy. Reproductive biology, physiology, ecology, and feeding mechanisms of the molluscs.

670 - Stock Assessment Methods. Spring (4) Mr. Hoenig
Survey of methods for assessing the status of exploited populations given various combinations of data types. Emphasis is on deriving statistical methods using maximum likelihood and other analytical techniques, and on computing estimates for a variety of datasets. Use of population models to integrate information on stock status in order to determine appropriate management measures. Analysis of uncertainty in assessment results and implications of uncertainty for management. Analysis of research survey, commercial catch, fishing effort, and tagging data will be considered.

671 - Fisheries Population Dynamics. Spring (3-4) Mr. Chittenden
Theory and practice of stock identification, growth, abundance, mortality, recruitment, and biomass production in fisheries stocks. Objectives of fishery management. Responses of stocks and fisheries to exploitation. Fluctuations in abundance, population growth forms, and population regulation. Theory, interpretation, and application of fisheries yield models including yield and eggs-per-recruit, production, and spawner-recruit models. Examples drawn from finfish and shellfish stocks.

672 - Applied Regression and Forecasting. Spring (3) Mr. Kirkley. Prerequisite: MS 505 or equivalent
Course introduces theory and practice of quantitative methods in marine science. Methods of regression and time-series analysis will be emphasized. Topics include linear and nonlinear regression, model validation and testing, univariate and multivariate models, transfer functions, intervention analysis, and forecasting.

673 - Marine Molecular Genetics. Spring, (3) Mr. Graves, Ms. Reece. Prerequisite: Undergraduate Genetics or permission of instructor
A study of the evolutionary processes responsible for the intra- and interspecific genetic relationships of marine organisms with an emphasis on the application of current molecular methodologies. 3 hrs. lecture.

674 - Marine Molecular Genetics Laboratory. Spring (2) Mr. Graves, Ms. Reece. Prerequisite: Undergraduate Genetics or permission of instructor
Students will elucidate intra- and interspecific genetic relationships by employing a variety of molecular techniques for the analysis of proteins and nucleic acids, 5 hrs. laboratory.

685 - Practical Application of Marine Resource Management Techniques. As required (1-3) Mr. Hershner, Staff
Students participate in real world management activities under the guidance of involved faculty members and in association and consultation with members of various levels of government. May include issue identification and resolution, committee involvement at local, regional, state, interstate, and federal levels of government,

development of management plans, drafting position papers, developing draft legislation and exposure to policy making mechanisms. Requirements will vary depending on the issue(s) addressed. Students will be evaluated on participation, written work (memoranda, position papers, etc.) and knowledge gained as evidenced by interaction with staff and by other means. Students may repeat the course provided the instructor determines there is no duplication of material. Credit, which must be arranged in advance of registration, will depend upon difficulty of the assignment.

690 - Progress and Process - The Relationships of Science and Law in Determining Public Policy on the Environment. Spring (3) Mr. Taylor
This course is given from the perspective of the working scientist, and it is intended to provide an understanding of the relationships between the disparate cultures of science and law in the arena of public policy. We will examine the two professional cultures, their historic and ethical foundations, their place with the constitutional framework of the United States, and their origins in the Age of Reason. The dynamic tension of their respective roles in determining the outcome of environmental policy in the contemporary American context will be examined along with alternatives to the status quo. Readings, lectures and discussion.

691 - (LAW 414). Toxic Torts. As required (3) Law School Staff. Prerequisite: Consent of instructor
A study of the legal and policy issues governing resolution of claims of harm to persons, property, or the environment arising from toxic products, substances, services, or processes. The course will explore how common law and statutory principles define the rights, duties, liabilities, and remedies of parties involved in disputes over environmental and toxic harm. Special consideration will be given to the traits that set environmental and toxic torts apart from traditional and mass torts: long latency periods, distinctive causation problems, the central role of scientific and other expert evidence, and a complicated relationship between common law and statutory environmental law.

692 - (LAW 417). International Environmental Law. As required (3) Law School Staff. Prerequisite: Consent of instructor
This course focuses on bilateral, regional and international agreements and principles governing ocean pollution, air pollution, hazardous and nuclear waste, deforestation, and other environmental problems with a global impact. The course also will address population control and food shortages under international law, especially in developing countries, and how these problems relate to international peace and security. The basic courses in public international law and environmental law are not prerequisites, but are recommended.

693 - (LAW 424). Environmental Law. As required (3) Law School Staff. Prerequisite: Consent of instructor
A study of the nature and causes of environmental pollution and of the main legal techniques for its control. The course will consider the common law, the environmental impact assessment process (e.g., the National Environmental Policy Act), and the basic regulatory framework for air, water and solid and hazardous waste control (the

Federal Clean Air Act, Clean Water Act and Resource Conservation and Recovery Act), with attention given under each statute to the basic regulatory framework and the main policy issues presented by it. Other topics will include the role of the federal courts in reviewing agency action, new developments in federal administrative law (including current efforts at administrative law reform), natural resource management and allocation issues involved in the division of scarce resources (e.g., air and water) among competing users, toxic and hazardous substance regulation, and enforcement of environmental laws.

694 - (LAW 425). Land Use Control. As required (3) Law School Staff, Ms. Butler. Prerequisite: Consent of instructor
An analysis of the legal principles governing the use and management of land and the fundamental values underlying those principles. While focusing primarily on government regulation of land use, the course also will examine common law rules which affect the way that land is used. Topics that might be considered include judicial control of land use, zoning and the rights of landowners, zoning and the rights of neighbors, land use planning, public regulation of land development, aesthetic regulation, and the preservation of natural and historic resources.

695 - (LAW 453). Administrative Law. As required (3) Law School Staff. Prerequisite: Consent of instructor
A study of practice in the administrative process, examining the procedures for administrative adjudication and rule making; legislative and judicial control of administrative action; and public access to governmental processes and information.

696 – (LAW 467). Legislative Process. As required (2) Law School Staff, Mr. Koch. Prerequisite: Consent of instructor
This class focuses primarily on the structure and operations of the federal legislative process. Topics include, among others, theories of and doctrines relating to statutory construction; Congress' role in the constitutional system of government; the significance of legislative precedent; prospective and retroactive lawmaking; and the scope of particular legislative functions, including legislative drafting and confirmation and impeachment proceedings.

697 - Problems in Marine Science. Fall, Spring and Summer (1-4) Staff
Supervised projects selected to suit the needs of the graduate student, including those wishing to perform an internship as part of the Curricular Practical Training Program. Projects to be chosen in consultation with the student's major professor and the instructor. Acceptable research outlines and project reports are required. Amount of credit depends upon difficulty of course. Examples of projects offered in recent years include: management issues in shellfish sanitation; groundwater nutrient processes; bacterioplankton methods and techniques; pesticide analysis in environmental samples; marine molecular population genetics; and law and policy relating to the introduction of non-indigenous plants. Subjects will be announced prior to registration and after approval by the Educational Policy Committee (EPC). Hours to be arranged with instructor prior to registration.

698 - Special Topics in Marine Science. Fall, Spring and Summer (1-3) Staff
This is the avenue through which subjects not covered in other formal courses are offered. These courses are offered on an occasional basis as demand warrants. Examples of courses offered in recent years include: continental margin sedimentation; biomineralization in marine organisms; molecular markers and evolution; oligochaete biology; quantitative methods of image analysis; and organism-sediment interactions in coastal systems. Subjects will be announced prior to registration and after approval by the EPC. Hours to be arranged.

699 - Dissertation. Fall, Spring and Summer (hours to be arranged).
Original research in biological, physical, chemical or geological oceanography, environmental science, marine fisheries science, or marine resource management. Project to be chosen in consultation with the student's major professor with the approval of the Dean of Graduate Studies.

Undergraduate Courses

Undergraduates can take 500-550 level courses with the permission of instructor

330 - Introduction to Oceanography. Spring, odd years (3) Mr. Bauer, Mr. Patterson
Description of physical, chemical, biological and geological processes operating in the world ocean. The interdisciplinary nature of oceanography is emphasized, providing an integrated view of factors which control ocean history, circulation, chemistry and biological productivity

497 - Problems in Marine Science. Fall, Spring and Summer (1-4) Staff
Supervised projects selected to suit the need of the upper level undergraduate student. Projects are chosen in consultation with the student's supervising professor and the instructor. Credit hours depend upon the difficulty of the project and must be arranged with the instructor in advance of registration.

498 - Special Topics in Marine Science. Fall, Spring and Summer (1-3) Staff
This is the avenue through which subjects not covered in other formal courses are offered. These courses are offered on an occasional basis as demand warrants. Subjects will be announced prior to registration. Hours to be arranged.

Academic Program

General Program Description

The academic program of the School of Marine Science is intended primarily for the student who wishes to specialize in marine science at the graduate level. Degrees offered are the Master of Science and Doctor of Philosophy in Marine Science. The school offers research opportunities and instruction at the graduate level in five general areas: Biological Sciences, Coastal and Ocean Policy, Department of Environmental and Aquatic Animal Health, Fisheries Sciences and Physical Sciences.

Though the courses offered by the School are primarily for graduate students, advanced undergraduates (juniors and seniors) may participate. For instance, biology, chemistry, and physics majors can enroll in suitable 500-549 level marine science courses for credit toward the Bachelor's degree provided certain conditions (see College of William and Mary Undergraduate Program Catalog) are met. Undergraduates also may enroll for research credit to work on problems in marine science. The student is responsible for making the necessary arrangements with an individual School of Marine Science faculty member, and the consent of the chairperson of the student's major department is also required.

General Preparatory Requirements

Students who are interested in pursuing marine science as a profession should consult with their academic advisor or the Dean of Graduate Studies, School of Marine Science, early in their college careers to identify an academic program that will prepare them for graduate study in marine science. Students interested in biological sciences, Department of Environmental and Aquatic Animal Health, or fisheries sciences should have a strong background in basic sciences, including a suite of contemporary biology courses, physics and chemistry (through organic), and mathematics through calculus and differential equations. The prospective chemical, geological or physical oceanography student should have an undergraduate degree with appropriate course work in chemistry, geology or related geophysical science, physics, meteorology, mathematics or engineering, and a solid quantitative background. Course work in statistics and competence with computers are particularly important.

Degree Requirements

General

Students generally are bound by the requirements stated in the catalog that is in effect when they enter the School. The department in which the student specializes and individual advisory committees may prescribe additional requirements for their students.

Residency

To fulfill the full-time academic residency requirement of the School of Marine Science, students must:

1. Successfully complete the core course requirements
2. Be a full-time student in good standing for two consecutive semesters

Satisfactory Progress

To continue in a degree program, a student must make satisfactory progress towards the degree. If the faculty of a program in which a student is enrolled determines that satisfactory progress is not being made, a student may be required to withdraw because of academic deficiency. A student may appeal to the Academic Status and Degrees Committee.

Registration Requirements

All active students (i.e., those working toward completion of a degree program who have not been granted leave) must register for a minimum of nine paid hours each semester, and one paid hour for each term of the summer session. Students must be registered in the semester during which they graduate. For a single semester, the student may be given research student status. This generally would be the semester in which the student completes the thesis and graduates.

Changes in Registration

All changes in students' schedules after the close of registration require approval of the instructors involved and the Dean of Graduate Studies. Students may not add courses after the last day for changes in registration as indicated in the calendar. If the student drops a course or courses before mid-semester but remains registered for other academic work, the course or courses dropped will be removed from the student's record. If the student drops a course or courses after mid-semester through the last day of classes but remains registered for other academic work, the grade of "W" or

"F" will be awarded by the instructor in the course depending upon whether or not the student was passing at the time the course was dropped.

A student wishing to withdraw from a course (or courses) due to medical reasons after mid-semester may apply to the Academic Status and Degrees Committee for approval. With the approval of the request, a grade (or grades) of "W" will appear on the transcript.

Students may not drop a course after the last day of classes. If a student does not complete a course for medical reasons, "W" with appropriate notation will be entered on the record upon approval of the Dean of Graduate Studies and the appropriate authorities at the College.

System of Grading and Quality Points

The grades A (excellent), B (good), C (satisfactory), P (pass), in certain courses, D (unsatisfactory), and F (failure) are used to indicate the quality of work in a course. "W" indicates that a student withdrew from the College before mid-semester or dropped a course between mid-semester and the last day of class and was passing at the time that the course was dropped.

For each semester credit in a course in which a student is graded A, 4 quality points are awarded; A-, 3.7; B+, 3.3; B, 3; B-, 2.7; C+, 2.3; C, 2; C-, 1.7. P carries credit but is not included in a student's quality point average; D and F carry no credit, but the hours attempted are included in the student's average.

In addition to the grades A, B, C, P, D, F, and W, the symbols "G" and "I" are used on grade reports and in the College records. "G" is given to work in progress towards Masters (MS 599) or PhD (MS 699) research, since there is insufficient evidence upon which to base a grade. "I" indicates that because of illness or other major extenuating circumstances, the student has postponed, with the explicit consent of the instructor, the completion of certain required work. "I" automatically becomes "F" at the end of the next semester if the postponed work has not been completed.

Retaking a Course

Degree credit is granted only for coursework in which a student earns a grade of "C" or above. A graduate student may repeat one course outside of the core curriculum in which a grade of "C" or lower is received; however, the initial grade earned remains a part of the student's record and is included in computations of quality point requirements. Any student receiving more than one "D" or "F" in a program of study will not be permitted to continue in the School of Marine Science.

Transfer of Academic Credit

On the recommendation of the Academic Status and Degrees Committee and the approval of the Dean of Graduate Studies, a regular student may apply up to 15 hours of graduate credit for courses equivalent to the SMS core courses (MS 501-505) earned at another accredited institution. Command of material in MS 501-505 must still be demonstrated.

Students can petition for up to six hours of other graduate work not already applied toward another degree, but the total transfer cannot exceed 15 hours. The credits must have been earned in courses appropriate to the students program in the School and must fall within the time specified by the general college requirements for degrees.

Credit may be transferred only for courses in which the student received a grade of "B" or better and may not be counted in compiling his/her quality point average at William and Mary.

Qualifying Exam

Each student must satisfactorily complete a qualifying examination that indicates a proficiency in the student's particular field of study. This examination is coupled with a presentation of the student's thesis/dissertation prospectus. Qualifying exams usually are completed by the end of the third semester (MS) or fourth semester (PhD).

Leave of Absence

A student may request a leave of absence from the program for a specific period of time. Leaves of absence will relieve the student of the obligation of paying tuition during the approved absence from the program. It is understood that a student on leave of absence is not present on campus and drawing upon campus resources. A student must terminate the leave of absence and be a registered student in the semester in which his or her degree requirements are completed or in which he or she graduates. A leave of absence does not automatically extend the time limit for completion of degree requirements.

Probation

A student will be placed on probation for receipt of a grade of C+ or below or a cumulative average less than a B (< 3.0). In the case of a grade deficiency in a core course, the student must retake the course and receive a grade of B- or better, or successfully pass a comprehensive exam. The grade of any retaken course will not be counted in the student's cumulative average. Probation will last until a student's cumulative average is raised to at least a B (3.0), and will in no circumstances last longer than one calendar year.

If, during probation, the student receives a grade less than C+ or receives a semester average less than a B (<3.0), or fails to raise their cumulative average to at least a B (3.0), the penalty is automatic dismissal from the School of Marine Science, with the possibility of appeal to the Academic Status and Degrees Committee for reinstatement.

Withdrawal from the Program

Withdrawal from the program constitutes termination of the student's program of study in the School of Marine Science. Withdrawal may be voluntary on the part of the student or be imposed by the School of Marine Science for reasons of academic deficiency. A student who fails to register for a regular semester (Fall or Spring) once the student has begun his/her graduate study and who has not requested a leave of absence or permission to withdraw, will be placed on a leave of absence for one semester by the Dean of Graduate Studies. If the student has not applied for a leave of absence prior to the end of registration for the next regular semester, or if the Dean of Graduate Studies is not able to justify continuing the leave of absence, the ***student's record will be marked "withdrawn unofficially."***

If the student withdraws from the College before mid-semester, a grade of "W" will appear on the record for each course in progress at the time of withdrawal. After mid-semester through the last day of classes, students who withdraw from the College will be awarded a "W" or "F" by the faculty member teaching each course in progress at the time of withdrawal.

Reinstatement After Withdrawal

A student wishing reinstatement after withdrawal must reapply to the School of Marine Science under the procedures in effect at the time of reapplication.

Extension of Time Limit

Classified (regular) students who have exceeded the time limit for degree completion and who have not been granted a time extension will not be permitted to register in the School of Marine Science.

Required Courses

All students

By the end of a student's second year in the School, the student must have passed the following core courses: MS 501, MS 501L, MS 502, MS 504 and MS 505. Exemptions may be granted under exceptional circumstances.

Students in Biological Sciences

MS 526.

Students in Coastal and Ocean Policy

MS 542, MS 590, MS 591 and distribution requirements as specified by the department

Students in Department of Environmental and Aquatic Animal Health

Master of Science students must take a minimum of two (2) and Doctor of Philosophy students must take a minimum of four (4) of the following courses: MS 563, MS 564, MS 565, MS 566, MS 573, MS 638, MS 640 and MS 641.

Students in Fisheries Science

MS 528.

Must take one of the following: MS 625, MS 667, MS 670 or MS 672.

Students in Physical Sciences

Required courses for the different disciplines in Physical Sciences are as follows:

Physical Oceanography: MS 520; Geological Oceanography: MS 522; Marine Chemistry: MS 524.

In addition, all students in Physical Sciences must take at least one advanced course (550-level or higher) appropriate to the student's specialty (marine chemists must include MS 555).

Language Requirement

Although graduate students at the School of Marine Science are not required to demonstrate a proficiency in a foreign language, we strongly encourage them to acquire such skills. In the increasingly international arena of marine science, the experience of learning and the ability to read, write and speak a foreign language cannot be minimized. In some cases, a student's advisory committee may require demonstration of foreign language skills prior to admission to candidacy.

Degree of Master of Science

The steps to be accomplished and requirements for the degree are:

1. The student must select a suitable major professor, who must be a faculty member of the School of Marine Science, as soon as possible following admission. The student and the major professor will choose an Advisory Committee, which must be approved by the Dean of Graduate Studies. The major professor and Advisory Committee direct the student's program.

2. The Advisory Committee, chosen by the student and approved by the Dean of Graduate Studies, must consist of at least four members. A majority of the Committee's members must be members of the faculty of the School of Marine Science, although persons with appropriate qualifications from outside the School of Marine Science may serve on the committee. For students with a specialty in biology or fisheries science, at least one member must be from the discipline of physical or environmental science. For students with a specialty in physical or environmental science, at least one member must be from the discipline of biological or fisheries science. For students with a specialty in coastal and ocean policy, at least one member must be from another discipline within the School of Marine Science.

3. At least one year of each student's program must be spent as a full-time resident student as defined in the general degree requirements.

4. At least 36 credit hours of advanced work, of which at least 9 credit hours must have been earned in courses numbered 550 or above with a grade point average of 3.0 or better, are required for the MS degree. In addition, a student must have registered for thesis (MS 599) for at least one semester. No more than six thesis credits may be counted toward the minimum 36 credits required for the MS. Credits more than seven (7) years old and earned in the program in which the student is currently enrolled will be deleted from the accumulation of credits required for a degree. Credits acquired while enrolled in previous programs here or elsewhere generally are not subject to this limitation.

5. Upon a favorable recommendation of the student's Advisory Committee and the Academic Status and Degrees Committee, followed by a majority vote of the Academic Council and the approval of the Dean of Graduate Studies, a student may be admitted to candidacy after completion of the following requirements:

a. The student must have achieved a grade point average of B (3.0) or better, averaged over all courses taken for credit at the time of application for admission to candidacy.

b. All core courses required by the School of Marine Science (MS 501, MS 501L, MS 502, MS 504, MS 505) must be passed with a grade of B- or better (or successful completion of a comprehensive examination) or officially exempted, based on prior coursework and all other courses specifically required by the student's department and Advisory Committee must be completed.

c. The qualifying examination and prospectus must be completed.

6. The student must present a seminar to the marine science faculty, staff and students on a thesis topic approved by the major professor, the Advisory Committee and the Dean of Graduate Studies, and must defend this thesis before his/her major professor and committee. The defense of the thesis shall be separate from any other examination. Full details of this requirement can be obtained from the Office of the Dean of Graduate Studies.

7. All requirements for the degree must be completed within three calendar years after commencing graduate study. In exceptional cases, if recommended by the Academic Status and Degrees Committee, the Dean of Graduate Studies may approve time extensions.

Degree of Doctor of Philosophy

The steps to be accomplished and the requirements are:

1. The student must select a suitable major professor, who must be a faculty member of the School of Marine Science, as soon as possible following admission. The student and the major professor will choose an Advisory Committee, which must be approved by the Dean of Graduate Studies. The major professor and Advisory Committee direct the student's program.

2. The Advisory Committee, chosen by the student and approved by the Dean of Graduate Studies, must consist of at least five members, at least one of whom must be from outside the College of William and Mary. A majority of the Committee's members must be members of the faculty of the School of Marine Science, although persons with appropriate qualifications from outside the School of Marine Science may serve on the committee. For students with a specialty in biology or fisheries science, at least one member must be from the discipline of physical or environmental science. For students with a specialty in physical or environmental science, at least one member must be from the discipline of biological or fisheries science. For students with a specialty in coastal and ocean policy, at least one member must be from another discipline within the School of Marine Science.

3. A minimum of three years of graduate study beyond the baccalaureate is required. At least one academic year must be or have been spent in residence

as a full-time MS or PhD student of the College of William and Mary at either the Williamsburg or the Gloucester Point campus, or both, as defined in the general requirements above.

4. At least 42 credit hours of advanced work, of which at least 15 credit hours must have been earned in courses numbered 550 or above with a grade point average of 3.0 or better, are required for the PhD degree. In addition, a student must have registered for dissertation (MS 699) for at least one semester. At least 9 but no more than 12 dissertation credits may be counted toward the minimum 42 credits required for the PhD degree. Credits more than seven (7) years old and earned in the program in which the student is currently enrolled will be deleted from the accumulation of credits required for a degree. Credits acquired while enrolled in previous programs here or elsewhere generally are not subject to this limitation.

5. Upon a favorable recommendation of the student's Advisory Committee and the Academic Status and Degrees Committee, followed by a majority vote of the Academic Council and the approval of the Dean of Graduate Studies, a student may be admitted to candidacy after completion of the following requirements:

    a. The student must have achieved a grade point average of B (3.0) or better, averaged over all courses taken for credit at the time of application for admission to candidacy.

    b. All core courses required by the School of Marine Science (MS 501, MS 501L, MS 502, MS 504, MS 505) must be passed with a grade of B- or better (or successful completion of a comprehensive examination) or officially exempted, and all other courses specifically required by the student's department and Advisory Committee must be completed.

    c. The qualifying examination and prospectus must be completed.

6. The student must present a seminar to the marine science faculty; staff and students on a dissertation topic approved by the major professor, the Advisory Committee and the Dean of Graduate Studies, and must defend this dissertation before his/her major professor and committee. The defense of the dissertation shall be separate from any other examination. Full details of this requirement can be obtained from the Office of the Dean of Graduate Studies.

7. All requirements for the degree must be completed within the following time frame:

   4 years with a Master's Degree from the School of Marine Science

   5 years with a Master's Degree from another Institution

   6 years with direct admittance (bypass Master's Degree)

   In exceptional cases, if recommended by the Academic Status and Degrees Committee, the Dean of Graduate Studies may approve time extensions.

8. Dissertations will be published by having a master microfilm negative made from each original dissertation. Each dissertation, when submitted, must be accompanied by two copies of an abstract of not more than 350 words. This abstract or summary will be published in Microfilm Abstracts for national distribution. No dissertation will be accepted without this abstract. The candidate for the Doctor of Philosophy degree must pay a fee for the above services before it is conferred. All dissertation research, however, should be planned, conducted and reported with a view toward publication of the results in a peer-reviewed scientific journal.

General Statement of Policy

The School of Marine Science and the College of William and Mary have an Affirmative Action Policy and are committed to attracting minorities into marine science. The School's Admissions Committee considers applicants without regard to sex, race, color, religion, national origin, sexual orientation, or disability. Admissions criteria are based on past and potential academic and research performance.

The facilities and services of the College are open to all enrolled students on the same basis, and all standards and policies of the institution, including those governing employment, are applied accordingly.

Senior citizens of Virginia who wish to take advantage of fee waiver privileges in order to attend courses at William and Mary are invited to contact the Office of Admissions for full details.

The College reserves the right to make changes in the regulations, charges and curricula listed herein at any time.

Honor System

The Honor System, first established at William and Mary in 1779, remains one of the College's most cherished traditions. It assumes that principles of honorable conduct are familiar and dear to all students, and hence dishonorable acts will not be tolerated. Students found guilty of cheating, stealing or lying are subject to dismissal. The principles of the Honor System and the method of administration are described in the Student Handbook (www.wm.edu).

Graduate Regulations

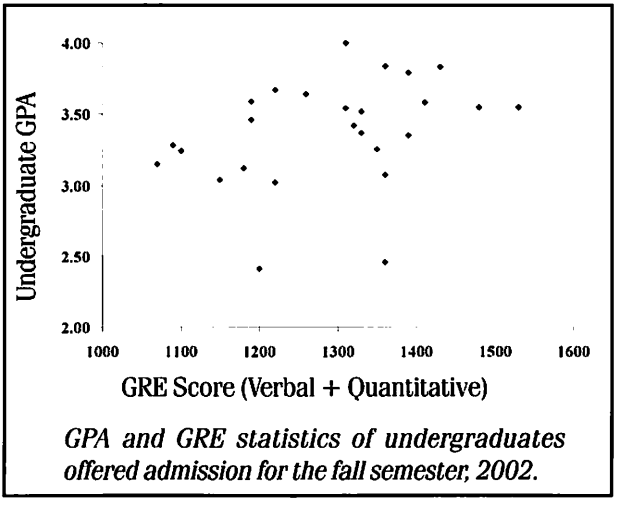
Application for Admission

Requests for application forms and completed application materials should be sent to:

Dean of Graduate Studies
School of Marine Science
College of William and Mary
Gloucester Point, Virginia 23062

Application forms are also available electronically at: www.vims.edu/sms/admissions/

Students are encouraged to apply for admission during the winter of each calendar year, with a closing date of January 15. Applicants will be notified after April 1. Admission will be valid for matriculation for the following summer, fall and winter semesters. Most students should anticipate a Fall matriculation. The Dean of Graduate Studies should be contacted prior to submitting applications at any other time or regarding any special circumstances the student's application or matriculation might present.



GPA and GRE statistics of undergraduates offered admission for the fall semester, 2002.

The following are required of applicants to the School of Marine Science:

1. One (1) copy of the completed application form.
2. A non-refundable processing fee of $30. This fee is not credited to the student's account. There is no fee for application for admission as an unclassified (post-baccalaureate) student.
3. Three (3) letters of recommendation.
4. Official transcripts of all college work. (Final degree transcripts are required of admitted students before they matriculate).
5. Official Scores of the Verbal and Quantitative sections of the Graduate Record Examination (GRE).

Scores in an advanced section of the Graduate Record Examination in the applicant's undergraduate major field or an area appropriate to the applicant's proposed concentration in marine science are informative but not essential. *GRE scores more than 5 years old are not acceptable, and the examination must be retaken. Applicants are*

encouraged to take the Graduate Record Examination at scheduled dates that will allow for receipt of scores by the aforementioned closing date. The Faculty cannot evaluate applications lacking GRE scores or other critical materials after the closing date.

International Students

In addition to the verbal and quantitative sections of the Graduate Record Examination (GRE), international applicants whose primary language is not English must submit the results of the GRE English Language Proficiency Test, Test of English as a Foreign Language (TOEFL).

In general, the minimum acceptable TOEFL score is 550. The TOEFL requirement may be waived if the applicant has completed an undergraduate or graduate degree at an accredited U.S. institution or other appropriate institution in which the language of instruction is English. Students with marginal proficiency in English will be required to register for an appropriate English course offered at the Williamsburg campus. A reduced load of graduate courses is suggested for these students.

Transcripts, certificates of degrees and similar documents submitted by international applicants must be accompanied by an English translation and must include titles of all courses taken and the grade received in each course.

International students admitted to the School must present proof that they have available funds sufficient to meet all costs they will incur while studying at the School of Marine Science. The form I-20 will not be mailed until this proof of financial support is received. For those students offered financial aid by the School of Marine Science, such aid may be included as a source of funds. For additional information, please contact the International Student Coordinator.

Admission Information

Applicants are encouraged to visit the campus to contact faculty members about specific research interests, funding opportunities, and program information.

Admission to the School of Marine Science is highly competitive; there were more than 156 applicants for the entering class of 2002, of which only 55 were accepted. The Faculty carefully evaluates criteria of performance, which include GRE scores, overall GPA and GPA in area of concentration, the applicant's statement of purpose, letters of recommendation, and prior experience. Although it is neither possible nor desirable to provide absolute values of criteria that will ensure admission, see the figure on the previous page for GPA and GRE scores of students offered admission in 2002.

Degree-Seeking Students

Students are admitted as regular or provisional graduate students in either the MS or Ph.D Program. For matriculation as a regular graduate student, an applicant must have completed the requirements for a bachelor's degree at an accredited college, with a record of high performance, and must have the recommendations of the faculty and officials of the School of Marine Science.

Students may be admitted to either the Master of Science or Doctor of Philosophy programs. Direct admission into the Doctor of Philosophy program is available to qualified applicants without a Master's degree. Direct admission must be granted and therefore requires an evaluation by the Admissions Committee. The following guidelines are employed by Admissions for this purpose: 1) direct admission is considered for applicants of exceptional promise and superior academic performance, and 2) the applicant must have the support of an appropriate faculty member who agrees to mentor the applicant over the course of study. Identification of a faculty mentor usually requires that the applicant visit campus to interview appropriate SMS faculty. The Admissions Committee's actions on requests for direct admission are transmitted to the Dean of Graduate Studies for final action.

Applicants judged deficient in preparatory studies or other areas may be admitted as provisional students. A provisional student may petition for regular student status after successful completion of those requirements stipulated in his/her notification of admission. Petition for change in status shall be reviewed by the Academic Status and Degrees Committee, using as criteria overall academic performance and performance standards previously specified on the student's notification of admission. Graduate credit earned by a provisional student will be applied toward the graduate degree upon conversion to regular student status.

Master of Science Bypass Option

A superior student accepted into the Master's program may petition for a bypass of the Master of Science degree after meeting the following requirements: 1) completion of the core course requirements for the MS degree (MS 501, MS 501L, MS 502, MS 504, MS 505) and any courses required by the student's department with a grade point average of at least 3.5; 2) submission of a statement by the student's advisor of the student's achievements and demonstrated potential to conduct independent research; 3) receipt of at least one draft prospectus for the students' intended doctoral research by the Advisory Committee; and 4) recommendation by the student's Advisory Committee to bypass the Master's degree. It is important that a student submit the bypass form in a timely fashion, no later than the start of the third year.

Following review of the petition and supporting documents and consideration of all faculty approved requirements for bypass, the Academic Status and Degrees Committee will recommend to the Dean of Graduate Studies whether or not permission to bypass should be granted. Authority for the final decision rests with the Dean of Graduate Studies.

Students completing a MS degree in the School of Marine Science and who desire to enter the PhD program are required to submit a formal application for admission.

Non Degree-Seeking Students

Students who have received a Bachelor's degree from an accredited college or university and who wish to take courses in the School of Marine Science but who are not entering an advanced degree program may apply for unclassified student status (post-baccalaureate). Graduate credit earned as an unclassified student may be applied toward the graduate degree upon matriculation as a regular graduate student.

Financial Information

Tuition and Fees

The College reserves the right to make changes in its charges for any and all programs at any time, after approval by the Board of Visitors.

For Fall 2002, the tuition and general fee for full-time students in the School of Marine Science is $3,069 per semester for residents of Virginia and $8,986 per semester for non-residents.

Special Note: All incoming students registered for nine hours or more in 500-level courses or above, or for twelve hours or more at any level, are considered full-time students and charged the full-time rates unless qualified to be a Research Graduate Student.

Tuition for part-time students, at both the undergraduate and graduate levels, is as follows:

$191 per semester hour for Virginia residents.

$572 per semester hour for out-of-state students.

Regularly enrolled degree-seeking students of the College will be charged these rates during the regular session for part- time work, based on their established domiciliary status.

Rates for students who enroll in the Summer Session will be charged on the same basis, with an additional $25 registration fee.

Part-time students who are not regularly enrolled at the College of William and Mary, and for whom, therefore, no domiciliary status previously has been determined, will be charged on the basis of their satisfactorily established domiciliary status. (See statement regarding Eligibility for In-state Tuition Rate).

Auditing fees are the same as those specified for part-time students, unless the auditor is a full-time student. Permission to audit must be obtained from the instructor.

Graduate Assistantships

Graduate research and graduate teaching assistants work an equivalent of twenty hours a week. For graduate research assistants, every effort will be made to ensure that assistantship duties are relevant to the student's course of study and research program. Graduate assistants must satisfactorily carry out the duties assigned by the School of Marine Science, must make satisfactory progress on their programs as defined by the College degree requirements and the regulations of the School of Marine Science, and may not hold any other employment or appointment of a remunerative nature during the term of their assistantships without approval of the Dean of Graduate Studies. Failure to comply with these conditions will lead to revocation of appointments.

Graduate Fellowships

A limited number of outstanding applicants are awarded fellowships that consist of "tuition remission" in addition to a graduate assistantship. These fellowships are awarded via a priority ranking system and are renewable annually for up to 33½ months, contingent upon satisfactory performance. All fellowship students are expected to participate (equivalent to twenty-hours a week) in their advisor's group activities and in a research project or program as determined jointly with their faculty advisor.

Research Graduate Student Status

Upon the recommendation of a student's major professor, advisory committee, and the Academic Status and Degrees Committee, the Dean of Graduate Studies may approve a student obtaining Research Graduate status for a single semester. This generally would be the semester in which the student completes the thesis and graduates.

The following conditions must be met:

1. The student has completed all required coursework.
2. The student is not employed significantly in any activity other than research and writing in fulfillment of degree requirements.
3. The student is present on the campus or is engaged in approved fieldwork related to his/her thesis or dissertation.

While classified as a Research Graduate, a student may register for a maximum of 12 credit hours of Thesis or Dissertation per regular semester upon payment of the part-time rate for only three credit hours of Thesis/Dissertation. The student may elect to utilize up to two (2) of the three paid credit hours for formal coursework.

A Research Graduate student may register for additional course credit only upon payment of the generally applicable additional part-time tuition.

A Research Graduate student is eligible for services (e.g. student health and athletic events) only if required fees are paid.

Eligibility for In-state Tuition Rate

To be eligible for the lower tuition rate available to in-state students, a student must meet the statutory test for domicile set forth in Section 23-7.4 of the Code of Virginia. Domicile is a technical legal concept, and a student's status is determined objectively through the impartial application of established rules. In general, to establish domicile students must be able to show (1) that for at least one year immediately preceding the first official day of classes their permanent home was in Virginia and (2) that they intend to stay in Virginia indefinitely after graduation. Residence in Virginia primarily to attend college does not establish eligibility for the in-state tuition rate. On admission to the College an entering student who claims domiciliary status is sent an application form and instructions on how to fill it out. The Office of the Registrar evaluates the application and notifies the student of adverse decisions only. A student re-enrolling in the College after an absence of one or more semesters must re-apply for domiciliary status and is subject to the same requirements as an entering student.

A matriculating student whose domicile has changed may request reclassification from out-of-state to in-state; since reclassification is effective only prospectively, however, it must be applied for before the beginning of the academic semester. Any student may ask for written review of an adverse decision, but a change in classification will be made only when justified by clear and convincing evidence. All questions about eligibility for domiciliary status should be addressed to the Office of the Registrar.

Payment of Accounts

Charges for the tuition and general fees are payable by each semester's due date as established by the Office of the Bursar. Any unpaid balance remaining on an individual's account after the end of the add/drop period may result in cancellation of registration. Payment must be made in U.S. dollars by cash or check made payable to the College of William & Mary. Checks returned by the bank for any reason will constitute nonpayment of fees and may result in cancellation of registration. In the event a past-due account is referred for collection, the student is required to pay all costs associated with the collection and/or litigation. Failure to receive a bill does not waive the requirements for payment by the due date. *Credit card payments are not accepted.*

Students Who Withdraw from the College

Subject to the following regulations and exceptions, all charges made by the College are considered to be fully earned upon completion of registration by the student. Due to administrative procedures, refunds will not be processed until after the end of the add/drop period.

Full-time Graduate Students Who Withdraw From College

All charges made by the College are considered to be fully earned upon completion of registration by the student.

1. No refunds will be made to a student who has been required by the college to withdraw, regardless of the date of withdrawal.
2. A full-time student who withdraws within five calendar days following the first day of classes is entitled to a refund of all payments, less any administrative fees and/or any deposits or advanced payments which may have been required by the College as evidence of the student's intent to enroll.
3. A full-time student who withdraws on the 6th through 30th calendar day will be charged 25% of tuition and fees.
4. A full-time student who withdraws on the 31st through 60th calendar day will be charged 50% tuition and fees.
5. A full-time student who withdraws after 60th calendar day following the first five-day period of classes will receive no refund.
6. Refunds for students with Title IV Federal Aid (Pell, Stafford, SEOG, Perkins, Plus) who withdraw from school will be calculated in compliance with Federal Regulations.

Part-time Graduate Students Who Withdraw From College

A part-time student at the graduate level is defined as one who is enrolled for 8 credit hours or less.

A part-time student who withdraws from the College during the add/drop period is eligible for a refund of all payments less a $50.00 administrative fee.

A part-time student who withdraws from the college after the add/drop period but within 60 days following the first day of classes will be refunded 50% of tuition.

No refunds will be made to a part-time student who withdraws after 60 days following the first day of classes, or who has been required by the College to withdraw.

Graduate Students Who Withdraw From a Course

A part-time student who withdraws from a course(s) after the add/drop period and remains registered for other academic work will not be eligible for a refund.

Withholding of Transcripts and Diplomas in Cases of Unpaid Accounts

Transcripts or any other information concerning scholastic records will not be released until College accounts are paid in full. Diplomas will not be awarded to persons whose College accounts are not paid in full.

Student Facilities and Services

Housing

There is no student housing on the SMS/VIMS campus, and most students live in Gloucester Point or in surrounding communities. Rental housing is plentiful, and area rents generally range from $350 to $475 or more per month, depending on the accommodations. Students often elect to share housing in order to keep costs to a minimum. A limited number of apartments for graduate students are available on the Williamsburg campus. Located next to the Marshall-Wythe School of Law, the Graduate Housing Complex is within walking distance of the College's main campus and historic Colonial Williamsburg. Information and application forms can be obtained from the Office of Residence Hall Life located on the main campus (757) 221-4134, or email housing@wm.edu.

Cultural Life at William and Mary

As part of the William and Mary community, School of Marine Science students may participate in a broad range of cultural activities on the Williamsburg campus. Under the auspices of the Committees on Concerts and Lectures and the Speakers Forum, the College provides its students opportunities to enjoy a full spectrum of public lectures and concerts. In recent years, College audiences have enjoyed performances by nationally and internationally recognized theatre arts performers. In addition, the William and Mary Theatre annually present four full-length plays in public performance. The Speakers Forum offers subscription series featuring prominent national personalities from the worlds of politics, entertainment and the arts. Under the sponsorship of the Fine Arts Department, the Campus Center, and the Muscarelle Museum of Art, exhibits in painting, sculpture, and architectural design, theatre and industrial arts are shown throughout the year.

Numerous small and large cities including the major metropolitan areas of Norfolk, Virginia Beach, and Richmond are within easy driving distance of Gloucester Point. Each provides a broad array of cultural and entertainment events throughout the year.

Campus Parking

Many students drive a motor vehicle to the SMS/VIMS campus, and parking can sometimes be at a premium. However, space is usually available in one of the many campus-parking areas. All motor vehicles, including motorcycles and motorbikes, parked on SMS/VIMS property must be registered with Parking Services. Registration includes the purchase of a College of William and Mary parking decal, which must be displayed on or in the vehicle. Illegally parked or unregistered vehicles are subject to citation, and students with unresolved citations are not allowed to register for classes or to receive degrees. A full description of campus motor vehicle regulations is contained in a booklet available from Parking Services.

Outdoor Life and Athletics

With SMS/VIMS' semi-rural setting in close proximity to the Chesapeake Bay and its many tributaries, and with the Blue Ridge Mountains only a few hours drive to the west,

students enjoy diverse opportunities for outdoor activities ranging from sailing, canoeing, and kayaking to biking, hiking, and both fresh- and saltwater fishing.

Graduate students regularly participate in informal and organized soccer, basketball and other team sports, and are eligible for reduced-rate health club memberships at community fitness centers in Gloucester and nearby Newport News.

The Williamsburg campus includes the 15,000-seat capacity Cary Field stadium used for competitive football, track, soccer and lacrosse events, as well as providing space for intramural sports. William and Mary Hall has an indoors seating capacity of 10,000 for basketball, gymnastics and track. Graduate students who pay full tuition and general fees are admitted to all athletic contests by presenting their ID cards.

The Office of Recreational Sports provides a variety of leisure pursuits to all students through intramural, sport club, informal recreation, fitness/wellness and outdoor programs. Facilities include the Student Recreation Center, Adair Gymnasium, William and Mary Hall, Lake Matoka and various other outdoor facilities. The Recreation Center and Adair Gymnasium each have a 25-yard indoor pool. Facilities are open seven days per week during the academic year and often during the break periods. Facility schedules and procedures for checking out equipment are available at any recreational facility or the Campus Center. Intramurals are separated into co-rec, men's and women's divisions for most activities.

Play is held for each of over 25 sports/activities during the year. Informal or open recreation, generally considered "free-play," is offered in aerobics, swimming, racquetball and squash, basketball, weightlifting, canoeing and kayaking and other sports.

The Sport Club program consists of 28 clubs, each self-governing and self-supporting and dictated simply by participants' interest in the activity. Clubs include badminton, ballroom dancing, baseball, fencing, gymnastics, women's field hockey, ice hockey, judo, men's and women's lacrosse, martial arts, outdoor racquetball, rock climbing, rowing, men's and women's rugby, running, sailing, VIMS sailing, shotokan karate, women's soccer, synchronized swimming, tae kwon do, men's and women's volleyball, ultimate frisbee, and yoga.

The use of the recreational sports facilities is included in the payment of full-time tuition. Graduate students who pay for fewer than 9 credit hours per semester may use the facilities by paying an annual activities fee. For information on the annual fee, any activity, program or service offered by Recreational Sports, the office may be contacted at (757) 221-3310.

Student Health Service

The Student Health Center provides high-quality, primary medical care for students becoming ill or experiencing minor emergencies while away from home.

The Health Center delivers a wide variety of services, many of which are covered by the Student Health Fee included in the Tuition and General Fee. All matters between a student and the Health Center staff are confidential and, except in the case of life-threatening situations, medical emergencies, or when required by law, will not be released without the student's written consent.

Virginia State law requires all full-time students enrolling for the first time in a four-year public institution to provide a health history and an official immunization record.

The College of William and Mary further requires ALL full-time students (including previously matriculated students) to submit a physical examination performed within twelve-months preceding the student's enrollment or re-enrollment, as well as providing documentation of meeting the same immunization requirements. Previously enrolled students re-entering as full-time students after an absence from campus of greater than 10 years must also revalidate their immunization record. This information MUST be submitted on William and Mary's Health Evaluation Form.

Medical services are provided for all full-time students and for those graduate students certified by the Dean of their school to be doing the "equivalent of full-time work." In order to be eligible for medical care both groups of students must have paid the Student Health Fee for the current semester and have met the Health Evaluation Form requirements including a physical examination and submission of an official immunization record.

Students choosing to seek care at an off-campus site are responsible for charges incurred. Likewise, if a Health Center physician deems it medically necessary to refer a student to an off-campus specialist, this also becomes the student's financial responsibility. Students are strongly encouraged to carry health insurance to assist with the cost of health care obtained outside the Student Health Center.

Students experiencing severe emotional or psychological distress, making a threat or a gesture of suicide, or attempting suicide, will be evaluated by the College's medical/emotional emergency response team and appropriate measures instituted. Anyone having knowledge of such circumstances should immediately contact the Dean of Students at (757) 221-2510, or the Student Health Center at (757) 221-4386.

The Student Health Center is located on Gooch Drive, South of Zable Stadium (Cary Field). Hours of operation are Monday, Tuesday, Thursday and Friday from 8:00 A.M. to 5:00 P.M.; Wednesday from 10:00 A.M. to 5:00 P.M.; and Saturday from 12 Noon to 4:00 P.M. (limited services only). Appointments with physicians and nurse practitioners may be scheduled by calling (757) 221-2998.

William and Mary Counseling Center

The Counseling Center offers a wide range of psychological and counseling services for William and Mary students. For example, we provide professional help in the following areas: psychological issues, personal concerns, interpersonal issues, and crisis intervention. Staff members are available to discuss any important personal concern a student may be facing and work with that student to develop new ways of resolving the problem or mastering the concern.

The staff of the Counseling Center consists of both male and female mental health professionals, including psychologists, counselors and social workers. A sport psychologist is available for students interested in learning how to enhance their athletic performance. Psychiatric consultation can be arranged when needed. All staff are trained and experienced in dealing with problems university students encounter. Students are initially seen by a counselor individually. Continuing services are free of charge to full-time enrolled students.

Appointments may be made by calling the Counseling Center at (757) 221-3620 or by coming to the office located in Blow Memorial Hall, Room 240. Office hours are 8:00am-noon and 1pm-5pm, Monday through Friday. Appointments will be scheduled as soon as possible after the initial request, usually within a week, depending upon the urgency of the situation and staff availability. If appropriate, a student may be referred to other sources of help after an initial evaluation. Emergency services during the Fall and Spring semesters are also available after hours and on weekends by calling the Campus Police at (757) 221-4596 and asking to speak with the Counseling Center "on-call" counselor.

Counseling is confidential. Therapy is most effective when a student can be direct and honest with a counselor without fear that personal information will be divulged. Information about a student is not released with that student's written permission, except in the case of imminent danger to self or others, child/adult abuse, court order, or where otherwise required by law. Notations of counseling are not a part of a student's College record.

Office of Career Services

The Office of Career Services, located in Blow Memorial Hall on the William and Mary campus, offers individual career advising and assessment for VIMS students as well as support in the job search. The staff is available to present workshops and seminars at VIMS in addition to those presented on the William and Mary campus through the Graduate Center. Call (757) 221-3228 to make an appointment or to talk with Mary Schilling, Director.

The Graduate Student Association

The Graduate Student Association is a voluntary organization open to all graduate students in the School of Marine Science. The purpose of the Association is to advance the academic and social interests of its members. Officers are elected each spring for the following academic year.

Sexual Harassment Policy Procedures

The College of William and Mary is committed to an environment in which students, faculty, staff and guests are free from sexual harassment. Sexual harassment threatens the legitimate expectation of all members of the campus community that academic achievement or employment progress is determined by classroom and job performance. Particularly unacceptable in a college setting, sexual harassment seriously undermines the atmosphere of trust essential to the academic enterprise. Sexual harassment is prohibited at The College of William and Mary and in its programs, activities and functions. Sexual harassment may also constitute violations of the criminal and civil laws of the Commonwealth of Virginia and the United States.

This policy is also available from the website of the Office of Equal Opportunity and Affirmative Action located at http://www.wm.edu/affirmative-action. Should you have any questions, please contact the Office of Equal Opportunity/Affirmative Action at (757) 221-2615.

School of Marine Science
Virginia Institute of Marine Science
College of William and Mary
P.O. Box 1346
Gloucester Point, Virginia 23062 USA

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WILLIAM & MARY
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