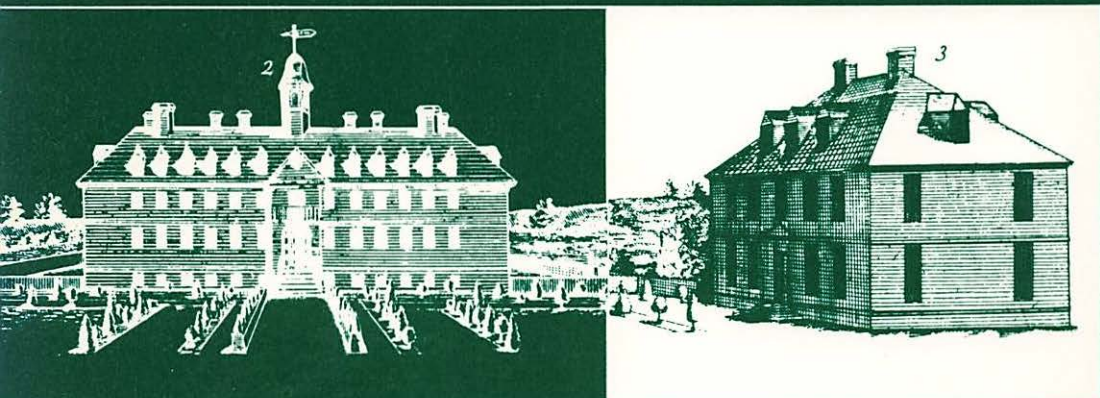


The College of William and Mary

SCHOOL OF MARINE SCIENCE
1981-82 PROGRAM





**The College of
William and Mary**

**SCHOOL OF MARINE SCIENCE
1981-82 PROGRAM**

GLOUCESTER POINT, VIRGINIA 23062



TABLE OF CONTENTS

School of Marine Science Calendar	4
Board of Visitors	5
Officers of Administration	5
The Faculty of the School of Marine Science	6
Associate Faculty	10
General Statement of Policy	12
The College of William and Mary	13
School of Marine Science	15
Program	17
Preparatory Studies	18
Description of Courses	19
Degree Requirements	
Degree of Master of Arts	29
Degree of Doctor of Philosophy	30
Financial Information	
Tuition and Fees	32
Definition of Residency	33
In-State Tuition Eligibility	34
Payment of Accounts	35
Financial Aid	36
Refunds	36
Credit on Accounts	37
Withholding of Transcripts and Diplomas	37
Graduate Regulations	
Application Procedure	37
Transfer of Graduate Credit	38
Changes in Registration	38
Examinations	38
Submission of Theses and Dissertations	39
Notice of Candidacy for Graduation	39
Grading System	39

College of William and Mary
SCHOOL OF MARINE SCIENCE

Calendar 1981-82

1981

FIRST SEMESTER

August 25	Registration of Graduate Students (Tuesday)
August 27	Beginning of classes: 8 a.m. (Thursday)
September 11	Last day to add courses (Friday)
October 12-13	Fall Break (Monday, Tuesday)
October 16	Mid-Semester (Friday)
November 25	Beginning of Thanksgiving Holiday: 1 p.m. (Wednesday)
November 30	End of Thanksgiving Holiday: 8 a.m. (Monday)
December 4	End of Classes: 5 p.m. (Friday)
December 5-8	Reading Period (Saturday-Tuesday)
December 9-17	Examinations (Wednesday-Thursday)
December 18	1st day to submit theses and dissertations for December conferral of degrees (Friday)

1982

SECOND SEMESTER

January 15	Registration of Graduate Students (Friday)
January 18	Beginning of classes: 8 a.m. (Monday)
February 2	Last day to add courses (Tuesday)
February 6	Charter Day (Saturday)
March 5	Beginning of Spring Vacation: 5 p.m. (Friday)
March 15	End of Spring Vacation: 8 a.m. (Monday)
March 15	Mid-Semester (Monday)
April 28	End of Classes: 5 p.m. (Wednesday)
April 29-May 2	Reading Period (Thursday-Sunday)
May 3-11	Examinations (Monday-Tuesday)
May 7	Last day to submit theses and dissertations for May Commencement (Friday)
May 16	Commencement (Sunday)

SUMMER SESSION

June 1	Beginning of First Term (Tuesday)
July 2	End of First Term (Friday)
July 6	Beginning of Second Term (Tuesday)
August 6	End of Second Term (Friday)
August 20	Last day to submit theses and dissertations for August conferral of degrees (Friday)

BOARD OF VISITORS

Edward E. Brickell Rector
T. C. Clarke Vice Rector
Pamela P. Chinnis Secretary

J. Bruce Bredin
Colin R. Davis
Milton L. Drewer, Jr.
Robert J. Faulconer
The Honorable A. Linwood Holton
Robert S. Hornsby
Jerry K. Jebo

Herbert V. Kelly
Aubrey L. Mason
Anne Dobie Peebles
A. Addison Roberts
Harriet N. Storm
Henry T. Tucker, Jr.
Raymond T. Waller

OFFICERS OF ADMINISTRATION

Thomas A. Graves, Jr. *President*
George R. Healy *Vice President for
Academic Affairs*
William J. Carter *Vice President for
Business Affairs*
Duane A. Dittman *Vice President for
University Advancement*
Frank O. Perkins *Acting Dean of School of
Marine Science*

**THE FACULTY OF THE
SCHOOL OF MARINE SCIENCE**

Frank Overton Perkins, *Acting Dean and Professor of Marine Science. B.A., University of Virginia; M.S., Ph.D., Florida State University.*

Jay Donald Andrews, *Professor of Marine Science. B.S., Kansas State College; M.A., Ph.D., University of Wisconsin.*

Michael E. Bender, *Professor of Marine Science. B.A., Southern Illinois University; M.S., Michigan State University; Ph.D., Rutgers University.*

Robert E. Lee Black, *Professor of Biology and Marine Science. A.B., William Jewell College; M.A., Ph.D., University of Washington.*

Robert J. Byrne, *Professor of Marine Science. M.S., Ph.D., University of Chicago.*

Ching Seng Fang, *Professor of Marine Science. B.S., National Taiwan University, M.S., Ph.D., North Carolina State University.*

George C. Grant, *Professor of Marine Science. B.S., University of Massachusetts; M.A., College of William and Mary; Ph.D., University of Rhode Island.*

William Jennings Hargis, Jr., *Professor of Marine Science. A.B., M.A., University of Richmond; Ph.D., Florida State University.*

Dexter S. Haven, *Professor of Marine Science. B.S., M.S., Rhode Island State College.*

Albert Y. Kuo, *Professor of Marine Science. B.S., National Taiwan University; M.S., University of Iowa; Ph.D., The Johns Hopkins University.*

Maurice P. Lynch, *Professor of Marine Science. A.B., Harvard University; M.A., Ph.D., College of William and Mary.*

John C. Munday, *Professor of Marine Science. A.B., Cornell University; Ph.D., University of Illinois.*

John A. Musick, *Professor of Marine Science. A.B., Rutgers University; M.A., Ph.D., Harvard University.*

Maynard M. Nichols, *Professor of Marine Science. B.A., Columbia University; M.S., Scripps Institution of Oceanography; Ph.D., University of California at Los Angeles.*

Willard Abraham Van Engel, *Professor of Marine Science. PH.B., PH.M., University of Wisconsin.*

Kenneth L. Webb, *Professor of Marine Science. A.B., Antioch College; M.S., Ph.D., Ohio State University.*

- John M. Zeigler, *Professor of Marine Science. B.A., University of Colorado at Boulder; Ph.D., Harvard University.*
- Herbert Martin Austin, *Associate Professor of Marine Science. B.S., Grove City College; M.S., University of Puerto Rico; Ph.D., Florida State University.*
- Rudolph H. Bieri, *Associate Professor of Marine Science. Dr.rer.nat. Johann Gutenberg University.*
- John D. Boon, III, *Associate Professor of Marine Science. B.A., Rice University; M.A., Ph.D., College of William and Mary.*
- Michael Castagna, *Associate Professor of Marine Science. B.S., M.S., Florida State University.*
- William David DuPaul, *Associate Professor of Marine Science. B.A., Bridgewater State College; M.A., Ph.D., College of William and Mary.*
- David A. Evans, *Associate Professor of Marine Science. B.A., M.A., Cambridge University; Ph.D., Oxford University.*
- Robert J. Huggett, *Associate Professor of Marine Science. M.S., Scripps Institution of Oceanography; Ph.D., College of William and Mary.*
- John N. Kraeuter, *Associate Professor of Marine Science. B.S., Florida State University; M.A., College of William and Mary; Ph.D., University of Delaware.*
- Joseph G. Loesch, *Associate Professor of Marine Science. B.S., University of Rhode Island; M.S., Ph.D., University of Connecticut.*
- William G. MacIntyre, *Associate Professor of Marine Science. B.S., M.S., Ph.D., Dalhousie University.*
- John V. Merriner, *Associate Professor of Marine Science. B.A., Rutgers University; M.S., Ph.D., North Carolina State University.*
- Bruce J. Neilson, *Associate Professor of Marine Science. B.A., M.S.E., M.A., Princeton University; Ph.D., The Johns Hopkins University.*
- Morris H. Roberts, Jr., *Associate Professor of Marine Science. B.A., Kenyon College; M.A., Ph.D., College of William and Mary.*
- Gene M. Silberhorn, *Associate Professor of Marine Science. B.S., Eastern Michigan University; M.S., West Virginia University; Ph.D., Kent State University.*
- Craig L. Smith, *Associate Professor of Marine Science. A.B., The Johns Hopkins University; Ph.D., University of Florida.*
- N. Bartlett Theberge, Jr., *Associate Professor of Marine Science. B.S., J.D., College of William and Mary; LL.M., University of Miami.*

Marvin Leroy Wass, *Associate Professor of Marine Science. B.S., Winona State College; M.S., Florida State University; Ph.D., University of Florida.*

Christopher S. Welch, *Associate Professor of Marine Science. B.S., Stanford University; Ph.D., Massachusetts Institute of Technology, Woods Hole Oceanographic Institute.*

Paul L. Zubkoff, *Associate Professor of Marine Science. B.S., University of Buffalo; M.A., George Washington University; Ph.D., Cornell University.*

Eugene M. Burreson, *Assistant Professor of Marine Science. B.S., Eastern Oregon College; M.S., Ph.D., Oregon State University.*

Hsuan Shan Chen, *Assistant Professor of Marine Science. B.S., M.S., National Taiwan University; S.M., Ph.D., Massachusetts Institute of Technology.*

Robert J. Diaz, *Assistant Professor of Marine Science. B.A., LaSalle College; M.S., Ph.D., University of Virginia.*

Leonard W. Haas, *Assistant Professor of Marine Science. A.B., Dartmouth College; M.S., University of Rhode Island; Ph.D., College of William and Mary.*

Carl Hershner, *Assistant Professor of Marine Science. B.S., Bucknell University; Ph.D., University of Virginia.*

Carl H. Hobbs, III, *Assistant Professor of Marine Science. B.S., Union College; M.S., University of Massachusetts.*

Paul V. Hyer, *Assistant Professor of Marine Science. B.S., University of Notre Dame; Ph.D., University of Maryland.*

Robert A. Jordan, *Assistant Professor of Marine Science. B.S., M.S., Ph.D., University of Michigan.*

Howard Kator, *Assistant Professor of Marine Science. B.S., Harpur College; Ph.D., Florida State University.*

Robert J. Orth, *Assistant Professor of Marine Science. B.S., Rutgers University; M.A., University of Virginia; Ph.D., University of Maryland.*

Polly A. Penhale, *Assistant Professor of Marine Science. B.A. Earlham College; M.S., Ph.D., North Carolina State University.*

William F. Roller, *Assistant Professor of Marine Science. B.S., M.A., University of South Carolina; Ph.D., Virginia Polytechnic Institute and State University.*

Evon Paul Ruzicki, *Assistant Professor of Marine Science. A.B., Knox College; M.S., University of Wisconsin; Ph.D., University of Virginia.*

Philip M. Shou, Assistant Professor of Marine Science. B.S., National Tsing Hua University; Ph.D., Scripps Institution of Oceanography.

Chih-Wu Su, Assistant Professor of Marine Science. B.S., Cheng Kung University; Ph.D., University of California.

J. Ernest Warinner, III, Assistant Professor of Marine Science. B.S., M.A., College of William and Mary.

Richard L. Wetzel, Assistant Professor of Marine Science. B.S., M.S., University of West Florida; Ph.D., University of Georgia.

Frank J. Wojcik, Assistant Professor of Marine Science. B.S., University of Massachusetts; M.S., University of Alaska.

Thomas A. Barnard, Jr., Instructor in Marine Science. B.A., Milligan College; M.A., College of William and Mary.

Cynthia L. Bosco, Instructor in Marine Science. B.S., M.A., College of William and Mary.

Carl F. Cerco, Instructor in Marine Science. B.S., Newark College of Engineering; M.S., University of North Carolina; M.S., Massachusetts Institute of Technology.

Elizabeth A. Cornell, Instructor in Marine Science. B.S., University of Wisconsin; M.S., University of Rhode Island.

J. Claiborne Jones, Instructor in Marine Science. B.S., Hampden-Sydney College; M.A., College of William and Mary.

Jon A. Lucy, Instructor in Marine Science. B.S., University of Richmond; M.A., College of William and Mary.

Robert J. Lukens, Instructor in Marine Science. B.S., Massachusetts Institute of Technology.

John E. Olney, Instructor in Marine Science. B.S., M.A., College of William and Mary.

John B. Pleasants, Instructor in Marine Science. B.S., U.S. Naval Academy; M.M.A., University of Rhode Island.

Ginny H. Shaw, Instructor in Marine Science. B.A., M.S., College of William and Mary.

Kenneth J. Sulak, Instructor in Marine Science. B.A., Harvard University, M.S., University of Miami.

David E. Zwerner, Instructor in Marine Science. B.S., George Washington University; M.A., College of William and Mary.

ASSOCIATE FACULTY

Iris C. Anderson, B.S., Colby College; S.M., Massachusetts Institute of Technology; Associate Professor of Biology, Thomas Nelson Community College.

Roger D. Anderson, B.A., St. Olaf College; M.S., Texas A&M University; Ph.D., Texas A&M University; Executive Director, Gulf & South Atlantic Fisheries Development Foundation, Inc.

Kenneth F. Bick, B.S., M.S., Ph.D., Yale University; Professor of Geology, College of William and Mary.

Donald Boesch, B.S., Tulane University; Ph.D., College of William and Mary; Louisiana Universities' Marine Consortium.

Mitchell A. Byrd, B.S., M.S., Ph.D., Virginia Polytechnic Institute and State University; Professor of Biology, College of William and Mary.

Robert L. Ellison, A.B., Cornell University; Ph.D., Pennsylvania State University; Associate Professor of Environmental Sciences, University of Virginia.

Michael L. Fine, B.S., University of Maryland; M.A., College of William and Mary; Ph.D., University of Rhode Island.

Paul A. Haefner, Jr., B.S., Franklin and Marshall College; M.S., Ph.D., University of Delaware; Professor of Biology, Rochester Institute of Technology.

Robert C. Harriss, B.S., Florida State University; M.A., Ph.D., Rice University; Senior Marine Scientist and Acting Head of the Marine Environments Branch, NASA Langley Research Center.

Sewell H. Hopkins, B.S., College of William and Mary; M.A. Ph.D., University of Illinois; Professor Emeritus, Texas A&M.

Harold J. Humm, B.S., University of Miami; M.S., Ph.D., Duke University; Professor of Marine Science, University of South Florida.

Martin L. Lenhardt, B.S., M.A., *Seton Hall University*; Ph.D., *Florida State University*; Associate Professor of Otolaryngology, *Medical College of Virginia*.

Victor A. Liguori, A.B., *Haverford College*; M.A., Ph.D., *Princeton University*; Associate Professor of Sociology, *College of William and Mary*.

Charlotte P. Mangum, A.B., *Vassar College*; M.S., Ph.D., *Yale University*; Professor of Biology, *College of William and Mary*.

James Glen Mead, B.S., *Yale University*; M.A., *University of Texas*; Ph.D., *University of Chicago*; Associate Curator of Mammals, *Smithsonian Institution*.

Thomas H. Provert, B.A., *University of New Hampshire*; ABT, *Northeastern University*; M.S., Ph.D., *University of Massachusetts*; Computer Scientist NOAA, *Department of Commerce*.

D. Keith Serafy, B.A., *University of South Florida*; M.S., Ph.D., *University of Maine*; Assistant Professor of Biology and Marine Science, *Southampton College*.

Carl N. Shuster, Jr., B.S., M.S., *Rutgers, The State University of New Jersey*; Ph.D., *New York University*; Environmental Biologist, *Federal Energy Regulatory Commission*.

Lamar Trott, A.A., *St. Petersburg Junior College*; B.A., M.A., *Florida State University*; Ph.D., *University of California*; Deputy Director, *Office of Science and Environment, NMFS-NOAA*.

Sheppard Y. Tyree, Jr., B.S., Ph.D., *Massachusetts Institute of Technology*; Professor of Chemistry, *College of William and Mary*.

Michael P. Weinstein, B.A., *Hofstra University*; M.S., *Rutgers State University*; Ph.D., *Florida State University*; Assistant Professor of Biology, *Virginia Commonwealth University*.

Scott C. Whitney, A.B., *University of Nevada*, LL.B., J.D., *Harvard Law School*; Professor of Law, *George Mason University*.

Lawrence L. Wiseman, A.B., *Hiram College*; M.A., Ph.D., *Princeton University*; Associate Professor of Biology, *College of William and Mary*.



GENERAL STATEMENT OF POLICY

Within the limits of its facilities and its obligations as a State university, the College of William and Mary opens the possibility of admission to all qualified students without regard to sex, race, color, age, religion, or national origin, and provides reasonable accommodations for handicapped students. 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.

THE COLLEGE OF WILLIAM AND MARY

OBJECTIVES OF THE COLLEGE

Founded in 1693 as the second institution of higher education in the country, the College of William and Mary in Virginia is today a small, residential, full-time coeducational university. It is a state university, drawing seventy percent of its over four thousand undergraduate students from the Commonwealth of Virginia. It is also national and international in character and contribution, enrolling students from throughout the nation, many foreign countries, and varied backgrounds.

William and Mary at the undergraduate level is dedicated to providing a liberal education that is rounded and thorough, preparing its students to live and make a living. All students gain a broad base of understanding and knowledge in arts and sciences in their freshman and sophomore years. In their junior and senior years, they may pursue work toward the bachelor of arts or bachelor of science degrees in a full range of concentrations in arts and sciences or education, or they may enter a program of study in the School of Business Administration leading to the Bachelor of Business Administration degree.

The College also provides opportunity for its students to pursue graduate work compatible with the liberal undergraduate program. Advanced studies are offered in several fields in the arts and sciences leading to the master of arts and master of science degrees, and in history, physics, and psychology, leading to the Ph.D. and Psy.D. degrees. In the professional schools, the Juris Doctor degree is offered by the Marshall-Wythe School of Law; the Master of Business Administration degree by the School of Business Administration; and the Master of Arts in Education degree, the Master of Education degree, the Certificate of Advanced Study and the Doctor of Education degree by the School of Education. The School of Marine Science offers programs leading to the Master of Arts and Ph.D. degrees.

The College's commitment in all programs to liberal education is the source of institutional coherence. William and Mary emphasizes, in its undergraduate, graduate and professional programs, the development of the student as a whole individual. The criterion of excellence in teaching and learning, in class and out of class, is at the heart of the educational process. With such objectives, and with a selective and limited enrollment, the College strives to provide its students with a quality education, and to make a significant contribution to the Commonwealth of Virginia and to the nation through the development of independent, responsive individuals. Faculty, students, and administrators work closely together to create this educational environment, under the leadership of the Board of Visitors and with the support of the Board of the Society of the Alumni.

Continuing exploration of and participation in innovative and experimental approaches to teaching and learning are a significant aspect of the College's forward movement, and emphasis on research and high quality graduate programs contribute strongly to the development of excellence at William and Mary.

The College is accredited by the Southern Association of Colleges and Schools. It offers a wide range of courses, seminars, and programs, both for credit and non-credit, in the evening and during the day, at its Williamsburg campus, at the Virginia Associated Research Campus in Newport News, and at the Gloucester Point and Wachapreague campuses of the School of Marine Science. This contribution to the educational enrichment of the citizens of Virginia throughout their careers is provided by the professional schools of education, business, and law, and by the faculty of arts and sciences. It is in keeping with the College's commitment, as a State institution, to community service and enhanced educational opportunities for the adult citizens of the State of Virginia, and for its more than 30,000 known alumni.

William and Mary is a college community, small enough to provide for relationships that allow true teaching and learning; large enough to have the resources to achieve excellence. An important aspect of this community is the location of the College in the beautiful and historic city of Williamsburg, where it constitutes an integral part of the restoration of Colonial Williamsburg. The partnership of the College, the City, and the Restoration, and the education, cultural and recreational opportunities afforded to all students at the College by this partnership add to the quality of life and the quality of education at William and Mary.



**SCHOOL OF MARINE SCIENCE
AND
VIRGINIA INSTITUTE OF MARINE SCIENCE**

History

The School of Marine Science had its inception in the establishment of the Virginia Fisheries Laboratory by the Commonwealth in 1940. From 1940 until 1959 the academic program of the Laboratory was conducted as the Department of Biology of the College of William and Mary.

In 1959 the program was established as the Department of Marine Science, and in 1961 the Board of Visitors established the marine training program as the School of Marine Science. The General Assembly in 1962 reestablished the Virginia Fisheries Laboratory as the Virginia Institute of Marine Science, an independent research and service institution providing educational offerings in the marine sciences. In 1979 the General Assembly action merged the Institute with the College of William and Mary.

Laboratories of the Institute were originally located on the main campus at Williamsburg and at Yorktown. In 1950 the first permanent building was erected at Gloucester Point, across the York River from Yorktown, the present location of the School. The School awarded its first master's degree in 1943, and in 1964 inaugurated a doctoral program in Marine Science.

Facilities

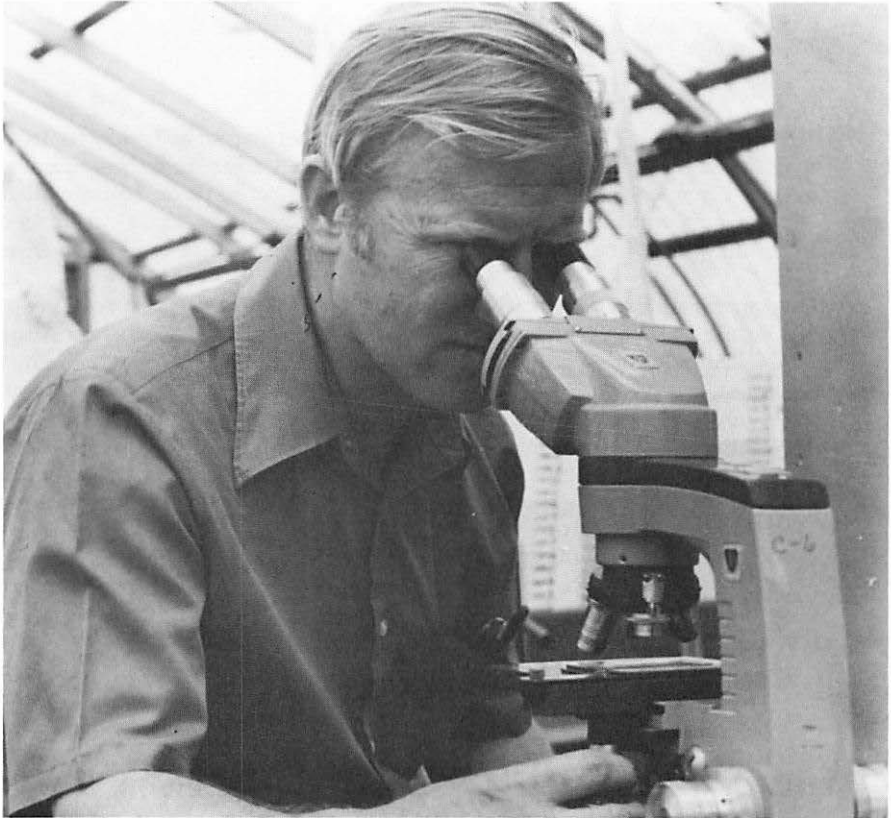
Through offerings of the School of Marine Science, an unusual opportunity is afforded students of Marine Science (including Marine Fisheries Science, Biological, Chemical, Geological, and Physical Oceanography, and certain other areas of concentration including Marine Affairs) to take advanced undergraduate and graduate training at an active, year-round center of marine research.

The principal marine campus is located at Gloucester Point on the York River, an important estuary with easy access to Chesapeake Bay and the nearby Atlantic. The Institute and the School are admirably situated to conduct research and teaching in marine, estuarine, and freshwater biology, chemistry, geology, and physical oceanography and engineering. The campus of the Eastern Shore Branch Laboratory at Wachapreague, Virginia, offers access to the embayments, salt marshes, barrier beaches and coastal water of Virginia's Eastern Shore. At Wachapreague are located laboratories for mariculture and research as well as dormitory and classroom space.

The first permanent building, Maury Hall, constructed in 1950, is devoted primarily to administrative offices, a lecture and exhibit room and small display aquaria, and an extensive and growing reference library. Brooke Hall (1958) contains offices, and other laboratory facilities, and Davis Hall (1961) houses the Department of Microbiology-Pathology. A second floor was added to Davis Hall in 1974, and it houses laboratories associated with the bacteriology program. Byrd Hall (1969) houses ecology-pollution, chemistry, physiology, data processing, and MERRMS (Marine Environment and Resources Research and Management System), several lecture rooms and a class laboratory. Jefferson Hall (which was purchased in 1966 and added to in 1972) houses most of the

fisheries oceanography faculty and laboratories as well as the vertebrate and invertebrate collections of the Institute. Three buildings have flow-through saltwater systems providing additional experimental facilities. Modern well-equipped chemical laboratories allow scientists and students to pursue marine chemistry with state-of-the-art facilities. The small-boat basin and Newport Building (housing much of Marine Geology) are located at the Franklin Marine Center. The Division of Physical Sciences and Ocean Engineering is quartered in several buildings about the campus as well as at the Franklin Marine Center.

The Institute has an extensive complement of modern scientific equipment including a mass spectrometer, two electron microscopes (both scanning and transmission) and a sophisticated electronic computing center. Also on campus are a marine science library containing approximately 28,000 volumes and 1,500 serial titles. A hydraulic flume and a ripple tank are housed in the Franklin Marine Center. In addition to these, a hydraulic model of the James River, located at Vicksburg, Mississippi, and a hydraulic model of the entire Chesapeake Bay, located at Kent Island, Maryland, are available for research by qualified students.



PROGRAM

The program of the School of Marine Science is primarily intended for the student who wishes to specialize in Marine Science or Oceanography at the graduate level. The degrees offered are the Master of Arts and Doctor of Philosophy in Marine Science. Majors in Biological Oceanography (Marine Biology), General Oceanography (Physical, Chemical or Geological areas), Fisheries Oceanography (Marine Fisheries Science), and Marine Affairs are available at both levels. Within these general areas, study of several specialties may be undertaken--for example, Marine Pollution Biology, Wetlands Ecology, Benthic Ecology, etc. The curriculum available to students working toward either degree is comprised of some 60 formal courses, two problem courses, two seminar courses, and two thesis courses.

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 may enroll in suitable 500 level courses. An undergraduate major in Chemistry, Geology, Physics, or Psychology may work on a marine problem in the field of specialization. Consent of the Chairman of the student's major department is required to take problems courses in Marine Science.

As in most marine institutions, activities are accelerated in the summer. Qualified undergraduate students may take advanced training in Invertebrate Ecology, Marine Science, Physiology, and other subjects as scheduled. Several scientists are usually added to the research and teaching staff. In addition to the regular academic courses offered, special summer research courses in Marine Science may be arranged.

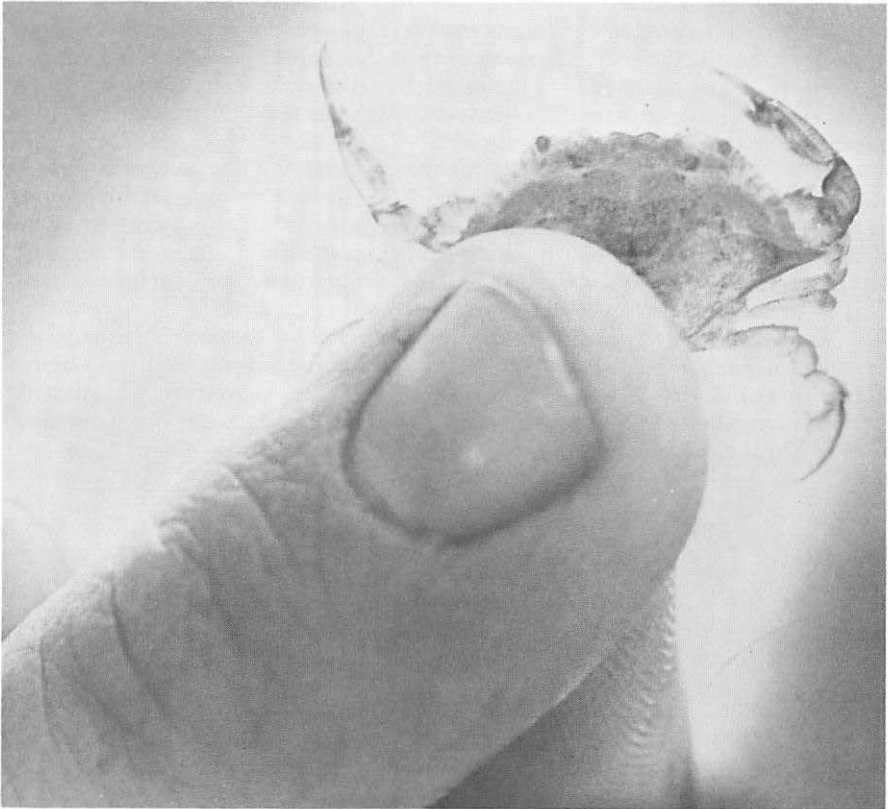
Because the entire program is marine-oriented and the faculty is heavily engaged in research as well as teaching, students have an unusual opportunity to become intimately familiar with the field. This advantage is increased by the fact that the student's entire training program is carried out on the seacoast. Time is not lost in traveling from an inland campus to the sea; and the sea itself, is a constant classroom companion.

Approved marine science courses are offered at Williamsburg, but most are conducted on the campus of the School of Marine Science and the Virginia Institute of Marine Science at Gloucester Point, Virginia. Accordingly, students commuting between campuses must schedule classes so as to allow time between them. Usually, thirty minutes are required to make the passage.

PREPARATORY STUDIES

It is recommended that students who are seriously interested in Marine Science as a profession consult with the Dean of the School as early in their college careers as possible regarding an academic program to be followed. The student interested in Biological Oceanography or Marine Fisheries Science should plan to take such subjects as Genetics, Comparative Anatomy of Vertebrates, Comparative Anatomy of Invertebrates, Histology, Embryology, Systematic Botany, Microbiology; several courses in Chemistry, i.e., General Qualitative and Quantitative, Organic and, if possible, Biochemistry and General Physics. College Mathematics through Trigonometry is very important. The Calculus is recommended.

The prospective general oceanographer should have an undergraduate major in Chemistry, Physics, Meteorology or Geology. Students of the last three subjects should have taken Fluid Mechanics or Gas Dynamics or similar subjects and have Mathematics through the Calculus. Certain engineering courses are also acceptable.



DESCRIPTION OF COURSES

501. Introduction to Physical Oceanography. Fall (3) Staff. Prerequisites: Physics 101-102, Math 103.

Physical properties of sea water, descriptive oceanography, air-sea interactions, heat budget, methods and measurements, dynamics of circulation, waves and tides. Required of all students unless justification for exemption is approved by the Dean of the School of Marine Science upon the recommendation of the appropriate faculty committee. Lectures and laboratory.

502. Introduction to Chemical Oceanography. Spring (3) Staff. Prerequisites: Chemistry 101-102.

The properties of water and its solutions. Major and minor components of natural waters. Sedimentary cycles. Nutrient cycles. Dissolved gases. Geochemical cycles. Anthropogenic input. Required of all students unless justification for exemption is approved by the Dean of the School of Marine Science upon the recommendation of the appropriate faculty committee. Three lecture hours.

503. Introduction to Biological Oceanography. Fall (3) Staff.

Introduction to principles and concepts of marine ecology; characteristics of the oceans and estuaries as ecosystems. Occurrence and distribution of marine organisms in relation to hydrography. Required of all students unless justification for exemption is approved by the Dean of the School of Marine Science upon the recommendation of the appropriate faculty committee. Lectures and laboratory.

504. Introduction to Geological Oceanography. Spring (3) Mr. Boon, Mr. Hobbs.

Concepts of marine geology: coastal processes, sea-floor spreading and continental drift, sediments and sedimentation, shelf and canyon development. Required of all students unless exemption is approved by the Dean of the School upon the recommendation of the appropriate faculty committee. Lectures and field trips.

505. Problems in Marine Science. Fall, Spring and Summer. (1-4) Staff.

Supervised projects selected to suit the needs of the graduate or advanced undergraduate student. Projects to be chosen in consultation with the head of the student's major department, the supervising professor and the Dean of the School of Marine Science. Acceptable topic outlines and terminal project reports are required. Credit dependent upon difficulty of course. Credit levels must be arranged with instructor in advance of registration.

506. Introduction to Marine Science. Summer Session (5); Evening College (3); Fall and Winter (3 or 5). Mr. Hargis and Staff.

A general introduction to marine science, including biological, chemical geological, physical oceanography and the interactions between marine science and society. Lectures, laboratory and field trips, twenty-six hours per week for five weeks in summers. Evening College courses limited to (3) lecture hours and (3) semester hours credit. Fall and Winter courses may include lectures,

laboratory and field trips. Laboratory sessions will be presented at the discretion of the instructor. If all three are included, students may register for either three (3) hours (lecture and field trips only), or five (5) hours (lecture, field trips and laboratory) of credit.

507. Statistics for Marine Scientists I. Fall (3) Staff.

Application of statistical methods to analysis of biological and physical data. Binomial and chi-square distributions, normal distribution. Hypothesis testing, introduction to analysis of variance and regression analysis. Three lecture hours. Required of all students unless justification for exemption is approved by the Dean of the School of Marine Science upon the recommendation of the appropriate faculty committee.

508. Introduction to Computer Programming for Marine Scientists (3). Ms. Shaw. Fall.

Introduction to time-sharing and use of terminals; introduction to computer language, elements of FORTRAN IV including flow charts and program documentation, writing interactive programs, file creation and access. One lecture hour, assigned laboratory problems using the VIMS PRIME 750 computer system.

509. Topics in Computer Use for Marine Scientists (1) Staff. Spring.

This course will include the following topics: FORTRAN 77 extensions such as character types and block structure programming, computer graphics, program optimization and programming style, data management. One lecture hour, assigned laboratory problems using the VIMS PRIME 750 computer system.

510. Marine and Freshwater Invertebrates. Summer session (5) Staff.

Classification and identification, adaptation, ecology, life histories. Local marine, estuarine and freshwater forms emphasized. May be required of all students with concentration in Biological Oceanography or Fisheries Oceanography. Lectures, laboratory and field trips, twenty-six hours per week for five weeks.

512. Marine Botany. Summer Session (5). Staff.

A general introduction to the ecology and systematics of algae and tracheophytes encountered in the marine environment. May be required of all students with concentration in Biological Oceanography or Fisheries Oceanography. Lectures, laboratory and field trips, twenty-six hours per week for five weeks.

513. Coastal Botany. Fall (3) Mr. Silberhorn.

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.

514. Wetlands Ecology. Spring (4) Mr. Hershner.

Classical and recent work on wetland ecology, primarily in tidal marshes. Emphasis on the analysis of the marsh system at the community level. Introduction and practical experience in common research techniques, including vegetation mapping, sediment coring and faunal sampling methods. Small research project on field site expected. Lectures and field trips.

515. History of Marine Science. As required (3) Mr. Hargis.

Comprehensive review and evaluation of the major events, personages, and organizations involved in the development of marine science and marine affairs, the acquisition of knowledge of the World Ocean, its coastal waters and tributaries, and the ability to work on and in the sea and make use of its resources with consideration of the impacts of the resources on the affairs of man. Lectures, discussion and reading.

519. Computer Applications in Marine Science. As required (1) Staff.

Course designed primarily for students who require special programming for analysis of their research data. Following instruction in basics of programming language, each student will develop, with guidance, one or more computer programs pertinent to his or her thesis research. One lecture hour.

520. Literature Search and Scientific Writing. Spring (1) Mr. Grant.

Instructions on use of selected abstracting and indexing services appropriate to marine science, and development of search strategy techniques applicable to on-line data bases. Step-by-step analysis of the preparation of a journal article; structure and content of research and thesis proposals. One lecture hour.

560. Thesis. Fall, Spring and Summer (hours to be arranged).

Original research in Biological Oceanography (Marine Biology), General Oceanography (Physical, Chemical or Geological areas), Fisheries Oceanography (Marine Fisheries Science), and Marine Affairs. 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) Staff.

The organization and presentation of scientific data. Oral discussion and written outlines and critiques of selected seminar topics are required of all students. One credit each semester; maximum three credits.

602. Advanced Biological Oceanography. As required (3) Staff.

Seminar covering broad concepts, principles and problems in biological oceanography. Recommended for advanced graduate students.

603. Advanced Problems in Marine Science. Fall, Spring and Summer (1-4) Staff.

Supervised research projects selected to suit the needs of the graduate student. Projects to be chosen in consultation with the student's major professor and the Dean of the School. Acceptable research outlines and project reports are required. Amount of credit depends upon difficulty of course. Hours to be arranged with instructor prior to registration.

604. Biology of Selected Marine Invertebrates. As required (3) Staff. Prerequisite: Marine Science 503 and undergraduate course in invertebrate zoology.

Detailed studies of the functional anatomy and physiological ecology of major groups of marine organisms. Emphasis on invertebrates of economic importance. Five lecture and laboratory hours.

605. Radiobiology. As required (4) Mr. Zubkoff, Mr. Warinner.

The principles of tracer techniques and procedures for radio-assay determinations in marine studies, including autoradiography, liquid scintillation, and gamma ray spectroscopy. Lecture and laboratory.

606. Fisheries Oceanography. Fall (3) Mr. Austin. Prerequisites: Physical Oceanography or Marine Fishery Science.

Concept of the effects of natural environmental variability on the recruitment, availability (yield), abundance and behavior of living marine resources. Applica-

tion to real-time fishing operations and climate scale analysis of fishery fluctuations. Two lecture hours and one laboratory hour.

607. Marine Microbiology. Fall; even-numbered school years (4) Mr. Kator, Mr. Perkins. Prerequisite: Biology 301 or equivalent.

Morphology, physiology, ecology, taxonomy, and methods of isolation, cultivation and identification of micro-organisms encountered in the marine environment. Two lecture and four laboratory hours.

608. Ichthyology. As required (3 or 5) Mr. Musick.

Functional Morphology, behavior, ecology, zoogeography and evolution of fishes. Seven lecture, laboratory and field hours. Three (3) credits without lab; five (5) credits with lab.

609. Oceanographic Instrumentation. Fall (1) Mr. RuzECKi.

General description and function of field sensors, instrument suites and sampling equipment used to study the marine environment to include meteorological, hydrographic, geological, geophysical, chemical and biological measurements. Deployment, retrieval, general maintenance and cost of equipment is stressed. Lecture and demonstration.

610. Pollution Biology. As required (3) Mr. Bender.

Study of the various types of pollutants, domestic and industrial wastes, soils, insecticides and radioactive materials and their effects on the marine environment. Lecture three hours.

611. Advanced Analytical Methods for Water Quality Studies. Spring (1) Mr. Neilson, Staff.

Analytical methods used in assessing water quality conditions in the estuarine and marine environment will be presented. Techniques presented will include basic and specialized physical, chemical, geological, and bacteriological measurements. Related topics, such as NPDES regulations, standardization of procedures and analytical quality control, will be discussed. Three laboratory hours.

612. Diseases of Marine Organisms. Spring; even-numbered school years (4) Mr. Hargis, Mr. Zwerner, Mr. Burreson.

Identification, life cycles, pathology and control of disease agents, including viruses, bacteria, protozoa, helminths and arthropods in marine fishes and shellfishes. Two lecture and four laboratory hours.

613. Marine Biogeography. As required (3) Staff.

Latitudinal zonation, distribution of major phyla, classes and economic species. Factors affecting dispersal, reproduction and survival.

614. Coastal Processes. As required (3) Mr. Nichols. Prerequisite: Marine Science 501 and 504.

Sedimentary processes of erosion, transportation and deposition in response to energy by currents, waves, tides, organic action and man. Character of sedimentary features in a range of coastal environments: estuaries, lagoons, bays, marshes, tidal flats and the continental shelf. Reading, discussion and seminars.

615. Embryology of Marine Invertebrates. As required (5) Staff. Prerequisite: Biology 202 or equivalent.

The comparative embryology and adult anatomy of local representatives of all major phyla will be considered. Emphasis will be placed on the evolutionary relationships between groups. Experiments to illustrate possible mechanisms of

fertilization, cleavage and organ differentiation will be performed. Seven lecture and laboratory hours.

616. Dynamics of Coastal Geomorphology. As Required (3) Staff.

Descriptions, origins, processes and classifications of the morphological elements composing the continental shelf (pleistocene drainage, ridge and swale), shoreface (bar systems), beach (forms under varying energy conditions) and barrier-spits (inlets, dunes). Lecture and field trips.

617. Engineering Structures and Environmental Effects. Spring (3) Staff. Prerequisite: Dynamics of Coastal Geomorphology.

Design, case history, and management implication (especially in conflicting demand situations) of man-made structures on the continental shelf (artificial islands, energy-related activities), and dunes (buildings, dune fencing and plantings). Lecture and field trips.

618. Marine Fishery Science. As required (4) Staff.

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. Six lecture, laboratory and field hours.

619. Statistics for Marine Scientists II. Spring (3) Staff. Prerequisite: Marine Science 507 or equivalent, or permission of instructor.

An introduction to the design of experiments. Analysis of variance, regression and correlation, analysis of covariance and factorial arrangements. Three lecture hours.

620. Environmental Physiology. Spring (3) Ms. Mangum, Staff. Prerequisite: Acceptable course in physiology.

Physiology of adaptation of physical and biological variables of the environment. Emphasis given to cold-blooded animals. Three lecture hours.

621. Advanced Chemical Oceanography. As required (3) Mr. MacIntyre. Prerequisites: Chemistry 201, 202; Math 201, 202, 203; Physics 101, 102.

Physical chemistry of electrolytic solutions. Study of equilibrium and non-equilibrium models of chemical processes occurring at water-sediment, water-organism, and water-atmosphere boundaries. Three lecture hours; two laboratory hours; cruises.

622. Environmental Physiology Laboratory. Spring (3) Ms. Mangum, Staff. Prerequisite or corequisite: Marine Science 620.

Selected exercises which illuminate basic physiological functions. Emphasis is given marine organisms. Four laboratory hours.

623. Topics in Applied Marine Science. Fall, Spring and Summer (1-4) Staff.

Supervised individual and group consideration of various aspects of applied marine science, such as utilization, development and conservation of marine resources. Number of credits depends upon difficulty of course. Hours to be arranged with instructor in advance of registration.

624. Physiology of Marine Organisms. Spring, alternate years (5) Staff. Prerequisite: Biology 101, 102; Chemistry 301, 302.

Major physiological processes will be considered. Special attention will be given to those processes in which evolutionary trends are apparent. Seven lecture, laboratory and field hours.

625. Hydromechanics. Fall (3) Mr. Fang, Mr. Hyer. Prerequisites: Math 302, Physics 101, 102 or equivalent.

Basic principles and equations, flow patterns, energy and momentum principles, dimensional analysis and dynamical similitude, potential flow,

viscous flow, turbulence. Gradually varied flow, rapidly varied flow, introduction to coastal hydraulics. Lectures three hours.

627. Advanced Physical Oceanography. As required (3) Mr. Welch, Mr. Kuo. Prerequisites: Math 212, 302.

Equations of motion, scaling and non-dimensional numbers, geostrophic and quasi-geostrophic motion. Frictional and convective boundary layers, currents at horizontal boundaries, equatorial currents. Internal-inertial and quasi-geostrophic waves.

628. Micrometeorology and Hydrology of the Coastal Zone. As required (3) Mr. Ruzecki, Mr. Fang. Prerequisite: Marine Science 501 and 625 or consent of instructor.

Mass, momentum, and heat movement and transfer near and at the atmospheric-hydrosphere-lithosphere interfaces. Lectures and laboratory four hours.

629. Introduction to Sediment Transport. Fall (2) Mr. Byrne, Mr. Boon. Prerequisite: Marine Science 501, 504 and 631 or consent of instructor.

Classical and recent work on sediment transport due to unidirectional and wave-induced motion in fluids. Topics include particle settling velocity, incipient motion criteria, bedload and suspended load transport formulations and bedform regimes. Two lecture hours.

630. The Early Life History of Marine Fishes. Fall, alternate years (4) Staff.

Development, physiology, behavior, and ecology of egg, larval, and juvenile stages with special reference to adaptations for larval survival in the sea, larval characters useful in identification, techniques in larval rearing, and egg and larval sampling methods will be outlined. Two lecture and four laboratory hours.

631. Estuarine Hydrodynamics I. As required, (3) Mr. Kuo, Mr. Fang. Prerequisite: Marine Science 625 (Hydromechanics).

Classification of estuaries, time scales of motions, tidal dynamics in estuaries, non-tidal circulation, mechanism of arrested salt wedge, gravitational circulation, diffusion induced circulation, turbulence in stably stratified flows. Three lecture hours.

632. Estuarine Hydrodynamics II. As required (3) Mr. Kuo, Mr. Chen. Prerequisite: Marine Science 631.

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. Three lecture hours.

633. Remote Sensing of Environment. Fall (3) Staff. Prerequisite: Introductory physics or consent of instructor.

Principles, methods and application of remote data collection and analysis. Cameras, infrared scanners, microwave, radiometers, and radar as used on aircraft and earth satellites. Photo-interpretation, analysis and enhancement, applications to oceanography and other disciplines.

634. Scientific Information Resources. Spring; odd numbered school years (1) Mr. Lynch.

A review of available data bases, referral systems, federal information programs, etc., which would aid scientists or environmental managers in obtaining information relative to their research or management needs.

636. Ecosystem Model Simulation and Analysis. Fall (5) Mr. Wetzel (odd numbered years).

Theoretical and practical aspects of conceptualizing, simulating and analyzing digital computer models of estuarine and marine ecosystems. Systems theory, control and optimization is presented in terms of ecological processes. Computer modeling project required. Five lecture and laboratory hours. Consent of instructor.

637. Ecological Energetics. Spring (5) Mr. Wetzel (even numbered years).

Bioenergetics at the physiological, organismal and ecosystem level of complexity is presented. Practical instruction for measuring bioenergetic parameters are presented in selected laboratory exercises. Participation in class project on development of an ecosystem energy budget is required. Five lecture and laboratory hours. Consent of instructor.

638. Turbulent Diffusion and Dispersion. As required (3) Mr. Kuo, Mr. Hyer. Prerequisite: Marine Science 625 (Hydromechanics).

Principle of mass conservation, gradient transport theories, turbulent transport and concept of eddy diffusivity, mixing-length theory, dispersion in shear flow, in oscillatory flow and in stratified flow, applications of dispersion theories in estuaries and open seas. Three lecture hours.

639. Estuarine Water Quality Models. As required (3) Staff. Prerequisite: Marine Science 631.

Water quality parameters, application of mass-balance equation, dissolved oxygen modeling, ecosystem modeling, finite difference approximations, finite element techniques, numerical integrations, time scales and spatial dimensions, survey of different types of models.

640. Population Dynamics. Fall (4) Mr. Loesch. Prerequisite: Marine Science 507 or equivalent.

Absolute, relative and instantaneous rates of mortality and growth; production and biomass; computations of yield; estimates of population size; relationship between recruitment and size of stock; examples from important fisheries. May be required of students with concentration in Fisheries Oceanography (Marine Fisheries Biology) or Biological Oceanography.

641. Advanced Techniques in Statistical Analysis. As required (to be arranged) Staff. Prerequisite: Marine Science 619 and consent of instructor.

Advanced statistical techniques designed for individual student requirements. Subject matter and methods of study variable. Topics may include techniques used in bio-assay, discriminant functions. Sequential analysis, multi-variate analysis, non-parametric analysis or other techniques as required.

642. Coastal Engineering. As required (3) Staff. Prerequisite: Marine Science 625.

Introduction to the wave hydrodynamics in deep and shallow water, including some nonlinear aspects. Wave refraction, diffraction, reflection, and radiation. Wind-generated wave. Wave-structure interaction. Coastal wave level fluctuation. Coastal zone processes. Diffusion processes in coastal waters.

644. Marine Mycology. Fall; odd numbered school years (4) Mr. Perkins.

Ecology, physiology, and taxonomy of fungi encountered in the marine environment. Three lecture and two laboratory hours.

645. Marine Phytoplankton. Spring; even numbered school years (3) Staff. Prerequisite: Marine Science 501, 502, 503, and 504.

Contemporary problems in marine phytoplankton investigations. Factors controlling the distribution, abundance, and production of planktonic organisms. Five lecture and laboratory hours.

646. Marine Zooplankton. Spring; odd numbered school years (3) Mr. Grant.

The morphology, adaptations, distribution, taxonomy and ecology of marine zooplankton with attention to interrelationships with the remaining biota. Five lecture and laboratory hours.

647. Marine Benthos. Fall (3) even numbered school years, Staff. Prerequisites: Marine Science 503, 510 or equivalent.

Ecology of marine benthic organisms. Factors affecting distribution, benthic habitats, structure and function of communities, biotic interrelationships and analytical techniques. Three lecture hours.

648. Marine Protozoology. Spring; even numbered school years (4) Mr. Perkins. Ecology, physiology, and taxonomy of Protozoa found in the marine environment. Three lecture and two laboratory hours.

649. Marine Resources in Public Affairs. As required (2) Mr. Hargis, Staff.

Consideration of the methods by which public policy regarding marine natural resources is formed and executed. The structure and functioning of public management regulatory agencies and private lobbying organizations. Interaction among science and technology and public environmental and resource management activities. Interaction among governments including the formation and operation of interstate compacts, international commissions, and international agreements. Lecture, discussion and observation. Two hours.

650. Environmental Law and Marine Affairs I, Fall and II, Spring (1 to 3) Mr. Theberge.

An interdisciplinary course offered to law and science students and designed to examine the interrelationships between scientific and legal concepts. Issues associated with coastal zone management, outer continental shelf development, fisheries management and other questions related to marine resources will be explored. Selected guest lecturers will speak on topics within their areas of competence.

651. Natural History of the Chesapeake Bay - Physical. Spring (3) Mr. Zeigler.

This course is a non-mathematical summary of the Chesapeake Bay. It stresses the origin of the Bay, its features and dynamics of circulation, sedimentation stratigraphy and their interrelation with biology and man's use of the system. The course is structured around three formal lectures each week, several field trips and a very heavy reading load. Homework, quizzes and a term paper are to be expected.

652. Practical Application of Marine Resource Management Techniques. Fall and Spring (1 to 4) Staff. Prerequisites: Environmental Law and Marine Affairs.

This course is designed to offer students possessing management fundamentals an opportunity to participate in real world management activities under the guidance of involved faculty members and association and consultation with members of various levels of government. Such activities will possibly include but not be limited to 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.

Student requirements may vary significantly depending on the management issue(s) addressed. Students will be evaluated on participation, written work product (memoranda, position papers, etc.) and knowledge gained as evidenced

by interaction with staff and by other means. One to four credits will be awarded as appropriate for satisfactory completion of clinical research activities. Students may repeat the course provided the instructor determines there is no duplication of material.

653. Secondary Production of Invertebrates. As required (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.

654. Oligochaete Biology. As required (2) Mr. Diaz.

Taxonomy of aquatic and marine oligochaetes, life history strategies and ecology, and the role of oligochaetes in benthic communities.

655. Scanning Electron Microscopy in Marine Science. As required (2) Mr. Perkins.

Lectures on theory of the scanning electron microscope, techniques of specimen preparation and image interpretation. Instruction in use of scanning electron microscope and use of instrumentation necessary for specimen preparation. Research project required.

656. Seagrass Ecosystems. Fall odd numbered years (1-2) Ms. Penhale, Mr. Wetzel.

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, 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. Light Microscopy for Marine Scientists. As required (2) Mr. Hargis, Staff.

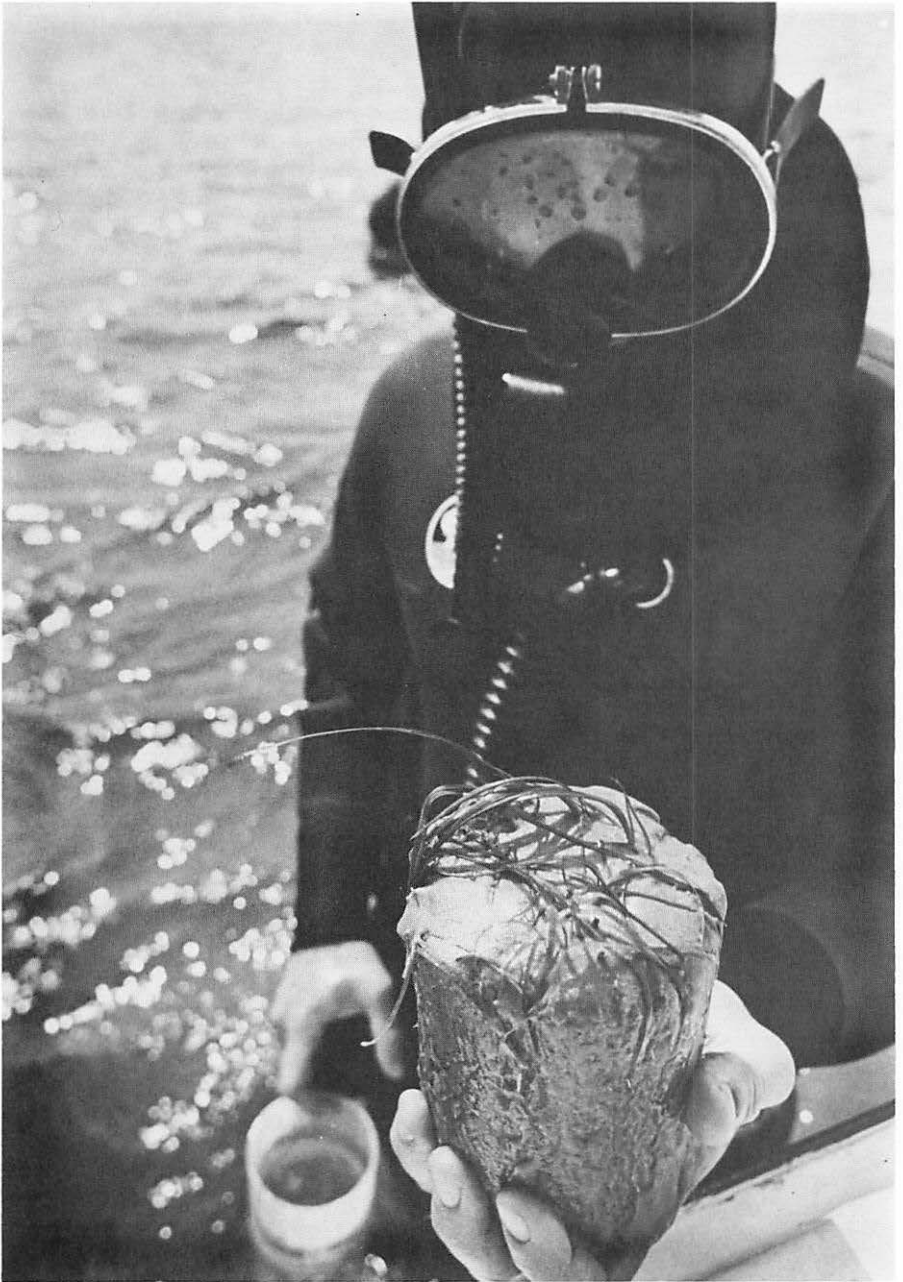
Principles and practice of various techniques of light microscopy in research and teaching in the marine sciences and related scientific fields. Lectures and Laboratory two (2) hours.

658. History of Marine Science. As required (3) Mr. Hargis.

Comprehensive review and evaluation of the major events, personages, and organizations involved in the development of marine science and marine affairs, the acquisition of knowledge of the World Ocean, its coastal waters and tributaries, and the ability to work on and in the sea and make use of its resources and amenities, with consideration of the impacts of the resources and amenities of the ocean on the affairs of men. Lecture, discussions and reading. All students will be required to prepare and submit a suitable course-related term paper.

660. Dissertation. Fall, Spring and Summer (Hours to be arranged).

Original research in Biological Oceanography (Marine Biology), General Oceanography (Physical, Chemical or Geological areas), Fisheries Oceanography (Marine Fisheries Science), and Marine Affairs. Project to be chosen in consultation with the student's major professor and the Dean of the School.



Methods of transplanting eelgrass (*Zostera marina*) into areas where large beds of this ecologically-important sea grass once existed, are being developed as part of an overall study of submerged aquatic vegetation.

DEGREE REQUIREMENTS

General

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

1. Twelve hours in the Fall semester and twelve hours in the following Spring semester;
2. Twelve hours in the Spring semester and twelve hours in the following Fall semester;
3. Twelve hours in the Spring semester, followed by six hours in Summer Session I and six hours in Summer Session II; or
4. Six hours in Summer Session I, six hours in Summer Session II, and twelve hours in the following Fall semester.

All active students (i.e. those working toward completion of a degree program who have not graduated, resigned or been granted leave), whether in residence or not, must register for a minimum of three (3) hours each semester, and one (1) hour for each summer session.

Degree of Master of Arts

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

1. As soon after registration as possible, the student must select a major professor, an advisory committee and a research project. The major professor, working with the committee, will prescribe the student's program which will include the required courses.

2. The major professor and advisory committee, chosen by the student and approved by the Dean, direct the student's program. The advisory committee consists of five faculty members (three members and two examining members) from the School of Marine Science. For students with a concentration in biological or fisheries oceanography, at least one of the members must be from physical, chemical or geological oceanography. For students with a concentration in physical, chemical or geological oceanography at least one member must be from biological or fisheries oceanography. For students with a concentration in marine affairs, one member must be from physical, chemical or geological oceanography and one from either biological or fisheries oceanography.

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 presented above.

4. At least twenty-four (24) semester credits of advanced work, of which at least one-half must have been earned in courses numbered 600 or above and with a grade average of B or better, are required for the M.A. degree. In addition master's students are required to register for at least six (6) semester hours of M.S. 560 (Thesis).

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 faculty of the School of Marine Science and the approval of the Dean, a

student may be admitted to candidacy after completion of a minimum of ten (10) hours of graduate work at the School of Marine Science.

6. The student must fulfill the language requirement by completing one of the following:

a. At least six (6) semester hours of courses in at least one pertinent foreign language (German, French or Russian are recommended) at the college sophomore level or above must have been completed with grades of C or better; or

b. The student must pass the Educational Testing Service Foreign Language Examination with a score no lower than the thirty-fifth percentile in his subject option; or

c. With prior approval of the Dean, the student must pass an examination administered by a member of the Department of Modern Languages who is competent in the language.

All students who use English to fulfill the foreign language requirement (when the native language is Chinese, Japanese or some other) must pass a test administered by someone approved by the Dean prior to the testing. Satisfactory completion of this test will constitute fulfillment of the requirement for one language.

7. The student must present and defend a thesis approved by major professor, advisory committee and Dean. The thesis must be submitted in final form for acceptance or rejection two weeks before the student expects to receive the degree. The degree will not be granted until 5 copies (approved and signed by the major professor and the committee and prepared for binding), one of which is the original, have been presented by the student to the authorities as required by the College. Detailed information regarding procedures for submission of the thesis should be obtained from the Office of the Dean.

8. An examination covering the entire field of study is required and is administered by the student's major professor and his advisory committee. This examination shall be open to the faculty and such outside persons as may be invited.

9. All requirements for the degree must be completed within six (6) calendar years after commencing graduate study.

Degree of Doctor of Philosophy

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

1. The student must select a suitable major professor as soon as possible following admission. The student and the major professor will choose an advisory committee, which must be approved by the Dean. Major professor and advisory committee direct the student's program.

2. Course requirements will be established and approved by the student's major professor, in cooperation with the advisory committee, and approved by the Dean.

3. The advisory committee must consist of at least five members, one of whom must be from outside the School of Marine Science. The director of the dissertation, who must be a faculty member of the College, will serve as the

committee's chairman. A majority of the committee must be faculty members of the College, although qualified persons from outside the College may be included. For students with a concentration in biological or fisheries oceanography, one member must be from physical, chemical or geological oceanography. For students with a concentration in physical, chemical or geological oceanography, one member must be from biological or fisheries oceanography. For students with concentration in marine affairs, one member must be from physical, chemical or geological oceanography and one from biological or fisheries oceanography.

4. A minimum of three years of graduate study beyond the baccalaureate is required. At least one academic year beyond the first must be spent in continuous residence as a full-time student of the College of William and Mary at either the Williamsburg or the Gloucester Point campus, or both.

5. In order to fulfill the full-time academic residency requirements of the College and the School of Marine Science, the doctoral student must enroll for one of the options presented in the General Section above.

6. Upon a majority vote of the faculty of the School of Marine Science, a favorable recommendation of the appropriate faculty committee, and the approval of the Dean of the School of Marine Science, a student may be admitted to candidacy. Prior to admission to candidacy, the student must have begun dissertation investigations on a research project approved by his committee and the Dean, completed a comprehensive qualifying examination to demonstrate factual and theoretical knowledge in Marine Science, and satisfied the Dean of the School of Marine Science that he has a reading knowledge of two approved foreign languages, which may be French, German, Russian, or some other acceptable one. All students who use a language other than French, German or Russian must obtain prior approval from the Dean and pass a test administered through the Department of Modern Languages at the College. If competency has been demonstrated in one language while engaged in the Master's program in the School of Marine Science, reading knowledge in only one other language will be required, with one exception: completion of the language requirement in the form of an undergraduate course is not acceptable for the doctorate. To demonstrate competency the student will be required to pass the Educational Testing Service Foreign Language Examination with a score no lower than the thirty-fifth percentile in his subject option or, with prior approval of the Dean of the School of Marine Science, by passing an examination administered by a member of the Department of Modern Languages competent in the language. All students who use English to fulfill the foreign language requirement (when the native language is Chinese, Japanese, or some other) must pass a test administered by someone approved by the Dean *prior to the testing*.

7. The dissertation submitted for the degree must be approved and accepted at least two weeks before the date of commencement.

8. Each candidate must successfully defend his dissertation in a final examination before it can be accepted by the College. This examination may be written or oral at the discretion of the School of Marine Science and shall be open to the faculty and to such outside persons as the School may invite.

9. All graduate work in the School of Marine Science must be accomplished within a seven-year period beginning with formal acceptance of the student. In exceptional cases, extensions may be approved by the Dean.

10. All dissertations will be published by having a master microfilm negative made from each original dissertation. These negatives will be stored and serviced by "University Microfilms" of Ann Arbor, Michigan, and positive microfilms, or enlarged prints, will be produced to order at the standard rate for other scholars who desire access to any dissertation. Each dissertation, when submitted, must be accompanied by two copies of an abstract of not more than 600 words. This abstract, or summary, will be published in Microfilm Abstracts for national distribution. No dissertation will be accepted without this abstract. A fee of \$25 for the above services must be paid by the candidate for the Doctor of Philosophy degree before it is conferred. All dissertation research should be planned, conducted and reported with a view toward publication of the results in a legitimate scientific journal.

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.

The tuition and general fee for full-time students in the School of Marine Science is \$667 per semester for residents of Virginia and \$1,684 per semester for others.

SPECIAL NOTE. Effective September 1, 1981, any incoming student registered for NINE (9) hours or more in 400-level courses or above, or for TWELVE (12) hours or more at any level, will be considered a full-time student and will be charged the full-time rates approved for 1981-82 by the Board of Visitors of the College of William and Mary. Students who in 1981-82 are in a *continuing* status from 1980-81, will continue paying according to the 1980-81 semester-hour rule, in which eleven semester hours of credit or more per semester were regarded as full-time, at rates approved by the Board for 1981-82.

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

\$42 per semester hour for Virginia students

\$102 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 Evening College or in Summer Session will be charged on the same basis.

The diploma fee is \$20.00 for all degrees.

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 below regarding in-State, out-of-State classification for fee purposes).

Auditing fees are the same as those specified for part-time students, unless the auditor is a full-time student.

Classified employees of the Institute who were in student status when employed (as classified employees) and remain in student status are not eligible for the classified employee tuition waiver during the period they are in student status. This is to discourage students from leaving student status for employment in the Institute. It is also to discourage seeking of employment by students for the purpose of evading tuition and fees.

DEFINITION OF RESIDENCY: The legislative Act affecting residency, as it relates to calculation of charges for tuition and fees, is as follows:

Be it enacted by the General Assembly of Virginia, that the domicile of an unemancipated minor may be the domicile of either parent; provided, however, that if one parent has custody, the domicile of an unemancipated minor shall be the domicile of the parent having custody. If there is no surviving parent or the whereabouts of the parents are unknown, then the domicile of an unemancipated minor shall be the domicile of the legal guardian of such unemancipated minor if there are no circumstances indicating that such guardianship was created primarily for the purpose of conferring a Virginia domicile on such unemancipated minor.

No person in attendance at a State institution of higher education shall be entitled to reduced tuition charges unless such person is and has been domiciled in Virginia for a period of at least one year immediately prior to the commencement of the term, semester or quarter for which any such reduced tuition charge is sought.

A person who enrolls in any such institution while not domiciled in Virginia does not become entitled to reduced tuition charges by mere presence or residence in Virginia. In order to become so entitled, any such person must establish that, one year before the date of alleged entitlement, he or she was at least eighteen years of age or, if under the age of eighteen was an emancipated minor, and had abandoned his or her old domicile and was present in Virginia with the unqualified intention of remaining in Virginia for the period immediately after leaving such institution and indefinitely thereafter.

A person who is classified or classifiable at the date of his or her marriage as eligible to receive the privileges herein described, may receive or continue to receive such privileges until he or she abandons his or her Virginia domicile other than through any presumption of law attaching to the ceremony of marriage.

A student who is not a member of the armed forces and who is not otherwise eligible for reduced tuition charges and whose spouse or parent is a member of the armed forces stationed in this State pursuant to military orders shall be entitled to reduced tuition charges if such spouse or either parent, for a period of at least one year immediately prior to and at the time of the commencement of the term, semester or quarter for which reduced tuition charges are sought, has resided in Virginia, been employed full time and paid personal taxes to Virginia. Such student shall be eligible for reduced tuition charges through such parent under this section only if he or she is claimed as a dependent for Virginia and federal income tax purposes. Such student shall be entitled to reduced tuition charges so long as such parent or spouse continues to reside in Virginia, to be employed full time and to pay personal income taxes to Virginia.

Entitlement to reduced tuition charges must be established by convincing evidence and the burden of establishing entitlement shall be on the person claiming such entitlement.

IN-STATE TUITION ELIGIBILITY

Procedure for Determination of In-State Tuition Eligibility

I. Application for In-State Tuition Eligibility

The Registrar or his delegate shall provide appropriate forms to be completed by all persons who wish to claim eligibility for in-state tuition. Such forms shall be prepared and from time to time revised in consultation with the Chairman of the Status Appeals Board.

A. **Entering Students**—Such forms shall be furnished to entering students claiming eligibility for in-state tuition prior to their matriculation, and shall be completed and returned by them to the Registrar's Office. A student to whom such a form was sent who fails to complete and return such form not later than five calendar days after the first day of classes of the semester for which in-state status is sought shall be deemed to have waived classification as an in-state student for the semester involved. A student claiming entitlement to in-state tuition to whom such a form was not furnished and to whom a bill for non-resident tuition was mailed or given, shall, on or before the close of the drop/add period, request such form and complete and return it within three calendar days of its being furnished him. Failure to do so shall likewise be deemed a waiver of classification as an in-state student for the semester involved.

B. **Matriculated Students**—Matriculated students who have been classified as ineligible for in-state tuition shall remain in that classification until changed. A student desiring a change in classification shall, not later than five calendar days after the first day of classes of the semester for which the change in status is sought, request the appropriate form from the Registrar's Office and shall complete and return such form within ten calendar days of its being furnished him. His failure to do so shall be deemed a waiver of classification for in-state tuition status for the semester involved.

II. Initial Evaluation of Application for Classification

The Registrar or his delegate shall initially evaluate all requests for in-state tuition classification or re-classification according to Section 23-7 of the Code of Virginia and shall inform the student of his classification. Where the student's eligibility for in-state tuition is not clear, the Registrar, or his delegate, shall refer the matter to the Status Reviewing Officer. A student who receives an adverse decision by the Registrar or his delegate may, within ten calendar days by written request to the Registrar's Office, obtain a hearing by the Status Reviewing Officer.

III. Review by the Status Reviewing Officer

The Status Reviewing Officer, who shall be appointed by the President and shall be legally trained, shall consider all status determinations referred to him pursuant to Section II above, and make such determinations as he may deem proper under Section 23-7 of the Code of Virginia, and shall communicate such determination in writing to the student with a copy to the Registrar's Office. If the determination be favorable to the

student, the Registrar's Office may have five calendar days in which to request an appeal, which request shall be addressed to the Chairman of the Status Appeals Board. If the determination is unfavorable to the student he may, within ten calendar days, request in writing an interview with the Status Reviewing Officer which shall be awarded him, and at which time the student may be accompanied by counsel and may present such evidence or explanations as he deems appropriate. The Status Reviewing Officer shall thereupon or as soon thereafter as is reasonably possible, and with due regard to matters brought out at the interview, affirm or modify his previous determination and inform the student of his action. If the matter is again determined adversely to the student, the Status Reviewing Officer shall inform the student of his right to appeal to the Status Appeal Board, which appeal must be made within ten calendar days of the date of the final determination by the Status Reviewing Officer. Failure of any student notified of an adverse determination to request an interview or make an appeal within the time limits provided herein shall be deemed a waiver of classification for in-state tuition for the semester involved, unless a satisfactory excuse for the delay is presented and accepted by the Chairman of the Status Appeals Board.

IV. Appeal

The Status Appeals Board shall consist of three persons of faculty rank, none of whom shall be employed by the office of the Vice President for Business Affairs. They shall be appointed by the President, who shall also designate a Chairman. Appeals to the Board shall be in writing and addressed to the Chairman in care of the Registrar's Office and need take no particular form. The Chairman shall, upon receipt of an appeal, schedule a hearing at a time convenient to the parties, and shall, in addition to consideration of whatever documents are deemed relevant, consider such statements as the appellant may wish to make and such evidence, oral or otherwise, as he may present. The hearing shall not be a review of the findings of the Status Reviewing Officer, but a hearing de novo. A student appellant may be represented by counsel. However, the Chairman may invite the Status Reviewing Officer to appear and communicate his evaluations and observations and/or may request a written statement from the Status Reviewing Officer regarding the reasons for his determinations. Upon completion of the hearing, the Board shall make such determination as is deemed proper and communicate the same in writing to the appellant with reasons therefor. The determination of the Board shall be dispositive of the matter unless, in the case of a student appellant, an appeal is made in writing to the President within five calendar days of the determination by the Appeals Board. The President, or his impartial delegate acting in his behalf, in considering the appeal shall review only the documentary data involved unless an interview with the student is deemed appropriate. The President or his delegate shall thereupon decide the matter and make the final decision.

PAYMENT OF ACCOUNTS. Charges for tuition are payable in advance at the time of registration.

Students will not be permitted to complete registration if there is any unpaid balance on the individual's account in the Treasurer's Office. Checks returned

by the bank for any reason will constitute non-payment of fees and will result in subsequent cancellation of registration.

FINANCIAL AID. Application for aid should be made on the application form for admission to graduate study. Awards are made on the basis of merit.

Graduate assistants work twenty hours a week. They must satisfactorily carry out the duties assigned by the School of Marine Science, must make satisfactory progress on their degree 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 the School of Marine Science. Failure to comply with these conditions will lead to revocation of appointments.

For information regarding the College Work-Study, National Direct Student Loan, and Guaranteed Student Loan Programs, write to: Director of Student Financial Aid, College of William and Mary, Williamsburg, Va. 23185.

REFUNDS TO STUDENTS WHO WITHDRAW FROM 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.

1. A student who withdraws within the first five-day period immediately following the first day of classes is entitled to a refund of all charges, with the exception of \$50.00 which shall be retained by the College to cover the costs of registration, subject to Item 5, below. (Such refunds shall not include any deposits or advance payments which may have been required by the College as evidence of the student's intention to enroll.)

2. A student who withdraws at any time within the next following 25 days after the first day of classes shall be charged 25% of the tuition and general fee plus 25% of the semester's room rent, subject to Item 5 below.

3. A student who withdraws at any time within the second thirty-day period after the first day of classes shall be charged 50% of the tuition and general fee, plus 50% of the room rent for a semester, subject to Item No. 5 below.

4. A student who withdraws at any time after sixty calendar days following the first day of classes shall be charged the full tuition and general fee, room rent, and board for a semester, subject to Item No. 5 below.

5. No refunds will be made to a student who has been required by the College to withdraw, regardless of the date of withdrawal.

6. No refunds will be made to a student who withdraws unofficially.

7. A registration fee of at least \$50.00 will be deducted from the amount due and paid by a part-time student who withdraws within sixty calendar days immediately following the first day of classes, except in the case of an in-state student who is registered for only one credit hour. In such a case, the student will receive no refund.

If the total amount due and paid is more than \$100.00, a maximum of 50% of that total will be refunded. The graduated refund policy noted for full-time students will not apply to part-time students.

No refund will be granted to a part-time student who withdraws after sixty calendar days immediately following the first day of classes; or who has been required by the College to withdraw, regardless of the date of withdrawal; or who withdraws unofficially.

At the graduate and/or law school level, a part-time student is one who is enrolled for 8 credit hours or less. An exception to this rule is noted in the Financial Information section.

8. In cases of official withdrawal, not required by the College, during the first sixty calendar days following the first day of classes, charges for board shall be calculated on a pro-rata basis, determined by the date of official withdrawal, provided the Dining Commons Card is surrendered at the Treasurer's Office on this date. The board plan "week" covers the period of Thursday through Wednesday, days inclusive.

CREDITS ON ACCOUNTS OF HOLDERS ON SCHOLARSHIPS. Students holding scholarships are required to pay all fees less the value of the scholarship which they hold.

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.

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

GRADUATE REGULATIONS

APPLICATION. A non-refundable processing fee of \$20.00 is required for application to the School of Marine Science for graduate study. This fee is not credited to the student's account. There is no fee for application for admission as an unclassified (post-baccalaureate) student.

ADMISSION. Application forms for admission to graduate study should be requested from:

Dean's Office
School of Marine Science
College of William and Mary
Virginia Institute of Marine Science
Gloucester Point, Virginia 23062

Students are admitted as regular or provisional graduate students, or as unclassified students (post-baccalaureate). For admission as a regular graduate student an applicant must have completed the requirements for a bachelor's degree at an accredited college, must have a quality point average of 2.5 on a 4.0 scale, or the equivalent on a 3.0 scale, and must have the recommendation of the School. (Applicants with less than a 2.5 quality point average may be admitted as provisional graduate students upon the recommendation of the school.)

Applicants who have received a bachelor's degree from an accredited college or university and who wish to take courses in the College but not to enter a program for an advanced degree, may apply for admission as unclassified students (post-baccalaureate). Unclassified students may not register in the School for courses above the 500-level, except on the recommendation of the Dean. Graduate credit earned by an unclassified student may not be applied toward a graduate degree under the School of Marine Science.

Applicants for admission to graduate study in the School are required to take the Graduate Record Examination. Applicants must register directly for this test with Educational Testing Service, Princeton, New Jersey. Forms may be obtained from the Office of the Dean.

TRANSFER OF GRADUATE CREDIT. On the recommendation of the Academic Status and Degrees Committee and the approval of the Dean of the School, a regular student may apply up to six hours of graduate credit earned at another accredited institution of higher learning toward an advanced degree at William and Mary. The credits must have been earned in courses appropriate to the student's 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 or her quality point average at William and Mary.

CHANGES IN REGISTRATION. All changes in students' schedules after the close of registration will be initiated through the School, and require approval of the instructors involved and the Dean. 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.

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 the withdrawal.

EXAMINATIONS. The examinations, given at the end of each semester, take place at the times announced on the examination schedule, which is posted at the beginning of the semester. Students are required to take all of their examinations at the time scheduled unless excused by the instructor or Dean on account of illness or other sufficient reason. Whenever possible, students must make their request to be excused from an examination in advance of the examination. Permission to take a deferred examination must be obtained from the Instructor and the Dean. Students excused from an examination will have "I" entered on the record until they make up the examination. Deferred examinations must be made up by the end of the following semester.

SUBMISSION OF THESES AND DISSERTATIONS. Detailed procedures regarding submission of theses and dissertations and payment of binding fees may be obtained from the Dean's Office.

NOTICE OF CANDIDACY FOR GRADUATION. Candidates for advanced degrees must submit a Notice of Candidacy for Graduation to the Registrar at the beginning of the semester in which they expect to receive the degree. If they subsequently fail to complete the requirements, they must cancel the notice at least two weeks before the date of Commencement and must resubmit the notice in whatever semester they complete the requirements. Students should pay the diploma fee at the Treasurer's Office. No bill for this fee will be sent separately to the student.

SYSTEM OF GRADING AND QUALITY POINTS. The grades A (excellent), B (good), C (satisfactory), or in certain courses, P (pass), 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; B, 3; C, 2; D, 1. P carries credit but is not included in a student's quality point average; F carries 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" indicates that the instructor has deferred reporting the student's grade since there is not sufficient evidence on 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. In case of absence from the final examination for reasons of illness or other good grounds, "I" automatically becomes "F" at the end of the next semester if the postponed work has not been completed.

The College of
William and Mary

SCHOOL OF MARINE SCIENCE
1981-82 PROGRAM



Non-Profit
Organization
U. S. Postage
PAID
Williamsburg
Virginia
Permit No. 26