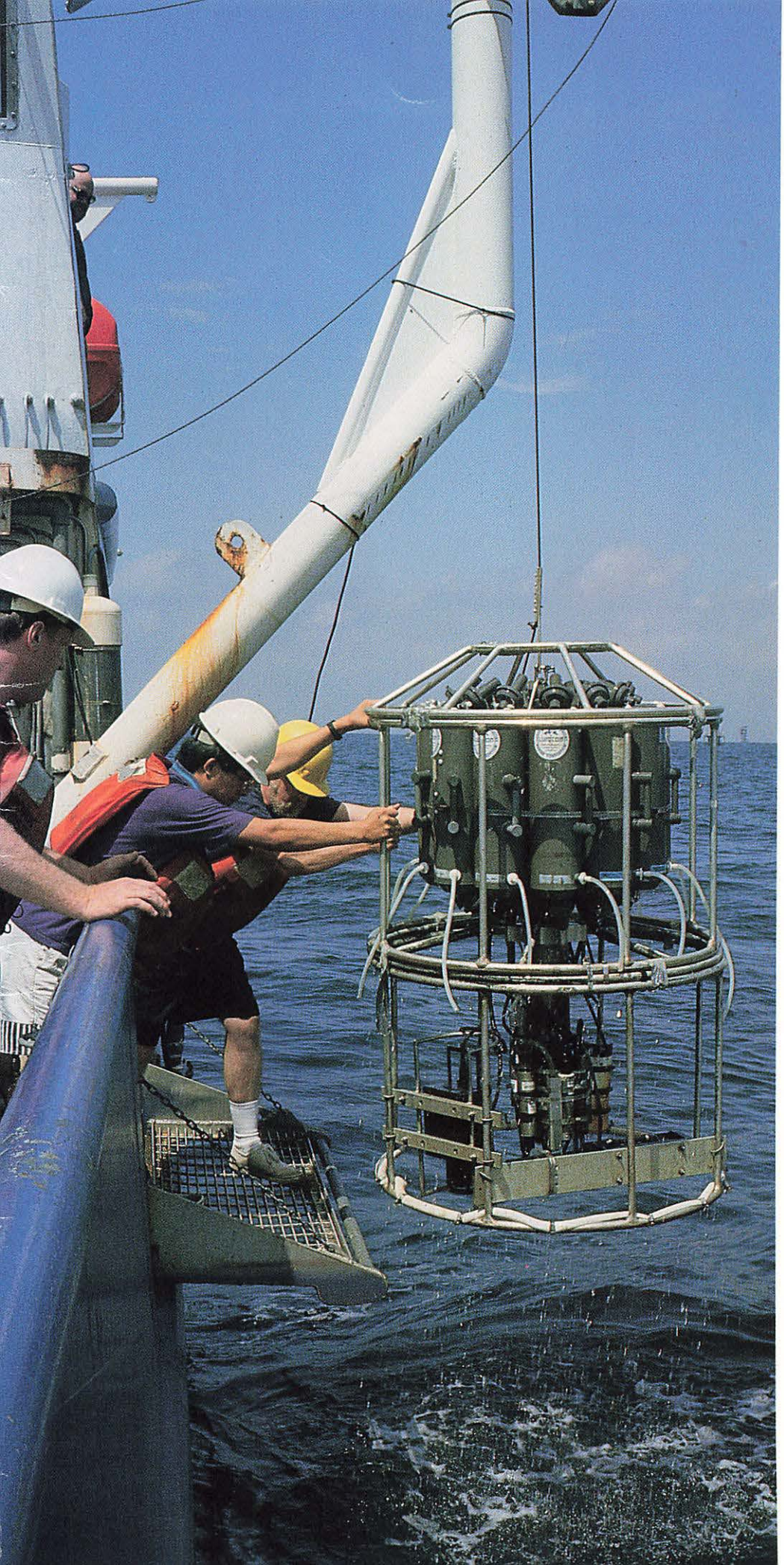
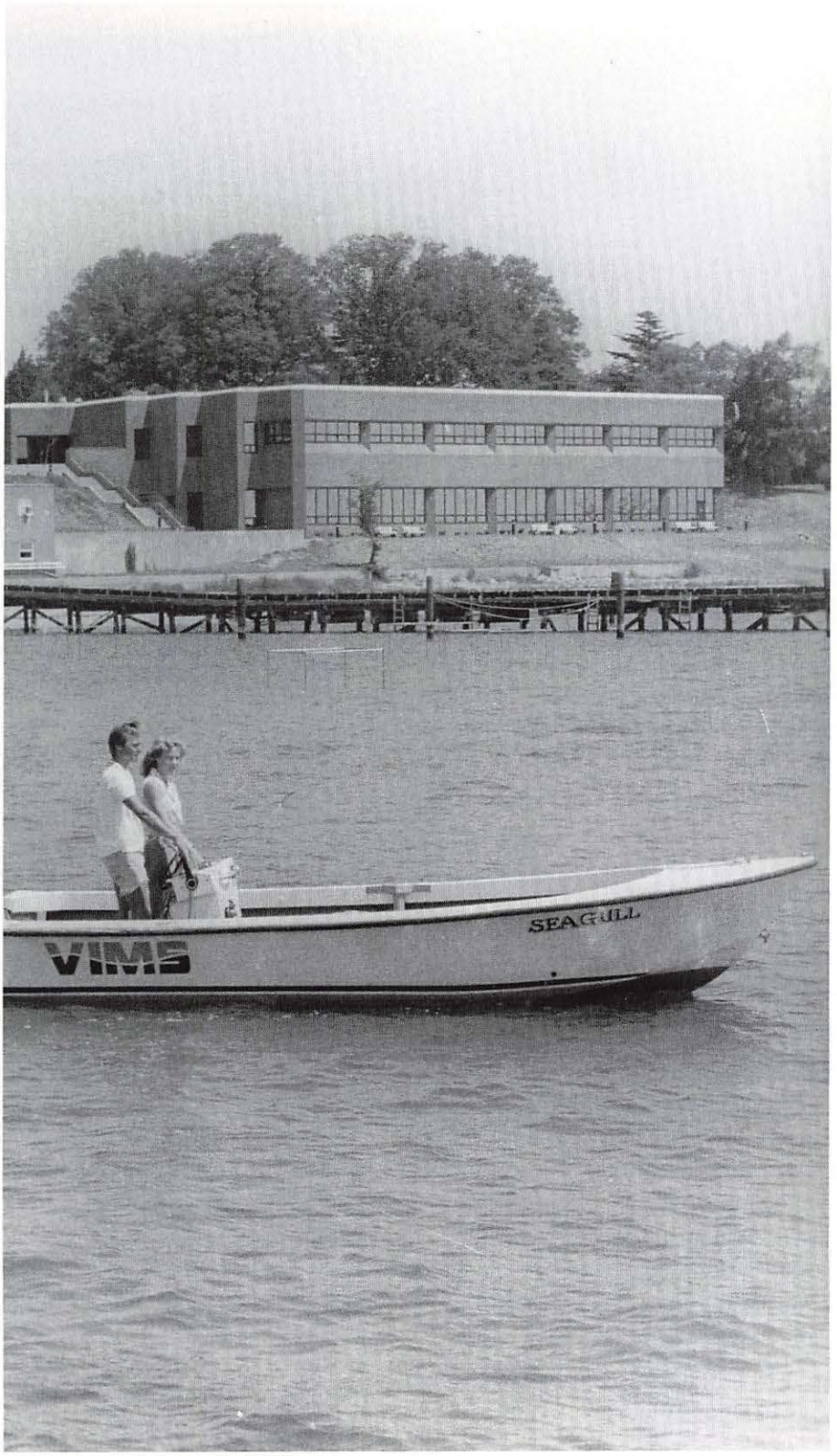


The College of William & Mary

PHYSICAL SCIENCES

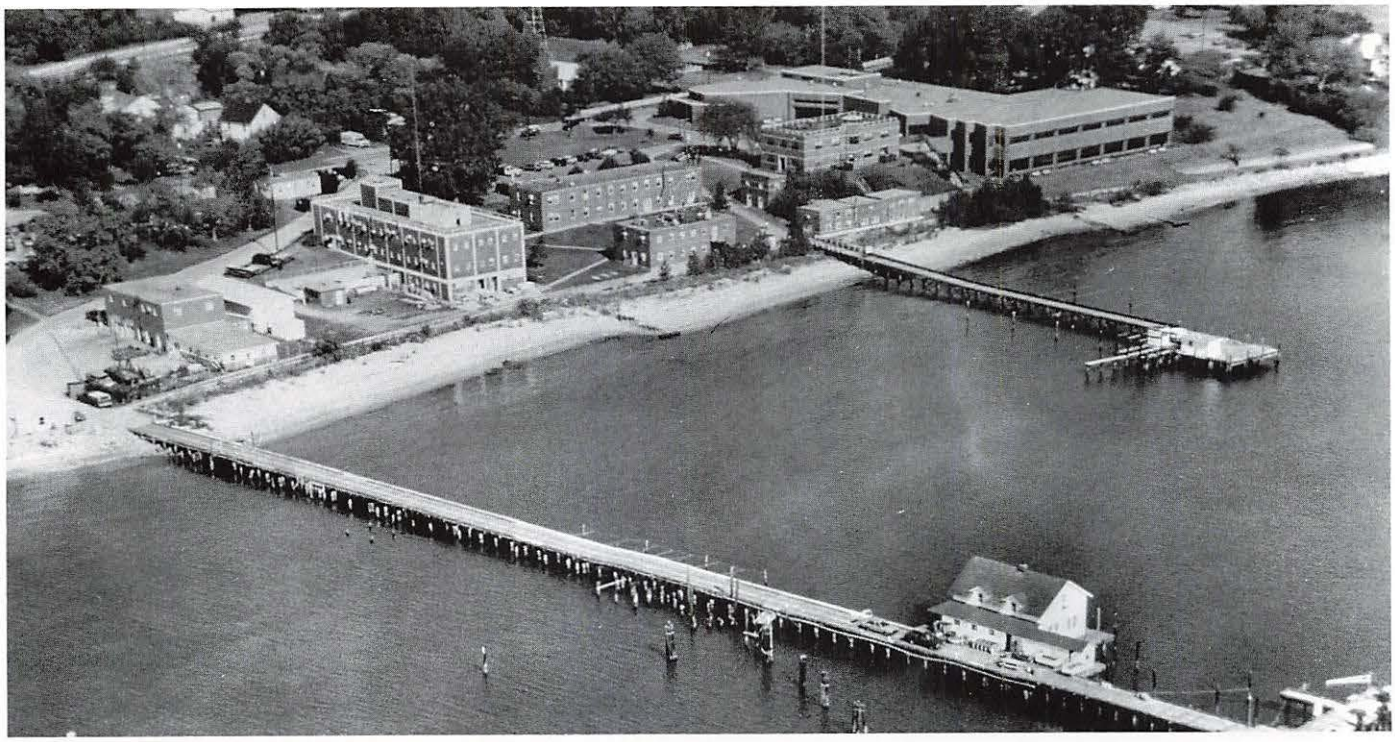
School of Marine Science

Virginia Institute of Marine Science



The School of Marine Science is one of four professional graduate schools of the College of William & Mary. The objective of the educational program is to provide a fertile and stimulating learning environment for students preparing for careers in marine science.

The School of Marine Science



The School of Marine Science/Virginia Institute of Marine Science occupies the site of Gloucester Town, a colonial settlement established in 1680. The remains of military fortifications from both the Revolutionary War and the Civil War reflect Gloucester Point's strategic location at the mouth of the York River.

Chartered in 1940, the School of Marine Science/Virginia Institute of Marine Science (SMS/VIMS), has a tripartite mission of research, education, and advisory service in marine science. This mandate established an institution that is uniquely prepared to educate the highly qualified researchers, resource managers, and educators needed for the future. Today, SMS/VIMS is the third largest marine research and education center in the country.

The School awards both Master of Arts and Doctor of Philosophy degrees. Graduate studies are offered in five areas:

Biological Sciences
Environmental Sciences
Fisheries Science
Physical Sciences
Resource Management & Policy

Academic programs are closely allied to the research and advisory programs of the Virginia Institute of Marine Science enabling students to participate in basic and applied science. Faculty scientists are involved in collaborative research with scientists from other institutes both nationally and internationally. In addition, researchers work closely with marine industries, policy makers, and regulatory agencies.

The Institute accommodates the interdisciplinary investigation that is essential to understanding and addressing the complex issues of modern marine science. Faculty, researchers, and students maintain a primary affiliation in one of the five departments. However, programs and research within departments are often carried out in association with scientists from other departments. Students with specific interests in areas outside their department may arrange crossover study and research. This interactive approach enables students to work with various members of the diverse faculty and provides access to all facilities at the Institute.

In a society that is increasing its pressure on the environment and natural resources, the coastal, estuarine, and marine environment has become an area of critical concern.

Research at SMS/VIMS encompasses all elements—land, sea, and air—that affect marine ecosystems.

Major Programs

Resource Management and Policy

- Wetlands
- Comprehensive Coastal Inventory
- Chesapeake Bay National Estuarine Research Reserve in Virginia
- Water Quality Monitoring/ Modeling
- Ocean and Coastal Law
- Coastal Management and Policy

Biological Science

- Physical Biology
- Seagrass Biology & Ecology
- Plankton Processes
- Nutrient Processes
- Benthic Ecology
- Benthic Processes
- Ichthyoplankton Research
- Fisheries Systematics
- Ecosystem Modelling
- Microbial Ecology
- Evolutionary Ecology

Physical Sciences

- Biogeochemistry
- Surface Geochemistry
- Organic Geochemistry
- Chemical Fate & Transport
- Sediment Geochemistry/ Geochronology
- Sediment Environments and Stratigraphy
- Shoreline Studies
- Sediment Erosion & Deposition
- Hydrodynamic Modeling
- Small-Scale Physical Processes
- Wave Climate and Air-Sea Interaction
- Benthic Boundary Layer Dynamics
- Shelf Dynamics
- Estuarine Dynamics
- Water Quality
- Input and Dispersal of River Sediment in Coastal Seas

Fisheries Science

- Crustacean Ecology
- Bivalve Ecology
- Fisheries Oceanography
- Fish and Shellfish Pathology
- Finfish Ecology
- Chondrichthyan Biology
- Sea Turtle Ecology
- Marine Mammal Ecology
- Systematics
- Population Genetics
- Population Dynamics

Environmental Sciences

- Environmental Chemistry
- Analytical Chemistry
- Biochemistry
- Toxicology
- Pathobiology and Histology
- Immunology

Located in Gloucester Point at the mouth of the York River, the campus has easy access to Virginia's estuaries, tidal and non-tidal wetlands as well as the Chesapeake Bay and Atlantic Ocean. The Wachapreague campus, on Virginia's Eastern Shore, is surrounded by embayments, salt marshes, barrier beaches, and coastal waters. Both locations provide ideal settings for research and teaching.

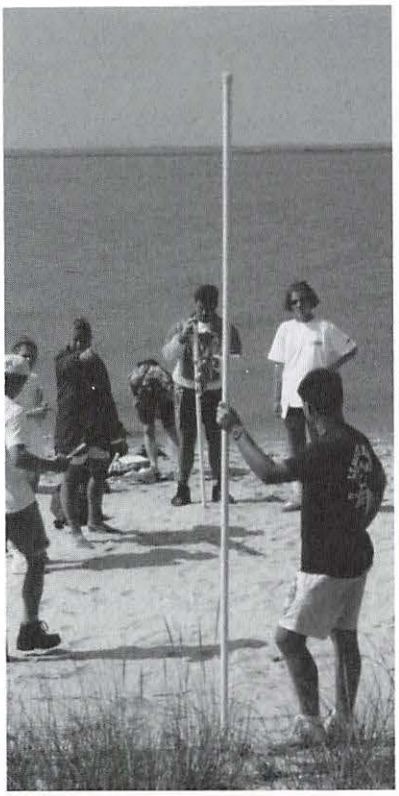
The thirty-five acre Gloucester Point campus houses six buildings with flow-through salt water systems and various laboratories that are well equipped for basic as well as specific project research. Equipment includes: a mass spectrometer, scanning and transmission electron microscopes, hydraulic flumes, an underwater video system, acoustic doppler current profilers, electromagnetic current meters, and a Geographic Information System.

A 60,000 square foot laboratory is scheduled for completion in the fall of 1995. The facility will house highly-specialized labs for advanced research in chemistry, geochemistry, toxicology, pathobiology, microbiology, genetics, physiology, planktonology, nutrient cycling, and parasitology.

The Institute is the largest marine center in the U.S. that is focused on coastal and estuarine science.

Institute scientists have monitored natural, commercial, and industrial effects on the Chesapeake Bay and its estuaries for more than fifty years.

EASTERN SHORE LABORATORY



Students from Virginia Polytechnic Institute & State University utilize facilities at the Eastern Shore Lab.

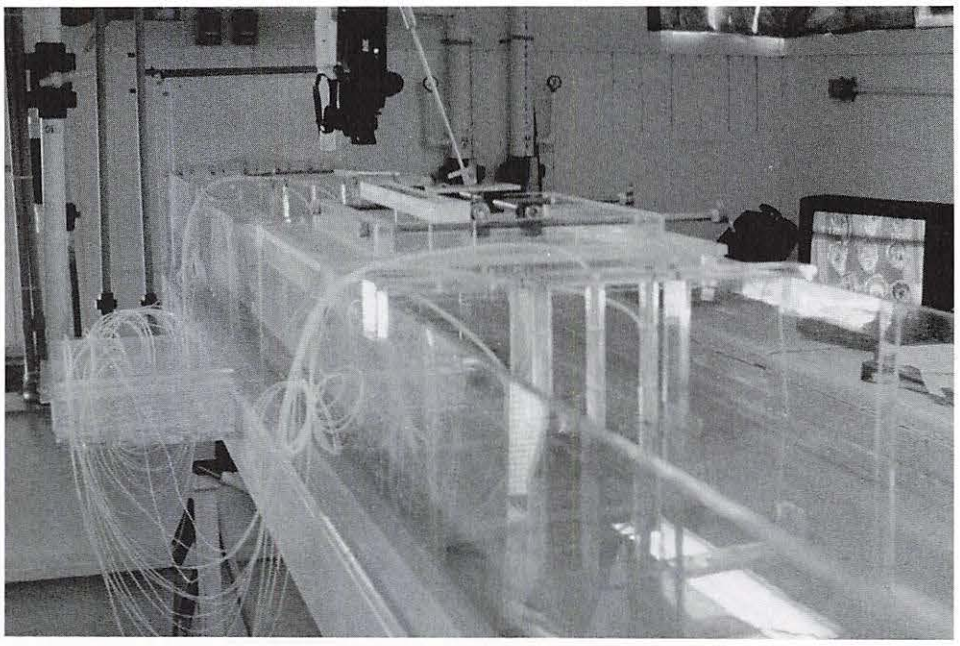
The VIMS Eastern Shore Laboratory, located in the seaside village of Wachapreague, serves as a field station for research, teaching, and advisory activities of SMS/VIMS.

Along the approximately 100 km of its Atlantic shoreline, the Virginia Eastern Shore remains one of the least developed coastal regions in the United States, with essentially no development on its barrier islands. This pristine area is uniquely suited for field research into coastal processes. The location provides convenient access to the eastern portion of the Chesapeake Bay and the barrier island, salt marsh-lagoonal systems along Virginia's Atlantic shore.

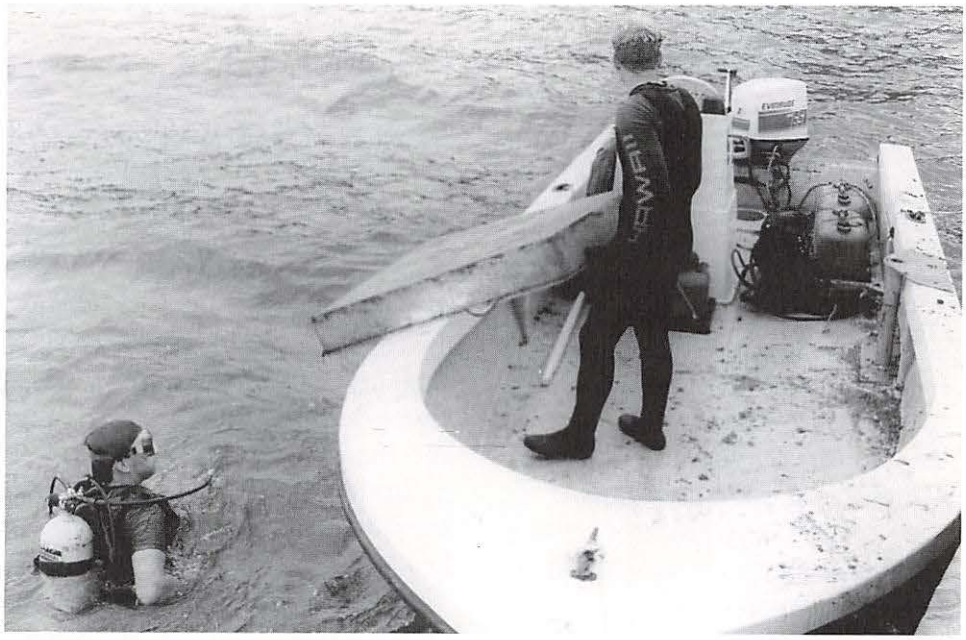
Widely recognized for its contributions to research in bivalve aquaculture, the Lab also supports activities of scientists and students from the Gloucester Point campus and other institutions. Recent research activities at the facility include: investigations into nitrogen cycling in salt mashes, disease transmission between mollusks, population dynamics of finfish and shellfish, chemical induction of settlement in invertebrates, and hydrodynamic characteristics of seagrass seeds.

Extensive wet laboratory facilities include running seawater tables and large holding tanks. A small hatchery for the culture of marine and estuarine organisms is especially well suited for mollusk culture. An on-site flume laboratory permits investigation of processes (hydrodynamic, sedimentological, and biological) in the benthic boundary layer.

Office and dry laboratory space are available to students and visiting investigators. An on-site dormitory can accommodate up to 28 visitors.



The seawater flume laboratory was designed and built by the Eastern Shore Lab faculty and staff.



More than 600 dives are logged annually by the 40-member dive team.

VESSELS CENTER

The vessels center maintains and operates a fleet of 40 vessels. The 65-foot *R/V Bay Eagle* is outfitted with a wet lab containing a flow-through seawater system, a dry lab housing electronics, and project-oriented equipment. Similarly outfitted is the 44-foot *R/V Langley*. Both vessels have Loran interface for downloading information to on board computers. In 1990, the 29-foot *R/V Fish Hawk* was especially designed and equipped to perform trawl surveys. A sizeable trailerable fleet supports estuarine and tributary research. Electronic systems can be transferred to these smaller boats, enabling precise scientific surveys to be conducted on board. A new diving facility includes a diver training room and classrooms to support the 40-member VIMS dive team. The VIMS diving program is an organizational member of the American Academy of Underwater Sciences.

LIBRARY

The library supports the Institute's mission by collecting and providing access to marine science literature, with emphasis on estuaries and the coastal zone. Currently the collection includes 521 journal subscriptions, 44,000 volumes and 19,200 titles in addition to topographic maps, nautical charts, and scientific archives. Access is provided through the card catalog as well as through the circulation terminal and personal computers. On-line networks provide access to marine science literature through *Aquatic Sciences and Fisheries Abstracts* and the *Chesapeake Bay Bibliography*, and Swem Library on the Main Campus in Williamsburg. The library workstation is networked to computers in the student User's Room.

MARINE ADVISORY SERVICES/SEA GRANT

Marine Advisory Services' (MAS) role is to be directly responsive to the needs of industry and the general public, and to provide information that will increase the public's awareness of the marine environment. MAS is associated with the Sea Grant Program, a state/federal program administered through the National Oceanic and Atmospheric Administration.

Specialists from MAS work closely with businesses, governmental agencies, educational organizations, and individuals to provide information and advice on a wide range of marine-related programs and activities.

The direction of MAS research is dictated by industry and government needs. Research has ranged from gear selectivity experiments and sea scallop biology, to technology for soft crab shedding and clam relaying. MAS works extensively with the recreational fishery, marine trades, and the offshore pelagic fishery.

In the past few years, changing needs and opportunities—driven in part by enacted or pending regulatory measures–have presented new challenges to MAS in the areas of seafood processing, water quality, and mariculture development.

Students at MAS are generally associated with Fisheries Science or Resource Management departments. Their research has been diverse. Projects have included sea scallop biology, the socioeconomics of Virginia's recreational fishery, the food/feeding habits and trophic interaction of tuna species in Virginia's offshore waters, and the biology of recreational reefs.

Advisory scientists work closely with industry, in this case the operator of a blue crab shedding facility.

MAS maintains the aquarium that attracts more than 5,000 visitors each year.

CHESAPEAKE BAY NATIONAL ESTUARINE RESEARCH RESERVE

Since 1987, Virginia Institute of Marine Science has been the lead agency for the Reserve System in Virginia. Reserve sites are preserved for estuarine research, monitoring, education, and conservation of key resources in relatively pristine settings. Establishment of four sites began a system that will include sites on the York, Pamunkey, Potomac, Rappahannock, and James rivers, the mainstem of the Bay and the Eastern Shore. Sites of activity today are the Goodwin Islands, the Catlett Islands, Taskinas Creek, and Sweet Hall Marsh. More than 20 research projects involving investigators from several colleges and universities are currently underway. The program provides study areas for numerous graduate research projects, "outdoor classrooms" and ecology presentations.

FISH COLLECTIONS

Nunnally Hall, completed in 1992, houses the extensive ichthyology collection that includes approximately 85,000 specimens in 247 families from Chesapeake Bay and contiguous waters, the continental slope and abyssal plain of the western Atlantic, and freshwater species of the southern Appalachians. More than 13,000 catalogued lots are stored on specially constructed shelving that provides access to the entire collection. The Institute also maintains a growing collection of marine and estuarine ichthyoplank-ton from Chesapeake Bay, Mid-Atlantic Bight, and Caribbean waters as well as a number of exotic species including a 5-foot female coelacanth from the Comoros Island in the Indian Ocean. There are facilities for processing acquisitions, x-ray studies, and performing necropsies on large fishes, sea turtles and cetaceans.

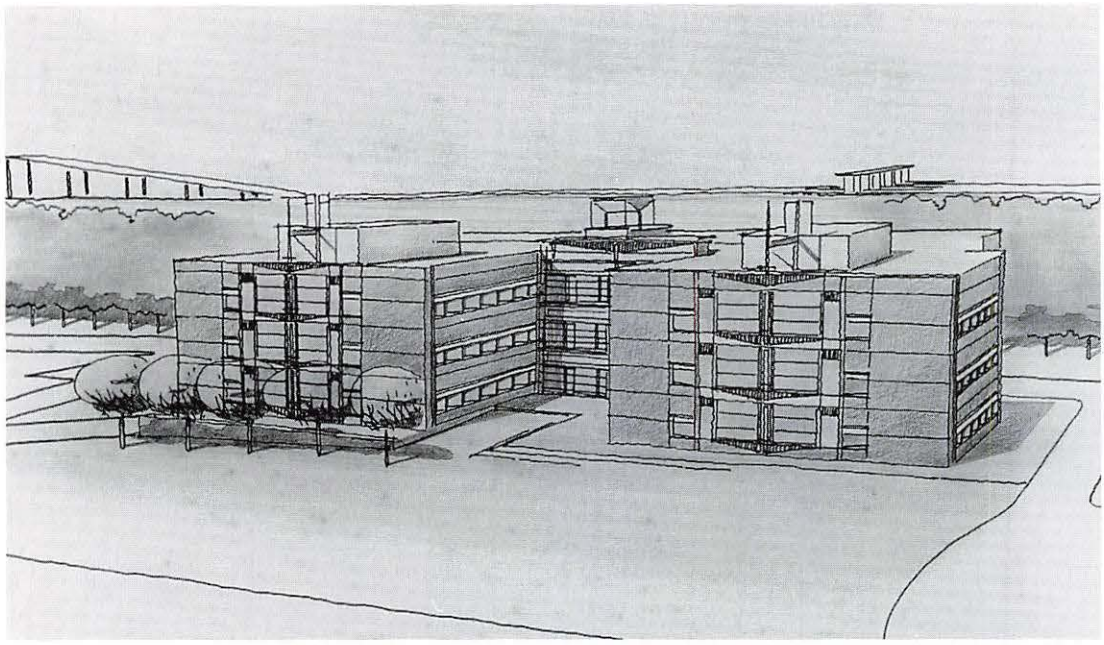
The Institute houses one of the most extensive fisheries collections on the East Coast.

Taskinas Creek is one of the four Reserve Sites for estuarine research.

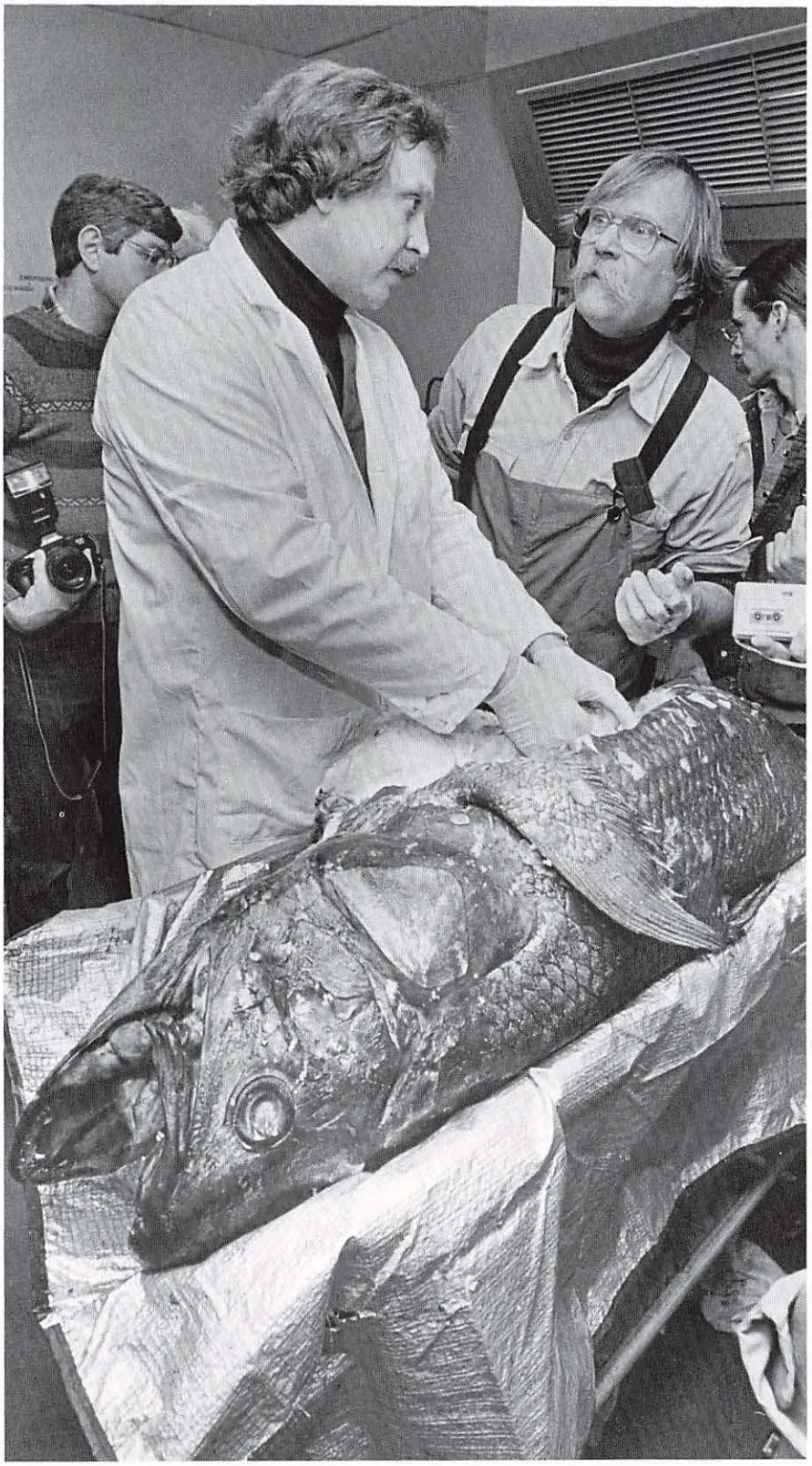
OYSTER HATCHERY

Established in 1985, the Oyster Hatchery provides breed stock (up to 2,000 at any given time) for research, conditioning, and selective breeding experiments. Specimens of any specified size are provided for class labs on a year-round basis. The hatchery is equipped with setting tanks for fertilization and a temperature controlled environment for development from larval to spat stage. Grow-out spats for oyster aquaculture are produced by the hatchery as well. In addition, the laboratory houses the largest algae culture lab on the East Coast. Four 1,000-gallon tanks, four 400-gallon tanks, state-of-the-art water temperature control and filtering systems enable the lab to produce vast quantities of virtually any kind of algae required for research or as a food source.

Oyster research ranges from cell cultures of the Perkinsus *protozoan, to developing disease-resistant hybrids and oyster aquaculture.*



The Marine Chemistry and Toxicology building will house specialized laboratories designed for biological and chemical research to examine the fate and effects of organic pollutants.



The diverse faculty is the cornerstone of the Institute's nationally and internationally recognized education and research programs.

Physical Sciences

School of Marine Science

Dennis L. Taylor, Dean and Acuff Professor of Marine Science. B.A., University of Pennsylvania; Ph.D., DSc., University of Wales. Biological Sciences.

John D. Milliman, Dean of Graduate Studies and Professor of Marine Science. B.S. University of Rochester; M.S., University of Washington (Seattle); Ph.D., University of Miami. Physical Sciences.

Henry Aceto, Jr., Associate Dean of Graduate Studies, Professor of Marine Science, and Professor of Biology. B.S., State University of New York, Albany; M.S., University of California, Berkeley; Ph.D., University of Texas. Environmental Sciences.

Herbert M. Austin, Professor of Marine Science. B.S., Grove City College; M.S., University of Puerto Rico; Ph.D., Florida State University. Fisheries Science.

John D. Boon, III, Professor of Marine Science. B.A., Rice University; M.A., Ph.D., College of William and Mary. Physical Sciences.

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

Robert J. Byrne, Director for Research and Advisory Services and Professor of Marine Science. M.S., Ph.D., University of Chicago. Physical Sciences.

Mark E. Chittenden, Jr., Professor of Marine Science. B.A., Hobart College; M.S., Ph.D., Rutgers University. Fisheries Science.

Hugh W. Ducklow, Loretta & Lewis Glucksman Professor of Marine Science. A.B. Harvard College; A.M., Ph.D., Harvard University. Biological Sciences.

William D. DuPaul, Professor of Marine Science. B.S., Bridgewater State College; M.A., Ph.D., College of William and Mary. Fisheries Science.

Robert J. Huggett, Professor of Marine Science. M.S., Scripps Institution of Oceanography; Ph.D., College of William and Mary. Environmental Sciences.

Stephen L. Kaattari, Professor of Marine Science. B.S., Ph.D., University of California, Davis. Environmental Sciences.

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

Joseph G. Loesch, Professor of Marine Science. B.S., University of Rhode Island; M.S., Ph.D., University of Connecticut. Fisheries Science.

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

William G. MacIntyre, Professor of Marine Science. B.S., M.S., Ph.D., Dalhousie University. Physical Sciences.

Roger L. Mann, Professor of Marine Science. B.S., University of East Anglia; Ph.D., University of Wales. Fisheries Science.

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

Bruce J. Neilson, Professor of Marine Science. B.A., M.S.E., M.A., Princeton University; Ph.D., The Johns Hopkins University. Resource Management and Policy.

Frank O. Perkins, Professor of Marine Science. B.A., University of Virginia; M.S., Ph.D., Florida State University. Fisheries Science.

Morris H. Roberts, Jr., Professor of Marine Science. B.A., Kenyon College; M.A., Ph.D., College of William and Mary. Environmental Sciences.

Gene M. Silberhorn, Professor of Marine Science. B.S., Eastern Michigan University; M.S., West Virginia University; Ph.D., Kent State University. Resource Management and Policy.

N. Bartlett Theberge, Jr., Professor of Marine Science. B.S., J.D., College of William and Mary; LL.M., University of Miami. Resource Management and Policy.

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

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

L. Donelson Wright, Chancellor Professor of Marine Science. B.A., University of Miami; M.A., University of Sydney; Ph.D., Louisiana State University. Physical Sciences.

Mohamed Faisal Abdel-Kariem, Associate Professor of Marine Science. B.V. Sci., M.V. Sci., Cairo University; D.V.M., University of Ludwig-Maximillian. Environmental Sciences.

John M. Brubaker, Associate Professor of Marine Science. A.B., Miami University; Ph.D., Oregon State University. Physical Sciences.

Fu-Lin Chu, Associate Professor of Marine Science. B.S., Chung Chi College; M.S., University of Rochester; Ph.D., College of William and Mary. Environmental Sciences.

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

David A. Evans, Associate Professor of Marine Science. B.A., M.A., Cambridge University; D.Phil., Oxford University. Physical Sciences.

John E. Graves, Associate Professor of Marine Science. B.S., Revelle College, University of California, San Diego; Ph.D., Scripps Institution of Oceanography, University of California, San Diego. Fisheries Science.

Robert C. Hale, Associate Professor of Marine Science. B.S., B.A., Wayne State University; Ph.D., College of William and Mary. Environmental Sciences.

John M. Hamrick, Associate Professor of Marine Science. B.C.E., Georgia Institute of Technology; M.S., Massachusetts Institute of Technology; Ph.D., University of California, Berkeley. Physical Sciences.

Carl H. Hershner, Associate Professor of Marine Science. B.S., Bucknell University; Ph.D., University of Virginia. Resource Management and Policy.

Howard I. Kator, Associate Professor of Marine Science. B.S., Harpur College; Ph.D., Florida State University. Biological Sciences.

James E. Kirkley, Associate Professor of Marine Science. B.S., M.S., Ph.D., University of Maryland. Fisheries Science.

Steven A. Kuehl, Associate Professor of Marine Science. B.A., Lafayette College; M.S., Ph.D., North Carolina State University. Physical Sciences.

Romuald N. Lipcius, Associate Professor of Marine Science. B.S., University of Rhode Island; Ph.D., Florida State University. Fisheries Science.

Jerome P.-Y. Maa, Associate Professor of Marine Science. B.S., M.S., National Cheng-Kung University; Ph.D., University of Florida. Physical Sciences.

Robert J. Orth, Associate Professor of Marine Science. B.A., Rutgers University; M.A., University of Virginia; Ph.D., University of Maryland. Biological Sciences.

Mark R. Patterson, Associate Professor of Marine Science. A.B., Harvard College; A.M., Ph.D., Harvard University. Biological Sciences.

Evon P. Ruzecki, Associate Professor of Marine Science. A.B., Knox College; M.S., University of Wisconsin; Ph.D., University of Virginia. Physical Sciences.

Beverly A. Weeks-Perkins, Associate Professor of Marine Science. B.A., Winthrop College; M.S., Tulane University; Ph.D., North Carolina State University. Environmental Sciences.

James E. Bauer, Assistant Professor of Marine Science. B.A., Boston University; M.S., State University of New York, Stonybrook; Ph.D., University of Maryland. Physical Sciences.

Elizabeth A. Canuel, Assistant Professor of Marine Science. B.S., Stonehill College; Ph.D., University of North Carolina. Physical Sciences.

Catherine J. Chisholm-Brause, Assistant Professor of Marine Science. B.A., Harvard University; M.S., Ph.D. Stanford University. Physical Sciences.

Rebecca M. Dickhut, Assistant Professor of Marine Science. B.S., St. Norbert College; M.S., Ph.D., University of Wisconsin, Madison. Physical Sciences.

Linda C. Schaffner, Assistant Professor of Marine Science. B.A., Drew University; M.A., Ph.D., College of William and Mary. Biological Sciences.

Peter Van Veld, Assistant Professor of Marine Science. B.S., University of North Carolina, Chapel Hill; M.A., College of William and Mary; Ph.D., University of Georgia. Environmental Sciences.

Wolfgang Vogelbein, Assistant Professor of Marine Science. B.S., Southampton College; M.S., California State University; Ph.D., Louisiana State University. Environmental Sciences.

Virginia Institute of Marine Science

All School of Marine Science faculty are also Virginia Institute of Marine Science faculty.

Iris C. Anderson, Professor of Marine Science. B.S., Colby College; S.M., Massachusetts Institute of Technology; Ph.D., Medical College of Virginia, Virginia Commonwealth University. Biological Sciences.

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

Mark W. Luckenbach, Associate Professor of Marine Science. B.S., University of North Carolina; Ph.D., University of South Carolina. Biological Sciences.

Craig L. Smith, Associate Professor of Marine Science. A.B., The Johns Hopkins University; Ph.D., University of Florida. Environmental Sciences.

Thomas A. Barnard, Jr., Assistant Professor of Marine Science. B.A., Milligan College; M.A., College of William and Mary. Resource Management and Policy.

J. Emmett Duffy, Assistant Professor of Marine Science. B.S. Spring Hill College; M.S. University of Maine; Ph.D. University of North Carolina at Chapel Hill. Biological Sciences.

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

John E. Olney, Assistant Professor of Marine Science. B.S., M.A., College of William and Mary. Biological Sciences.

James E. Perry, III, Assistant Professor of Marine Science. B.S., Murray State University; Ph.D., College of William and Mary. Resource Management and Policy.

Michael A. Unger, Assistant Professor of Marine Science.B.S., Michigan State University; M.S., Ph.D., College of William and Mary. Environmental Sciences.

Kevin P. Kiley, Instructor in Marine Science. B.S., Tufts University; M.A., College of William and Mary. Resource Management and Policy.

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

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

Kenneth A. Moore, Instructor in Marine Science. B.S., Pennsylvania State University; M.S., University of Virginia. Biological Sciences.

Walter I. Priest, III, Instructor in Marine Science. B.S., Virginia Military Institute; M.S., Old Dominion University. Resource Management and Policy.

Martha W. Rhodes, Instructor in Marine Science. B.S., Virginia Polytechnic Institute and State University; M.A., Medical College of Virginia, Virginia Commonwealth University. Biological Sciences.

Jacques van Montfrans, Instructor in Marine Science. B.S., Florida State University; M.S., Florida Atlantic University. Fisheries Science.

Gary F. Anderson, B.S., Southampton College of Long Island University; M.A., College of William and Mary. Physical Sciences.

C. Scott Hardaway, B.A., M.S., East Carolina University. Physical Sciences.

John N. Posenau, B.A., Christopher Newport College. Physical Sciences.

Emeritus

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

Rudolf H. Bieri, Professor Emeritus of Marine Science. Dr.rer.nat. Johann Gutenberg University. Environmental Sciences.

Michael Castagna, Professor Emeritus of Marine Science. B.S., M.S., Florida State University. Biological Sciences.

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

William J. Hargis, Jr., Professor Emeritus of Marine Science. A.B., M.A., University of Richmond; Ph.D., Florida State University. Biological Sciences.

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

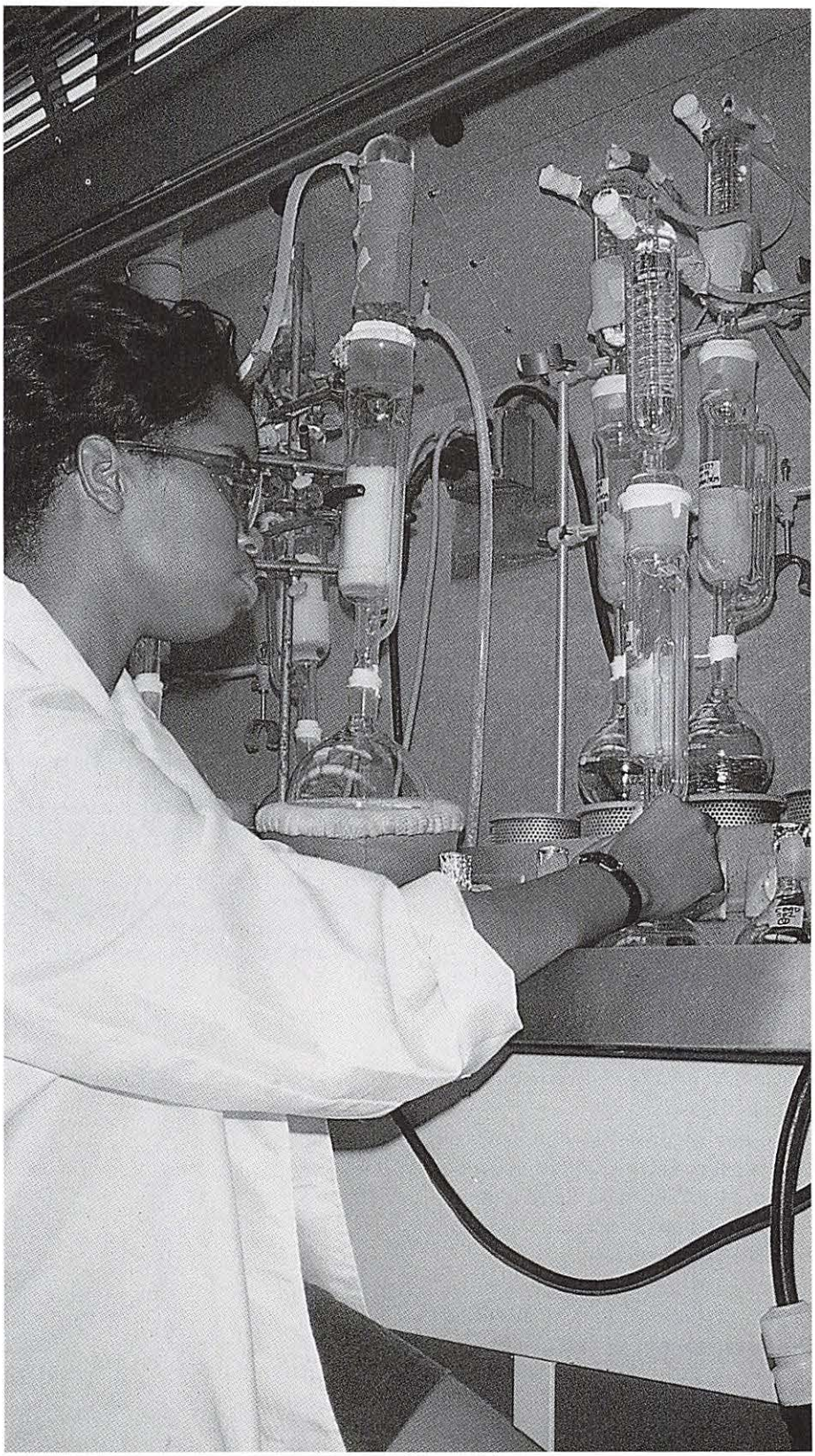
Maynard M. Nichols, Professor Emeritus of Marine Science. B.S., Columbia University; M.S., Scripps Institution of Oceanography; Ph.D., University of California at Los Angeles. Physical Sciences.

Willard A. Van Engel, Professor Emeritus of Marine Science. Ph.B., Ph.M., University of Wisconsin. Fisheries Science.

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

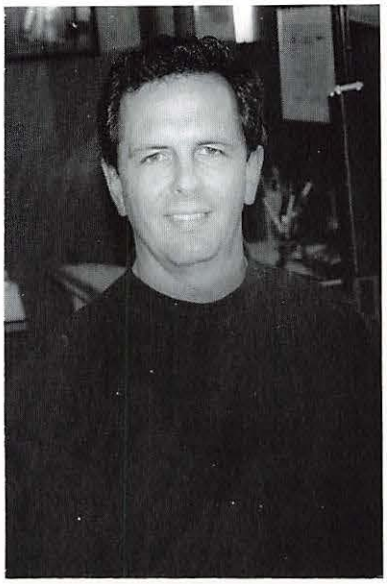
Frank J. Wojcik, Assistant Professor Emeritus of Marine Science. B.S., University of Massachusetts; M.S., University of Alaska. Fisheries Science.

The specially equipped DeHavilland-Beaver aircraft logged 300 hours in 1993 to support various research.



The Department of Physical Sciences includes the subdisciplines of physical, chemical, and geological oceanography. Many of the education and application aspects of quantitative methods are incorporated. This union facilitates a new level of interdisciplinary synergy, appropriate to rapidly evolving needs and emphases. The global objective of the department is: to generate, communicate, and apply knowledge concerning physical, chemical, and geological processes that operate in the coastal ocean and estuaries.

The Department of Physical Sciences



James E. Bauer

Assistant Professor of Marine Science

B.A., Boston University;
M.S., SUNY, Stony Brook;
Ph.D., University of Maryland

RESEARCH INTERESTS

My primary interests are isotope geochemistry of marine organic matter, marine biogeochemistry, and the role of bacteria in ocean carbon cycling and food webs.

The work in my laboratory is focused on elucidating and quantifying some of the major biogeochemical processes and pathways involved in carbon and nitrogen cycling in ocean waters and sediments.

Current emphasis is on the cycling of the dissolved organic matter (DOM) in waters of the open Atlantic and Pacific Oceans.

We are assessing the sources, sinks and turnover times of colloidal and small suspended particulate organic carbon on a seasonal basis in the eastern North Pacific Ocean. A long time-series station in this region will help us understand the effects of global-scale phenomena, such as El Nino, on the sequestrations and transformation of carbon in the deep ocean.

Also, we are investigating the role of marine bacteria in controlling both the turnover and distributions of DOM.

CURRENT PROJECTS

- Radiocarbon studies of dissolved and particulate organic carbon in the eastern north pacific.
- Transport of dissolved and particulate organic carbon to the Atlantic Ocean by the Amazon River plume.
- Sources and properties of colloidal trace metals in the ocean.
- Transformation rates and fate of dissolved, colloidal and particulate organic carbon in ocean margins.

CURRENT STUDENTS

Jennifer Cherrier, Ph.D. - Microheterotrophic utilization of marine dissolved organic matter.
Gary Schultz, M.S. - Seasonal distributions of dissolved and particulate amino acids and carbohydrates in the eastern North Pacific Ocean.

RECENT PUBLICATIONS

Bauer, J. E., M. L. Occelli, P. M. Williams and P. C. McCaslin. 1993. Heterogeneous catalyst structure and function: Review and implications for the analysis of dissolved organic carbon and nitrogen in natural waters. *Marine Chemistry* **41**:75-89.

Williams, P. J. LeB. and J. E. Bauer. 1993. Measurement of dissolved organic carbon and nitrogen in natural waters: DOC subgroup report. *Marine Chemistry* **41**:11-21.

Bauer, J. E., P. M. Williams and E. R. M. Druffel. 1992. Recovery of sub-milligram quantities of carbon dioxide from gas streams by molecular sieve for subsequent determination of isotopic natural abundances (13C and 14C). *Analytical Chemistry* **64**: 824-827.

Bauer, J. E., P. M. Williams and E. R. M. Druffel. 1992. 14C activity of dissolved organic carbon fractions in the central North Pacific and Sargasso Sea. *Nature* **357**: 667-670.

RESEARCH INTERESTS

My primary interests are hydrodynamics shorelines and beaches and sediment dynamics of tidal inlets. I am also interested in analysis and prediction of tides and tidal currents, beach and nearshore processes, wave measurement and analysis.

Additional programs of interest include: benthic boundary layer processes, resuspension and transport of fine-grained sediments in inner shelf, lagoonal and estuarine environments and artificial beach development.

CURRENT PROJECTS

- Wave monitoring and statistical analysis determining the wave climatology of the lower Chesapeake Bay.
- Wave structure interaction studies at Virginia Beach using the REF/DIF1 combined refraction/diffraction model.

SELECTED PUBLICATIONS

Madsen, O. S., L. D. Wright, J. D. Boon and T. A. Chisholm, 1993. Wind stress, bed roughness, and sediment suspension on the inner shelf during an extreme storm event. *Continental Shelf Research* **13**(11):1302-1324.

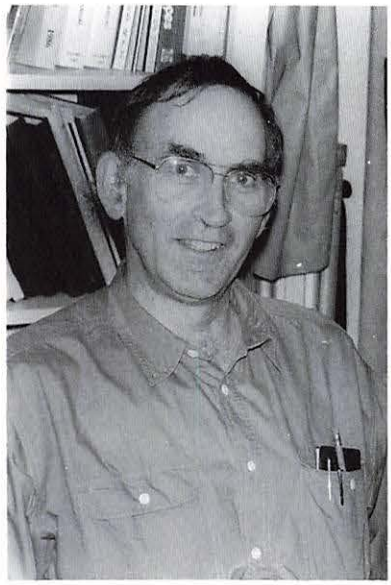
Green, M. O. and J. D. Boon, 1993. The measurement of constituent concentrations in non-homogenous sediment suspensions using optical backscatter sensors. *Marine Geology*, **110**:73-81.

Wright, L. D., J. D. Boon, J. P. Xu and S. C. Kim, 1992. The bottom boundary layer of the bay stem plains environment of lower Chesapeake Bay. *Estuarine, Coastal and Shelf Science*, **35**:17-36.

Boon, J. D., D. A. Hepworth, K. D. Suh and F. H. Farmer. Chesapeake Bay Wave Climate - Thimble Shoals Wave Station, Report and summary of wave observations, October 8, 1990 through August 22, 1991. VIMS Data Report No. 44, January 1993.

Wright, L. D., J. D. Boon, J. P. Xu and S. C. Kim, 1992. The bottom boundary layer of the bay stem plains environment of lower Chesapeake Bay. *Estuarine, Coastal and Shelf Science*, **35**:17-36.

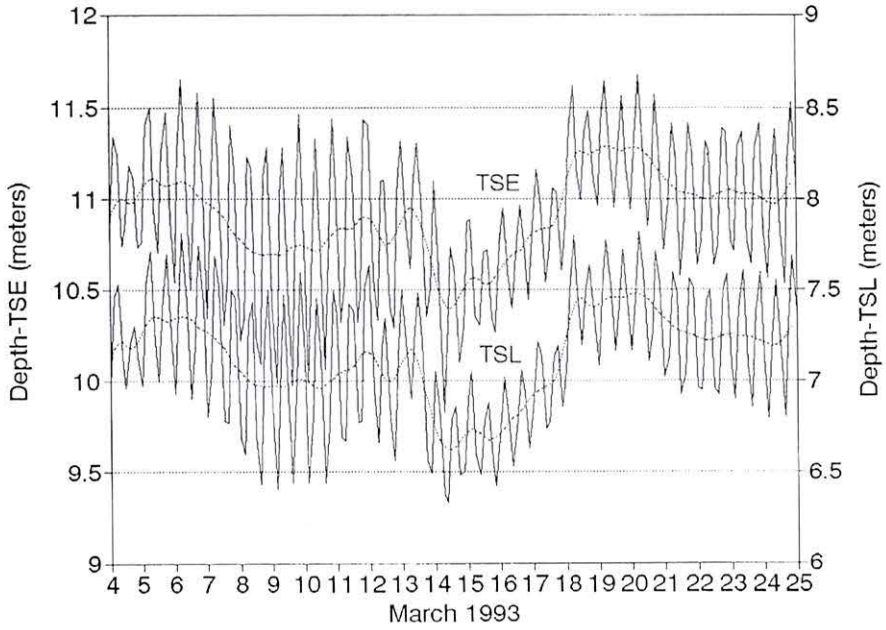
Boon, J. D. and C. R. Berquist, Jr. 1991. Evaluation of sediment dynamics and the mobility of heavy minerals on a linear sand shoal. *Journal of Coastal Research*, **7**:989-1002.



John D. Boon

Professor of Marine Science

B.A., Rice University; M.A., Ph.D., College of William and Mary



Sea level change, March 1993 storm at Thimble Shoal entrance channel.

John M. Brubaker

Associate Professor of Marine Science

A.B., Miami University; Ph.D., Oregon State University

RESEARCH INTERESTS

Within a broad interest in the dynamics of circulation and transport processes in estuaries and on the continental shelf, a particular focus for me is the role of smaller scale processes and variability, characterized by time scales of tidal period or less, and length scales often associated with stratification and bottom topography. The underlying goal, a better understanding of vertical and horizontal fluxes in estuaries and on the shelf, has led to consideration of phenomena such as estuarine and coastal fronts, internal waves, and the development and breakdown of density stratification. Often, these processes are patchy and ephemeral, requiring adaptive sampling strategies in the field. Recently, I have used an acoustic Doppler current profiler (ADCP) extensively in these studies.

CURRENT PROJECTS

- Internal hydraulic control and two-way exchange in the lower Hudson River. Funded by Hudson River Foundation. Co-PI, R. Wilson, SUNY/ Stony Brook.
- Physical processes influencing hypoxia in the Chesapeake Bay system.
- Cross-shelf transport processes: ADCP observations. A component of the CoOP program funded by NSF. PI's, R. Guza & J. Largier, Scripps; C. A. Butman & S. Lentz, WHOI; D. Wright, VIMS.
- Internal waves in the rocky subtidal zone. Funded by NSF. PI's, M. Patterson, VIMS, and J. Witman, Northeastern U.

CURRENT STUDENTS

William Stockhausen, M.A., Directional wave spectra using an acoustic Doppler current profiler.

Bohyun Bang, Ph.D., Inverse estimation of vertical eddy viscosity and shear stress in shallow tidal flows.

Pablo Glorioso, Ph.D. (on leave at Proudman Lab, U.K.), Variations in the vertical structure in the northern North Sea: observations and numerical modeling.

SELECTED PUBLICATIONS

Brubaker, J.M. 1987. Similarity structure in the convective boundary layer of a lake. *Nature,* **330**:742-745.

Huzzey, L.M. and J.M. Brubaker. 1988. The formation of longitudinal fronts in coastal plain estuaries. *J. Geophys. Res.*, **93**(C2):1329-1334.

Kuo, A.Y., R.J. Byrne, J.M. Brubaker and J.H. Posenau. 1988. Vertical transport across an estuary front, in *Physical Processes in Estuaries,* edited by J. Dronkers and W. van Leussen, pp. 93-109, Springer-Verlag, Berlin.

Kuo, A.Y., E.P. Ruzecki, B.J. Neilson, J.M. Brubaker and R.J. Byrne. 1990. Circulation and transport of oyster larvae in Virginia estuaries, in *Physics of Shallow Seas,* edited by W. Huatong, W. Jingyong, and D. Hua, pp. 41-51, China Ocean Press, Beijing.

Sharples, J., J.H. Simpson and J.M. Brubaker. 1994. Observations and modeling of periodic stratification in the upper York River estuary. *Est. Coastal and Shelf Sci.* **38**:301-312.

Brubaker, J. M. and J. H. Simpson. Flow convergence and stability at a tidal estuarine front: acoustic Doppler current observations. Submitted.

RESEARCH INTERESTS

My principal research interest is coastal processes and estuarine sedimentation processes and the appropriate applications to marine resource management issues. Applications include ramifications of development of the shoreland on beaches and embayments, and the persistent issue of channel dredging and dredged material placement.

CURRENT PROJECTS

- Beneficial Uses of Dredge Material from the Waterway on the Coast of Virginia (WCV). PIs - Walter Priest, Ill (VIMS) and Robert Grabb (VMRC).
- Development of a Water Quality Model for Small Coastal Basins to Address Management Needs. PIs - Albert Kuo (VIMS) and Arthur Butt (DEQ).

SELECTED PUBLICATIONS

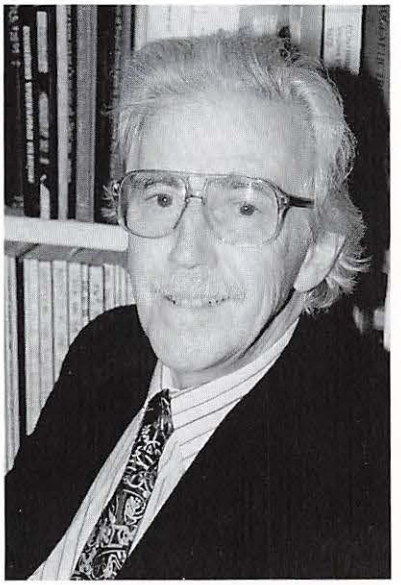
Byrne, R. J. 1993. Beneficial Uses of Dredged Material in Hampton Roads, Virginia. House Document No. 16, Report to the Governor and the General Assembly of Virginia, 47 pps.

Zhang, Q., R. J. Byrne and G. R. Thomas. 1992, Analyses of Recent Geomorphic Evolution of Gargathy Inlet, Eastern Shore, Virginia, USA. *Chin. J. Oceanol. Limnol.* **10**(1):9-22.

Wright, L. D., R. A. Gammisch, and R. J. Byrne. 1990. Hydraulic Roughness and Mobility of Three Oyster-bed Artificial Substrate Materials, *J. Coastal Research*, **6**:867-878.

Kuo, A. Y., R. J. Byrne, P. V. Hyer, E. P. Ruzecki and J. M. Brubaker. Practical Application of Theory for Tidal Intrusion Fronts. ASCE *J. Waterway, Port, Coastal and Ocean Eng.*, May 1990, **116**(3):341-361.

Gammisch, R. A. C. H. Hobbs, III and R. J. Byrne. 1988. Evolution of tidal inlet-drainage basin systems. *J. Coastal Research* **4**:543-550.



Robert J. Byrne

Director for Research and Advisory Services

Professor of Marine Science

M.S., Ph.D., University of Chicago

Elizabeth A. Canuel

Assistant Professor of Marine Science

B.S., Stonehill College; Ph.D., University of North Carolina at Chapel Hill

RESEARCH INTERESTS

My research efforts are aimed at understanding the processes which control the cycling of organic carbon in the marine environment. This includes the delivery of organic matter, its subsequent alteration by microbially-mediated processes during early diagenesis and the storage of organic matter (as carbon) in the sedimentary record. The focus of my work has been in estuarine and shallow water coastal sediments where I have evaluated variations in organic matter imputs and degradation rates over seasonal to annual timescales. While these environments are both complex and dynamic, processes occurring in these regions play an important role in the global carbon cycle. Nearshore environments have also been important in the geologic past as most of the organic carbon which has been preserved is concentrated in sediments deposited along the continental margins.

CURRENT PROJECTS

- Biomarker characterization of organic matter associated with water column particles and surface sediments.
- Differential reactivity of organic matter.
- Microbially-mediated degradation of organic matter.
- Factors controlling the preservation of organic carbon in marine sediments.

CURRENT STUDENTS

Dr. Canuel is new to the SMS faculty for the 1993-1994 academic year.

SELECTED PUBLICATIONS

Canuel, Elizabeth A., James E. Cloern, David B. Ringelberg, James B. Guckert and Greg Rau. (In press). Using molecular and isotopic tracers to examine sources of organic matter and its incorporation into the food webs of San Francisco Bay. *Limnology & Oceanography.*

Canuel, E. A. and C. S. Martens. 1993. Seasonal variations in the sources and alteration of organic matter associated with recently-deposited sediments. *Organic Geochemistry*, **20**:563-577.

Canuel, E. A., C. S. Martens and L. K. Benninger. 1990. Seasonal variations in ^{7}Be activity in the sediments of Cape Lookout Bight, North Carolina. *Geochimica et Cosmochimica Acta*, **54**:237-245.

Wakeham, S. G. and E. A. Canuel. 1990. Fatty acids and sterols of particulate matter in a brackish and seasonally anoxic coastal salt pond. *Organic Geochemistry*, **16**:703-713.

Wakeham, S. G. and E. A. Canuel. 1988. Organic geochemistry of particulate matter in the eastern tropical North Pacific Ocean: Implications for particle dynamics. *Journal of Marine Research*, **46**:183-213.

Wakeham, S. G., E. A. Canuel and P. H. Doering. 1986. Geochemistry of volatile organic compounds in seawater. *Geochimica et Cosmochimica Acta*, **50**:1163-1172.

RESEARCH INTERESTS

My research focuses on the chemical reactions and mobility of metals in soils, sediments, and aquifers. Knowledge of these chemical processes is fundamental to understanding a wide range of ecological topics, including transport of toxic substances in ground and surface waters; interactions between biological organisms and metals in aquatic ecosystems; remediation of contaminated soils; and formation of ore deposits. In studying chemical processes which occur at the solid/water interface, I use a combination of spectroscopic and microscopic char-acterization methods, laboratory and field measurements, and thermodynamic computer modeling. I am currently studying the basic mechanisms of metal-ion uptake by oxides and clays at the molecular-level. In addition, I am investigating the efficiency and chemical basis for uranium removal from contaminated soils. I am developing collaborative projects at SMS/VIMS which couple aqueous and surface geochemistry with physical and biological processes.

CURRENT PROJECTS

- Spectroscopic characterization of toxic metals in soils and associated with mineral surfaces.
- Evaluation of chemical and physical changes in the contaminant and in the soil during carbonate heap-leach.
- Influence of dissolved organics on the transport of metals in the aquatic environment.
- Mediation of redox processes at the mineral/water interface.

CURRENT STUDENTS

Dr. Chisholm-Brause is new to the SMS faculty in the 1993-1994 academic year, and is actively recruiting students to this new program.

SELECTED PUBLICATIONS

Chisholm-Brause, C. J., S. D. Conradson, C. T. Buscher, P. G. Eller, and D. E. Morris. 1994. Speciation of uranyl sorbed at multiple binding sites on montmorillonite. *Geochimica et Cosmochimica Acta* **58**: in press.

Morris, D. E., C. J. Chisholm-Brause, M. E. Barr, S. D. Conradson, and P. G. Eller. 1994. Optical spectroscopic studies of the sorption of UO_2^{2+} species on a reference smectite. *Geochimica et Cosmochimica Acta* **58**: in press.

Longmire, P. A., W. R. Turney, C. J. Chisholm-Brause, B. M. Thomson, C. F. V. Mason, and D. A. York. 1994. Predictive geochemical modeling of uranium and other contaminants in laboratory columns in relatively oxidizing, carbonate-rich solutions. In: *HLW, LLW, Mixed-Waste, and Environmental Restoration–Working Towards a Cleaner Environment.* WM Symposia, Inc., pp. 2081-2085.

Combes, J-M, C. J. Chisholm-Brause, G. E. Brown, Jr., G. A. Parks, S. D. Conradson, P. G. Eller, I. R. Triay, D. E. Hobart, and A. Meijer. 1992. EXAFS spectroscopic study of neptunium (V) sorption at the α-FeOOH/water interface. *Environmental Science and Technology* **26**:376-382.

Chisholm-Brause, C. J., P. A. O'Day, G. E. Brown, Jr., and G. A. Parks. 1990. Evidence for multinuclear metal-ion complexes at solid/water interfaces from x-ray absorption spectroscopy. *Nature* **348**:528-531.

Chisholm-Brause, C. J., K. F. Hayes, A. L. Roe, G. E. Brown, Jr., G. A. Parks, and J. O. Leckie. 1990. Spectroscopic investigation of Pb(II) complexes at the γ-Al_2O_3/water interface. *Geochimica et Cosmochimica Acta.* **54**:1897-1909.

Catherine J. Chisholm-Brause

Assistant Professor of Marine Science

B.A., Harvard University; M.S., Stanford University; Ph.D., Stanford University

Rebecca M. Dickhut

Assistant Professor of Marine Science

B.S., St. Norbert College; M.S., Ph.D., University of Wisconsin - Madison

RESEARCH INTERESTS

My primary research objective is the development of a quantitative understanding of the partitioning, transport, and transformation processes governing the fate and effects of organic chemical pollutants in the environment. The goal of the chemical pollutant fate and transport research program is to examine the mechanisms by which organic contaminants are distributed in the environment to provide accurate assessment of the impact of these substances on aquatic ecosystems. Findings of our research are generally incorporated into models and management stratagies for evaluating the environmental impact of potentially toxic substances.

CURRENT PROJECTS

- Atmospheric (wet and dry) deposition of organic contaminants to Chesapeake Bay, gas exchange of organic pollutants across the air/water interface.
- Assessment of the role of the sea surface microlayer in organic contaminant fate and transport.
- Determination of physical-chemical properties for modeling air/water exchange of organic contaminants.
- Investigation of the role of benthic communities on the fate and transport of sediment-associated organic pollutants.
- Organic contaminant - particle interactions and mechanisms controlling the release and transformation of these pollutants from sediments.
- Study of metabolic transformations of organic contaminants in benthic invertabrates.

CURRENT STUDENTS

Kurt E. Gustafson - Gas exchange of organic pollutants across the air/water interface of southern Chesapeake Bay.
Kewen Liu - Influence of the sea surface microlayer on the distribution, transport and transformation of organic contaminants.
Siddhartha Mitra - Partitioning and transport for organic contaminants in biogeochemically reactive sediments.
Caryn Huszai - Bioaccumulation and metabolism of organic contaminants in benthic macrofauna from lower Chesapeake Bay.

RECENT PUBLICATIONS

Dickhut, R.M. and K.E. Gustafson. 1994. Atmospheric Levels and Inputs of Polycyclic Aromatic Hydrocarbons and Polychlorinated Biphenyls in the Southern Chesapeake Bay Region. Submitted to *Marine Environ. Bull.*

Dickhut, R.M., J.E. Baker and D.L. Leister. 1993. Design and Field Validation of an Automated Precipitation sampler for Hydrophobic organic contaminants. In preparation.

Liu, K. and R.M. Dickhut. 1994. Saturation Vapor Pressures and Thermodynamic Properties of Selected Chlorinated Benzenes. *Chemosphere.* In press.

K.E. Gustafson and R.M. Dickhut. 1994. Molecular Diffusivity of Polycyclic Aromatic Hydrocarbons in Aqueous Solution. *J. Chem. Eng. Data* **39**:281-285.

K E. Gustafson and R.M. Dickhut. 1993. Molecular Diffusivity of Polycyclic Aromatic Hydrocarbons in Air. Submitted to *J. Chem. Eng. Data* **39**:286-289.

Dickhut, R.M., L. W. Schaffner, P. W. Lay and S. Mitra. Bioaccumulation and Biotransformation of selected Organic Contaminants by Benthic Macrofauna from Chesapeake Bay. In preparation.

RESEARCH INTERESTS

My interest lies in the exploration and development of innovative techniques of data analysis, particularly in the area of time series such as environmental data, abundance data, etc., and two dimensional spatial data such as surface topography, species distribution and density, etc. "Traditional" methods such as Fourier analysis have been used in these areas, but the investigation of techniques based on non-linear, chaotic processses offers an intriguing field of endeavor. I am in the process of developing this research program which has grown out of experience collaborating with colleagues.

I am also investigating how species identification might be automated by using artificial neural networks to perform pattern recognition tasks.

RECENT PUBLICATIONS

Evans, D. A. January 1993. The Statistics of Measurement. Magill's Survey of Science: Applied Science, 2459-2466 pp. Pasadena, Salem Press.

Loesch, J. G. and D. A. Evans, 1992. Seasonal Variations in Surf Clam (Spisula solidissimus) yields. American Fisheries Society, 122nd Annual Meeting, September 14-17, 1992, Rapid City, S. Dakota.

Evans D. A., R. J. Huggett, D. J. Westbrook and E. J. Travelstead, 1991. Statistical Modeling of Intensive TBT Monitoring Data in Two Tidal Creeks of the Chesapeake Bay. *Jounal. Marine Environmental Research* **32**(1-4): 169-186.

Musick, J. A., C. Tabit and D. A. Evans. 1990. Surface Area on Galleoid Sharks. *Copeia* 4:1130-1133.

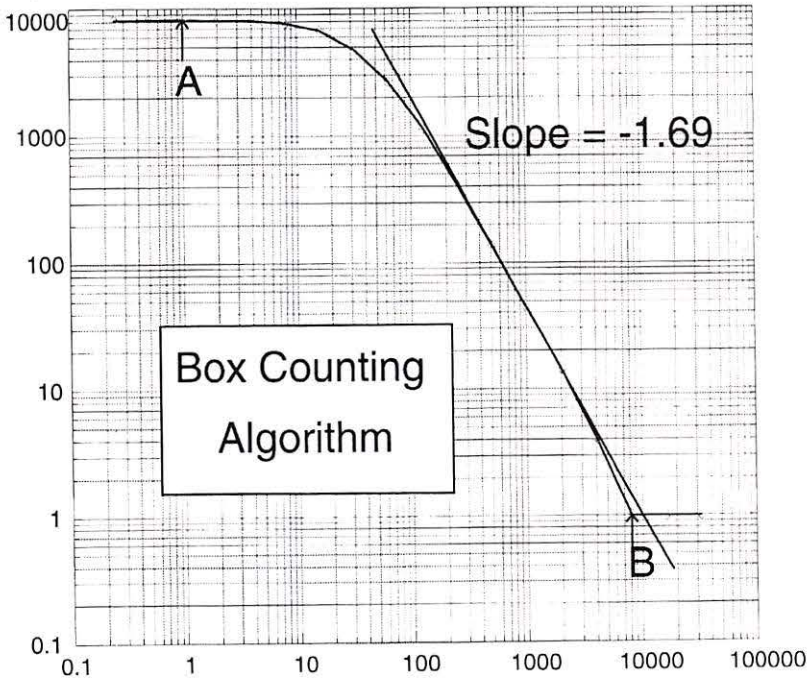
Frisch, A. A., D. A. Evans and J. P. Husdon. May 1987. Shape Discrimination of Sand Samples using Fractal Dimension. Symposium on Advancements in Understanding of Coastal Sediment Processes, American Society of Civil Engineers.

Austin, H. M., D. A. Evans and B. L. Norcross. 1984. Time Series Analyses as a Means of Examining Long Term Biological and Environmental Data Sets. ICES Statutory Meeting, Statistics Committee, C.M. 1984/D:1, 14p.

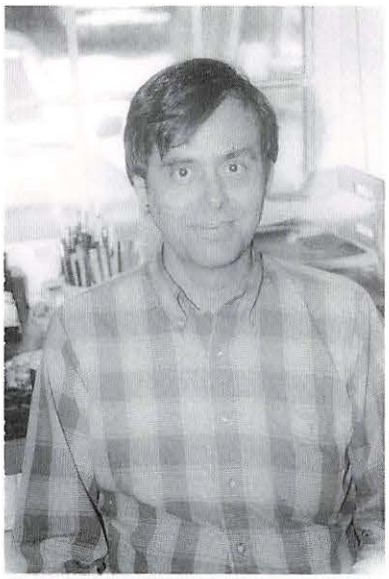
David A. Evans

Associate Professor of Marine Science

B.A., M.A., University of Cambridge; D.Phil., University of Oxford



Estimation of fractal dimension of a time series of tide residuals.



John M. Hamrick

Associate Professor of Marine Science

B.C.E., Georgia Institute of Technology;
S.M., Massachusetts Institute of Technology;
Ph.D., University of California, Berkeley

RESEARCH INTEREST

My primary research interests are in the areas of theoretical and computational modeling of estuarine and coastal ocean physical processes including the interaction of physical and biological processes. My theoretical work focuses on the dynamics of subtidal circulation and long-term mass transport in estuaries, as well as the coupled dynamics of estuaries and adjacent shelf regions. Over the past five years, I have developed a three-dimensional, primitive equation estuarine and coastal ocean circulation and transport modeling system. The model has been used for studies related to resources management issues, including contaminant mixing and transport and analysis of shoreline modification impacts. As a research tool, the model has been used to study the dynamics of estuarine frontal systems and the dynamics of long-term transport processes in the Chesapeake Bay system. My current computational modeling research is equally divided between the extension of the circulation and transport model for the coupled simulation of physical and biological processes and the development and analysis of advanced numerical techniques.

CURRENT PROJECTS

- Development of coupled circulation and biogeochemical transport models for estuarine and coastal waters.
- Development of coupled circulation, sediment transport and toxic contaminant transport models for estuarine and coastal waters.
- Variational inverse parameter identification methodologies for circulation and reactive biogeochemical transport problems.
- Biological and physical determinants of blue crab recruitment: sources, sinks and metapopulation dynamics. Funded by NOAA Sea Grant.
- Balancing the budget: progress towards a stock recruit relationship for the James River oyster resource. Funded by NOAA Sea Grant.
- Use of a three-dimensional hydrodynamic and transport model to predict the distribution of a candidate viral indicator of fecal pollution from a large point source of sewage effluent. Funded by NOAA Sea Grant.
- Mixing and dilution of the Surrey Nuclear power plant discharge into the James River. Fund by Virginia Power Corp.

CURRENT STUDENT

Zhaoqing Yang, Ph.D. - Variational inverse parameter identification methodologies for transport problems.

RECENT PUBLICATIONS

Hamrick, J. M., 1994: Linking hydrodynamic and biogeochemcial transport models for estuarine and coastal waters. Estuarine and Coastal Modeling III, Proceedings of the 3rd International Conference, M. L. Spaulding et al, Eds., American Society of Civil Engineers, New York, 591-608.

J. M. Hamrick, 1990. The dynamics of long-term mass transport in estuaries. Residual Circulation and Long-Term Transport in Estuaries and Shallow Bays, R. T. Cheng (ed.), Springer-Verlag, New York, 17-33.

Hamrick, J. M., 1992: Estuarine environmental impact assessment using a three-dimensional circulation and transport model. Estuarine and Coastal Modeling II, Proceedings of the 2nd International Conference, M. L. Spaulding et al, Eds., American Society of Civil Engineers, New York, 292-303.

Hamrick, J. M., 1989. Excitation-response analysis of estuarine Circulation. Circulation Patterns in Estuaries, B. J. Neilson et al, (eds.), Humana Press, Clifton, New Jersey, 157-182.

RESEARCH INTERESTS

The geology of the Quaternary sediments of Chesapeake Bay and its tributaries, the continental shelf of the mid-Atlantic region, and the outer coastal plain is the major focus of my studies and interest. The studies have both academic and practical applications. The very high resolution, seismic reflection techniques provide a significant quantity of data on the region's shallow stratigraphy. We have applied the work in studies of sand resources for beach nourishment and of potential resources of heavy minerals.

Also, studies of recent coastal geology, specifically Jamestown Island, and the comparison of the island today with when the area was occupied by early inhabitants. This work is being performed in cooperation with the Department of Geology and the Center for Archaeological Research of the College of William and Mary and with historians and archaeologists from Colonial Williamsburg.

CURRENT STUDENTS

Donna R. Milligan - B.S. Coastal Carolina, 1991.

SELECTED PUBLICATIONS

Hobbs, C. H., III, J. P. Halka, R. T. Kerhin, and M. J. Carron, 1992. Chesapeake Bay sediment budget. *Journal of Coastal Research*, **8**(2):292-300.

Coleman, S. M., J. P. Halka, and C. H. Hobbs, III, 1992. Patterns and rates of sedimentation in the Chesapeake Bay during the Holocene rise in sea level. In: C. H. Fletcher, III and J. F. Wehmille (eds.), Quaternary Coastal Systems of the United States, S.E.P.M. Special Publication No. 48, p. 104-111.

Colman, S. M., J. P. Halka, and C. H. Hobbs, III, 1992. A summary of the geological evolution of Chesapeake Bay, eastern United States. p. 53-56 In G. S. Gohn, (ed.) Proceedings of the 1988 U. S. Geological Survey Workshop on the Geology and Geohydrology of the Atlantic Coastal Plain. U. S. Geological Survey Circular 1059.

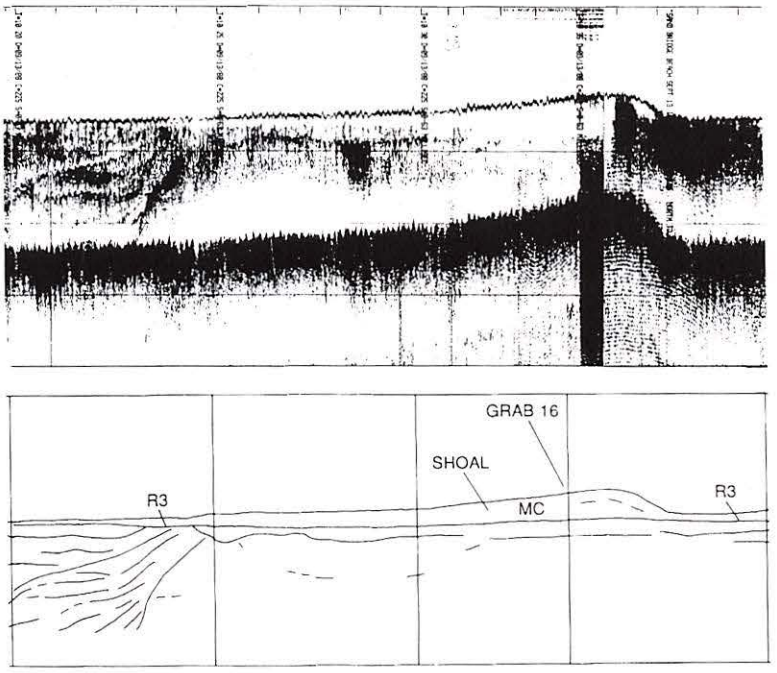
Hobbs, C. H., III and J. K. Dame, II. 1992. Very high resolution, seismic-reflection profiling and other acoustic techniques with examples from Virginia. In: R. A. Geyer (ed.), C.R.C. Handbood of Geophysical Exploration at Sea, 2nd ed. Hard Minerals, p.193-211.

Hobbs, C. H., III, 1991. Marine mineral resources of the United States mid and south Atlantic coast. *Marine Mining*. **10**:215-230.

Carl H. Hobbs III

Assistant Professor of Marine Science

B.S., Union College; M.S., University of Massachusetts



Portion of sub-bottom profile running offshore from Virginia Beach.

Steven A. Kuehl

Associate Professor of Marine Science

B.A., Lafayette College; M.S., Ph.D., North Carolina State University

RESEARCH INTERESTS

Primary research in my lab centers on sediment dispersal and the accumulation of fine-grained sediments in continental margin environments.

The formation of marine sedimentary strata rarely results from the simple settling of sedimentary material to the sea floor, but rather from the complex interaction of physical, chemical, and biological processes operating in the marine environment. These processes, such as resuspension and biological mixing, impart characteristic signatures to the sediment and control the burial and preservation of important sedimentary components such as organic carbon and anthropogenic materials. We are investigating the characteristics of recent sedimentary strata on spatial scales ranging from less than a mm to 100's of meters and on temporal scales from seconds to 1,000's of years in a variety of continental margin environments.

Some of my future planned projects focus on sediment dispersal from major river systems. These systems, such as the Amazon and Ganges-Brahmaputra, are important contributors of sediment and water to the world ocean and have substantial impact on the adjacent marine environment.

CURRENT PROJECTS

- Sediment accumulation and strata formation on the Bengal Shelf. Funded by NSF.
- Biological mediation of material fluxes across the sediment-water interface in estuaries and coastal systems. Funded by ONR.
- The formation of sedimentary strata on the Amazon Continental Shelf. Funded by NSF.

CURRENT STUDENTS

Beth Levy, M.A. - Subaqueous delta off the Ganges-Brahmaputra River System: Moders and Ancient Analogs.
Timothy Dellapenna, Ph.D. - Sedimentary processes and strata formation in Chesapeake Bay.

SELECTED PUBLICATIONS

Jorissen, F. J., M. A. Buzas, S. J. Culver and S. A. Kuehl. 1994. Vertical distribution of living benthic foraminifera in submarine canyons off New Jersey. *J. Foram. Res.* **24**:28-36.

Kuehl, S. A., T. J. Fuglseth and R. C. Thunnel. 1993. Sediment mixing and accumulation rates in the Sulu and South China Seas: implications for organic carbon preservation in deep-sea environments. *Mar. Geo.* **111**:15-35.

Segall, M. P. and S. A. Kuehl. 1992. Sedimentary processes on the Bengal continental shelf as revealed by clay-size mineralogy. *Cont. Shelf Res.* **12**:517-541.

Kuehl, S. A., T. M. Hariu, M. W. Sanford, C. A. Nittrouer and D. J. DeMaster. 1991. Millimeter-scale sedimentary structure of fine-grained sediments: examples from continental margin environments. *In*: Bennett, R. H., Bryant, W. R. and Hulbert, M. H., (eds.), Microstructure of Fine-Grained Sediments. Springer-Verlag, New York, pp. 33-45.

Nittrouer, C. A., S. A. Kuehl, J. M. Rine, A. G. Figueiredo, L. E. C. Faria, G. T. M. Dias, M. A. M. Silva, M. A. Allison, T. D. Pacioni, M. P. Segall, E. C. Underkoffler, H. V. Borges and O. F. Silverira. 1991. Sedimentology and stratigraphy of the Amazon continental shelf: *Oceanography* **4**:33-38.

Kuehl, S. A., T. M. Hariu and W. S. Moore. 1989. Shelf sedimentation off the Ganges-Brahmaputra River system: evidence for sediment bypassing to the Bengal fan. *Geology* **17**:1132-1135.

RESEARCH INTERESTS

My primary areas of study/research are mathematical modeling of estuarine hydrodynamics and water quality, diffusion of pollutants and transport of sediments in estuaries and coastal waters. Included are the investigation of physical transport processes in estuaries and coastal seas, and their effects on water quality and living resources. The ultimate goal is to understand these processes well enough to develop predictive models as management tools.

One of my current research projects is the hypoxia/anoxia research supported by Virginia Chesapeake Bay Initiatives. The processes contributing to oxygen depletion in estuarine bottom waters are investigated through field observations and modeling. The objective is to develop models simulating cause-effect relation of the hypoxia/anoxia phenomenon so that it may be accurately predicted. Another project is supported by the U.S. Environmental Protection Agency to study the boundary layer flow structure in estuaries. The objective is to relate bottom shear stress to near bottom velocity in an unsteady, stratified flow. The accurate description of bottom shear stress should enhance our understanding of sediment deposition and resuspension processes.

CURRENT STUDENTS

Kyeong Park, Ph.D. - A model study of hydrodynamic and water quality characteristics in the Rappahannock River.
Jian Shen, M.A. - Boundary layer structure in homogeneous tidal flows: a theoretical and numerical study.

CURRENT PROJECTS

- Mixing and dilution of cooling water discharge. Funded by Virginia Power.
- Development of water quality model for small coastal basins to address management needs. Funded by DEQ/NOAA.
- Physical processes affecting hypoxia/anoxia in Virginia estuaries. Funded by Virginia Chesapeake Bay Initiatives.
- Development of three-dimensional real-time water quality model. Funded by Virginia Chesapeake Bay Initiatives.

SELECTED PUBLICATIONS

Kuo, A. Y., and K. Park. 1992. Transport of Hypoxic Waters: An Estuary Subestuary Exchange. *In* D. Prandle (ed.), Dynamics and Exchanges in Estuaries and the Coastal Zone. Coastal and Estuarine Study, 40. American Geophysical Union, Washington, D. C., pp. 599-615.

Kuo, A. Y., and D. F. Hayes. 1991. Model for Turbidity Plume Induced by Bucket Dredge. ASCE *J. Waterway, Port, Coastal and Ocean Eng.* **117**(6):610-622.

Kuo, A. Y, K. Park and M. Z. Moustafa. 1991. Spatial and Temporal Variabilities of Hypoxia in Rappahannock Estuary, VA. *Estuaries,* **14**(2):113-121.

Kuo, A. Y., J. M. Hamrick and G. M. Sisson. 1990. Persistence of Residual Currents in the James Estuary and Its Implication to Mass Transport. *In* R. Cheng (ed.), Residual Currents and Long-Term Transport. Coastal and Estuarine Studies, 38. Springer-Verlag, Berlin, pp. 389-401.

Kuo, A. Y. and B. J. Neilson. 1988. A modified Tidal Prism Model for Water Quality in Samll Coastal Embayments. *Water Sci. Tech.* **20** (6/7):132-142.

Albert Y. Kuo

Chair of Department

Professor of Marine Science

B.S., National Taiwan University; M.S., University of Iowa; Ph.D., The Johns Hopkins University

Jerome P.-Y. Maa

Associate Professor of Marine Science

B.S., M.S., National Cheng-Kung University; Ph.D. University of Florida

RESEARCH INTERESTS

My interests lie in two primary areas: cohesive sediment transport and water wave mechanics. I recently developed the VIMS Sea Carousel for in situ experiments to identify the critical bed shear stress for sediment resuspension. We are also working on developing methods to measure the bulk density profile on the micro scale level. The studies will help resolve the erosion rate problem and provide input date on the simulation of sediment transport.

Research on wave water mechanics includes wave refraction, diffraction, reflection, breaking, and associated sediment transport processes. Our work involves numerical simulation as well as field measurements to address shoreline response problems.

CURRENT PROJECTS

- Biological Mediation of Material Fluxes Across the Sediment Water Interface in Estuaries and Coastal Systems.
- Shore Erosion Research and Technical Analysis Program.
- Dynamics of Sediment Resuspension: Bay-stem Plains of the Low Chesapeake Bay.
- Cross-shore Sediment Transport on the Shoreface and Associated Bed Response: Middle Atlantic Bight.
- Cohesive Sediment Resuspension and Deposition in Tidal Estuary Flows.

CURRENT STUDENTS

Chang-Hee Lee, Ph.D. - Erosion behavior of natural sediment.
Changqing Li, Ph.D. - New approach to solve water wave transformation processes.

SELECTED PUBLICATIONS

Maa, J. P.-Y., L. D. Wright, C.-H. Lee, and T. W. Shannon. 1993. VIMS Sea Carousel: A Field Instrument for Studying Sediment Transport, *Marine Geology* **115**(3/4):271-287.

Maa, J. P.-Y., 1993, VIMS Sea Carousel: Its Hydrodynamic Characteristics. *In Mehta, A. J., (ed.),* Nearshore and Estuarine Cohesive Sediment Transport, Coastal and Estuarine Studies, 42, American Geophysical Union, Washington DC, 265-280.

Maa, J. P.-Y. and C.-S. Kim, 1992, The Effect of Bottom Friction on Breaking Waves using RCPWAVE Model. *J. Waterway, Port Coastal and Ocean-Engrg.*, **118**(4):387-400.

Maa, J. P.-Y., Jingping Xu, Marjorie Victor, 1992, Notes on the Optical Backscatter Sensor for Cohesive Sediments, *Marine Geology*, **104**(1/4):215-218.

Wright, L.D., G.C. Greene, J. P.-Y. Maa, S. Siddigi, 1992, Passive Artificial Ventilation of Hypoxic Estuarine Benthic Environment: A feasibility study, *J. of Coastal Research*, **8**(1): 134-152.

Maa, J. P.-Y. 1990. An Efficent Horizontal Two-dimensional Hydrodynamic Model. *Coastal Engineering* 14:1-18.

Maa, J. P.-Y. and A. J. Mehta, 1990, Modeling Water Waves over Soft Muds, *J. of Waterway, Port, Coastal and Ocean Engrg.*, ASCE, **116**(5), 634-650.

RESEARCH INTERESTS

Groundwater contaminat fate and transport, reactions and transport near the sediment water interface, physical chemistry of marine systems.

CURRENT PROJECTS

- Groundwater contaminant fate and transport research with USAF support has been active for the last eleven years and involves on site work for 3 months per year at the Armstrong Laboratories, Tyndall AFB, Panama City FL. Recent work involved designing and conducting of the MADE 2 organic contaminant biodegradation experiment which has just been completed at the Columbus AFB test site, Columbus MS in cooperation with the USAF, EPRI and TVA. A new test treating hydrocarbon mixture biodegradation in the Columbus aquifer by oxic and by metal oxide driven anoxic oxidation has been designed in cooperation with other federal and university researchers.
- Research on Zinc contamination in the vicinity of a pond at the BASF Inc. plant site in Williamsburg, VA is being done in cooperation with Dr. Mike Unger from SMS, and Dr. Gary Rice from the Chemistry department. Work has begun to support and document proposed site remediation activities.
- Research on geohydrology and on local land use effects on groundwater quality in the Colonial National Park, VA, is in progress with support from the National Park Service.

CURRENT STUDENTS

Laurence Libelo, Ph.D. - Stability of triazine herbicides in ground water-aquifer material systems, and transport through the sediment-water interface.

Michael L. Chasey, M.A. - Equilibrium distribution of carbon dioxide between buffered water and aromatic hydrocarbons in support of field research on hydrocarbon degradation in field experiments.

Jennifer Gundersen, Ph.D. - Determination of acidities of chlorinated guiacols by experiment and by quantum chemical calculations, and correlation of these acidities with sorption properties of guiacols on marine sediments.

Alan Duchovnay, Ph.D. - Research topic not decided.

RECENT PUBLICATIONS

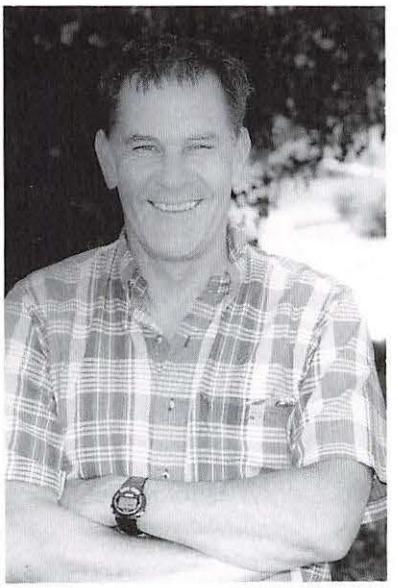
Greaves, J., E. Harvey and W. G. MacIntyre. Correlation between electron capture negative chemical ionization mass spectrometric fragmentation and calculated internal energies for polychlorinated biphenyls. *J. Am. Soc. Mass Spectrometry* **5**:44-52. 1994.

Libelo, E.L. and MacIntyre, W.G., 1993. Water Transport Across the Sediment-Water Interface and Through Sediments Driven by Passive and Active Pumping Associated with Benthic Biological Structures. *Marine Geology* (In press).

MacIntyre, W.G., J.M. Boggs, C.P. Antworth and T.B. Stauffer 1993. In Situ Biodegradation Kinetics of Organic Solutes Introduced to a Heterogeneous Unconfined Aquifer. *Water Resources Research,* **29**(12):4045-4051.

Schwarzschild, A.C.; MacIntyre, W.G.; Moore, K.A. and Libelo, E. L., 1993. Growth Response of Eelgrass (zostera marina L.) to Root - Rhizome and Whole Plant Exposure to Atrazine. Submitted to *Marine Ecology* (In review).

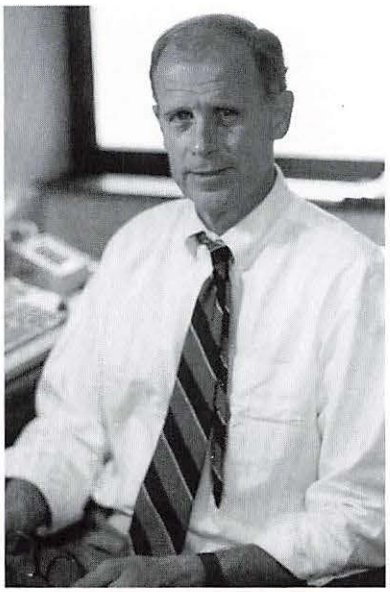
Liebelo, E. L. and W. G. MacIntyre. 1994. Groundwater Monitoring Studies at Virginia's National Estuarine Research Reserve Sites. Proceedings of the Coastal Society 13th International Conference, *Organizing The Coast.* Washington, D. C. (In press).



William G. MacIntyre

Professor of Marine Science

B.S., Ph.D. Dalhousie University



John D. Milliman

Dean of Graduate Studies and Professor of Marine Science

B.S., University of Rochester; M.S., University of Washington - Seattle; Ph.D., University of Miami

RESEARCH INTERESTS

My research interests center on the flux and fate of sediment in the ocean. In practice this involves the study of both river-derived sediment (the single greatest source of sediment in the oceans) and calcium carbonate. Research has included the study of such diverse areas as rivers and their estuaries (ranging from the Amazon River down to rivers orders of magnitude smaller) to carbonate environments on tropical banks and shelves. This research has involved a variety of techniques and approaches, such as timeseries measurements within estuaries, high-resolution seismic profiling of the late Quaternary geological record, and the petrographic study of carbonate sediments and their cements. Recently my studies have included armchair reviews and synopses of fluvial and carbonate systems and their budgets.

In recent years these studies have led me to investigate the societal and economic implications of natural and anthropogenic changes on sedimentary systems, both on local and global scales. For example, what is the impact on a low-lying area from a relative rise of sea level, when a river is diverted or fringing coral reefs effectively stunted? Ultimately answering these questions can involve an interesting series of studies that can lead to unexpected scientific results as well as societal implications.

CURRENT PROJECTS

- Flux and fate of sediment and water from small mountainous rivers to the continental margin: The Gulf of Alaska example. National Science Foundation- 12/93 - 11/96.
- Fine-scale morphology and shallow structure of the outer shelf and upper slope. Office of Naval Research.
- Neritic and deep-sea carbonate systems: coupling and decoupling sea level and climate change. National Science Foundation 8-94-2-95.

CURRENT STUDENT

Nicole Scott, M.A. - Fine-scale shallow structure and development of the continental slope off northem New Jersey.

RECENT PUBLICATIONS

Milliman, J. D., 1993. Production and accumulation of calcium carbonate in the ocean: Budget of a non-steady state. *Global Biogeochem. Cycles* **7**:927-957.

Milliman, J.D., Freile, D., Steinen, R.P. and Wilber, R.J., 1993. Great Bahama Bank aragonitic muds: mostly precipitated, mostly exported. *Jour. Sediment. Petrol.*, **63**:589-595.

Milliman, J.D., 1992. Sealevel change in the Mediterranean Sea: Past, present and future. *In* L. Jeftic, J. D. Milliman and G. Sestini (eds). Climate Change and the Mediterranean Sea. Edward Arnold Publ., pp. 45-56

Milliman, J.D. and Syvitski, J.P.M., 1992. Geomorphic/tectonic control of sediment discharge to the ocean: The importance of small mountainous rivers: *Jour. Geol.*, **100**: 525-544.

Milliman, J. D., Broadus, J. M. and Gable, F., 1989. Environmental and economic impact of rising sea level and subsiding deltas: The Nile and Bengal examples. *Ambio*, **18**:340-345.

Milliman, J. D., 1991. Flux and fate of fluval sediment and water in coastal seas. *In* R. F. C. Mantoura, J.-M. Martin and R. Wollast (eds), Ocean Margin Processes in Global Change. John Wiley and Sons, 69-89.

RESEARCH INTERESTS

Water quality monitoring, and environmental assessments.

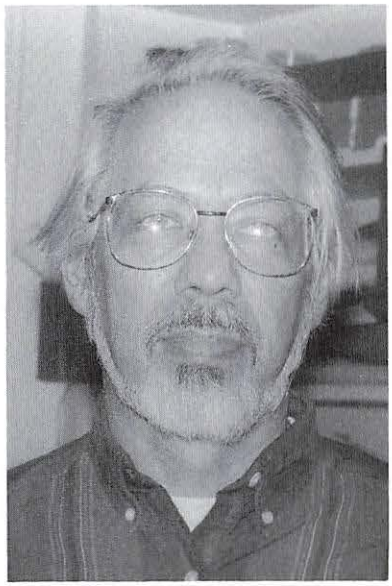
CURRENT PROJECTS

- Water quality monitoring of the mid-portion of Chesapeake Bay, as part of the Chesapeake Bay Program's water quality monitoring program.
- Characteristics and causes of bottom water hypoxia in Virginia's tidal waters.

SELECTED PUBLICATIONS

Water quality in Chesapeake Bay - Virginia portion - Water Year 1991. Kevin Curling and Bruce Neilson, VIMS Data Report No. 49.

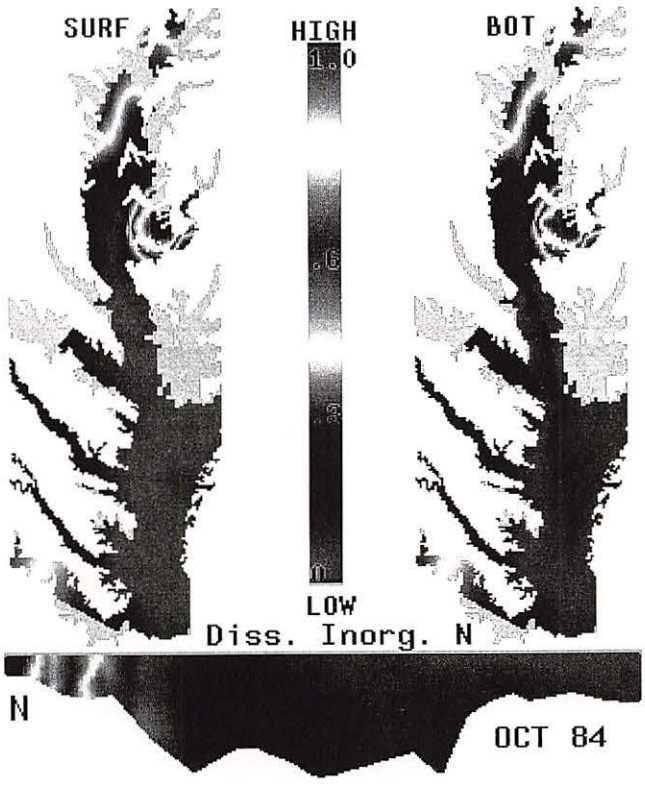
Chesapeake Bay atlas of U.S. EPA monitoring program water quality data 1984-1991. On CD-ROM. Sarah Rennie and Bruce Neilson.



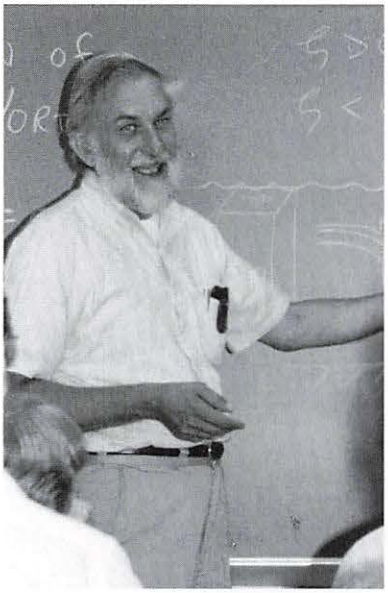
Bruce J. Neilson

Professor of Marine Science

B.A., M.S.E., M.A., Princeton University; Ph.D., The Johns Hopkins University



Surface and bottom concentration contours and the concentration countours for the "verticle slice" running from the Susquehanna River to the Atlantic Ocean. This image portrays dissolved inorganic nitrogen during the month of October 1984.



Evon P. Ruzecki

Associate Professor of Marine Science

M.S., University of Wisconsin; Ph.D., University of Virginia

RESEARCH INTERESTS

My research interests involve physical oceanography; meteorology; relationship between physics and biology of ocean systems; circulation of estuarine and coastal waters; and interaction between continental shelf, slope, and Gulf Stream waters.

CURRENT PROJECTS

Dr. Ruzecki has been on an extended leave of absence. He will resume his academic responsibilities in the fall of 1994.

RECENT PUBLICATIONS

A. Y. Kuo, R. J. Byrne, P. V. Hyer, E. P. Ruzecki and J. M. Brubaker. 1990. Preactical Application of Theory for Tidal-Intrusion Fronts. ASCE *Jour. Waterway, Port, Coastal and Ocean Engineering* **116**(3):341-361.

A. Y. Kuo, E. P. Ruzecki, J. M. Brubaker, B. J. Neilson, R. J. Byrne. 1990. Circulation and Transport of Oyster Larvae in Virginia Estuaries. *In* Wang Huatons, Wang Jingyong and Dai Hua (eds.). Physics of Shallow Seas, China Ocean. Press, Beijing.

E. P. Ruzecki and W. J. Hargis, Jr. 1989. Interaction Between Circulation of the Estuary of the James River and Transport of Oyster Larvae. *In* B. J. Neilson, et al. (eds.), Estuarine Circulation, Humana Press.

E. P. Ruzecki and D. A. Evans. 1986. Temporal and spatial sequencing of destratification in a coastal plain estuary. *In* Bowman, Yentsch and Peterson (eds.), Tidal Mixing and Phytoplankton Dynamics. Springer/Verlag - Berlin.

E. P. Ruzecki, P. V. Hyer, K. Kiley and M. S. Jablonsky. 1986. Imaging System Techniques Applied to Analysis of Hydraulic and Finite Element Model Experiment REsults, in: Proceedings, Fourth Working Symposium on Oceanographic Data Systems, IEEE Computer Society Press, Los Angeles.

RESEARCH INTERESTS

My ongoing research is focused on: bottom boundary layer and sediment transport processes operating in the coastal ocean and adjoining estuaries; on the cross-shelf flux of particles; and on the morphodynamics of the inner continental shelf. We are trying to determine the time-varying hydraulic roughness and bottom drag associated with contrasting benthic subenvironments, the associated rates of bed level change and sediment resuspension, near-bottom flow structures (particularly in the cross-shelf dimension), and the net morphody namic responses to these processes. The research is interdisciplinary to the extent that it involves elements of physical, geological, and biological oceanography and has direct engineering and environmental applications. Currently, field observations under the full annual range of wave and wind conditions, including storm events, are being carried out on the inner shelf of the Middle Atlantic Bight and lower Chesapeake Bay, on the Louisiana-Texas shelf and in the Baltic Sea. The dispersal of river-borne sediment into the coastal ocean continues to be one of my long-term interests. I hope to soon be able to extend work that I conducted a few years ago off the mouth of the Yellow River to similar questions off the mouth of the Fly River of Papua-New Guinea.

CURRENT PROJECTS

- Cross-shore sediment transport on the shoreface. NSF.
- Sediment Transport and benthic boundary layer: Lousiana-Texas shelf, Mineral Management Service via LSU.
- Suspension, cross-shelf transport ... of larvae .... NSF.
- Physical and biological mechanisms ... development and evolution of sedimentary structure. NRL.
- An Investigation of shallow stratigraphy at Duck, NC. USACOE.
- Biological mediation of material fluxes across the sediment water interface in estuaries. Office of Naval Research.

CURRENT STUDENTS

Patricia Tiedman, M.A, Shallow stratigraphy and shoreface evolution, Middle Atlantic Bight.
Baeck Oon Kim, Ph.D., Boundary layer roughness and micromorphology on the inner continental shelf.
Linda Frizzell, Ph.D., Internal waves in the Chesapeake Bay.
Tom Chisholm, Ph.D., Continental shelf bottom boundary layer processes.
Sarah Rennie, Ph.D., Wind-generated circulation on the inner continental shelf.

RECENT PUBLICATIONS

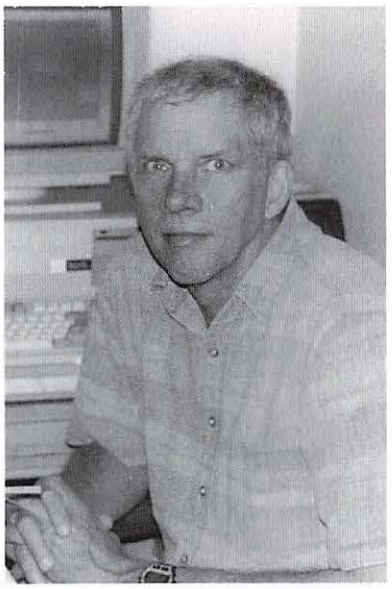
Wright, L.D., 1993, Micromorphodynamics of the Inner Continental Shelf: A Middle Atlantic Bight Case Study, *Journal of Coastal Research*. Special Issue 15, pp. 93-124.

Wright, L.D., J.D. Boon, S.C. Kim and J.P. Xu, 1992, The Bottom Boundary Layer of the Bay Stem Plains Environment of Lower Chesapeake Bay, *Estuarine, Coastal and Shelf Science,* **35**:17-36.

Wright, L.D., J.P. Xu and O.S. Madsen. 1994. Across-shelf Benthic Transports on the Inner Shelf of the Middle Atlantic Bight During the Halloween Storm of 1991. *Marine Geology,* **118**:61-77.

Wright, L.D., J.D. Boon, S.C. Kim, and J.H. List, 1991, Modes of Cross-Shore Sediment Transport on the Shoreface of the Middle Atlantic Bight, *Marine Geol.*, **96**:19-51.

Wright, L.D., W.J. Wiseman, Z.-S. Yang, B.D. Bornhold, G.H. Keller, D.B. Prior, and M. Suhayda, 1990, Processes of Marine Dispersal and Deposition of Suspended Silts off the Modern Mouth of the Huanghe (Yellow River), *Cont. Shelf Res.*, **10**:1-40.



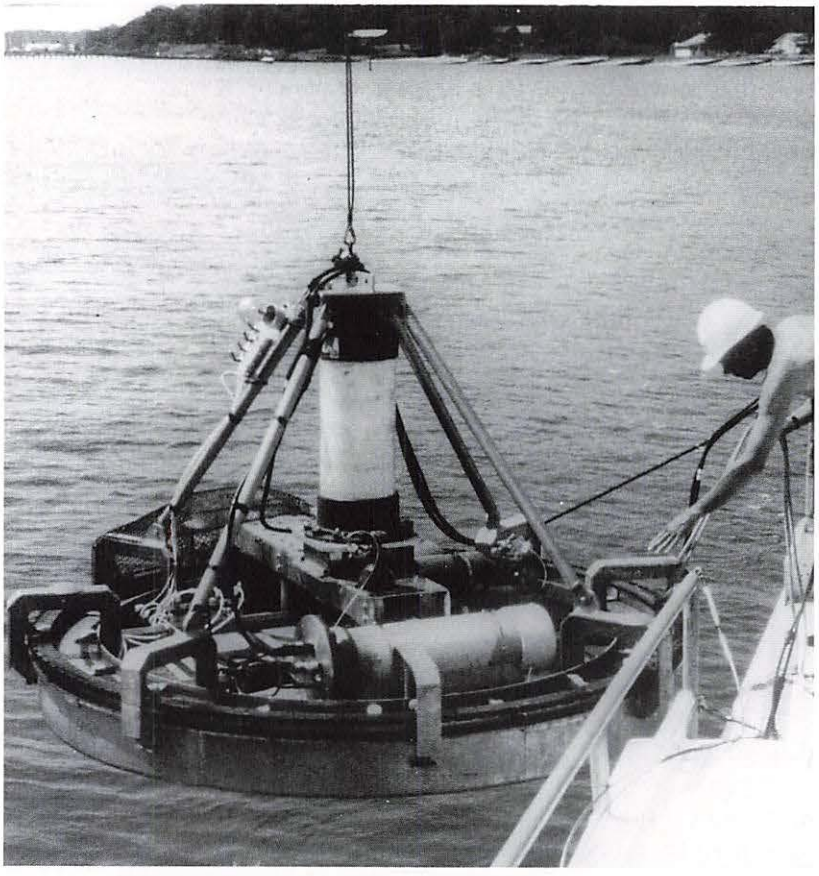
L. Donelson Wright

Chancellor Professor of Marine Science

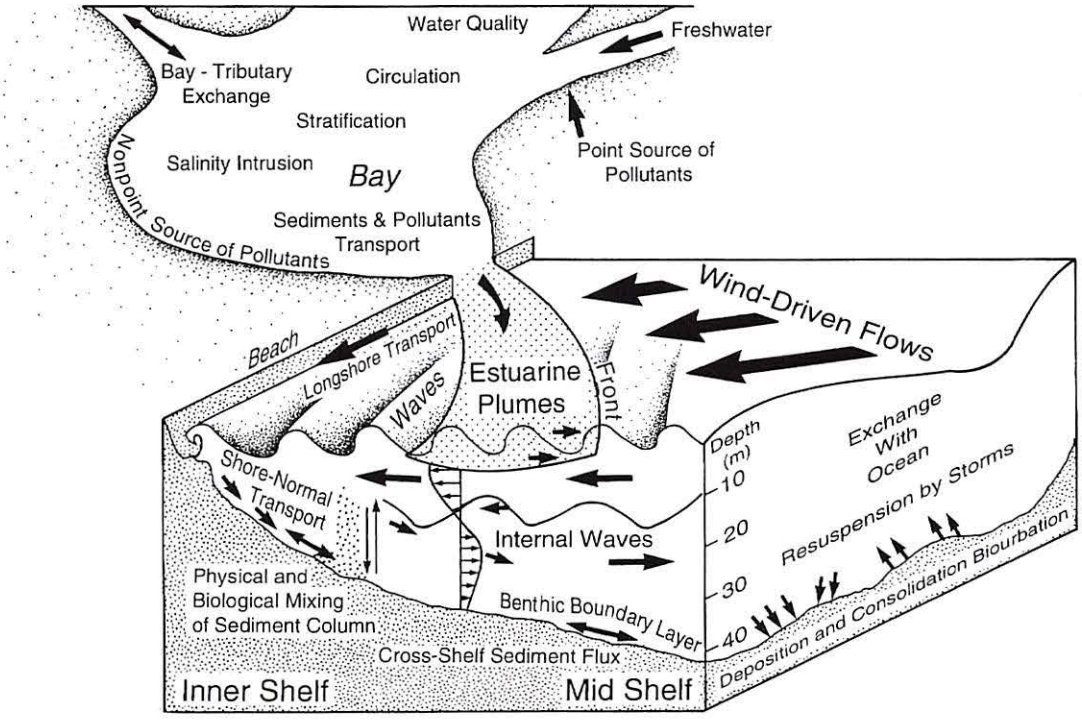
B.A., University of Miami;
M.A., University of Sydney;
Ph.D., Louisiana State University

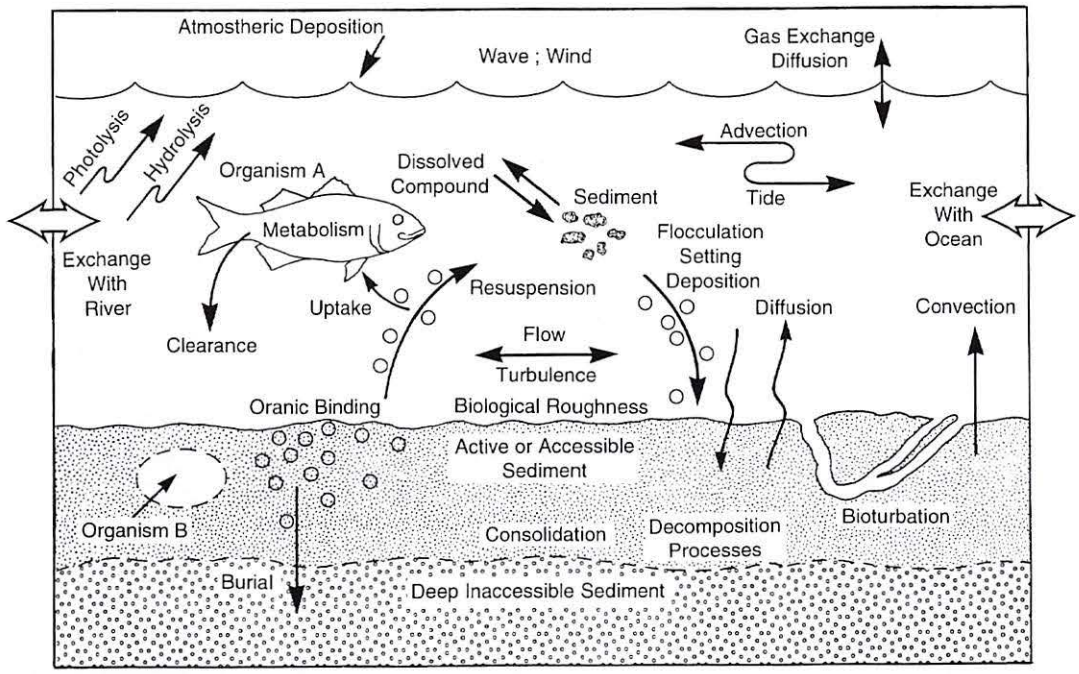
DEPARTMENT EQUIPMENT

The department maintains state-of-the-art equipment for conducting high quality field and laboratory research. Major facilities include a sea-bed hydraulic flume, two laboratory flumes (recirculating and annular), 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 sub-bottom profiling systems, directional wave gauges, turbidity sensors, an acoustic doppler current profiler (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. Laboratory instrumentation includes: a sedigraph automatic particle analyzer, gas chromatographs with flame ionization and electron capture detectors, two quadrupole mass spectrometers, an inductively coupled plasma spectrometer, and a high performance liquid chromatograph with UV absorbance and liquid scintillation detectors, four intrinsic germanium gamma spectrometers, an eight channel alpha spectroscopy system, an X-ray radiography unit, and a rapid sedimentanalyzer. 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. DOS, UNIX, and MacIntosh systems are supported by departmental staff and by the Institute's computer center.



An innovative seabed flume was developed by scientists at VIMS to determine *in situ*, the shear stress levels at which sediments are eroded from river and coastal ocean beds. This is valuable in understanding sediment transport.





Conceptual diagram illustrating transport mechanisms in estuaries and the coastal ocean.

ADMISSION POLICY

Applicants are encouraged to visit the campus and contact faculty members about specific research interests, funding opportunities, and program information. Admission to the School of Marine Science is highly competitive, and admissions procedures are designed to provide adequate information for objective evaluation by the faculty.

Applicants are required to submit:

1) One copy of the completed application form;
2) A non-refundable processing fee of $20. This fee is not credited to the student's account;
3) Three 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);
   and
6) International students whose primary language is not English are required to submit GRE-TOFEL scores.

Requests for application forms as well as additional information should be directed to:

Dean of Graduate Studies
School of Marine Science
Virginia Institute of Marine Science
College of William & Mary
P.O. Box 1346
Gloucester Point, VA 23062
(804) 642-7000
Fax (804) 642-7097

GENERAL INFORMATION

Located in historic Tidewater Virginia, Gloucester Point is within 20 minutes of Williamsburg and Hampton/Newport News, Virginia. Major metropolitan areas of Norfolk, Virginia Beach, and Richmond are within easy driving distance. The semi-rural location offers diverse opportunities for outdoor activities from sailing, windsurfing, canoeing, and kayaking to biking, hiking, fresh and salt water fishing. SMS students may participate in a broad range of cultural and athletic activities on the nearby William & Mary campus.

A limited number of apartments for SMS graduate students are available on the William & Mary campus in Williamsburg. There are no housing facilities on the VIMS campus; however, most students live in Gloucester Point and surrounding communities. Rental housing is plentiful and rates are reasonable. It is advisable for students to have access to transportation as most living quarters are not within convenient walking distance of the campus.

The College of William & Mary
School of Marine Science
Virginia Institute of Marine Science