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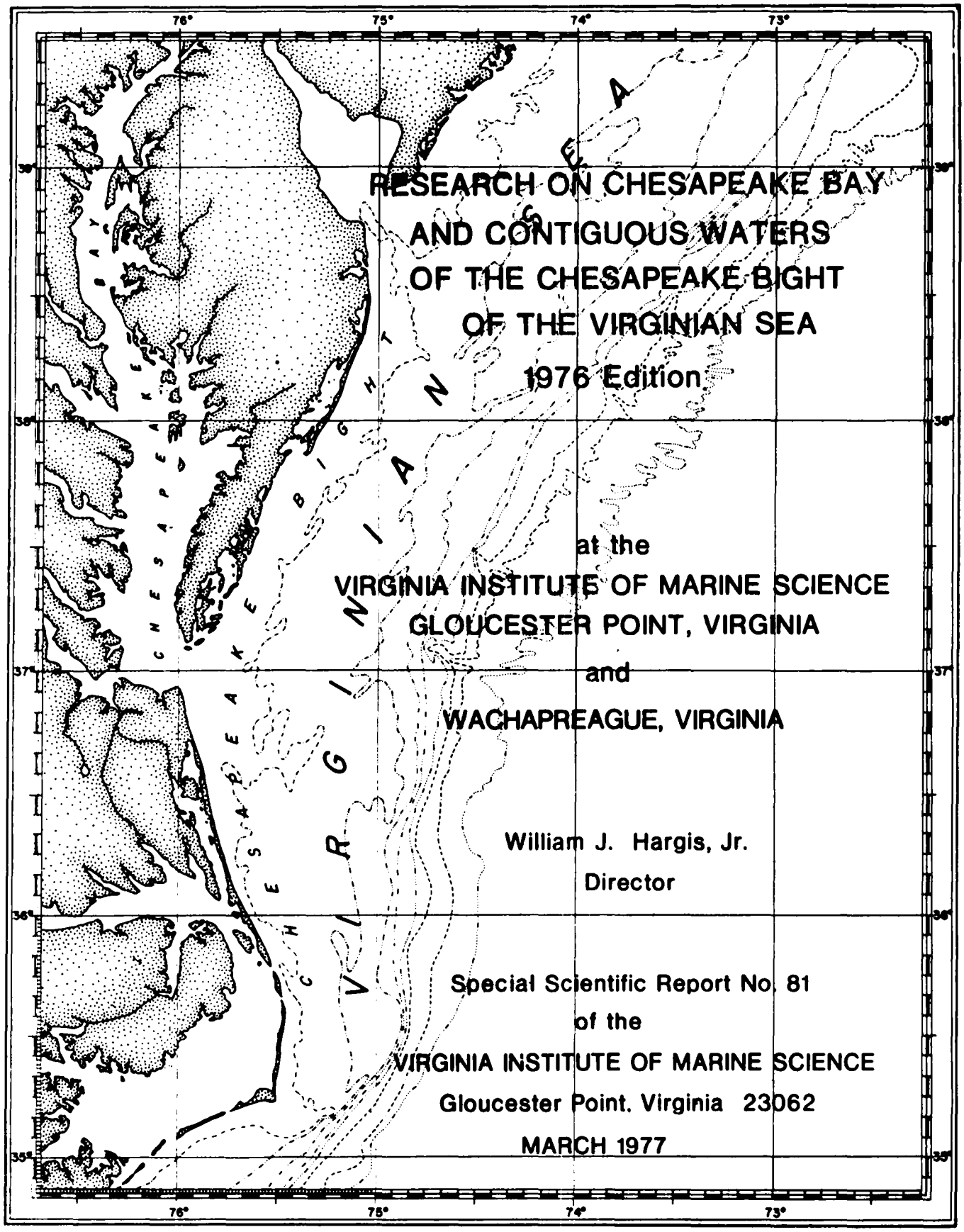
Research on Chesapeake Bay and Contiguous Waters of the Chesapeake Bight of the Virginia Sea 1976 Edition

Virginia Institute of Marine Science



RESEARCH ON CHESAPEAKE BAY AND CONTIGUOUS WATERS OF THE CHESAPEAKE BIGHT OF THE VIRGINIAN SEA

1976 Edition

at the

VIRGINIA INSTITUTE OF MARINE SCIENCE

GLOUCESTER POINT, VIRGINIA

and

WACHAPREAGUE, VIRGINIA

William J. Hargis, Jr.

Director

Special Scientific Report No. 81

of the

VIRGINIA INSTITUTE OF MARINE SCIENCE

Gloucester Point, Virginia 23062

MARCH 1977

1976 EDITION

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ACKNOWLEDGEMENTS

The work required to bring these research program and project status reports together was supported by internal funds of the Virginia Institute of Marine Science.

Beverly L. Laird, with the assistance of Dr. M. P. Lynch, accomplished the coordination and expediting necessary to bring this compilation about. Acknowledgements go to Barbara J. Crewe for typing and proofreading the final copy.

PREFACE

These brief status reports are provided to assist those who wish to know the scope and nature of VIMS' programs pertinent to the Chesapeake Bay and the contiguous waters of the Virginian Sea. More detailed information may be obtained from the personnel listed with each status report. Information is also provided on research by staff personnel in localities other than Chesapeake Bay.

Status statements are intentionally short and sometimes contain information which has not been published or, in some cases, not even reported upon. Accordingly, care should be taken in quoting the material.

For the first time, we are providing an appendix volume which abstracts or summarizes the completed projects previously listed. The appendix volume will be published shortly following this volume.

This report is updated periodically in order to inform planners and managers of research in progress and to facilitate research coordination and planning in Chesapeake Bay. The last edition was completed in 1975. A lot has taken place since then. Many new projects have been undertaken. A number of those shown in the 1975 edition have been completed.

The project descriptions are arranged by "Programs within Organized Research" (see p. 11). Many projects actually belong in more than one program, but we have tried, somewhat arbitrarily, to assign them to programs according to "best fit".

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Department of Geological Oceanography

Section of Legal Studies

Department of Physical Oceanography and Hydraulics

VIMS ORGANIZATIONAL ARRANGEMENT

(as of 31 December 1976)

OFFICE OF THE DIRECTOR

William J. Hargis, Jr., Ph.D., Director

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Information and Public Relations, Department of

Fred C. Biggs, B.A., Information Director

Legal and Social Studies, Section of

N. Bartlett Theberge, J.D., L.L.M., Associate Marine Scientist in Ocean and Coastal Law

Wachapreague Laboratory

Michael Castagna, M.S., Scientist-in-Charge and Senior Marine Scientist

ADMINISTRATION AND CENTRAL SERVICES GROUP

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Data Processing and Statistical Services, Department of

Gerald L. Engel, Ph.D., Department Head and Senior Marine Scientist

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John L. Wood, Ph.D., Division of Personnel

Roy J. Washer, B.A., Division of Plant Development and Management and Buildings, Vehicles, and Vessel Maintenance and Operations

Thomas Chapman, Department of Buildings and Grounds

Carter James, Department of Vessel Maintenance and Operations

SCIENTIFIC GROUP

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Division of Special Programs and Scientific Services

Roger Anderson, Ph.D., Acting Division Head and Senior Marine Scientist

Special Programs, Department of

Maurice P. Lynch, Ph.D., Assistant Director and Department Head

Advisory Services, Department of

Roger Anderson, Ph.D., Department Head and Senior Marine Scientist

Sea Grant, Department of

Roger Anderson, Ph.D., Department Head and Senior Marine Scientist

Coastal Zone Management, Department of

Roger Anderson, Ph.D., Department Head and Senior Marine Scientist

Non-University Education, Department of

Roger Anderson, Ph.D., Department Head and Senior Marine Scientist

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Division of Biological Oceanography

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Marvin L. Wass, Ph.D., Department Head and Senior Marine Scientist

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Donald F. Boesch, Ph.D., Senior Marine Scientist

Toxicology, Section of

Morris H. Roberts, Jr., Ph.D., Associate Marine Scientist

Microbiology-Pathology, Department of

Frank O. Perkins, Ph.D., Department Head and Senior Marine Scientist

Parasitology, Section of

David E. Zwerner, M.A., Assistant Marine Scientist

Bacteriology, Section of

Howard I. Kator, Ph.D., Associate Marine Scientist

Planktology, Department of

George C. Grant, Ph.D., Department Head and Associate Marine Scientist

Marine Culture, Department of

John L. Dupuy, Ph.D., Department Head and Senior Marine Scientist

Division of Physical Science and Ocean Engineering

John M. Zeigler, Ph.D., Assistant Director and Division Head

Physical Oceanography and Hydraulics, Department of

C. S. Fang, Ph.D., Department Head and Senior Marine Scientist

Geological Oceanography, Department of

Robert J. Byrne, Ph.D., Department Head and Senior Marine Scientist

Estuarine Processes and Chemical Oceanography, Department of

Bruce Neilson, Ph.D., Department Head and Senior Marine Scientist

Division of Environmental Science and Services

Michael E. Bender, Ph.D., Assistant Director and Division Head

Ecology-Pollution, Department of

Robert J. Huggett, M.S., Acting Department Head and Associate Marine Scientist

Environmental Biology, Section of

Michael E. Bender, Ph.D., Assistant Director and Acting Section Head

Environmental Chemistry, Section of

Rudolf H. Bieri, Ph.D., Section Head and Senior Marine Scientist

Wetlands Research, Department of

Gene M. Silberhorn, Ph.D., Department Head and Associate Marine Scientist

Environmental Impact Assessment, Section of

Col. George Dawes, B.S., Section Head and Assistant Marine Scientist

Environmental Physiology, Department of

Paul L. Zubkoff, Ph.D., Department Head and Senior Marine Scientist

RESEARCH IN PROGRESS BY DEPARTMENTS

Environmental Biology, Section of

Environmental Physiology, Department of

RESEARCH IN PROGRESS BY

PROGRAMS WITHIN ORGANIZED

RESEARCH

Programs within Organized Research

*Major Interdisciplinary Program

1. Preservation of Coastal Environments

   Preserve and improve the quality of life and ecology in the marine coastal environment and provide for multiple use which will include open spaces for recreation and public use.

   Develop the ability to predict and modify accidents of natural or human origin affecting the marine environment.

2. Biological Resources of the Coastal Zone

   Utilize tidal waters and wetlands to promote economic strength.

   Assist in the development of plans to utilize marine resources for optimum multiple use.

   Explore for unused or underutilized resources.

3. Biology of Coastal Waters and Wetlands

4. Coastal Zone Hydrography and Geology

   Explore and investigate estuarine waters and wetlands and the contiguous continental shelf to extend our understanding of their phenomena, processes, and resources.

5. Advisory Services Related to Marine Resources

   Disseminate and interpret the results of research to government agencies responsible for managing coastal zone resources.

   Encourage the growth of private initiative in the preservation and optimum multiple use of the coastal zone and its resources.

   Promote local, state, regional, national, and international cooperation in marine affairs.

INTERDISCIPLINARY PROGRAMS

PROJECT TITLE: THE VIRGINIA INSTITUTE OF MARINE SCIENCE INSTITUTIONAL SEA GRANT PROGRAM

INVESTIGATORS:

William J. Hargis, Jr., Institute Director
Roger D. Anderson, Sea Grant Program Coordinator

PROJECT SUMMARY:

This project represents the VIMS Sea Grant Program for the calendar year 1976. Subprojects include: (1) mariculture of shellfish-nutrition (Dupuy); (2) mariculture of shellfish-genetics and field testing (Andrews); (3) management of cownose rays, *Rhinoptera bonasus* (Merriner, Dias and Orth); (4) ocean engineering of shore protection structures (Byrne and Anderson); (5) acute toxicity of bromine chloride to estuarine organisms (Roberts and Bender); (6) synthesis and application of ocean wave refraction data (Goldsmith and Byrne); (7) advisory services-extension agents and publications; (8) national aquaculture information system; and (9) Sea Grant program administration, planning and coordination.

STATUS: Active. See subprojects listed under various investigators, subject areas or departments indicated by (SGP) after title.

FINANCIAL SUPPORT:

National Oceanic and Atmospheric Administration
(Office of Sea Grant)
Virginia Institute of Marine Science

KEY WORDS: Advisory services, aquaculture, erosion, management, mariculture, shellfish

PROJECT TITLE: ENVIRONMENTAL DATA ACQUISITION AND ANALYSES--MID-ATLANTIC OCS (OUTER CONTINENTAL SHELF BENCHMARK STUDIES)

INVESTIGATORS:

Maurice P. Lynch, Assistant Director
Eugene Burreson, Senior Marine Scientist, Program Manager
John P. Jacobson, Associate Marine Scientist*
William Athearn, Assistant Marine Scientist, Logistics Assistant
Beverly L. Laird, Research Assistant, Reports Assistant

PROJECT SUMMARY:

As part of the OCS Benchmark Program of the Bureau of Land Management, VIMS is undertaking a study of the mid-Atlantic outer continental shelf with primary emphasis on hydrocarbons and trace metals, which may potentially be associated with oil and gas development. Collection and interpretation of data are separated into benthic and water column programs, and collections will be made during four sampling seasons. Subprojects include: (1) zooplankton and neuston, (2) trace metals, (3) histopathology, (4) bacteriology, (5) physical oceanography, (6) hydrocarbons, (7) foraminifera, and (8) benthos. Special projects include wave climate model studies and analysis of historical fisheries trawl data in the region. These are described in further detail elsewhere in this report, indicated by (BLM) after the title.

STATUS: Active.

FINANCIAL SUPPORT:

U. S. Department of Interior
(Bureau of Land Management)
Virginia Institute of Marine Science

KEY WORDS: Baseline studies, oil and gas development, outer continental shelf

*Now with Yankee Atomic Electric Company, Westboro, Mass. 01581.

PROJECT TITLE: CHESAPEAKE RESEARCH CONSORTIUM, INCORPORATED (CRC)

INVESTIGATORS:

William J. Hargis, Jr., Institute Director and Institutional Representative to CRC Board of Trustees
John M. Zeigler, Assistant Director, Member of CRC Board of Trustees
Michael E. Bender, Assistant Director, Member of CRC Board of Trustees
Maurice P. Lynch, Assistant Director, CRC-VIMS Coordinator

PROJECT SUMMARY:

The Chesapeake Research Consortium, Inc., consisting of the Virginia Institute of Marine Science, The Johns Hopkins University, the Smithsonian Institution, and the University of Maryland, are cooperating in Bay-wide interdisciplinary studies in several areas. Present programs in which VIMS participated are: (1) Waste Water Treatment and Siting Criteria and (2) Pressures on the Edges of the Bay.

STATUS: Active. Specific programs and subprojects are described elsewhere in this volume, indicated by (CRC) after the title.

FINANCIAL SUPPORT:

National Science Foundation
(Research Applied to National Needs Program)
The Johns Hopkins University
University of Maryland
Smithsonian Institution
Virginia Institute of Marine Science

KEY WORDS: Interdisciplinary research, shorelines, waste water treatment

PROJECT TITLE: CHESAPEAKE BAY RESEARCH PLANNING AND MANAGEMENT (SGP)(CRC) (CRM)

INVESTIGATORS:

William J. Hargis, Jr., Institute Director
John L. Wood, Associate Director
Michael E. Bender, Assistant Director
W. Jackson Davis, Assistant Director
John M. Zeigler, Assistant Director
Maurice P. Lynch, Assistant Director

PROJECT SUMMARY:

This effort is designed to continually examine and maintain up-to-date the elements and research needs of the lower Chesapeake Bay System and the adjacent inshore waters of the Atlantic Ocean as well as contiguous littoral and lagoonal system.

Significant attention is being focused on the national problems of the coastal zone and its systems. This will lead to the development of statements of research and goals of wide applicability.

Particular emphasis is placed on developing or obtaining statements of informational needs from agencies legally responsible for planning for and management of the marine estuarine resources.

STATUS: Continuing.

FINANCIAL SUPPORT:

National Oceanic and Atmospheric Administration
(National Sea Grant Program)
(Office of Coastal Zone Management)
National Science Foundation
(Research Applied to National Needs)
Virginia Institute of Marine Science

KEY WORDS: Information needs, management, planning

PROJECT TITLE: WINDMILL POINT MARSH HABITAT DEVELOPMENT STUDIES

INVESTIGATORS:

Donald Boesch, Senior Marine Scientist (Benthos Studies)
John V. Merriner, Department Head and Senior Marine Scientist (Nekton Studies)
Marvin L. Wass, Department Head and Senior Marine Scientist (Wildlife Studies)
Gene M. Silberhorn, Associate Marine Scientist (Botanical Studies)
Maurice P. Lynch, Head, Division of Biological Oceanography (Project Coordinator)

PROJECT SUMMARY:

An integrated study of the benthos, nekton, wildlife and plant communities at the Windmill Point artificial island and a nearby reference site (Herring Creek) in the James River is being conducted as part of the Marsh Habitat Development portion of Dredged Material Research Program being conducted by the U. S. Army Corps of Engineers. Individual subprojects are described elsewhere in this volume.

STATUS: Active. Subprojects are indicated by (WES) after the titles.

FINANCIAL SUPPORT:

U. S. Army Corps of Engineers
(Waterways Experiment Station, Vicksburg, Mississippi)
Virginia Institute of Marine Science

KEY WORDS: Habitat, Windmill Point

PROGRAM 1:

Preservation of Coastal Environments

PROJECT TITLE: COASTAL RESOURCES MANAGEMENT PROGRAM

INVESTIGATORS:

Roger D. Anderson, Department Head and Senior Marine Scientist
Susan Barrick, Head Librarian
Robert Byrne, Senior Marine Scientist
Claiborne Jones, Assistant Marine Scientist
Maurice P. Lynch, Assistant Director
Ronald L. Schmied, Coastal Zone Management Advisory Specialist
Gene Silberhorn, Associate Marine Scientist

PROJECT SUMMARY:

This project represents the Institute's second year of participation in Virginia's Coastal Resource Management (CRM) Planning Program. While the Office of the Secretary of Commerce and Resources (OCR) has overall responsibility for the CRM program, VIMS has been sub-contracted to provide coastal/marine-resource-related research, advice and technical assistance. Specific subprojects undertaken during the year included: (1) tidal marsh inventories (Silberhorn, Dawes, Barnard, Moore, Mercer, Penney); (2) shoreline situation reports (Byrne, Zeigler, Hobbs, Anderson, Owens, Weishar); (3) marine environmental resources research and management system/information services (Jones, Pleasants); (4) geographical areas of particular concern (Schmied); (5) areas for preservation and/or restoration (Lynch, Dierks); (6) issues analyses (Dawes, Barnard); (7) public participation and education (Schmied); (8) outer continental shelf study review (Anderson); (9) Chesapeake Bay bibliography (Barrick, Gleeson); and (10) project administration, planning and coordination (Anderson, Schmied).

STATUS: Active. See subprojects as listed under various investigators, subject areas or departments indicated by (CRM) after title.

FINANCIAL SUPPORT:

National Oceanic and Atmospheric Administration
(Office of Coastal Zone Management)
Office of the Secretary of Commerce and Resources
Virginia Institute of Marine Science

KEY WORDS: Advisory services, bibliography, continental shelf, education, erosion, information systems, inventory, management, planning, shorelines, wetlands

PROJECT TITLE: PESTICIDE MONITORING PROGRAM

INVESTIGATORS:

Robert J. Huggett, Acting Department Head and Associate Marine Scientist
Michael E. Bender, Head, Division of Environmental Science and Services

PROJECT SUMMARY:

The National Marine Pesticide Monitoring Program, in which VIMS participates, is designed to determine pollution from pesticides in the marine environment.

Previously, oysters were used as sampling organisms but now fish of various trophic levels are utilized.

STATUS: Active. This is a continuation of a program in which VIMS has participated since 1965.

FINANCIAL SUPPORT:

Environmental Protection Agency
(National Marine Pesticide Monitoring Program)
Virginia Institute of Marine Science

KEY WORDS: Marine environment, pesticides

Department of Ecology-Pollution
(Environmental Chemistry Section)
Department of Geological Oceanography
Department of Applied Marine Biology

PROJECT TITLE: THE ROLE OF SEDIMENTS IN THE STORAGE, MOVEMENT AND BIOLOGICAL UPTAKE OF KEPONE IN ESTUARINE ENVIRONMENTS

INVESTIGATORS:

Robert J. Huggett, Acting Department Head and Associate Marine Scientist
Maynard Nichols, Associate Marine Scientist
Dexter S. Haven, Senior Marine Scientist

PROJECT SUMMARY:

This project is designed to study the following aspects:

1) The distribution of Kepone in bottom sediments of the James River

2) The routes of sediment transport below Hopewell

3) The major sediment sinks will be located and the rates of sediment deposition at these sites will be determined

4) The effect of varying environmental conditions of pH and salinity on release of Kepone from sediments will be determined

5) The ability of filter feeding organisms to concentrate Kepone from contaminated sediments will be determined

Data from this study will provide for a determination of the potential hazards which dredging poses to a variety of filter feeding organisms.

STATUS: Active.

FINANCIAL SUPPORT:

U. S. Environmental Protection Agency
Virginia Institute of Marine Science

KEY WORDS: Kepone, pesticides, pollution

PROJECT TITLE: KEPONE MONITORING

INVESTIGATORS:

Robert J. Huggett, Acting Department Head and Associate Marine Scientist
Michael E. Bender, Head, Division of Environmental Science and Services
Harold D. Slone, Assistant Marine Scientist
Dwight Hunt, Laboratory Technician
Keith Ward, Laboratory Technician
Peter Van Veld, Graduate Assistant

PROJECT SUMMARY:

This project involves the collection and analysis of Finfish, Shellfish and Crustaceans for the pesticide, Kepone. The purpose of the project is to determine the ambient levels of the substance in Chesapeake Bay Biota and by continuous monitoring to detect trends of Kepone in the animals. The data generated are shared with other members of Virginia's Kepone Task Force to aid in decisions concerning public health and possible Kepone cleanup options.

STATUS: Continuing.

FINANCIAL SUPPORT:

U. S. Environmental Protection Agency
Virginia Institute of Marine Science

KEY WORDS: Kepone, pesticides, pollution

PROJECT TITLE: HEAVY METALS IN SEDIMENTS AND OYSTERS

INVESTIGATORS:

Robert J. Huggett, Acting Department Head and Associate Marine Scientist
Michael E. Bender, Head, Division of Environmental Science and Services
Harold D. Slone, Assistant Marine Scientist

PROJECT SUMMARY:

This project is designed to assess the distributions and concentrations of cadmium, copper, lead, mercury, and zinc in the southern Chesapeake Bay and its major tributaries.

The Eastern Oyster (*Crassostrea virginica*), the brackish water clam (*Rangia cuneata*), and bottom sediments are being taken from numerous locations in the James, York, Rappahannock, Elizabeth Back, Poquoson, Piankatank rivers as well as Mobjack and Lynnhaven bays. The areas between these tributaries, in the Chesapeake Bay, are also being sampled.

Analyses are being performed by Atomic Absorption spectrophotometry.

STATUS: Active. This project represents, in part, Huggett's dissertation research.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science

KEY WORDS: Metals, oysters, sediments

Department of Ecology-Pollution
Environmental Chemistry Section

PROJECT TITLE: DETERMINATION OF DISTRIBUTION COEFFICIENTS FOR DISSOLVED ORGANICS AND ORGANO-METALS BETWEEN SEAWATER AND FISH "MUCUS"

INVESTIGATORS:

Robert J. Huggett, Acting Department Head and Associate Marine Scientist
Stanley Wasik*
Harry Rook*

PROJECT SUMMARY:

This project is designed to yield information pertaining to a better understanding of the concentrating mechanisms of organics and organo-metals by marine organisms. This project involves collecting body slimes or mucus from various fishes and mollusks and determining the distribution coefficients of 3 various compounds. These analytical determinations will be made utilizing gas chromatography and radioactive tracing techniques.

STATUS: Active.

FINANCIAL SUPPORT:

National Bureau of Standards
Virginia Institute of Marine Science

KEY WORDS: Distribution coefficient, pollution, slime

*National Bureau of Standards, Gaithersburg, Maryland.

PROJECT TITLE: AN INVESTIGATION TO DETERMINE THE ACUTE ECOLOGICAL EFFECTS OF OIL SPILLS IN EASTERN COASTAL PLAIN ESTUARIES

INVESTIGATORS:

Michael E. Bender, Head, Division of Environmental Science and Services
Rudolf H. Bieri, Section Head and Senior Marine Scientist
Robert J. Huggett, Acting Department Head and Associate Marine Scientist

PROJECT SUMMARY:

The objective is to determine the acute environmental effects of fresh and weathered South Louisiana crude oil spilled in coastal plain estuaries. The major chemical components of the oils are being followed through the ecosystem and the responses of the community to the oil are being followed as a function of time.

An existing tidal marsh-creek system, located at Cheatham Annex, is being used as the test site. The marsh-creek system was partitioned into areas of suitable size for dosing with the oil. Replicate "mini-ecosystems" were provided for each treatment. Due to space restrictions we tested only two types of oil. The duration of study on the system is dependent upon the rate of recovery of the communities; present estimates indicate at least an additional year will be necessary for recovery to be complete.

STATUS: Active.

FINANCIAL SUPPORT:

The American Petroleum Institute
Virginia Institute of Marine Science

KEY WORDS: Oil, oil pollution, oil spills

Department of Ecology-Pollution
Environmental Chemistry Section

PROJECT TITLE: BASELINE STUDY OF ORGANIC COMPOUNDS IN THE BAY ENVIRONMENT

INVESTIGATORS:

Rudolf H. Bieri, Section Head and Senior Marine Scientist
Robert J. Huggett, Acting Department Head and Associate Marine Scientist
Various personnel from NASA

PROJECT SUMMARY:

During the past year, the analytical facilities and capabilities at both VIMS and NASA to investigate the presence of natural and man-introduced organic compounds in waters, sediments and biota of the Bay have been developed. One of the mass spectrometers (CEC 104) has been modified and converted to a GC-MS system; major improvements now allow fast scan (mass 12-400 in 1 sec) and proportional signal enhancement with mass. A Finnigan GC-MS system with a dedicated computer has been equipped with a tape interface to a CDC-6000 computer for catalogue search. This instrument has been used extensively throughout the development of extraction methods and has yielded valuable information about the detailed composition of water soluble phases of No. 2 and 6 fuel oils. Preliminary analyses of natural samples (water, sediments, clams) are also available. Limitations due to sample contamination from a number of sources have been recognized and are being worked on. Analysis has been extended to different fractions of No. 2 fuel oil. Software to derive quantitative information from mass spectra has been acquired.

STATUS: Active. This is a cooperative program with the Langley Research Center of NASA, Hampton, Virginia.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science
National Aeronautics and Space Administration (Langley Research Center)

PUBLICATIONS:

Identification of Hydrocarbons in an Extract from Estuarine Water Accommodated No. 2 Fuel Oil. Marine Pollution Monitoring (Petroleum) Symposium and Workshop, 13-17 May 1974, Gaithersburg, Maryland.

Hydrocarbons Identified in Extracts from Estuarine Water Accommodated No. 2 Fuel Oil by Gas Chromatograph-Mass Spectrometer. NASA Techn. Memorandum, NASA TM x-72009.

KEY WORDS: Organic compounds

PROJECT TITLE: OUTER CONTINENTAL SHELF BENCHMARK STUDIES - TRACE METAL ANALYSIS (BLM)

INVESTIGATORS:

Robert J. Huggett, Acting Department Head and Associate Marine Scientist
Richard Harris, Associate Marine Scientist
Raj Jolly*

PROJECT SUMMARY:

This project involves the collection and analysis of samples of suspended particulate matter, sediments, and organisms for a suite of trace metals. The purpose of this project is to provide "benchmark" or baseline values of trace metal concentrations on the Mid-Atlantic OCS for later comparison with monitoring programs conducted after exploration and production of petroleum has been initiated. Analysis of samples are carried out at the VARC campus by the technique of Proton Induced X-ray Emission (PIXE), and at VIMS and VARC by flame and flameless Atomic Absorption Spectrophotometry.

STATUS: Active. This is a subproject of "Environmental Data Acquisition and Analysis, Mid-Atlantic OCS."

FINANCIAL SUPPORT:

U. S. Department of Interior
(Bureau of Land Management)
Virginia Associated Research Campus
Virginia Institute of Marine Science

KEY WORDS: Baseline studies, outer continental shelf, pollution, trace metals

*Raj Jolly, Virginia Associated Research Campus, Newport News, Virginia.

Department of Ecology-Pollution
Environmental Chemistry Section

PROJECT TITLE: A DETAILED CHEMICAL INVESTIGATION OF THE FATE OF CRUDE OIL IN A SEMINATURAL SPILL

INVESTIGATORS:

Rudolf H. Bieri, Section Head and Senior Marine Scientist
Vassilios C. Stamoudis, Associate Marine Scientist
M. Kent Cueman, Associate Marine Scientist

PROJECT SUMMARY:

Surface-contained spills of fresh and artificially weathered South Louisiana Crude Oil in intertidal marsh and creek were subjected to an interdisciplinary fate and effect study. The fate of petroleum hydrocarbons was assessed by identifying and quanitiatively evaluating a large number of aliphatic and aromatic hydrocarbons (by computerized GC-MS) in samples of surface film, water, organic detritus, sediment, marsh soil, fish *(Fundulus heteroclitus)* oysters *(Crassostrea virginica)* and clams *(Mercenaria mercenaria)*. This effort resulted in a comprehensive record of the fate of oil after a spill. While not all data are available at this time, some observations of special interest are mentioned.

Unexpected differences were found to be present between the fresh and the artificially weathered crude oil with respect to both fate and effects. All components of the two oils appear in the water column and in the tissues of exposed animals a few hours after the spill. Large quantitative changes occur with increasing time, due to loss (by evaporation and dissolution) of volatile components. While the fish exposed to the weathered crude oil spill were dead after 120 hours, those exposed to fresh oil showed no obvious effects, although no significant differences in the qualitative composition or in the exposure concentrations, except for the dependence of concentrations with time, could be found. Again all hydrocarbon extracts display an increasing complexity with time, suggesting extensive modification of the oil in the environment. These aspects command a high priority due to a general lack of knowledge about the reaction mechanisms involved and the possibility of increased toxicity that may parallel such modifications. Very high hydrocarbon concentrations were encountered in extracts from organic detritus, which also appeared to act as a sink for chlorinated hydrocarbons. The data lend additional support for the hypothesis that tissue concentrations of hydrocarbons in animals to some extent reflect a state of quasi-equilibrium with environmental hydrocarbon sinks.

STATUS: Active.

FINANCIAL SUPPORT:

American Petroleum Institute
Virginia Institute of Marine Science

KEY WORDS: Crude oil, fate, GC-MS, hydrocarbons, modification of oil, quasi-equilibrium, sink, spill

PROJECT TITLE: OUTER CONTINENTAL SHELF BENCHMARK STUDIES--TOTAL NITROGEN ANALYSES (BLM)

INVESTIGATORS:

R. L. Wetzel, Associate Marine Scientist
B. Pierce, Graduate Assistant

PROJECT SUMMARY:

This project provides analytical services and the development of methodologies for the analysis of total sediment nitrogen. Sediment samples are taken in conjunction with biological and chemical samples on the outer continental shelf. This project is a part of the larger BLM-OCS program at VIMS.

STATUS: Active.

FINANCIAL SUPPORT:

U. S. Department of Interior
(Bureau of Land Management)
Virginia Institute of Marine Science

KEY WORDS: Nitrogen, outer continental shelf, sediments

Department of Ecology-Pollution
(Environmental Biology Section)
Department of Wetlands Research

PROJECT TITLE: POST CONSTRUCTION STUDIES AT THE WINDMILL POINT MARSH DEVELOPMENT SITE: BOTANY/SOILS STUDIES (WES)

INVESTIGATORS:

R. L. Wetzel, Associate Marine Scientist
G. M. Silberhorn, Associate Marine Scientist
D. G. Doumlele, Graduate Assistant

PROJECT SUMMARY:

The botanical and soils studies associated with this interdisciplinary research effort are designed primarily for comparative purposes within the Habitat Development Section of the Dredged Materials Research Program, WES-ACE, Vicksburg, Mississippi. This project is one of several similar studies in marsh creation supported by the program. The botanical study centers largely on measures of plant preformance, species composition and distribution, and evaluation of various planting and fertilization treatments on vascular plants of the artificial island. The soils study employs standard measures to characterize the soils in various zones (plant and elevation). These measures include eH/pH profiles, % moisture, soil salinity, carbon, nitrogen, potassium, cation exchange capacity, and analysis of some micronutrient species. A natural freshwater marsh, Ducking Stool Point, has been chosen as a reference study site. Comparative botanical and soils studies are being preformed in both areas.

STATUS: The study is active and will be terminated early FY 78.

FINANCIAL SUPPORT:

U. S. Army Corp of Engineers, Waterways Experiment Station, Vicksburg, Mississippi
Virginia Institute of Marine Science

KEY WORDS: James River, marsh development, marshes

PROJECT TITLE: DREDGE MATERIAL DISPOSAL IN COASTAL WETLAND ECOSYSTEMS

INVESTIGATOR:

R. L. Wetzel, Associate Marine Scientist

PROJECT SUMMARY:

A review of the general ecology of coastal wetlands emphasing the effects of dredged material disposal is presented. The current literature on the impacts as related to physical, chemical and biological components of wetlands is reviewed and summarized. Current state and federal guidelines are included and proposal guidelines are recommended for EIS reviewers.

STATUS: This project is completed and awaiting publication.

FINANCIAL SUPPORT:

Environmental Protection Agency, Office of Federal Activities
Washington, D. C.

KEY WORDS: Disposal, dredging, impact statements, wetlands

Department of Ecology-Pollution
Environmental Biology Section

PROJECT TITLE: ECOLOGICAL STUDY OF THE TIDAL SEGMENT OF THE JAMES RIVER ENCOMPASSING HOG POINT

INVESTIGATORS:

R. A. Jordan, Associate Marine Scientist
P. A. Goodwin, Laboratory Specialist
R. K. Carpenter, Graduate Assistant

PROJECT SUMMARY:

Pre- and post-operational studies on selected biological communities in the vicinity of the VEPCO Surry Power Station have been conducted since May 1969. Communities presently under investigation are the benthic macroinvertebrates (16 stations, monthly in the summer and quarterly the rest of the year), phytoplankton and zooplankton (10 stations, monthly), and fouling organisms (3 stations, bimonthly). Population temporal patterns and spatial distributions are analyzed periodically to detect imparts of the power plant cooling water discharge.

STATUS: Active.

FINANCIAL SUPPORT:

Virginia Electric and Power Company
Virginia Institute of Marine Science

KEY WORDS: Benthos, fouling organisms, James River, phytoplankton, power plants, zooplankton

Department of Ecology-Pollution
Environmental Biology Section

PROJECT TITLE: THE MARINE NITROGEN CYCLE

INVESTIGATOR:

Kenneth L. Webb, Associate Marine Scientist

PROJECT SUMMARY:

The long term goal is to understand the cyclic flow of nitrogen in the marine environment as well as related processes necessary to the implementation of this goal. Specific processes, compounds, fluxes, organisms and environments which are considered relevant to the pursuit of this goal are studied. Active subprojects are identified in their own descriptions.

STATUS: Active.

FINANCIAL SUPPORT:

National Science Foundation
Virginia Institute of Marine Science

PUBLICATIONS:

Webb, K. L. et al. 1975. Eniwetok (Enewetak) Atoll: Aspects of the nitrogen cycle on a coral reef. Limnol. Oceanogr. 20: 198-210.

Webb, K. L. and W. J. Wiebe. Nitrification on a coral reef. Can. J. Microbiol. 21: 1427-1431.

Wiebe, W. J., R. E. Johannes and K. L. Webb. 1975. Nitrogen fixation in a coral reef community. Science 188: 257-259.

KEY WORDS: Amino acids, ammonia, bacteria, coral reefs, denitrification, detritus, dissolved organics, estuaries, eutrophication, flagellates, heterotrophy, metabolism, nitrate, nitrification, nitrite, nitrogen fixation, phytoplankton, primary production, salt marshes, urea, wetlands

Department of Ecology-Pollution
Environmental Biology Section

PROJECT TITLE: THE MARINE NITROGEN CYCLE: EFFECTS OF OIL POLLUTION ON NITROGEN FIXATION IN SALT MARSHES

INVESTIGATORS:

Kenneth L. Webb, Associate Marine Scientist
Alyce Thomson, Graduate Student

PROJECT SUMMARY:

A subproject of the marine nitrogen cycle. Salt marshes are among the world's most productive natural systems, to the extent that much of their productivity is exported to adjacent communities. Preliminary evidence from the New England area indicates that nitrogen fixation by blue-green algae in the salt marsh is an important source of the required nitrogen nutrient.

This project is using the acetylene reduction method to estimate nitrogen fixation in two Virginia mesohaline salt marshes, a control marsh and a marsh which is being subjected to chronic No. 2 fuel oil pollution in another project. A seasonal survey is being made to estimate nitrogen fixation on natural substrates in both marshes and the extent to which it is affected by oil pollution. Artificial substrates also are being presented for colonization along a transect in each marsh. Results will provide us with information concerning the seasonal cycle of colonization by nitrogen fixing organisms and possible effects of oil pollution on colonization. Our hypothesis is that if the oil pollution disrupts the ecosystem and returns it to an earlier stage of ecological succession, then nitrogen fixing organisms should be favored. Effects of oil on the physiology of specific organisms, however, may negate this proposed advantage.

STATUS: Active. This project represents, in part, Thomson's thesis research.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science

KEY WORDS: Bacteria, blue-green algae, estuaries, nitrogen cycle, nitrogen fixation, oil pollution, salt marshes, wetlands

PROJECT TITLE: NITROGEN, PHOSPHORUS AND CARBON CYCLES ON CORAL REEFS

INVESTIGATORS:

Kenneth L. Webb, Associate Marine Scientist
Jean Baker, Graduate Student

PROJECT SUMMARY:

Coral reefs are particularly interesting and useful systems with which to study both a total system and its constituent parts because of their great diversity of life, their high rates of organic production and their occurrence in nutrient depleted environments. Our current efforts will be directed toward assembling available knowledge of the system into an ecosystem model. Experimental efforts are being directed toward filling information gaps which become apparent during the modeling effort.

STATUS: Active. This project represents, in part, Baker's thesis research.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science
ERDA (grant support to the Univ. of Hawaii to support the Mid-Pacific Marine Laboratory at Enewetak)

PUBLICATIONS:

Webb, K. L. et al. 1975. Eniwetok (Enewetak) Atoll: aspects of the nitrogen cycle on a coral reef. Limnol. Oceanogr. 20: 198-210.

LIMER 1975 Expedition Team. 1976. Metabolic processes of coral reef communities at Lizard Island, Queensland. Search 7: 463-467.

KEY WORDS: Coral reefs, ecosystem models, nutrients

Department of Ecology-Pollution
(Environmental Biology Section)
Wachapreague Laboratory

PROJECT TITLE: NUTRIENT CYCLES AND EXCHANGE BETWEEN THE MARINE BENTHOS AND THE WATER COLUMN

INVESTIGATORS:

Kenneth L. Webb, Associate Marine Scientist
Richard L. Wetzel, Associate Marine Scientist
Michael Castagna, Senior Marine Scientist
Maurice P. Lynch, Assistant Director
Robert Middleton, Graduate Student

PROJECT SUMMARY:

This project's objectives are to develop and utilize in situ instrumentation and underwater habitat compatible chemical methodology. It is desired to develop a simulation model of the water column-sediment interaction in terms of carbon, nitrogen and phosphorus. In situ incubations are carried out utilizing hemispheres deployed and sampled by saturation divers living in the underwater laboratory "Helgoland". Water column and sediment samples are also taken as indexes of ambient conditions for many factors.

STATUS: Active. This in part is a subproject of the marine nitrogen cycle project.

FINANCIAL SUPPORT:

NOAA, Manned UnderSea Science and Technology Office
Virginia Institute of Marine Science

KEY WORDS: Ecosystem models, nutrients

PROJECT TITLE: INSTRUMENTAL ANALYSIS OF ENVIRONMENTAL SAMPLES: 1. NEUTRON ACTIVATION ANALYSIS

INVESTIGATORS:

Paul L. Zubkoff, Department Head and Senior Marine Scientist
J. Ernest Warinner, III, Assistant Marine Scientist
Walter E. Carey*

PROJECT SUMMARY:

Selected sediments from tributary rivers of the Chesapeake Bay are subjected to a neutron flux of $2x10^{11}$ neutrons cm^{-2} sec^{-1} for either 5 minutes or 2 hours.

The resulting gamma-ray spectra are analyzed using a NaI(TI) crystal or Ge(Li) detector with a multichannel analyzer interfaced with a dedicated computer for the measurement of Na, Mn, Cr, La and Sc content.

These samples will be used for the preparation of radioactive sediment particles for exploring mechanisms of particulate uptake by invertebrates.

STATUS: Continuing.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science

KEY WORDS: Gamma-ray spectroscopy, heavy metals, James River, metals, minerals, neutron activation analysis, sediments

*Walter E. Carey, Director, Nuclear Reactor Laboratory, Ohio State University, Columbus, Ohio

PROJECT TITLE: INSTRUMENTAL ANALYSIS OF ENVIRONMENTAL SAMPLES: 2. PROTON INDUCED X-RAY EMISSION (PIXE)

INVESTIGATORS:

Paul L. Zubkoff, Department Head and Senior Marine Scientist
J. Ernest Warinner, III, Assistant Marine Scientist
Raj Jolly*

PROJECT SUMMARY:

Selected water samples and/or sediments from the Rappahannock River are analyzed for 35 constituent metals using proton induced x-ray emission (PIXE).

Prepared samples are irradiated with a high intensity proton beam (2 MEV) produced by a Van de Graaff generator with ion current up to 200 μA at the sample and concommitant analysis by a Si(Li) detector and multichannel analyzer. Identification and quantification is carried out by curve-fitting analysis using the method of least squares. Elements with atomic number (Z) greater than 30 are analyzed in the part per million (ppm) to part per billion (ppb) range.

STATUS: Continuing.

FINANCIAL SUPPORT:

Virginia Associated Research Campus
Virginia Institute of Marine Science

KEY WORDS: PIXE, proton induced x-ray emission, Rappahannock River, trace metal analysis

*Raj Jolly is a Senior Research Physicist at the Virginia Associated Research Campus of the College of William and Mary

PROJECT TITLE: REMOTE SENSING APPLICATIONS IN MARINE SCIENCE

INVESTIGATORS:

J. C. Munday, Associate Marine Scientist, Remote Sensing Section, Department of Geological Oceanography
H. H. Gordon, Assistant Marine Scientist, Remote Sensing Section, Department of Geological Oceanography
C. S. Welch, Associate Marine Scientist, Department of Physical Oceanography and Hydraulics

PROJECT SUMMARY:

Remote sensing is being applied to Commonwealth needs and environmental problems in the marine waters of Virginia. The principal theme of the applications is remote study of circulation to solve siting problems. Applications this year included sewage outfall siting, siting of structures to protect against shoreline erosion, and evaluation of wetlands by aerial photography.

Various remote sensing techniques are being incorporated into the Institute response to siting problems, including low and high altitude aerial photography, satellite imagery, infrared mapping, and multispectral analysis. In many cases, these techniques are proving to be rapid and cost-effective.

STATUS: Active.

FINANCIAL SUPPORT:

National Aeronautics and Space Administration (Office of University Affairs, NASA-Wallops)
Virginia Institute of Marine Science
Various public agencies

PUBLICATIONS (as of 1974):

Munday, J. C., Jr., Welch, C. S. and Gordon, H. H. 1977. Submitted. Outfall siting with dye-buoy remote sensing of coastal circulation. 30 p. plus fig.
Alföldi, T. T. and Munday, J. C., Jr. 1977 Submitted. Water quality analysis by digital chromaticity mapping of Landsat data. 17 p. plus fig.
Munday, J. C., Jr., Gordon, H. H., Welch, C. S., and Williams, G. 1976. Annual report for Year 4. Application of remote sensing to estuarine management. VIMS.
Munday, J. C., Jr., Byrne, R. J., Welch, C. S., and Gordon, H. H. 1975. Annual report for Year 3. Application of remote sensing to study nearshore circulation. VIMS.
Zeigler, J., Haas, L., Lobecker, R., Stauble, D., Welch, C., and Fang, C. S. 1974. Annual report for Year 2. Application of remote sensing to study nearshore circulation. VIMS.

KEY WORDS: Circulation, remote sensing, siting

PROJECT TITLE: PESTICIDES AND HEAVY METALS IN TISSUES OF STRIPED BASS TAKEN IN WATERS NEAR CAPE HATTERAS, NORTH CAROLINA AND IN VIRGINIA

INVESTIGATOR:

John V. Merriner, Department Head and Senior Marine Scientist

PROJECT SUMMARY:

Liver tissues from 12 adult striped bass obtained in a haul seine during January 1973 at Cape Hatteras, North Carolina and 10 fish each from the James, York, and Rappahannock rivers were analyzed for pesticide residues and PCB's. Relationships of residues present to age and weight of fish specimens shall be evaluated as to possible effects upon spawning success of striped bass and to provide baseline data for each sampling area.

STATUS: Active. Manuscript in preparation.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science

KEY WORDS: Chlorinated hydrocarbons, DDT, estuaries, James River, *Morone saxatilis*, PCB's, pesticides, Rappahannock River, striped bass, York River

PROJECT TITLE: EFFECTS OF SAMPLING DESIGN ON RESULTS IN ENVIRONMENTAL IMPACT ASSESSMENTS

INVESTIGATORS:

Donald F. Boesch, Senior Marine Scientist
Priscilla Hinde, Graduate Assistant

PROJECT SUMMARY:

Design of sampling strategy varies widely in ecological investigations of the effects of pollution. Often sampling design can seriously affect the results and interpretation of the study. As a demonstration of the effect of sampling strategy on application of analyses and results, macrobenthos was sampled over an extensive grid in the vicinity of an oil refinery in the lower York River estuary. Samples will be chosen from this large set of samples using different design strategies and results separately analyzed in order to detect effects on multivariate analytical results.

STATUS: Active. This project represents Hinde's thesis research.

FINANCIAL SUPPORT:

Environmental Protection Agency
Virginia Institute of Marine Science

KEY WORDS: Benthos, data analysis, oil refinery, pollution studies, sampling

Department of Invertebrate Ecology
Toxicology Section

PROJECT TITLE: SUBLETHAL EFFECTS OF CHLORINE ON SELECTED MARINE DECAPOD CRUSTACEANS

INVESTIGATORS:

Morris H. Roberts, Jr., Associate Marine Scientist
Chae E. Laird, Graduate Assistant

PROJECT SUMMARY:

Chlorine and its many derivatives are known to kill various organisms at high concentrations. Sublethal concentrations are expected to reduce egg hatchability, larval growth, juvenile growth, sexual maturation, fecundity, and other parameters of an organism's well-being. These effects are being examined in selected decapod crustaceans representative of the Chesapeake Estuarine System. These studies are being conducted in flowing river water systems in the laboratory where most variables can be held within definable limits.

STATUS: Active.

FINANCIAL SUPPORT:

Environmental Protection Agency
Virginia Institute of Marine Science

KEY WORDS: Chlorine, decapods, hermit crab, larval development, mud crab, reproductive biology, toxicity

PROJECT TITLE: SUBLETHAL EFFECTS OF CHLORINE ON BLOOD SERUM CONSTITUENTS OF THE BLUE CRAB, *CALLINECTES SAPIDUS*

INVESTIGATORS:

Morris H. Roberts, Jr., Associate Marine Scientist
Maurice P. Lynch, Head, Division of Biological Oceanography
Chae E. Laird, Graduate Assistant

PROJECT SUMMARY:

Chronic exposure to chlorine and/or its products may cause deviations of blue crab blood serum constituents from baseline levels. We are attempting through laboratory studies to ascertain which serum constituents are affected by various chronic levels of chlorine, and whether there is a predictable and specific effect of chlorine on serum constituents. These data will provide insight into the mechanism of chlorine toxicity.

STATUS: Active. This project represents Laird's dissertation research. It is a subproject of "Sublethal Effects of Chlorine on Selected Marine Decapod Crustaceans."

FINANCIAL SUPPORT:

Environmental Protection Agency
Virginia Institute of Marine Science

KEY WORDS: Blood serum, blue crab, chlorine, condition index, toxicity

Department of Invertebrate Ecology
(Toxicology Section)
Department of Ecology-Pollution

PROJECT TITLE: TOXICITY OF CHLORINATED AND DECHLORINATED SEWAGE EFFLUENTS

INVESTIGATORS:

Morris H. Roberts, Jr., Associate Marine Scientist
Michael E. Bender, Head, Division of Environmental Science and Services

PROJECT SUMMARY:

The objective of this project is to evaluate the reduction of toxicity of a dechlorinated sewage effluent to various estuarine species, especially chlorine sensitive forms such as oyster larvae, copepods and several fishes. Dechlorination is a proposed alternative to use of new disinfectants for treated sewage effluent.

STATUS: Active.

FINANCIAL SUPPORT:

National Oceanic and Atmospheric Administration
(National Sea Grant Program)
Virginia Institute of Marine Science

KEY WORDS: Acute toxicity, dechlorination, estuarine biota

PROJECT TITLE: BROMINE CHLORIDE TOXICITY TO ESTUARINE ORGANISMS (SGP)

INVESTIGATORS:

Morris H. Roberts, Jr., Associate Marine Scientist
Richard Gleeson, Graduate Assistant

PROJECT SUMMARY:

The objective of this project is to determine the acutely toxic levels of bromine chloride to various invertebrates and fishes. These data are part of an evaluation of bromine chloride as an alternative to chlorine for disinfection of treated sewage effluent.

STATUS: Active.

FINANCIAL SUPPORT:

National Oceanic and Atmospheric Administration
(National Sea Grant Program)
Virginia Institute of Marine Science

KEY WORDS: Acute toxicity, bromine chloride, estuarine biota

PROJECT TITLE: ACUTE TOXICITY OF EFFLUENTS FROM THE JAMES RIVER STP $BrCl/Cl_2$ PILOT PLANT STUDY

INVESTIGATOR:

Morris H. Roberts, Jr., Associate Marine Scientist

PROJECT SUMMARY:

This project is one phase of the program developed by the Virginia Chlorine Task Force to evaluate the use of BrCl as a disinfectant for treated sewage effluent under pilot plant conditions. The objectives are to determine the toxicity of bromochlorinated and chlorinated wastes and to define the LC 50 for each type of effluent. The primary test species will be juvenile spot, the species most affected in fish kills in 1973-74.

STATUS: Active.

FINANCIAL SUPPORT:

Ethyl Corporation
Coastal Plains Regional Commission
Virginia Institute of Marine Science

KEY WORDS: Acute toxicity, bromine chloride, chlorine, spot

Department of Invertebrate Ecology
(Toxicology Section)
Department of Environmental Physiology

PROJECT TITLE: EFFECTS OF CHLORINE ON NATURAL PHYTOPLANKTON POPULATIONS

INVESTIGATORS:

Morris H. Roberts, Jr., Associate Marine Scientist
Paul Zubkoff, Senior Marine Scientist
Jerome Illowsky, Graduate Assistant

PROJECT SUMMARY:

The objective of this project was to evaluate photosynthesis and heterotrophic carbon uptake rates of natural phytoplankton populations to the combined stresses of chlorination and temperature change over an annual cycle. Radiometric methods were used to measure both rates. The chlorine concentration causing a 50% reduction in photosynthetic production and heterotrophic production at each test temperature are the primary data outputs. These experiments are designed to provide information regarding the relative seasonal sensitivity of phytoplankton populations to chlorination of power plant cooling systems.

STATUS: Active.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science

KEY WORDS: Chlorination, environmental effects, heterotrophic production, phytoplankton, productivity, toxicity

Department of Invertebrate Ecology
(Toxicology Section)
Department of Crustaceology
Department of Ecology-Pollution

PROJECT TITLE: EFFECT OF KEPONE CONTAMINATION ON BLUE CRAB EGGS

INVESTIGATORS:

Morris H. Roberts, Jr., Associate Marine Scientist
Paul Haefner, Associate Marine Scientist
Willard A. Van Engel, Senior Marine Scientist
Michael E. Bender, Head, Division of Environmental Science and Engineering

PROJECT SUMMARY:

This study is designed to evaluate the hatchability of eggs and viability of larvae as a function of the Kepone content of the eggs. Eggs will be derived from feral populations in Kepone contaminated waters. Chemical analyses are proposed for Kepone in eggs and selected body tissues including ovary, hepatopancreas, backfin and haemolymph.

STATUS: Pending.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science

KEY WORDS: Bioconcentration, blue crabs, eggs, James River, Kepone, larvae, pesticides

PROJECT TITLE: A STUDY OF COMMON LANDS IN VIRGINIA

INVESTIGATORS:

N. Bartlett Theberge, Associate Marine Scientist in Ocean and Coastal Law
William J. Hargis, Jr., Institute Director
K. A. Dierks, Graduate Assistant
A. Gary Thompson, Legal Research Assistant

PROJECT SUMMARY:

Primarily a legal and historical effort, the project is seeking to locate, delineate and determine the legal status of coastal lands subject to statutory and common law as available for use by all people of the Commonwealth. Proceeding along two separate but related lines the study is utilizing historic and current records to locate coastal lands which may be classified as common. Simultaneously an effort is being made through historical records and legal research to determine the proper interpretation of various statutes and common law principals affecting the common lands concept in Virginia. This effort includes establishing a nexus between common lands and the public trust theory.

A detailed analysis is also being conducted on the evolution of the "common land" concept of Virginia from the establishment of the Jamestown Colony in 1607 to the present. This analysis has included preliminary research on the land grant policy of Virginia.

STATUS: Continuing.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science

KEY WORDS: Coastal zone management, common lands, Eastern Shore, legal studies, public access, public lands, wetlands

PROJECT TITLE: THE PRESERVATION OF NATURAL AREAS IN COASTAL VIRGINIA: AN ASSESSMENT OF PUBLIC AND PRIVATE ACTIVITIES (CRM)

INVESTIGATORS:

Maurice P. Lynch, Head, Division of Biological Oceanography
K. A. Dierks, Graduate Assistant

PROJECT SUMMARY:

This project is intended to assess public and private efforts to preserve ecological diversity in coastal Virginia through the protection of coastal natural areas and marine environments. The study will detail the various types of coastal, estuarine and marine environments in Virginia and identify important coastal natural areas and marine ecosystems. The adequacy of present local, state, regional and federal activities in preserving such areas will be assessed along with the contribution being made by non-governmental activities. Existing activities will then be compared against programs in other states and recommendations made for improvements in the identification and management of coastal ecosystems important to ecological diversity in Virginia's coastal environment.

STATUS: Active. This project represents Dierks' thesis research.

FINANCIAL SUPPORT:

National Oceanic and Atmospheric Administration
(Office of Coastal Zone Management)
Virginia Institute of Marine Science

KEY WORDS: Chesapeake Bay, coastal zone management, local planning, marine ecosystems, natural areas, wetlands

Department of Microbiology-Pathology
Bacteriology Section

PROJECT TITLE: THE EFFECT OF THE CHESAPEAKE CORPORATION ON THE WATER QUALITY OF THE UPPER YORK RIVER WITH RESPECT TO TOTAL AND FECAL COLIFORMS AND FECAL STREPTOCOCCI

INVESTIGATOR:

Howard Kator, Associate Marine Scientist

PROJECT SUMMARY:

The hypothesis is being tested that conditions within the Chesapeake Corporation may be conducive for the generation of indicator bacteria and/or for the enhanced survival of indicator bacteria in the upper York River. Levels of indicator bacteria, including total and fecal coliforms and fecal streptococci, are being determined in water samples from the plant and river. Additionally, the species composition of bacteria which comprise "fecal coliforms" are being measured at selected locations and time periods. Levels of total heterotrophic bacteria are being measured as a general indicator of microbial activity.

STATUS: Active.

FINANCIAL SUPPORT:

The Chesapeake Corporation of Virginia
Virginia Institute of Marine Science

KEY WORDS: Estuarine bacteria, fecal and total coliform bacteria, pulp mill, water treatment

Department of Microbiology-Pathology
Bacteriology Section

PROJECT TITLE: OUTER CONTINENTAL SHELF BENCHMARK STUDIES - BACTERIAL DISTRIBUTION AND MICRODEGRADATION (BLM)

INVESTIGATORS:

Howard Kator, Associate Marine Scientist
Alex Maccubbin, Graduate Assistant

PROJECT SUMMARY:

The distribution and abundance of total aerobic heterotrophic and petroleum utilizing marine bacteria will be measured in sediments and at selected surface water transect stations. During favorable conditions, the abundance of these bacterial populations will be measured at the surface interface.

In addition, at selected surface transect stations, samples of seawater will be inoculated with sterile crude oil to determine petroleum utilization rates and degradative patterns (of n-paraffins) under ambient and enriched inorganic nutrient regimes.

The most abundant heterotrophic and hydrocarbon oxidizing bacteria will be isolated from water and sediment samples, identified to genus level, and assayed with respect to growth rates on simple organic substrates in the presence of crude oils.

Finally, experiments will be performed to measure the effects of crude oil on degradation of cellulose and chitin using isolates from the study area.

STATUS: Active. This is a subproject of the project "Environmental Data Acquisition and Analysis, Mid-Atlantic OCS".

FINANCIAL SUPPORT:

U. S. Department of the Interior (Bureau of Land Management)
Virginia Institute of Marine Science

KEY WORDS: Marine bacteria, petroleum degradation

Department of Microbiology-Pathology
Bacteriology Section

PROJECT TITLE: DEGRADATION OF PETROLEUM BY MARINE BACTERIA (BLM)

INVESTIGATOR:

Alexander E. Maccubbin, Graduate Student

PROJECT SUMMARY:

The degradation of petroleum by bacteria from mid-Atlantic outer continental shelf waters in open and closed systems is being investigated. The rate of degradation, compounds being degraded, changes of the bacterial populations in terms of numbers and species composition, and the effects of nutrient levels and temperature are being explored. Rates are being determined for degradation of the n-paraffin and aromatic fractions of the crude oil by using gravimetric measurements. The compounds being degraded are determined by gas-chromatography and mass spectrometry. Changes in numbers are being determined by the MPN technique and species composition is being established through numerical taxonomy. A series of experiments is being conducted at various temperature and nutrient levels to evaluate their effect on the bacterial populations.

STATUS: Active. This project represents Maccubbin's dissertation research.

FINANCIAL SUPPORT:

U. S. Department of Interior (Bureau of Land Management)
Virginia Institute of Marine Science

KEY WORDS: Degradation, gas chromatography, mass spectrometry, numerical taxonomy, species composition

Department of Microbiology-Pathology
Parasitology Section

PROJECT TITLE: STUDIES TO DETERMINE THE EFFECTS OF KEPONE ON SELECTED SPECIES OF CHESAPEAKE BAY FISHES

INVESTIGATOR:

David E. Zwerner, Assistant Marine Scientist

PROJECT SUMMARY:

A histopathological approach is being used to determine whether or not selected species of naturally occurring finfishes are affected by the insecticide Kepone and if they are to determine the nature and extent of the effect. Selected tissues sampled from those fishes analyzed for Kepone are being processed for histological examination. Fishes were collected from the James, York, Rappahannock, and Potomac Rivers and from the lower Chesapeake Bay. Comparisons of tissues from fishes with non-detectable quantities of Kepone, the controls, and those fishes with high levels of Kepone, the test animals, are being made. It is hoped that gross tissue changes, if present, will be evident with this technique. Relating Kepone load to lesions or a series of tissue alterations with any certainty requires not only an abundance of data to satisfy statistical rules of evidence but also the ability to recognize the normal condition with its variances due to differences in sex, age, season, etc. Work towards a total understanding of the processes continues. A great quantity of material has been and is being collected; much remains to be analyzed for Kepone and prepared for histological examination. In addition to the histological examination, all fishes are being checked for gut parasites. It is hoped that qualitative and quantitative changes in parasite fauna as related to Kepone load might tell us something about the effects of Kepone on the parasites, intermediate hosts, and susceptibility of the fishes to parasites.

Laboratory studies are being conducted to supplement the information derived from the above-mentioned field studies.

STATUS: Active.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science

KEY WORDS: Fishes, histopathology, Kepone, parasites

PROGRAM 2:

Biological Resources of the Coastal Zone

PROJECT TITLE: AN INVESTIGATION OF THE SEED OYSTER RESOURCES IN VIRGINIA AND TECHNICAL DEVELOPMENT OF GEAR TO HARVEST OYSTERS

INVESTIGATORS:

Dexter S. Haven, Department Head and Senior Marine Scientist
Joseph G. Loesch, Associate Marine Scientist
James P. Whitcomb, Assistant Marine Scientist

PROJECT SUMMARY:

The objectives of this project were: (1) to determine through sub-sampling with patent tongs the magnitude of Virginia's seed oyster resources in the James, Great Wicomico and Piankatank rivers; (2) to modify and test an oyster harvester developed previously at the Virginia Institute of Marine Science; and (3) to demonstrate the oyster harvester to dealers, growers and processors.

STATUS: A final report was submitted to the VMRC and NMFS entitled "An Investigation of the Seed Oyster Reserves in Virginia, and Testing and Modifying Gear to Harvest Oysters". The harvester was demonstrated.

A descriptive brochure on the oyster harvester is being prepared. Technical papers are being written.

FINANCIAL SUPPORT:

National Oceanic and Atmospheric Administration
(National Marine Fisheries Service) PL 88-309
Virginia Institute of Marine Science
Coastal Plains Regional Commission

KEY WORDS: Harvester, James River, seed oysters

PROJECT TITLE: THE PRESENT AND THE POTENTIAL PRODUCTIVITY OF BAYLOR GROUNDS IN VIRGINIA

INVESTIGATORS:

Dexter S. Haven, Department Head and Senior Marine Scientist
James P. Whitcomb, Assistant Marine Scientist
Paul C. Kendall, Research Assistant

PROJECT SUMMARY:

The present and potential productivity of Baylor Grounds in Virginia is to be determined. During this study a boat will be navigated along transects with the aid of navigational gear and the bottom type determined using an underwater microphone and a sounding pole. Charts will be prepared showing bottom types suitable for oysters, soft clams and hard clams.

STATUS: Active.

FINANCIAL SUPPORT:

National Oceanic and Atmospheric Administration
(National Marine Fisheries Service)
Virginia Institute of Marine Science

KEY WORDS: Baylor Grounds, fisheries management, hard clam, mariculture, productivity of oysters, soft clam

PROJECT TITLE: PLANS FOR MANAGEMENT OF THE FISHERIES OF THE TIDAL POTOMAC RIVER

INVESTIGATORS:

Jackson Davis, Assistant Director and Head, Division of Fisheries Science and Services
Dexter Haven, Department Head and Senior Marine Scientist
Klaus Drobeck*
Elgin A. Dunnington*

PROJECT SUMMARY:

Suggest management plans for the fisheries of the tidal Potomac. One option (Plan I) would expand the oyster fishery to make greater use of the tremendous potential of the Potomac as a growing area by leasing barren bottom for privately financed aquaculture. The natural oyster bottoms would be held in the public domain under management much as it now exists. A second option (Plan II) would continue the public fishery as it is now managed. The soft clam fishery would be managed as it is at present and consideration would be given to development of a fishery for brackish water clams in the future. Slight modification of size limits on crabs is recommended to increase the value of the catch. No fundamental change is recommended in the finfishery, though some regulations might be changed to maximize the yield.

STATUS: Active.

FINANCIAL SUPPORT:

Chesapeake Biological Laboratory
Virginia Institute of Marine Science

PUBLICATION:

Davis, J. et al. 1976. Plans for management of the fisheries of the tidal Potomac River. SRAMSOE No. 117, Virginia Institute of Marine Science.

KEY WORDS: Blue crab finfisheries, clam, oyster fishery

*University of Maryland

PROJECT TITLE: A SURVEY IN THE LAFAYETTE RIVER FOR OYSTERS, CLAMS AND SHELL IN THE VICINITY OF THE PROPOSED GRANBY STREET BRIDGE

INVESTIGATORS:

Dexter S. Haven, Department Head and Senior Marine Scientist
Paul C. Kendall, Research Assistant

PROJECT SUMMARY:

The leased oyster bottoms were studied in the Lafayette River prior to the construction of the Granby Street Bridge. A survey is planned after construction is completed.

STATUS: Active.

FINANCIAL SUPPORT:

The Virginia Department of Highways and Transportation
Virginia Institute of Marine Science

KEY WORDS: Construction impact, Lafayette River, leased oyster bottoms, oyster culture

PROJECT TITLE: UPTAKE OF KEPONE FROM BOTTOM SEDIMENTS BY FIVE SPECIES OF INVERTEBRATES

INVESTIGATORS:

Reinaldo Morales-Alamo, Assistant Marine Scientist
Dexter S. Haven, Department Head and Senior Marine Scientist

PROJECT SUMMARY:

Five species of molluscs will be held in troughs of flowing sea water. Sediments containing Kepone will be added at known rates. At regular intervals, meats of these molluscs will be analyzed for Kepone.

STATUS: Active. This is one of four parts of a grant supervised by the Department of Ecology-Pollution.

FINANCIAL SUPPORT:

Environmental Protection Agency
Virginia Institute of Marine Science

KEY WORDS: Kepone, molluscs, sediments, uptake

PROJECT TITLE: SURVEYS ON PUBLIC ROCKS OF OYSTER MORTALITY AND DENSITIES, SEASONAL SPATFALL STUDIES, AND STUDIES OF OYSTER DRILL ABUNDANCE

INVESTIGATORS:

Dexter S. Haven, Department Head and Senior Marine Scientist
Paul C. Kendall, Research Assistant

PROJECT SUMMARY:

This study monitors the public oyster rocks in Virginia to evaluate quantities of shell, oysters, and spat. Data are recorded in terms of spat, shell, or oysters per bushel. Data are also collected on predators such as *Urosalpinx cinerea* and mortalities based on box counts.

A second aspect of this program is the monitoring of oyster spatfall in the rivers and tributary creeks. Data are collected weekly at over 90 locations each year beginning in June and ending in October by placing strings of shells in representative locations. After being in the water a week, the shells are removed and taken to the laboratory where attached spat are counted. Survival of set is also monitored by placing bags of shells in representative locations in the spring and counting surviving set in the fall. Results of this study are published weekly.

STATUS: Active.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science

KEY WORDS: Market oysters, mortalities, oyster drill, public rocks, seed oysters, *Urosalpinx cinerea*

PROJECT TITLE: THE RELATION BETWEEN CONDITION INDEX OF OYSTERS AND LEVELS OF KEPONE IN THE MEATS

INVESTIGATOR:

Dexter S. Haven, Department Head and Senior Marine Scientist

PROJECT SUMMARY:

Samples of oysters are taken at intervals from the James River and levels of Kepone determined. Duplicate samples are analyzed for condition index. The data are graphed to show possible relationships.

STATUS: Active. Data have been supplied to regulatory agencies.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science

KEY WORDS: Condition index, James River, Kepone

PROJECT TITLE: A STUDY OF SEASONAL SETTING OF THE AMERICAN OYSTER IN VIRGINIA

INVESTIGATORS:

Dexter Haven, Department Head and Senior Marine Scientist
Paul Kendall, Research Assistant

PROJECT SUMMARY:

Each year seasonal setting of the American Oyster, *Crassostrea virginica* is followed in the principal rivers of Virginia.

The study is based on number of oyster larvae attaching weekly to oyster shells suspended in the water at representative locations. Results are reported bi-weekly during the season in the Institute's Marine Resource Information Bulletin.

STATUS: Continuing.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science

KEY WORDS: Oyster setting in Virginia

PROJECT TITLE:. DISTRIBUTION OF OYSTER DRILLS IN THE JAMES RIVER

INVESTIGATORS:

Dexter S. Haven, Department Head and Senior Marine Scientist
James P. Whitcomb, Assistant Marine Scientist

PROJECT SUMMARY:

Distribution, mortality, and growth of oyster drills were studied in the James River in 1964, 1965, and 1966.

STATUS: Continuing.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science

KEY WORDS: James River, oyster drills

PROJECT TITLE: A STUDY OF THE VIRGINIA OYSTER INDUSTRY

INVESTIGATORS:

Dexter S. Haven, Department Head and Senior Marine Scientist
Paul C. Kendall, Research Assistant
William J. Hargis, Jr., Institute Director

PROJECT SUMMARY:

An in-depth study is being prepared which covers all phases of the Virginia oyster industry from 1931 to 1975.

STATUS: Active. Draft manuscript has been prepared.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science

KEY WORDS: Fisheries management, mariculture, Virginia oyster industry

PROJECT TITLE: SEASONAL CHANGES IN OYSTER MEAT QUALITY

INVESTIGATORS:

Dexter S. Haven, Department Head and Senior Marine Scientist
Paul C. Kendall, Research Assistant

PROJECT SUMMARY:

Surveys of the principal public oyster rocks are made at intervals during the year to determine quality of the meats of oysters. This is determined monthly at 14 locations. Results are reported in the Institute's Marine Resource Information Bulletin.

STATUS: Active.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science

KEY WORDS: Meat quality, oyster surveys

PROJECT TITLE: STUDY OF THE ECOLOGY OF THE SOFT CLAM, *MYA ARENARIA*

INVESTIGATORS:

Dexter S. Haven, Department Head and Senior Marine Scientist
Jon Lucy, Graduate Student

PROJECT SUMMARY:

The ecology of the soft clam, *Mya arenaria*, was studied at two stations in the York River, Virginia. One aspect of this study was to investigate time of setting and the abundance of juveniles during the first year. Also, included in the program was an investigation of the gonadal cycle and a study of the relation between the substrate and depth of burial. Growth studies were also included.

STATUS: This project represents Lucy's thesis research.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science

KEY WORDS: Ecology, *Mya arenaria*, soft clam

PROJECT TITLE: BIOLOGY OF DECAPOD CRUSTACEA OF NORFOLK CANYON WITH EMPHASIS ON THOSE OF COMMERCIAL IMPORTANCE

INVESTIGATORS:

P. A. Haefner, Jr., Associate Marine Scientist
W. A. Van Engel, Department Head and Senior Marine Scientist

PROJECT SUMMARY:

Objectives are (1) to determine composition and spatial distribution of decapod communities in the Norfolk Canyon and to compare them with communities from a nearby "open slope" area and from the contiguous continental shelf adjacent to Chesapeake Bay, (2) to investigate biological aspects such as reproduction and intermolt cycle, of selected dominant species in order to recognize seasonal patterns, (3) to obtain as much biological data as possible from less dominant and rare species, and (4) to relate these data to the measured environmental parameters. Data for four seasons have been collected; data reduction is continuing.

The dominant decapods include four species of known commercial importance: American lobster, *Homarus americanus*; red crab, *Geryon quinquedens*, jonah crab, *Cancer borealis* and rock crab, *C. irroratus*. A fifth species *Bathynectes superbus* is a portunid crab of doubtful commercial value.

STATUS: Active. This project was initiated June 1973 and has the potential of future sampling in association with the project on the ecology of fish communities on Norfolk Canyon, J. A. Musick, Principal Investigator. Four papers have been published; four are in press; two manuscripts are in preparation; one thesis has been completed.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science
National Science Foundation
University of Virginia, Institutional Subgrant Program

PUBLICATIONS:

Haefner, P. A., Jr. 1977. Reproductive biology of the female deep-sea red crab, *Geryon quinquedens*, from the Chesapeake Bight. Fish. Bull. (in press).

Haefner, P. A., Jr. 1976. Distribution, reproduction and molting of the rock crab, *Cancer irroratus* Say, 1917, in the mid-Atlantic Bight. J. Nat. Hist. 10(4): 377-397.

Haefner, P. A., Jr. 1976. Distribution, reproduction and molting of the jonah crab, *Cancer borealis*, in the mid-Atlantic Bight. J. Nat. Hist. (in press).

Laird, C. E., E. G. Lewis and P. A. Haefner, Jr. 1976. Occurrence of *Munida forceps* A. Milne Edwards, 1880 and *Munidopsis bermudezi* Chace, 1939 (Decapoda: Anomura: Galatheidae) in the Chesapeake Bight of the western North Atlantic Ocean. Fish. Bull. 74(2): 462-463.

Lewis, E. G. 1976. Relative growth and sexual maturity of *Bathynectes superbus* (Costa) (Decapoda: Portunidae). J. Nat. Hist. (in press).

Lewis, E. G. 1976. Epizoites associated with *Bathynectes superbus* (Costa). Fish Bull. 74(1): 225-227.

Lewis, E. G. and P. A. Haefner, Jr. 1976. Intraspecific setal variation in *Bathynectes superbus* (Costa). Crustaceana (in press).

Lewis, E. G. 1975. Contributions to the biology of *Bathynectes superbus* (Costa) (Decapoda: Portunidae) from the Chesapeake Bight of the Western North Atlantic. M. A. Thesis, College of William and Mary, Williamsburg, Va. 176 p.

Haefner, P. A., Jr. and J. A. Musick. 1974. Observations on distribution and abundance of red crabs in Norfolk Canyon and adjacent continental slope. Mar. Fish. Rev. 36(1): 31-34.

KEY WORDS: American lobster, *Bathynectes superbus*, *Cancer borealis*, *Cancer irroratus*, continental shelf, continental slope, crabs, crustaceans, *Geryon quinquedens*, *Homarus americanus*, jonah crab, Norfolk Canyon, portunid crabs, red crabs, rock crab

PROJECT TITLE: GROWTH, ABUNDANCE AND DISTRIBUTION OF THE JONAH CRAB, *CANCER BOREALIS*, IN NORFOLK CANYON AND ADJACENT SLOPE

INVESTIGATORS:

Paul A. Haefner, Jr., Associate Marine Scientist
Richard K. Carpenter, Graduate Student

PROJECT SUMMARY:

The size at sexual maturity, abundance, and distribution of the Jonah crab in Norfolk Canyon and the adjacent slope is under investigation. Data collection is complete; data reduction is in progress.

STATUS: Active. This project represents Carpenter's thesis research.

FINANCIAL SUPPORT:

National Science Foundation
Virginia Institute of Marine Science

KEY WORDS: *Cancer borealis*, crabs, fisheries, Norfolk Canyon

PROJECT TITLE: BIOLOGY AND MANAGEMENT OF THE AMERICAN LOBSTER (*HOMARUS AMERICANUS*)

INVESTIGATORS:

W. A. Van Engel, Department Head and Senior Marine Scientist
Paul A. Haefner, Jr., Associate Marine Scientist
Robert E. Harris, Jr., Research Assistant
James R. Bloom, Jr., Graduate Assistant

PROJECT SUMMARY:

The objectives of this study are to obtain catch and effort data from the American lobster fishery and to describe some of the biological characteristics of the lobster stocks on the continental shelf and in canyons at the edge of the shelf off Virginia. This information will be used in guiding management of the resource.

STATUS: Active. This project was initiated in June 1974.

FINANCIAL SUPPORT:

National Oceanic and Atmospheric Administration
(National Marine Fisheries Service)
Virginia Institute of Marine Science

KEY WORDS: American lobster, biological characteristics, canyons, catch and effort, continental shelf, fishery, *Homarus americanus*

PROJECT TITLE: DISTRIBUTION, ABUNDANCE AND BIOLOGY OF THE ROCK CRAB, *CANCER IRRORATUS* IN THE CHESAPEAKE BAY AND COASTAL WATERS OF VIRGINIA

INVESTIGATORS:

W. A. Van Engel, Department Head and Senior Marine Scientist
Paul A. Haefner, Jr., Associate Marine Scientist

PROJECT SUMMARY:

A composite of information on distribution, abundance, biology and morphometry of the rock crab, obtained from studies in the Chesapeake Bay and continental shelf waters, has been assembled. Data reduction is in progress.

STATUS: Active. One paper and three advisories have been published. Two theses have been completed.

FINANCIAL SUPPORT:

National Oceanic and Atmospheric Administration
(Office of Sea Grant Program)
Virginia Institute of Marine Science

PUBLICATIONS (as of 1974):

Haefner, P. A., Jr. 1976. A comparison of three commonly misidentified edible crabs of the Atlantic coast. VIMS Marine Resources Advisory Series No. 10, 3 p.

Haefner, P. A., Jr. 1976. Distribution, reproduction and molting of the rock crab, *Cancer irroratus*, in the mid-Atlantic Bight. Journal of Nat. Hist. 10(4): 377-397. VIMS Contribution No. 689.

Haefner, P. A., Jr. and W. A. Van Engel. 1975. Aspects of molting, growth and survival of male rock crabs, *Cancer irroratus*, in Chesapeake Bay. Chesapeake Science 16(4): 253-265. VIMS Contribution No. 669.

Van Engel, W. A. and P. A. Haefner, Jr. 1975. Discoloration in rock crabs: what to do about it. VIMS Marine Resources Advisory Series No. 9, 1 p.

KEY WORDS: *Cancer irroratus*, Chesapeake Bay, continental shelf, crabs, crustaceans

PROJECT TITLE: THE DECAPOD CRUSTACEANS OF THE VIRGINIA PORTION OF CHESAPEAKE BAY AND ITS TRIBUTARIES AND THE EAST COAST BAYS OF THE EASTERN SHORE

INVESTIGATORS:

W. A. Van Engel, Department Head and Senior Marine Scientist
Paul A. Haefner, Jr., Associate Marine Scientist

PROJECT SUMMARY:

Information on the distribution, abundance, general ecology, and biology of decapod crustaceans is being obtained from the Virginia portion of the Chesapeake Bay and its tributaries and the east coast bays of the Eastern Shore of Virginia. Field sampling has been conducted with a variety of gear. Collecting for penaeids, sand shrimp (*Crangon septemspinosa*) and xanthids has been underway for several years. From now on, sampling sites will be randomly chosen, stratified by depth, and carried out in four seasons.

STATUS: Continuing. Two papers have been published. Further support pending.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science

PUBLICATION:

Haefner, P. A., Jr. 1976. Seasonal distribution and abundance of sand shrimp, *Crangon septemspinosa*, in the York River-Chesapeake Bay estuary. Chesapeake Sci. 17(2):131-134.

KEY WORDS: Chesapeake Bay, *Crangon septemspinosa*, crustaceans, Eastern Shore, ecology, sand shrimp, shrimp, xanthids.

PROJECT TITLE: THE BLUE CRAB OF CHESAPEAKE BAY

INVESTIGATOR:

W. A. Van Engel, Department Head and Senior Marine Scientist
Paul A. Haefner, Jr., Associate Marine Scientist

PROJECT SUMMARY:

Information on the relative magnitude and value, historical and current situation, biology of the blue crab, commercial fishery catch and methods of fishing, fluctuations in abundance, estimates of population size, parent-progeny relationship, and management of the blue crab stocks of the Chesapeake Bay and of the bays of the ocean side of the Eastern Shore of Virginia and Maryland are being summarized.

STATUS: Active. A manuscript is in preparation.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science

KEY WORDS: Blue crabs, *Callinectes sapidus*, crabs, crustaceans, seafood industry

PROJECT TITLE: STUDY OF THE VIRGINIA WINTER DREDGE FISHERY FOR BLUE CRABS

INVESTIGATORS:

W. A. Van Engel, Department Head and Senior Marine Scientist
Mark E. Chittenden, Jr.*

PROJECT SUMMARY:

The objective of this project is to determine the effects of the Virginia winter dredge fishery on blue crab stocks of the Chesapeake Bay.

The winter dredge fishery of 1969-1970 was investigated and described to serve as a guide for development of a research program. A series of possible programs was drawn up to estimate costs and benefits of different studies.

A program was selected to provide information on population size, total catch, and fishing mortality of blue crab stocks vulnerable to the 1970-71 winter dredge fishery in Chesapeake Bay. Data were tabulated and transferred to IBM cards to permit computer analysis.

STATUS: A manuscript is now in preparation.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science

KEY WORDS: Blue crab, *Callinectes sapidus*, crabs, crustaceans, dredge fishery, population dynamics

*Dr. Mark E. Chittenden, Jr., former VIMS Scientist, Department of Wildlife and Fisheries Sciences, Texas A&M University, College Station, Texas 77843.

PROJECT TITLE: DEVELOPMENT OF ESTIMATES OF RELATIVE ABUNDANCE OF JUVENILE AND ADULT CRABS

INVESTIGATOR:

W. A. Van Engel, Department Head and Senior Marine Scientist

PROJECT SUMMARY:

Monthly trawl surveys are made using R/V *Pathfinder* or R/V *Langley* at stations on the York (4 stations), James (4 stations), and Rappahannock (5 stations) rivers, to obtain estimates of relative abundance of juvenile and adult blue crabs. Information is obtained that may be used to make estimates of: seasonal distribution, longitudinal distribution, sex composition, growth and mortality, and movements of blue crabs. General hydrographic data are obtained at each station.

Weekly pushnet surveys are made during April-November at stations located off VIMS' beach to obtain estimates of relative abundance of juvenile blue crabs. General hydrographic data are obtained each sampling day.

Forecasts of abundance of harvestable blue crabs are issued to the industry each year.

STATUS: Continuing.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science

KEY WORDS: Blue crabs, *Callinectes sapidus*, crabs, crustaceans, James River, prediction, Rappahannock River, York River

PROJECT TITLE: THE DEPENDENCY OF BLUE CRABS (*CALLINECTES SAPIDUS*) ON WETLANDS

INVESTIGATORS:

W. A. Van Engel, Department Head and Senior Marine Scientist
Paul A. Haefner, Jr., Associate Marine Scientist

PROJECT SUMMARY:

The role of wetlands in the life history of the blue crab will be investigated. Literature review and sampling methodology are the present areas of concentration.

STATUS: Active.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science
Additional support being sought.

KEY WORDS: Blue crab, *Callinectes sapidus*, wetlands

PROJECT TITLE: ALTERNATIVE MANAGEMENT SCHEMES FOR THE SURF CLAM FISHERY

INVESTIGATORS:

Jackson Davis, Assistant Director and Head, Division of Fisheries Science and Services
N. Bartlett Theberge, Associate Marine Scientist in Ocean and Coastal Law
John Gates*

PROJECT SUMMARY:

The purpose is to reexamine alternative schemes for managing the surf clam fishery in the light of the Fisheries Conservation and Management Act of 1976 and recent changes in the fishery. The three schemes previously developed by Davis, Gates, and Theberge were accepted by the Surf Clam Sub-board of the N. E. Fisheries Council. All three schemes would limit entry in the fishery and would assign property rights to the resource. Two of the schemes focus on limitation of effort while the other focuses directly on the resource through assignment of catch rights.

STATUS: Active. Review and revision to be completed by March 31, 1977.

FINANCIAL SUPPORT:

National Oceanic and Atmospheric Administration
(National Marine Fisheries Service, State Federal Program)

KEY WORDS: Catch rights, jurisdictional, management schemes, surf clams

*Economist, University of Rhode Island

PROJECT TITLE: BIOLOGY AND MANAGEMENT OF MID-ATLANTIC ANADROMOUS FISHES UNDER EXTENDED JURISDICTION

INVESTIGATORS:

J. G. Loesch, Associate Marine Scientist
J. V. Merriner, Senior Marine Scientist
W. J. Davis, Head, Division of Fisheries Science and Services
W. H. Kriete, Research Assistant

PROJECT SUMMARY:

Objectives of the project are: (1) collect catch and effort statistics from the inshore river herring and American shad fishery in North Carolina and Virginia; (2) derive estimates of population parameters such as age, size, mortality, sex ratio, etc. for the inshore river herring and shad fishery; (3) determine index of abundance for juvenile river herring and shad in North Carolina and Virginia; (4) pilot evaluation of the drift-net and dip-net fishery for river herring and shad in Virginia; (5) determine distribution, relative abundance, and biological attributes of anadromous fishes in the mid-Atlantic coastal region; (6) monitor foreign fishing activity and examine the catch for species composition and biological information; (7) collect river herring and shad for laboratory analysis of pollutant body burden in Virginia; (8) determine offshore distribution and migration of sturgeon in North Carolina and Virginia, determine if shortnose sturgeon still exist in the inshore areas of North Carolina and Virginia and evaluate aspects of life history of Atlantic sturgeon and its incidence in the inshore fishery in Virginia; (9) estimate size of the river herring population utilizing the Scuppernong River, North Carolina; (10) determine spawning areas utilized by alosine fishes in the Albemarle Sound area, North Carolina; (11) develop management alternatives for use by state and federal fishery management agencies pertaining to the anadromous species studied under the proposed research program.

STATUS: Three year project; commenced 1 November 1976.

FINANCIAL SUPPORT:

National Oceanic and Atmospheric Administration
(National Marine Fisheries Service)
U. S. Fish and Wildlife Service
Virginia Institute of Marine Science
North Carolina Department of Natural and Economic Resources

KEY WORDS: Alosa, anadromous, kepone, mid-Atlantic, population dynamics, river herring, shad, sturgeon

PROJECT TITLE: LIFE HISTORY ASPECTS OF THE GREY TILEFISH, *CAULOLATILUS MICROPS*

INVESTIGATORS:

John V. Merriner, Department Head and Senior Marine Scientist
Jeffrey Ross, Graduate Assistant

PROJECT SUMMARY:

This study is being undertaken in collaboration with the National Marine Fisheries Service-Atlantic Estuarine Research Center in Beaufort, North Carolina (Offshore Bottom Fishery Task, Dr. Gene Huntsman). This species is an important member of the northern tropical reef community and is harvested in the recreational fishery. Project objectives include evaluation of aging methods, reproductive biology, length-weight relationships, and food habits. Samples are obtained from the "head-boat" sport fishery between Charleston, South Carolina and Hatteras, North Carolina, and experimental cruises conducted by National Marine Fisheries Service in North Carolina waters.

STATUS: Active. This project represents Ross' thesis research.

FINANCIAL SUPPORT:

National Oceanic and Atmospheric Administration, (NMFS),
(Atlantic Estuarine Research Center)
Virginia Institute of Marine Science

KEY WORDS: Continental shelf, ecology, life history, tilefish

PROJECT TITLE: FECUNDITY RELATIONSHIPS OF RIVER HERRINGS, PUFFER, AND WHITE PERCH IN VIRGINIA RIVERS

INVESTIGATOR:

John V. Merriner, Department Head and Senior Marine Scientist

PROJECT SUMMARY:

Ovaries are being processed to obtain fecundity estimates for alewife, blueback, northern puffer, and white perch from Virginia rivers. Data will be related to age, weight, and length of fish. Results will be related to an overall ecological study of life history of estuarine fishes. Other estuarine species will be analyzed upon completion of the present study.

STATUS: Continuing.

FINANCIAL SUPPORT:

National Oceanic and Atmospheric Administration
(National Marine Fisheries Service)
Virginia Institute of Marine Science

PUBLICATION:

Merriner, J. V. and J. L. Laroche. Fecundity of the northern puffer, *Sphoeroides maculatus*, from Chesapeake Bay. Chesapeake Science.

KEY WORDS: Alewife, *Alosa* spp., Alosids, eggs, estuaries, fishes, life cycles, *Morone americana*, puffer, river herring, *Sphoeroides maculatus*, white perch

PROJECT TITLE: MANAGEMENT OF COWNOSE RAYS, *RHINOPTERA BONASUS* (SGP)

INVESTIGATORS:

John V. Merriner, Department Head and Senior Marine Scientist
Robert K. Dias, Assistant Marine Scientist
Robert J. Orth, Associate Marine Scientist

PROJECT SUMMARY:

Cownose rays, seasonally abundant in Chesapeake Bay during the summer and early fall, are destructive of shellfish resources and eelgrass beds. Ray life history, ecology, and feeding behavior are being investigated, as well as short-term and long-term protective mechanisms to protect resources from decimation by cownose rays. Utilization of cownose rays to produce an edible seafood product will be explored on a small scale. Project results will provide information necessary to the proper management of the cownose ray resources and will be of use to oyster growers, commercial fishermen and state management agencies.

STATUS: Active.

FINANCIAL SUPPORT:

National Oceanic and Atmospheric Administration
(National Sea Grant Program)
Virginia Institute of Marine Science

KEY WORDS: Cownose rays, eelgrass, shellfish

PROJECT TITLE: THE BIOLOGY OF THE COWNOSE RAY, *RHINOPTERA BONASUS* (MITCHILL 1815), IN THE VIRGINIAN PORTION OF THE CHESAPEAKE BAY (SGP)

INVESTIGATORS:

John V. Merriner, Department Head and Senior Marine Scientist
Joseph W. Smith, Graduate Assistant

PROJECT SUMMARY:

Cownose ray feeding habits result in the destruction of commercially important shellfish and the disruption of fin- and shellfish nursery areas but little is recorded in the literature on the biology of this species. Aerial reconnaissance and biological sampling from commercial fishing gear will help define distribution throughout the Bay. Age and growth, stomach and intestinal contents, reproduction, and parasites will be analyzed. Results of this investigation will help elucidate the life history of the cownose ray while in the Bay and will hopefully aid the commercial shellfish grower in abating the problem of cownose ray predation upon commercially important shellfish beds.

STATUS: Active. This project represents Smith's thesis research.

FINANCIAL SUPPORT:

National Oceanic and Atmospheric Administration
(National Sea Grant Program)
Virginia Institute of Marine Science

KEY WORDS: Cownose ray, eelgrass, life history, *Rhinoptera bonasus*, shellfish predation

PROJECT TITLE: FACTORS ASSOCIATED WITH ACCURACY IN SAMPLING FISH EGGS AND LARVAE

INVESTIGATORS:

J. V. Merriner, Department Head and Senior Marine Scientist
G. C. Grant, Associate Marine Scientist
B. Neilson, Associate Marine Scientist
R. B. Pagoria, Assistant Marine Scientist

PROJECT SUMMARY:

Research program will 1) evaluate and describe the biological and physical features of aquatic ecosystems which affect obtaining of accurate samples of fish eggs and larvae, 2) list the types of gear used and assess their accuracy in obtaining samples of fish eggs and larvae in relation to power generation facilities and, 3) compile a list of factors to be maximized in sampling gear. An ichthyoplankton gear and sampling handbook will be prepared for use by resource management personnel, program administrators, and researchers.

STATUS: Active.

FINANCIAL SUPPORT:

U. S. Fish and Wildlife Service
(National Power Plant Team)
Virginia Institute of Marine Science

KEY WORDS: Entrainment, fish eggs, fish larvae, power plant

PROJECT TITLE: ECOLOGICAL STUDY OF THE TIDAL SEGMENT OF THE JAMES RIVER ENCOMPASSING HOG POINT: ICHTHYOPLANKTON ENTRAINMENT

INVESTIGATORS:

John V. Merriner, Department Head and Senior Marine Scientist
A. Deane Estes, Research Assistant

PROJECT SUMMARY:

Fish eggs and larvae entrained by the VEPCO Surry Nuclear Power Station intake pumps and the plants heated discharge effluent are being assessed. Plant entrainment sampling is conducted over 24 hour periods with paired 0.5 m nets (505 μ) at the intake and discharge. Heated discharge effluent (Plume) sampling is conducted in the heated effluent and a control area with the same nets (0.5 m; 505 μ).

When the plant is not operational, samples to assess mechanical damage by the intake pumps are taken in lieu of plume samples. Samples are taken on both sides of the intake pumps and specimens are examined immediately for obvious damage.

STATUS: Active.

FINANCIAL SUPPORT:

Virginia Electric & Power Company
Virginia Institute of Marine Science

PUBLICATION:

Manuscript in review: "The occurrence of *Elops saurus* larvae in low salinity waters and a new record for Chesapeake Bay." by J. J. Govoni and J. V. Merriner.

KEY WORDS: Entrainment, fish eggs, fish larvae, ichthyoplankton, James River, mechanical damage, plant, plume, VEPCO Surry Nuclear Power Station

PROJECT TITLE: ARTIFICIAL REEF PROGRAMS IN VIRGINIA

INVESTIGATORS:

John V. Merriner, Department Head and Senior Marine Scientist
Mike Meier*

PROJECT SUMMARY:

Passage of P. L. 92-402 has resulted in the formulation of a proposed state program. Activities are being coordinated through the Virginia Marine Resources Commission. Provision is being made to coordinate and integrate existing reef associations within Virginia through the program. Reef structures and sites are being selected and proposed to provide benefits to offshore, nearshore, and Bay fisheries.

A test reef will be constructed in the Lower York River from automobile tires to evaluate the effectiveness of artificial reefs inside Chesapeake Bay. Scuba census, creel census, and hook and line survey data will be obtained from the reef and a control area.

STATUS: Continuing.

FINANCIAL SUPPORT:

Virginia Marine Resources Commission
Virginia Institute of Marine Science

KEY WORDS: Estuaries, fisheries, fishes, marine ecology

*Virginia Marine Resources Commission

PROJECT TITLE: INDEX OF YEAR CLASS STRENGTH OF FISHES FROM A SUMMER BEACH SEINE SURVEY OF VIRGINIA RIVERS

INVESTIGATOR:

John V. Merriner, Department Head and Senior Marine Scientist

PROJECT SUMMARY:

Selected seine stations in the James, York and Rappahannock rivers were sampled once each two weeks from July through October. Fish lists and a ranking of abundance for each station and each river were compiled. A relative abundance index (average number of fish per tow) allows prediction of future sport and commercial fishing success in these rivers.

STATUS: Continuing. A summary report is being prepared for the 1967-73 data base.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science

KEY WORDS: Estuaries, fishes, nursery grounds, prediction

PROJECT TITLE: ENERGY TRANSFORMATIONS AND FEEDING CHRONOLOGY IN JUVENILE SPOT, *LEIOSTOMUS XANTHURUS*, IN THE YORK RIVER, VIRGINIA

INVESTIGATOR:

John V. Merriner, Department Head and Senior Marine Scientist

PROJECT SUMMARY:

Field and laboratory segments of the study will include documentation of feeding periodicity over 24 hour periods on a monthly schedule (May through October). An energy budget for juvenile *Leiostomus xanthurus* is the overall objective of the study.

STATUS: Active. Summer 1975 data being prepared for publication.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science

KEY WORDS: Energetics, feeding habits, *Leiostomus xanthurus*, spot, York River

Department of Ichthyology
Department of Ecology-Pollution

PROJECT TITLE: DISTRIBUTION OF KEPONE IN MARINE FISHES: ROUTES, RATES, EXTENT

INVESTIGATORS:

J. V. Merriner, Department Head and Senior Marine Scientist
M. E. Bender, Assistant Director
R. Doyle, Laboratory Specialist

PROJECT SUMMARY:

Representative fishes of several trophic levels are being collected from the James River system during the summer and winter trawl surveys. Samples are to be analyzed for Kepone body burden and interpreted relative trophic transfers and energetics. Other studies conducted or planned include young-of-the-year uptake by sciaenids (monthly samples 1976), depuration by sciaenids (croaker), and Kepone effects upon reproduction.

STATUS: Active, continuing.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science

KEY WORDS: Estuary, fishes, James River, pesticide, pollution

PROJECT TITLE: ASPECTS OF THE MATTER/ENERGY UTILIZATION OF EARLY POSTLARVAL SPOT: *LEIOSTOMUS XANTHURUS*

INVESTIGATORS:

John V. Merriner, Department Head and Senior Marine Scientist
John J. Govoni, Graduate Assistant

PROJECT SUMMARY:

The early life history of marine teleostean fishes is marked by extremely high mortality. Mortality of eggs can be attributed to adverse environmental conditions, genetic defects, and predation. Mortality of larvae can be contributed to these factors plus starvation. Larvae appear most vulnerable to starvation at the time of complete yolk sac absorption; the life history stage when larvae undergo a shift from an endogenous to an exogenous food supply. The utilization as well as availability of food substrates of proper size and abundance may be manifest in determining recruitment to the adult populations. The ability of early postlarval marine fishes to utilize food resources when maximally available is not understood and is obviously important before a critical assessment of starvation can be made. This research proposes to determine uptake and retention of carbon as a measure of matter/energy utilization using radiotracer techniques for early postlarval spot, *Leiostomus xanthurus*. The general histology and morphology of the alimentary canal of these larvae will also be examined.

STATUS: Active. This project represents Govoni's dissertation research.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science

KEY WORDS: Fish larvae, *Leiostomus xanthurus*, starvation

PROJECT TITLE: AN ICHTHYOLOGICAL SURVEY OF TWO ATLANTIC COAST BEACHES; SANDBRIDGE BEACH, VIRGINIA AND CAPE HATTERAS, NORTH CAROLINA

INVESTIGATORS:

John V. Merriner, Department Head and Senior Marine Scientist
Robert K. Dias, Graduate Student

PROJECT SUMMARY:

Monthly sampling for 1 year at two Atlantic Coast beaches with a 50 ft. beach seine has been completed. Four duplicate tows were made at each location within each month during each of four sampling periods (sunrise, noon, sunset, midnight). Analyses of data are underway and include a description of the spatial and temporal patterns at the community level, identification of physical factors important to community structure, delineation of major species groupings and their relation to environmental discontinuities, and a description of the seasonal occurrence and relative abundance of species collected.

STATUS: Active. This project represents Dias' thesis research.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science

KEY WORDS: Abundance, community structure, seasonal occurrence, survey

PROJECT TITLE: DEVELOPMENT OF A SONIC TAG SYSTEM FOR EXACT LOCATION OF INDIVIDUAL FISH

INVESTIGATORS:

J. V. Merriner, Department Head and Senior Marine Scientist
C. E. Richards, Assistant Marine Scientist
R. Lovelady*
R. Mayhew*
R. Ferguson*
E. Hoffman*
P. Osborne*

PROJECT SUMMARY:

A prototype system developed by Osborne and Hoffman is being tested. The system involves receiving equipment suspended at two (or more) locations underwater that relay signal reception data to a data base which in turn feeds information to a computer to obtain exact coordinates of the fish location. Transits and radar systems have been used to verify locations.

STATUS: Active. Manuscript in preparation.

FINANCIAL SUPPORT:

National Aeronautics and Space Administration
(Langley Research Center)
Virginia Institute of Marine Science

PUBLICATION:

Osborne, P. W., E. Hoffman, J. V. Merriner, C. E. Richards, and R. W. Lovelady. 1976. Automatic electronic fish tracking system. in Oceans 76: MTS-IEEE Conference, Washington, D. C.

KEY WORDS: Fish, sonic tagging

*NASA, Langley Research Center

PROJECT TITLE: ANALYSIS OF SPORT CATCHES OF STRIPED BASS IN THE LOWER YORK RIVER, 1967 TO 1972

INVESTIGATORS:

J. V. Merriner, Department Head and Senior Marine Scientist
C. E. Richards, Assistant Marine Scientist

PROJECT SUMMARY:

This study includes the collection of sex, length, weight, gonad condition, and catch per unit of effort data to study changes and relate to population changes. The data from 1967-1972 are being drafted into two reports: (1) analyses of sport catches of striped bass in the lower York River, 1967-1972, and (2) hypothetical population system of Atlantic Coast striped bass.

STATUS: Active. Data were collected under a U. S. Fish and Wildlife Service grant.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science

KEY WORDS: Fisheries, population, striped bass

PROJECT TITLE: ANALOG COMPUTATION AND FISH POPULATION STUDIES

INVESTIGATOR:

C. E. Richards, Assistant Marine Scientist

PROJECT SUMMARY:

Simulation of population equations and modeling of multi- or single-species systems is being done. The project includes development of equations to represent systems.

STATUS: Continuing.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science

KEY WORDS: Fish populations, modeling

PROJECT TITLE: ASSESSMENT OF ESTUARINE FISH POPULATIONS

INVESTIGATOR:

Frank J. Wojcik, Assistant Marine Scientist

PROJECT SUMMARY:

(1) To conduct a semi-annual intensive survey of the Chesapeake Bay and lower rivers to determine the abundance and year class success of the migratory marine component, (2) to determine aspects such as mean weights, length, dominance, biomass and areas of greatest productivity through random stratified sampling in mid-June and winter, (3) to issue fishing projections to the commercial and recreational fishery and serve the Commonwealth through identification of key areas of productivity.

STATUS: Continuing, began June 1973.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science

KEY WORDS: Estuaries, fishes, population dynamics

PROJECT TITLE: COMMUNITY ECOLOGY OF ESTUARINE DEMERSAL FISHES IN THE YORK RIVER

INVESTIGATORS:

John A. Musick, Associate Marine Scientist
James Colvocoresses, Graduate Assistant

PROJECT SUMMARY:

A four-year field program of monthly stratified sampling of the lower York River was conducted from March 1971 to December 1974. Supplementary data were collected in a contiguous area as far upstream as West Point from July 1972 to October 1973. The data are being analyzed for trends in seasonal species dominance and diversity, general community and population structure of fishes in the area, and relationships between fish populations and physical parameters.

STATUS: Active. Sampling complete, analysis in progress. This project represents Colvocoresses' dissertation research.

FINANCIAL SUPPORT:

Virginia Electric and Power Company
National Oceanic and Atmospheric Administration
(National Marine Fisheries Service)
Virginia Institute of Marine Science

KEY WORDS: Estuaries, fishes, York River

PROJECT TITLE: STUDY OF THE REPRODUCTIVE BIOLOGY, BEHAVIOR AND POPULATION DYNAMICS OF BLACK SEA BASS (*CENTROPRISTIS STRIATA*)

INVESTIGATORS:

John A. Musick, Associate Marine Scientist
Linda P. Mercer, Graduate Student

PROJECT SUMMARY:

The northern black sea bass is a protogynous hermaphrodite. Females predominate in the smaller size and younger age groups, whereas larger and older fish are usually males. It was postulated that females change into males as they grow larger. This is substantiated by the presence of regressing ovarian tissue in mature testes and developing testicular elements within the ovaries of functional females. Size and age at first maturity are highly variable for both sexes as apparently are size and age at sex reversal for hermaphrodites. Not all individuals are hermaphroditic, some maturing first as male and remaining male, others being female throughout their life. Recent studies have shown that sex reversal in fishes (including serranids) may be controlled by social interactions within the population. Black sea bass have apparently been overharvested in the Middle Atlantic Bight. Landings have dropped sharply in recent years and fewer large and medium size fish are caught. In comparison South Carolina landings have increased due to the increase in fishing effort. Before it is possible to establish sustained yield fisheries for black sea bass it is necessary to know what percent of the population is hermaphroditic or potentially so, what mechanisms control sex reversal and what level of sexual unbalance can be sustained before the reproductive potential of the population becomes limited.

STATUS: Active. This project represents Mercer's dissertation research. All data have been collected and analyzed. Report is in process of being written.

FINANCIAL SUPPORT:

Sport Fishery Research Foundation
Virginia Institute of Marine Science

PUBLICATION:

"Seasonal distribution of black sea bass, *Centropristis striata*, in the Mid-Atlantic Bight with comments on the ecology and fisheries of the species." Trans. Amer. Fish. Soc. Vol. 106.

KEY WORDS: *Centropristis striata*, fishes, population dynamics, sea bass

PROJECT TITLE: ECOLOGY OF THE ELASMOBRANCH FISHES OFF VIRGINIA

INVESTIGATORS:

J. A. Musick, Associate Marine Scientist
W. Raschi, Graduate Assistant

PROJECT SUMMARY:

This project is a continuation of studies begun in 1973 of the seasonal patterns of distribution, abundance and species composition of sharks off Virginia. Life history data are being collected for dominant species. The project: "The biology of the sandbar shark" cited with E. Lawler in this report was derived from the present project.

STATUS: Continuing.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science

KEY WORDS: Ecology, elasmobranch fishes, seasonal distribution

PROJECT TITLE: BIOGEOGRAPHY OF CAPE HATTERAS AREA

INVESTIGATORS:

J. A. Musick, Associate Marine Scientist
J. D. Lazell*

PROJECT SUMMARY:

This project is a long-term study of distribution of plants, reptiles, amphibians, and mammals on the barrier beaches from Cape Henry, Virginia, to Cape Lookout, North Carolina. The study is conducted primarily on weekends.

STATUS: Continuing.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science
Personal

KEY WORDS: Biogeography, Cape Hatteras

*J. D. Lazell, Massachusetts Audubon Society

PROJECT TITLE: ANALYSIS OF THE EFFECT OF EXTENDED JURISDICTION ON THE MID-ATLANTIC SURF CLAM FISHERY

INVESTIGATOR:

N. Bartlett Theberge, Associate Marine Scientist in Ocean and Coastal Law

PROJECT SUMMARY:

On April 13, 1976 the Fisheries Conservation and Management Act of 1976 was signed into law by President Ford. This measure is probably the single most important piece of fisheries legislation ever enacted and will substantially affect the operation of many American coastal fisheries. Consequently the National Marine Fisheries Service has funded a study to determine the effect that extended jurisdiction and fishery management policies will have on previous management alternatives developed by the Surf Clam Technical Committee for the management of the Surf Clam fishery (*Spisula solidissima*).

STATUS: Active. This is a subproject of "Alternative Management Schemes for the Surf Clam Fishery."

FINANCIAL SUPPORT:

National Marine Fisheries Service
Virginia Institute of Marine Science

KEY WORDS: Extended jurisdiction, fishery management, legal studies, surf clam

PROJECT TITLE: PRODUCTION OF SUPERIOR OYSTERS FOR MARICULTURE - A GENETIC BREEDING PROGRAM (SGP)

INVESTIGATORS:

Jay D. Andrews, Department Head and Senior Marine Scientist
John L. Dupuy, Head, Department of Marine Culture
Michael Frierman, Research Assistant

PROJECT SUMMARY:

The objective of this program is to breed, test, and select genetic lines of superior broodstocks of oysters for mariculture in Chesapeake Bay. Several laboratory-bred lines of selected oysters going back to 1964 are available for breeding.

Oysters are selected for rapid growth, superior breeding characteristics, quality of meats and shells, and disease resistance. Progeny testing of pair and group breeding under field conditions is followed by inbreeding and outbreeding to attain broodstocks for hatchery use. Unselected native stocks, both wild and hatchery reared are used as background lots for evaluation of results. Diseases are monitored routinely in test and native stocks.

Hatcheries are being vigorously encouraged to supplement natural seed supplies in Chesapeake Bay because setting has been inadequate in recent years. Mariculture requires that brood stock used in hatcheries exhibit disease-resistance, uniformity of shape and quality, and rapid growth for early marketing (18 to 24 months). Genetic manipulation of seed stocks and use of cultchless spat in hatcheries and nurseries before planting on natural beds are objectives.

STATUS: Active. This program has been active for about ten years. Large genetic variations have been observed, and manipulation of inbred lines to produce hybrid vigor and desired traits is promising. One cupped-shell line with exceptionally vigorous growth is available for outcrosses with other selected lines. Outcrosses in 1975 and 1976 are being monitored now.

FINANCIAL SUPPORT:

National Oceanic and Atmospheric Administration
(National Marine Fisheries Service)
National Oceanic and Atmospheric Administration
(National Sea Grant Program)
Virginia Institute of Marine Science

KEY WORDS: Broodstocks, *Crassostrea virginica*, genetics, hatcheries, mariculture, oysters

PROJECT TITLE: DISTRIBUTION AND EPIZOOTIOLOGY OF SEASIDE DISEASE OF OYSTERS CAUSED BY *MINCHINIA COSTALIS*

INVESTIGATORS:

Jay D. Andrews, Department Head and Senior Marine Scientist
Mike Frierman, Research Assistant

PROJECT SUMMARY:

This disease was described in a paper in 1962 and 14 years of data have been collected since that report. No other laboratories have studied this disease except casually.

Samples of live oysters have been taken each year from trays and in some years from many planted and natural beds for prevalences and distribution. Mortality has been monitored each year in native oysters and susceptible James River imports.

Most samples have been processed into slides but many slides have not been read. Separating plasmodial stages of MSX and SSO is difficult but fortunately the latter organism always progresses into sporulation stages that are distinctive.

Comparisons of MSX and SSO for seasonality, salinity tolerances, life cycle stages, sporulation and distribution are important to the understanding of haplosporidan diseases.

STATUS: Active. Reading of slides and depiction of mortality rates are needed to write an updated report for the past 14 years.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science

KEY WORDS: Disease, epizootiology, oysters, pathology, seaside

PROJECT TITLE: MANAGEMENT OF MOLLUSC LARVAE, SUPPLY OF FOOD, AND SETTING OF LARVAE (SGP)

INVESTIGATORS:

John L. Dupuy, Department Head and Senior Marine Scientist
Nancy Windsor, Research Assistant

PROJECT SUMMARY:

Objectives of this project are: (1) development of methods to produce and handle oyster, clam, Bay scallop, and Calico larvae to post-setting juveniles for field use, (2) development of methods to fatten, condition, and spawn parent stocks, (3) development of two methods for obtaining cultch-free oyster spat, (4) bioassay of phytoplankton isolates for foods for invertebrate larvae, (5) bioassay of "red water" organisms with invertebrate larvae, (6) the application of these methods to hatchery operation, and (7) development of artificial food from analysis of four new species of algae successfully fed to oyster larvae.

STATUS: Continuing. Parts 2, 3, 4, 5 and 6 above have been completed.

FINANCIAL SUPPORT:

National Oceanic and Atmospheric Administration
(National Sea Grant Program)
Virginia Institute of Marine Science

PUBLICATIONS:

Dupuy, J. L. 1977. Handbook for design and operation of an oyster seed hatchery. In press.

Dupuy, J. L. 1975. The translation of mariculture research to viable commercial culture systems. Proc. 7th Annual Sea Grant Conf.: 196-199.

Dupuy, J. L. 1975. Some physical and nutritional factors which affect the growth and setting of larvae of the oyster, *Crassostrea virginica*, in the laboratory. Pages 319-331 in Physiology and Ecology of Estuarine Organisms, F. John Vernberg, Ed., Belle W. Baruch Laboratory, Univ. South Carolina Press, Columbia.

Dupuy, J. L., Rivkin, S. and Ott, F. 1974. A new type of oyster hatchery. Proc. 4th Ann. Workshop of World Mariculture Soc.: 353-368.

KEY WORDS: Cultch-free spat, molluscs, oysters

Department of Microbiology-Pathology
Bacteriology Section

PROJECT TITLE: USE OF AUTORADIOGRAPHY TO DETERMINE THE FATE OF BACTERIA WITHIN THE OYSTER, *CRASSOSTREA VIRGINICA*

INVESTIGATORS:

Howard I. Kator, Associate Marine Scientist
Darbie Lister, Graduate Student*

PROJECT SUMMARY:

Escherichia coli will be labeled with tritiated thymidine, and young oysters, approximately one year old, will be exposed to the labeled bacteria in static aerated tanks. At set time intervals, the oysters will be fixed, sectioned and prepared for autoradiography to determine where bacteria accumulate in the oyster and the rates of accumulation and elimination of the bacteria. Correlative studies using liquid scintillation will also be done. Various tissues will be removed from the oysters, dry combusted, and the tritium counted.

STATUS: Active.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science
College of William and Mary

KEY WORDS: Autoradiography, *Escherichia coli*, oyster depuration

*Graduate program, College of William and Mary.

Department of Microbiology-Pathology
Bacteriology Section

PROJECT TITLE: BACTERIOLOGY OF SHELLFISH GROWING AREAS

INVESTIGATORS:

Frank O. Perkins, Department Head and Senior Marine Scientist
Howard I. Kator, Associate Marine Scientist
Martha Rhodes, Assistant Marine Scientist

PROJECT SUMMARY:

Objectives of this project are: (1) to determine sources of and reasons for high coliform counts in certain Virginia shellfish growing areas, (2) to determine sources, movement, effects, and fate of selected groups of bacteria in shellfish growing areas, and (3) to compare bacteriological methods available for routine monitoring of water quality in shellfish growing areas.

STATUS: Active.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science

KEY WORDS: Bacteriology, oysters, water quality

PROJECT TITLE: MARICULTURE OF THE HARD CLAM, *MERCENARIA MERCENARIA*

INVESTIGATORS:

Michael Castagna, Senior Marine Scientist
John Kraeuter, Associate Marine Scientist

PROJECT SUMMARY:

The objective of this project is to develop practical methods to farm hard clams from brood stock to marketable product. Phases include: (1) development of culture methods to spawn and grow clams from eggs to juveniles, (2) development of methods of growing post set juveniles to a size large enough for field plantings, and (3) development of protection methods to grow clams in the field to market size without serious predation losses.

A pilot size project is still underway, and the clams will probably be ready to market in January or February 1977. Field protection methods are being tested to protect juveniles in field nursery areas. In addition, an analysis of variance experiment has been established to test the components of the system used in growing clams.

Field tests of baffles of several designs were started. These will be simplification or improvements of existing circular or square-panel baffles.

Laboratory experiments to test techniques to improve and optimize the production of seed from the hatchery and grow out facility have been started. These include experiments on the following: egg size correlation to survival; sperm concentration and effect on development (polyspermy); mesh damage to eggs by screens; and effect of increased surface area to volume in larval containers and its effect on survival of larvae.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science

PUBLICATIONS AND TALKS:

There are presently two manuscripts in press, and a talk will be given at the World Mariculture Society meeting in Costa Rica in January 1977.

KEY WORDS: Mariculture, *Mercenaria mercenaria*

PROJECT TITLE: STUDIES ON MARICULTURE OF BAY SCALLOP, *ARGOPECTEN IRRADIANS*

INVESTIGATORS:

Michael Castagna, Senior Marine Scientist
John Kraeuter, Associate Marine Scientist

PROJECT SUMMARY:

The purpose of this project is to develop practical methods to farm bay scallops from brood stock to marketable product. Phases include: (1) development of inexpensive culture methods for handling eggs and growing larvae, (2) development of practical methods of growing post set juveniles to size adequate for field planting, and (3) development of protection and containment methods adequate and practical for growing scallops to market size.

One large scale planting within an enclosure in Bradford's Bay was harvested and counts and measurements taken. Additional enclosures were established to test the effect of pens with and without bottoms and the effects of crowding. Laboratory experiments to test techniques to improve and optimize the production of seed from the hatchery and grow out facility have been started. These include experiments on the following: egg size correlation to survival; sperm concentration and effect on development (polyspermy); mesh damage to eggs by screens; and effect of increased surface area to volume in larval containers and its effect on survival of larvae.

STATUS: Active.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science

KEY WORDS: *Argopecten*, bay scallop, mariculture

PROJECT TITLE: CLAM MARICULTURE MANUAL

INVESTIGATORS:

Michael Castagna, Senior Marine Scientist
John Kraeuter, Associate Marine Scientist

PROJECT SUMMARY:

A manual that describes (in cookbook form) a method of growing clams is needed by scientists and laymen alike. This is apparent by the number of requests received annually. The method for growing clams used at the Eastern Shore Laboratory is a relatively simple and inexpensive method with proven success. Because of its simplicity (even for non-technical personnel), it is well suited for description in a manual.

STATUS: Active. We are presently writing the manual.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science

KEY WORDS: Advisory, clams, manual, mariculture

PROJECT TITLE: NATURAL HISTORY OF *BUSYCON CARICA*

INVESTIGATORS:

John Kraeuter, Associate Marine Scientist
Michael Castagna, Senior Marine Scientist

PROJECT SUMMARY:

This project is to study the life history and recruitment, movement, etc. of the inshore population of *B. carica* commonly found on the western side of the barrier islands near the inlets.

Approximately 750 adults (almost all female) have been collected from an intertidal area of Cedar Island, measured, tagged (with magic marker) and released in the same area. At intervals of several months the area is searched and counts are made of marked and unmarked individuals. Measurements are taken of the marked specimens.

STATUS: Active.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science

KEY WORDS: *Busycon carica*

PROJECT TITLE: BIVALVE CULTURE

INVESTIGATORS:

Michael Castagna, Senior Marine Scientist
John Kraeuter, Associate Marine Scientist

PROJECT SUMMARY:

This project is investigating the feasibility of growing selected pelecypod species in a culture program to learn more about their early life history and to investigate their potential as a commercial species or for experimental purposes.

Spisula have been grown in the hatchery and then placed out in the field to investigate the potential of this species for a steamer type clam.

Mulinia lateralis have been used to investigate the effect of selecting large siblings for spawners to attain larger offspring. Five generations of siblings have been cultured, the largest siblings selected and grown.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science

KEY WORDS: Bivalves, mariculture, *Mulinia*, *Spisula*, surf clam

Wachapreague Laboratory
Department of Environmental Physiology

PROJECT TITLE: GLANCY METHOD OF ALGAL CULTURE

INVESTIGATORS:

Russell Rhodes, Summer Professor
Michael Castagna, Senior Marine Scientist
J. E. Warinner, Assistant Marine Scientist
Paul L. Zubkoff, Senior Marine Scientist

PROJECT SUMMARY:

Although this method of centrifugation and incubation of seawater has been used successfully for years, little is known about it.

Experiments were undertaken to investigate: 1) density of bloom to time relationship cycle of log growth, crash and steady state; 2) spectrophotometric method of measuring algal quantity and quality in the context of a pelecypod larval food; 3) seasonal species composition and ratio before and after incubation; 4) the nutrient cycle in relation to chlorophyll; 5) heterotrophic potential; and 6) methods of influencing species composition by chemical additions.

It was found that at temperatures of 20 to 24°C peak production took place in a tank in about 12 hours. By 24 hours the culture would have crashed.

Attempts to develop a spectrophotometric method of evaluating algal blooms gave evidence that a high ratio of chlorophyll A to B indicated a good quality of larval food. However, the spectrophotometer used in this study proved inadequate to estimate quantity or quality. Species composition and density still required microscopic counts and identification. Due to time limitations this phase of the study will be postponed.

Insufficient data has been gathered to assess the nutrient cycle in relation to chlorophyll and heterotrophic potential. This will continue when time permits.

It was found that naked flagellates and diatoms with scaled or lattice type tests were the preferred food of pelecypod larvae. Some preliminary experiments indicated that clarified incubated seawater which has bloomed and crashed, then inoculated with some centrifuged seawater and $NaNO_3$ would bloom with a predominance of the naked scaled and latticed forms. This was probably due to the original bloom (which crashed) binding the available phosphates, nitrates and silicates making them unavailable. Then with the addition of nitrate the preferred forms could bloom while the diatoms with heavy tests are inhibited by the lack of silicates and phosphates. This then is a simple inexpensive method to partially control species composition. Studies are continuing.

Wachapreague Laboratory
Department of Environmental Physiology

FINANCIAL SUPPORT:

Virginia Institute of Marine Science

KEY WORDS: Algal culture, mariculture

PROGRAM 3:

Biology of Coastal Waters

And Wetlands

PROJECT TITLE: GLYCOGEN METABOLISM IN *CRASSOSTREA VIRGINICA*

INVESTIGATORS:

R. Joel Lowy, Graduate Student
Dexter S. Haven, Department Head and Senior Marine Scientist

PROJECT SUMMARY:

It has long been known from the seasonal variation in glycogen content that carbohydrates are of prime metabolic importance in the oyster. However, little has been done to characterize the free sugars of the hemolymph. The purpose of this study is to examine which carbohydrates are present and, hopefully, determine which one is the animal's "blood sugar". This information would aid future nutritional and physiological studies of this commercially valuable mollusc.

STATUS: Active. This project represents Lowy's thesis research.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science

KEY WORDS: Blood sugar, *Crassostrea virginica*, glycogen metabolism, oyster

PROJECT TITLE: ASPECTS OF STRUCTURE AND GENERAL BIOLOGY OF *MUNIDA IRIS* (ZARIQUIEY) (CRUSTACEA, ANOMURA, GALATHEIDAE)

INVESTIGATORS:

Paul A. Haefner, Jr., Associate Marine Scientist
James R. Bloom, Graduate Assistant

PROJECT SUMMARY:

Seasonal abundance and distribution, general external morphology and morphometrics, reproductive biology and feeding habits of *Munida iris* in the Norfolk Canyon area will be investigated.

STATUS: Active. This project represents Bloom's thesis research.

FINANCIAL SUPPORT:

National Science Foundation
Virginia Institute of Marine Science

KEY WORDS: Anomura, crustaceans, food habits, Galatheidae, morphometrics, *Munida iris*, Norfolk Canyon, reproductive biology

PROJECT TITLE: THE BIOLOGY OF ARCHIBENTHIC AND DEEP-SEA DECAPOD CRUSTACEA FROM NORFOLK CANYON AND THE ADJACENT CONTINENTAL SLOPE

INVESTIGATORS:

Paul A. Haefner, Jr., Associate Marine Scientist
Elizabeth G. Lewis, Graduate Assistant

PROJECT SUMMARY:

This study will describe the non-commercial crustaceans in Norfolk Canyon between the 200 and 2000 m isobaths, with emphasis on bathymetric distribution, reproductive biology, and feeding habits of the major species. Crustacean communities in the Canyon will be compared with communities of a nearby open slope.

STATUS: Active. This project represents Lewis' dissertation research.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science

KEY WORDS: Archibenthos, continental shelf, crustaceans, decapods, deep-sea, Norfolk Canyon

PROJECT TITLE: INCIDENCE OF RHIZOCEPHALAN PARASITES IN GALATHEIDAE COLLECTED IN NORFOLK CANYON

INVESTIGATORS:

Paul A. Haefner, Jr., Associate Marine Scientist
David E. Zwerner, Assistant Marine Scientist, Section of Parasitology
Elizabeth G. Lewis, Graduate Assistant
Nancy T. Windsor, Research Assistant

PROJECT SUMMARY:

Rhizocephalidae parasitizing galatheid crustaceans in the Norfolk Canyon are being identified and the incidence of infestation reported.

STATUS: Active.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science

KEY WORDS: Crustaceans, Galatheidae, Norfolk Canyon, parasites, Rhizocephalidae

PROJECT TITLE: POPULATION DYNAMICS OF CARIDEAN SHRIMP IN THE LOWER YORK RIVER ESTUARY

INVESTIGATORS:

Paul A. Haefner, Jr., Associate Marine Scientist
Michael A. Cavell, Graduate Student

PROJECT SUMMARY:

The interaction of caridean shrimp (*Palaemonetes pugio*, *P. intermedius*, *P. vulgaris* and *Crangon septemspinosa*) commonly occurring in the lower York River estuary is under investigation. Data on population density, length frequency distributions, sex ratios, and reproduction have been obtained monthly for channel, shoal and beach strata over a one-year period of time. Such information will provide some means of evaluating population movements of the species in reference to environmental temperature and salinity. Data collection is complete; a manuscript is in preparation.

STATUS: Active. This project represents Cavell's thesis research.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science

KEY WORDS: Carideans, *Crangon septemspinosa*, crustaceans, *Palaemonetes* sp., shrimp, York River

PROJECT TITLE: A PHYSIOLOGICAL INVESTIGATION OF PHEROMONE-MEDIATED BEHAVIOR IN THE BLUE CRAB, *CALLINECTES SAPIDUS* (SGP)

INVESTIGATORS:

Paul A. Haefner, Jr., Associate Marine Scientist
Richard A. Gleeson, Graduate Assistant

PROJECT SUMMARY:

The role of chemical communication in the courtship and mating of the blue crab and the physiological processes involved will be examined. Behavioral analysis and electrophysiological techniques will be used to ascertain the role of pheromone communication in reproductive interactions and to define the relationship between receptor and behavioral activities.

STATUS: Active. This project represents Gleeson's dissertation research.

FINANCIAL SUPPORT:

National Oceanic and Atmospheric Administration
(National Sea Grant Program)
Sigma Xi, The Scientific Research Society of North America
Virginia Institute of Marine Science

KEY WORDS: Behavior, blue crab, *Callinectes sapidus*, electrophysiology, pheromone

PROJECT TITLE: EFFECTS OF CHRONIC HYDROCARBON POLLUTION ON SALT MARSH COMMUNITIES

INVESTIGATORS:

Michael E. Bender, Head, Division of Environmental Science and Services
Carl H. Hershner, Graduate Assistant

PROJECT SUMMARY:

The project was designed to investigate the effects of repeated doses of a No. 2 fuel oil on a small pocket marsh in the lower Chesapeake Bay. Data were collected on growth, production, and decay of the major grass species. The population sizes and distributions of the gastropod species in the area were monitored. The ichthyofauna was also monitored for population size and diversity. Samples of the benthic infauna were collected regularly for community analyses.

Sampling was conducted in two small marshes, one of which was dosed with oil, the other was used as a control.

STATUS: Reports on several aspects of the project are presently in preparation. The project is part of Hershner's dissertation research.

FINANCIAL SUPPORT:

National Wildlife Federation
American Petroleum Institute
Virginia Institute of Marine Science

KEY WORDS: Oil, wetlands

PROJECT TITLE: EFFECTS OF THE CHESAPEAKE BAY OIL SPILL ON SALT MARSHES OF THE LOWER BAY

INVESTIGATORS:

Michael E. Bender, Head, Division of Environmental Science and Services
Carl H. Hershner, Graduate Assistant

PROJECT SUMMARY:

A study to determine the effects of the Chesapeake Bay oil spill of February 1976 and the subsequent cleanup operations was conducted on the eastern shore of the Bay. The primary objective was to assess the biological impact on the marshes at the population level. Populations of intertidal mussels, *Modiolus demissus*, and oysters, *Crassostrea virginica*, showed no significant short-term effects. The population of the snail, *Littorina irrorata*, was significantly reduced, but appears to be recovering well. The dominant marsh grass, *Spartina alterniflora*, showed increased net productivity as measured by standing crop, increased density, decreased mean height, and increased flowering success. Hypotheses to explain these observations are discussed.

The impact of the spill on the marshes is reasoned to be minimized by virtue of the relatively low toxicity of the oil, the time of year the spill occurred, and the comparatively high energy environment of the shoreline.

STATUS: Major sampling effort and report are completed. Monitoring of the study sites is continuing at a reduced level. This project is part of Hershner's dissertation research.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science

KEY WORDS: Chesapeake Bay, *Crassostrea*, *Littorina*, marshes, No. 6 oil,

PROJECT TITLE: MONITORING PHYSIOLOGICAL CHANGES IN *CRASSOSTREA VIRGINICA* IN RESPONSE TO ENVIRONMENTAL STIMULI

INVESTIGATOR:

Robert J. Huggett, Acting Department Head and Associate Marine Scientist

PROJECT SUMMARY:

Initial laboratory experiments seek to refine techniques for measuring the cardiac response of intact oysters to changing environmental conditions. These conditions consist of variations in salinity, temperature, and dissolved oxygen as well as water quality alterations due to various marine "pollutants". Ultimate application will entail the development of remote sensing instrumentation for fourteen in situ studies of oysters in their natural habitats.

STATUS: Active.

FINANCIAL SUPPORT:

National Aeronautics and Space Administration
(Langley Research Center)
Virginia Institute of Marine Science

KEY WORDS: Oysters, physiological monitoring

PROJECT TITLE: FACTORS INFLUENCING BIOCONCENTRATION PHENOMENA IN THE AMERICAN OYSTER

INVESTIGATOR:

Robert J. Huggett, Acting Department Head and Associate Marine Scientist

PROJECT SUMMARY:

Combined laboratory and field observations propose a correlation between certain environmental factors and the tendency toward bioconcentration of trace substances from the hydrosphere. The importance of soluble and particulate pathways, as well as the significance of variable salinity, temperature, and pH are being investigated. Of particular interest are factors regulating concentration of trace metals and the role of naturally occurring chelating and ion exchange substances in the marine environment.

STATUS: Active.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science

KEY WORDS: Bioconcentration, oysters

Department of Ecology-Pollution
Environmental Biology Section

PROJECT TITLE: A PRELIMINARY CHARACTERIZATION OF A NUTRIENT IMPACTED AQUATIC ECOSYSTEM: YORKTOWN CREEK

INVESTIGATORS:

R. L. Wetzel, Associate Marine Scientist
K. L. Webb, Associate Marine Scientist

PROJECT SUMMARY:

The project centers around analysis of a historically, nutrient-impacted aquatic ecosystem. Yorktown Creek, Yorktown, Virginia has been impacted by the addition of domestic sewage for approximately 19 years. Analysis of the creek-marsh system has dealt with both the spacial and temporal distribution of NO_3^-, NO_2^-, NH_3^+, urea and PO_4^{-3} in creek and marsh interstitial waters. Two diurnal studies have been completed for input-output (mass balance) relations with the adjacent York River. Production, distribution and nutrient relations of the vascular plant community and benthic algae are also being investigated. In addition to the above parameters, ATP and chlorophyll a are being determined routinely for marsh sediments and creek waters. In July of this year, domestic sewage disposal into the Yorktown Creek watershed was terminated. Continued research along the above lines following termination of sewage disposal should allow us some quantitative evidence concerning both the general ecosystem components responding to the nutrient relaxation and the rate of marsh-creek recovery. Long term objectives are more fundamental in approach and relate principally to nutrient cycling in coastal marsh ecosystems and modeling the flux of carbon-nitrogen.

STATUS: Preliminary studies (prior to and immediately following relaxation of the nutrient input) are completed. A final report is in preparation. Plans are for the research project to continue with funding through EPA.

FINANCIAL SUPPORT:

Environmental Protection Agency, Narragansett Environmental Research Laboratory, Narragansett, Rhode Island
Virginia Institute of Marine Science

KEY WORDS: Eutrophication, marshes, nutrients, productivity, sewage, York River

Department of Ecology-Pollution
Environmental Biology Section

PROJECT TITLE: DISTRIBUTION AND DIEL VARIATION OF ATP AND ENERGY CHARGE (EC) IN THE LOWER CHESAPEAKE BAY

INVESTIGATOR:

R. L. Wetzel, Associate Marine Scientist

PROJECT SUMMARY:

The distribution of ATP with depth and along a transect extending from the York River Mouth to approximately 10 miles outside the Chesapeake Bay mouth is being studied on a quarterly basis (beginning February, 1976) for two years. At one station, York River Mouth, diel studies have been done to assess both spacial and temporal variation in ATP. Energy charge (EC) and limited studies of heterotrophy are planned for the second year. Respiration of size-fractioned water concentrates have been attempted largely with little success. Concurrent studies by other investigators include measures of primary production, nutrient dynamics, chlorophyll distribution and structure and composition of the ultraplankton community along the sampling transect.

STATUS: Active. It is ancillary to a research grant to Drs. F. O. Perkins and K. L. Webb entitled "Ultraplankton Dynamics of the lower Chesapeake Bay" and funded by the National Science Foundation.

FINANCIAL SUPPORT:

National Science Foundation
Virginia Institute of Marine Science

KEY WORDS: ATP, bay-mouth studies, heterotrophy

Department of Ecology-Pollution
Environmental Biology Section

PROJECT TITLE: THE ANALYSIS OF ECOLOGICAL SYSTEMS: MARINE ECOSYSTEMS MODELING

INVESTIGATOR:

R. L. Wetzel, Associate Marine Scientist

PROJECT SUMMARY:

The principal objective of this research is to develop both the theoretical background and computer techniques for simulating the behavior of natural and perturbed marine ecological systems. The methods developing at this time seek to incorporate both physical and biological reality in the simulation model. Accomplishment of these objectives is being attempted by teaching a course (Ecosystem Modeling: Theory and Practice) and directing graduate level research projects. The course requires an active participation in a project level modeling effort. Also, for the majority of the research projects described within Wetlands Research, modeling is incorporated in the research design as a method of analysis.

STATUS: Continuing.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science

KEY WORDS: Mathematical models, simulation

Department of Ecology-Pollution
(Environmental Biology Section)
Wachapreague Laboratory

PROJECT TITLE: THE FUNCTIONAL ECOLOGY OF AN INTERTIDAL MUD FLAT: AN EXPERIMENTAL AND ECOSYSTEM MODELING APPROACH

INVESTIGATORS:

R. L. Wetzel, Associate Marine Scientist
K. L. Webb, Associate Marine Scientist
J. N. Kraeuter, Associate Marine Scientist

PROJECT SUMMARY:

This project is developmental in nature. The salt marsh-barrier island complex of Virginia's Eastern Shore is characterized by extensive shallow water embayments and tidal flats. These tidal flats are very productive systems and surprisingly little understood, either in terms of their general ecology or functional relation to the other two major components of the ecosystem; salt marsh and bay. Gates Bay, a small embayment approximately 70-80% tidal flat at low tide, is being studied with the overall objective of characterizing the general ecology of the system. Longer term objectives include quantitating the functional relations between marsh, mud flat and bay with regard to nutrient cycling and energy flow. Our current efforts include studies of marsh production, benthic algae, sediment ATP, benthic infauna, epifauna and sediment suspension/sedimentation. Standard methods are being used for analysis of NO_3^-, NH_3^+, PO_4^{-3} and organic carbon in water and sediment samples. Sampling has been done irregularly since the winter of 1976 but is continuing on a monthly basis (September 1976).

STATUS: This project is continuing and pending support.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science

KEY WORDS: Eastern Shore, marine ecology, marshes, mud flats

Department of Ecology-Pollution
(Environmental Biology Section)
Department of Microbiology-Pathology

PROJECT TITLE: ROLE OF HETEROTROPHIC PROTOZOA

INVESTIGATORS:

Kenneth L. Webb, Associate Marine Scientist
Frank O. Perkins, Senior Marine Scientist

PROJECT SUMMARY:

Our basic understanding of energy flow and nutrient cycling in coastal and estuarine plankton environments is not sufficient to predict or identify changes resulting from increased usage of these environments. Recently developed models of plankton communities suggest that microzooplankton, specifically phagotrophic protozoa, may play a significant role in energy flow and nutrient regeneration. By ingesting bacteria, these organisms complete the reentry of dissolved organic matter back into the particulate food chains. Their nutritional position near the base of the food chain suggests a significant role in the regeneration of essential nutrients. We are attempting to identify the dominant microzooplankton in a variety of marine plankton communities, develop techniques to measure in situ rates of phagocytosis and determine their contribution to nutrient regeneration. Increased understanding of this particular component of the plankton food web will be a significant advancement in our understanding of the structure and function of these environments.

STATUS: Active/pending. This is in part a subproject of the marine nitrogen cycle.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science
U. S. Energy Research and Development Administration (requested)

PUBLICATIONS:

Haas, L. W. and K. L. Webb. Nutritional mode of several non-pigmented microflagellates from the York River estuary, Virginia (in review).

KEY WORDS: Amino acids, bacteria, detritus, dissolved organics, flagellates, food chains, heterotrophy, metabolism, plankton, protozoa

PROJECT TITLE: THE ESTUARINE ECOSYSTEM: PRODUCTIVITY MEASUREMENTS OF THE LOWER CHESAPEAKE BAY (CRC)

INVESTIGATORS:

J. Ernest Warinner, III, Assistant Marine Scientist
Paul L. Zubkoff, Department Head and Senior Marine Scientist

PROJECT SUMMARY:

The primary productivity and heterotrophic potentials of the lower Chesapeake Bay and particularly a station of the York Spit area are under surveillance in conjunction with studies on the dynamics of plankton populations in the estuaries.

STATUS: Continuing. This was a subproject of the "Waste Water Treatment Program" of the Chesapeake Research Consortium, Inc. It is being continued with VIMS funds.

FINANCIAL SUPPORT:

National Science Foundation
(Research Applied to National Needs Program)
Virginia Institute of Marine Science

PUBLICATIONS:

Zubkoff, P. L. and J. E. Warinner, III. 1974. The effect of Tropical Storm Agnes as reflected in chlorophyll a and heterotrophic potential of the lower Chesapeake Bay. Symposium on Tropical Storm Agnes. College Park, Md., 6-7 May 1974.

Zubkoff, P. L. and J. E. Warinner, III. 1975. Synoptic sightings of Red Waters of the Lower Chesapeake Bay and its tributary rivers (May 1973-September 1974). Proceedings of First Internatl. Conf. on Toxic Dinoflagellate Blooms, 4-6 November 1974. Boston, Mass. (V. R. LoCicero, Ed.), Mass. Science & Techn. Foundation, Wakefield, Mass. p. 105-111.

Zubkoff, P. L. 1974. Symposium on Chemical Oceanography, "From Fresh Waters to the Sea". S4. Introduction. 26th Southeastern Regional Meeting, Am. Chem. Soc. 23-25 October 1974, Norfolk, Va.

Warinner, J. E., III. 1974. Symposium on Chemical Oceanography, "From Fresh Waters to the Sea". S6. Estuarine Waters. 26th Southeastern Regional Meeting, Am. Chem. Soc. 23-25 October 1974, Norfolk, Va.

Zubkoff, P. L. and J. E. Warinner, III. 1976. The heterotrophic potential as an indicator of environmental quality. 2nd Symposium: "Pollution and Physiology of Marine Organisms", 4-6 November 1975 Milford, Conn.

KEY WORDS: Biological oxygen demand (BOD), Chesapeake Bay, continental shelf, diatoms, dinoflagellates, dissolved organics, dissolved oxygen, emissions and additions, estuaries, floods, heterotrophy, James River, Mobjack Bay, phytoplankton, plankton, prediction, productivity, Rappahannock River, "red water", salinity, temperature, York River, zooplankton

Department of Environmental Physiology
Department of Invertebrate-Ecology
(Toxicology Section)

PROJECT TITLE: THE ESTUARINE ECOSYSTEM: EFFECTS OF CHLORINE ON NATURAL PHYTOPLANKTON POPULATIONS

INVESTIGATORS:

Paul L. Zubkoff, Department Head and Senior Marine Scientist
Morris Roberts, Associate Marine Scientist
Jerome Illowsky, Graduate Research Assistant

PROJECT SUMMARY:

The effect of varying concentrations of chlorine on the heterotrophic potential of estuarine water is measured using ^{14}C-glucose as substrate.

STATUS: Active. This sub-project of "Estuarine Ecosystem" is a cooperative project with the Department of Invertebrate Ecology.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science

KEY WORDS: Chlorine, chlorophyll a, glucose, heterotrophic potential, primary productivity potential, Vmax

PROJECT TITLE: THE ESTUARINE ECOSYSTEM: PLANKTONIC FOOD WEBS

INVESTIGATOR:

Paul L. Zubkoff, Department Head and Senior Marine Scientist

PROJECT SUMMARY:

Selected lipid constituents of estuarine organisms are used as tracers for ascertaining planktonic food webs. Fatty acid content is quantified using thin-layer and gas-liquid chromatographic techniques. The gas-liquid chromatograms are differentially compared with respect to 16:0, 16:1ω7, 18:0, 18:1ω9, and 20:5ω3 for ascertaining those components which are degraded, modified, or non-metabolized.

STATUS: Continuing.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science

PUBLICATIONS:

Joseph, J. D. and P. L. Zubkoff. Fatty acids of *Acartia tonsa*, *Mnemiopsis leidyi*, and *Chrysaora quinqueicrrha* with considerations of their trophic relationship (in review).

Weaver, J. E. 1974. Temporal trends in fatty acid composition of juvenile Atlantic menhaden fed brine shrimp nauplii. Trans. Am. Fish. Soc. 103:383-386.

KEY WORDS: *Acartia*, brine shrimp, *Chrysaora*, ctenophore, *Cyanea*, fatty acids, feeding habits, food chains, gas-liquid chromatography, jellyfish, lipids, menhaden, *Mnemiopsis*, *Neomysis*, plankton, thin-layer chromatography, York River, zooplankton

PROJECT TITLE: THE ESTUARINE ECOSYSTEM: THE DISTRIBUTION OF SCYPHOZOAN JELLYFISH IN THE LOWER CHESAPEAKE BAY SYSTEM

INVESTIGATOR:

Paul L. Zubkoff, Department Head and Senior Marine Scientist

PROJECT SUMMARY:

The relative abundance of any pelagic organism is a most difficult measurement to obtain with a high degree of precision and accuracy. However, over the course of the past decade, several subjective measurements have been acquired which are useful as a first order approximation for the analysis of general trends. These analyses include various surveys:

(1) Location and distributions of polyp opulations in the tributary creeks and rivers of the Lower Chesapeake Bay
(2) Ecological analysis of a typical tributary creek for identification of polyps and strobilae
(3) Meteorological analysis of environmental factors related to large and small populations of jellyfish
(4) Spring and fall surveys for polyp distributions in the major rivers of the lower Bay
(5) Recording of mid-water trawl catches of jellyfish in the Lower Chesapeake Bay during the early summer

STATUS: Continuing. This study is the present sub-project of "Chesapeake Bay Jellyfishes: Ecology."

FINANCIAL SUPPORT:

Virginia Institute of Marine Science

KEY WORDS: *Aurelia aurita*, Chesapeake Bay, *Chrysaora quinquecirrha*, *Cyanea capillata*, ephyrae, medusae, podocysts, polyps, *Rhopilema verilla*, scyphistomae, strobilae

PROJECT TITLE: THE CHESAPEAKE BAY JELLYFISHES: BIOCHEMISTRY, DEVELOPMENT AND ECOLOGY

INVESTIGATORS:

Paul L. Zubkoff, Department Head and Senior Marine Scientist
Robert E. Black, Associate Marine Scientist*

PROJECT SUMMARY:

Objectives are: (1) to elucidate metabolic pathways and biosynthetic processes of the stages of the Chesapeake jellyfishes, (2) to investigate further the developmental events associated with the process of strobilation, (3) to clarify further the ecological role of jellyfishes with special reference to their position in the food chain.

STATUS: Continuing.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science

PUBLICATIONS:

Enright, R. T. 1974. A study of the dormancy and development of podocysts of the scyphozoan *Chrysaora quinquecirrha*. B.A. Honors Thesis, College of William and Mary.

Quensen, J. M. 1975. Changes in amount and composition of gelatin from developmental stages of the scyphozoan jellyfish, *Chrysaora quinquecirrha*. M.S. Thesis, College of William and Mary.

Lin, A. L. and P. L. Zubkoff. 1976. Malate dehydrogenase isozymes of different stages of Chesapeake Bay jellyfish. Biol. Bull. 150: 268-278.

Black, R. E., R. T. Enright, and L. Sung. 1976. Activation of the dormant podocyst of *Chrysaora quinquecirrha* (Scyphozoa) by removal of the cyst covering. J. Exp. Zool. 197: 403-414.

KEY WORDS: *Aurelia*, *Chrysaora*, *Cyanea*, enzymes, feeding habits, food chains, jellyfish, life cycles, lipids, metabolism, Mobjack Bay, *Rhopilema*, strobilation, York River, zooplankton

*Dr. Robert E. L. Black, also professor of Biology, College of William and Mary, Williamsburg, Virginia.

PROJECT TITLE: CHESAPEAKE BAY JELLYFISHES: BIOCHEMISTRY: 1. METABOLISM

INVESTIGATOR:

Paul L. Zubkoff, Department Head and Senior Marine Scientist

PROJECT SUMMARY:

The identification of the enzymes associated with energy transformations and the isozyme changes during development are analyzed using either polyacrylamide gel electrophoresis or radiotracer techniques. Several dehydrogenases have been detected using gel electrophoresis.

STATUS: Continuing. This is a subproject of "Biochemistry, Development, and Ecology of Chesapeake Bay Jellyfishes".

FINANCIAL SUPPORT:

Virginia Institute of Marine Science

PUBLICATIONS (Since 1974):

Zubkoff, P. L. and A. L. Lin. 1974. Isozymes of *Aurelia aurita* obtained from different geographic locations. Third International Conference on Isozymes 18-20 May, New Haven, Conn. Isozymes: IV. Genetics and Evolution, 915-929, C. L. Markert, Ed., Academic Press, N. Y.

Lin, A. L. and P. L. Zubkoff. 1974. Malate dehydrogenase isozymes of developing *Cyanea capillata*. 168th ACS National Meeting, September 8-13, 1974, Atlantic City, N. J. Abstract 172.

Lin, A. L. and P. L. Zubkoff. 1976. Pentose phosphate pathway in the polyps of *Chrysaora quinquecirrha*. Comp. Biochem. Physiol. 54B: 33-36.

Lin, A. L. and P. L. Zubkoff. 1976. Malate dehydrogenase isozymes of different stages of Chesapeake Bay jellyfish. Biol. Bull. 150: 268-278.

Lin, A. L. and P. L. Zubkoff. 1976. Enzymes associated with carbohydrate metabolism of scyphistomae of *Aurelia aurita* and *Chrysaora quinquecirrha* (Scyphozoa: Semaeostomae). (in review)

Lin, A. L. and P. L. Zubkoff. 1976. Carbohydrate metabolism of scyphozoan jellyfish. 12th Annual Meeting. Assn. Island Marine Laboratories Caribbean. 22-25 September 1976. Curacea, Netherlands Antilles.

KEY WORDS: *Aurelia*, *Chrysaora*, *Cyanea*, development, enzymes, isozymes, jellyfish, malate dehydrogenase, metabolism, pentose phosphate pathway, radiotracer techniques, strobilation

PROJECT TITLE: CHESAPEAKE BAY JELLYFISHES: BIOCHEMISTRY: 2. POLYSACCHARIDES

INVESTIGATOR:

Paul L. Zubkoff, Department Head and Senior Marine Scientist

PROJECT SUMMARY:

The composition of the various polymorphic forms of the Scyphozoan jellyfishes undoubtedly differs markedly, with respect to the major classes of biochemical constituents, including the polysaccharides. Particular emphasis is placed on the identification and quantification of the monosaccharide constituents of the complex polymeric carbohydrates isolated from the mesoglea of the "stinging nettle", *Chrysaora quinquecirrha*. Several classes of carbohydrates have been identified (hexoses, pentoses, uronic acids, hexosamines) and quantified. Procedures used include thin-layer chromatography, spectrophotometry, and gas-liquid chromatography.

STATUS: This is a subproject of "Biochemistry, Development and Ecology of Chesapeake Bay Jellyfishes". Continuing.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science

PUBLICATIONS:

Gardner, E. P. 1975. The presence of acid polysaccharides in the mesoglea of *Chrysaora quinquecirrha*. M. S. Thesis, College of William and Mary.

KEY WORDS: Carbohydrates, chromatography, *Chrysaora quinquecirrha*, hexosamines, hexoses, jellyfish, monosaccharides, nettle, pentoses, polysaccharides, stinging, thin-layer, uronic acids

PROJECT TITLE: CHESAPEAKE BAY JELLYFISHES: BIOCHEMISTRY: 3. PROTEINS

INVESTIGATORS:

Paul L. Zubkoff, Department Head and Senior Marine Scientist
J. Ernest Warinner, III, Assistant Marine Scientist

PROJECT SUMMARY:

The identification and quantification of macromolecules (proteins and glycoproteins) in the various life stages of the Chesapeake Bay jellyfishes are probed using radiotracer and other analytical techniques.

STATUS: Active. This is a subproject of "Biochemistry, Development and Ecology of Chesapeake Bay Jellyfishes".

FINANCIAL SUPPORT:

Virginia Institute of Marine Science

KEY WORDS: *Aurelia*, *Chrysaora*, *Cyanea*, development, gel electrophoresis, glycoproteins, jellyfish, macromolecules, polyacrylamide, proteins, radiotracer techniques

PROJECT TITLE: CHESAPEAKE BAY JELLYFISHES: DEVELOPMENT: COLLAGEN AND MESOGLEAL PROTEINS

INVESTIGATOR:

Robert E. Black*, Associate Marine Scientist

PROJECT SUMMARY:

Temperature conditioned polyps, polyps in early and late strobilation, and cysts are examined for the formation of unique subcellular structures associated with these reproductive processes. These developmental studies will provide insight into the mechanisms of strobilation and metamorphosis.

STATUS: Continuing. This is a subproject of "Biochemistry, Development and Ecology of Chesapeake Bay Jellyfishes".

FINANCIAL SUPPORT:

Virginia Institute of Marine Science

PUBLICATIONS:

Bynum, M. A. O. and R. E. Black. 1974. Ultrastructure of *Chrysaora quinquecirrha* strobilae. J. Exp. Zool. 187: 223-234.

Enright, R. T. 1974. A study of the dormancy and development of the Scyphozoan *Chrysaora quinquecirrha*. B. A. Honors Thesis, College of William and Mary.

Black, R. E., R. T. Enright, and L. Sung. 1976. Activation of the dormant podocyst of *Chrysaora quinquecirrha* (Scyphozoa) by removal of the cyst covering. J. Exp. Zool. 197: 403-414.

KEY WORDS: *Aurelia, Chrysaora, Cyanea,* development, dormancy, excystment, jellyfish, podocysts, strobilation

*Dr. Robert E. L. Black, also Professor of Biology, College of William and Mary, Williamsburg, Virginia.

PROJECT TITLE: METABOLITES OF INVERTEBRATE TISSUES: CALCIUM UPTAKE AND DEPOSITION IN RELATION TO THE PROCESSES OF SHELL FORMATION

INVESTIGATORS:

Paul L. Zubkoff, Department Head and Senior Marine Scientist
Ming-Shan Ho, Graduate Assistant

PROJECT SUMMARY:

The calcification process of commercially important marine bivalves is studied with respect to elucidating the fundamental processes of shell formation. Calcium-45 uptake and interaction with acid mucopolysaccharides are followed using selected life stages of marine bivalves. Possible effects of naturally-occurring and anthropomorphic-originating substances on the process of calcium transport will be explored. An effort to establish the potential of acid mucopolysaccharides to function as either a regulator of or a substrate for binding of calcium is undertaken.

STATUS: Continuing.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science

KEY WORDS: Acid mucopolysaccharides, bivalves, calcification, shell formation

PROJECT TITLE: METABOLITES OF INVERTEBRATE TISSUES: 2. COMPOSITION

INVESTIGATORS:

Paul L. Zubkoff, Department Head and Senior Marine Scientist
Ming-Shan Ho, Graduate Assistant

PROJECT SUMMARY:

At any given moment in organisms life, the complement of metabolites reflects the integrated history of the organism. The goal of this project is to exploit gas-liquid chromatographic procedures for rapidly identifying the composition of metabolites normally present in the fluid tissues of invertebrates.

STATUS: Continuing.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science

KEY WORDS: Fluid tissues, gas-liquid chromatography, metabolites

PROJECT TITLE: METABOLITES OF INVERTEBRATE TISSUES: 3. MECHANISMS OF DETOXIFICATION

INVESTIGATOR:

Paul L. Zubkoff, Department Head and Senior Marine Scientist

PROJECT SUMMARY:

The neutralization of foreign substance by conjugation with a carbohydrate moiety is one of many mechanisms of detoxification available to higher organisms. The goal of this project is to evaluate the role of carbohydrate conjugation in marine invertebrates as a secondary or tertiary pathway of carbohydrate metabolism.

STATUS: This project is in the literature study stage. Continuing.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science

KEY WORDS: Carbohydrates, detoxification, glycone conjugation

PROJECT TITLE: OUTER CONTINENTAL SHELF BENCHMARK STUDIES--FORAMINIFERA (BLM)

INVESTIGATORS:

Maynard M. Nichols, Associate Marine Scientist
Robert Ellison*

PROJECT SUMMARY:

Benthic Foraminifera of the continental shelf and upper slope from off New Jersey to off Virginia are being surveyed quarterly. Stations which represent bathymetric, sedimentary, and topographic habitats on the shelf and slope are sampled quarterly and semi-annually by bottom grabs to describe the distribution and of living and dead foraminiferal communities. Enumeration and identification of the living foraminiferans and tests will be carried out on the top 3 cm. of each core. Data will be reported as percentage abundance of each species, as live/total ratios, as diversities and dominant species based on occurrence of five percent occurrence in each sample.

STATUS: Active. This is a subproject of "Environmental Data Acquisition and Analysis--Mid-Atlantic OCS."

FINANCIAL SUPPORT:

U. S. Department of Interior
(Bureau of Land Management)
Virginia Institute of Marine Science

KEY WORDS: Benthos, continental shelf, Foraminifera

*Associate Professor, University of Virginia

PROJECT TITLE: WINDMILL POINT MARSH HABITAT DEVELOPMENT STUDIES--NEKTON STUDIES (WES)

INVESTIGATORS:

John V. Merriner, Department Head and Senior Marine Scientist
Robert K. Dias, Assistant Marine Scientist
Marion Y. Hedgepeth, Research Assistant

PROJECT SUMMARY:

Quarterly sampling of fish populations is being conducted at both a man-made and natural freshwater marsh utilizing fyke nets, beach seines and minnow traps. Major topics being investigated include community structure and population dynamics as they relate to location, season, sampling period (day versus night), and various physical parameters. Population studies of selected species are being made to define their distribution, abundance, age and growth characteristics and feeding habits.

STATUS: Active.

FINANCIAL SUPPORT:

U. S. Army Corps of Engineers
(Waterways Experiment Station, Vicksburg, Mississippi)
Virginia Institute of Marine Science

KEY WORDS: Habitat, nekton, Windmill Point

PROJECT TITLE: MORPHOMETRIC COMPARISON OF *GOBIOSOMA BOSCI* AND *G. GINSBERGI* LARVAE

INVESTIGATORS:

J. J. Govoni, Graduate Assistant
J. V. Merriner, Department Head and Senior Marine Scientist

PROJECT SUMMARY:

Morphometric characters of *Gobiosoma bosci* and *G. ginsbergi* are being sought which will be useful as distinguishing characteristics for the larval stages.

STATUS: Active.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science
Virginia Electric and Power Company

KEY WORDS: *Gobiosoma*, identification, larval fish, morphometrics

PROJECT TITLE: OUTER CONTINENTAL SHELF BENCHMARK STUDIES--COMMUNITY ECOLOGY OFFSHORE DEMERSAL FISHES (BLM)

INVESTIGATORS:

J. A. Musick, Associate Marine Scientist
E. J. Foell, Research Assistant
J. A. Colvocoresses, Research Assistant

PROJECT SUMMARY:

A description of community structure and related parameters of the finfishes of the Middle Atlantic Bight area is being developed utilizing the existing data base (NMFS, ICNAF, and VIMS).

STATUS: Active.

FINANCIAL SUPPORT

U. S. Department of Interior
(Bureau of Land Management)
Virginia Institute of Marine Science

KEY WORDS: Baltimore Canyon Trough Area, community structure, fishes, Middle Atlantic Bight, outer continental shelf

PROJECT TITLE: OUTER CONTINENTAL SHELF BENCHMARK STUDIES--COMMUNITY STRUCTURE OF THE FINFISHES IN THE BALTIMORE CANYON TROUGH AREA (BLM)

INVESTIGATORS:

J. A. Musick, Associate Marine Scientist
E. J. Foell, Graduate Student

PROJECT SUMMARY:

A description of community structure and related parameters of the finfishes of the Baltimore Canyon Trough Area utilizing data gathered during ongoing BLM cruises is being developed.

STATUS: Active. This project represents Foell's dissertation research.

FINANCIAL SUPPORT:

U. S. Department of Interior
(Bureau of Land Management)
Virginia Institute of Marine Science

KEY WORDS: Baltimore Canyon Trough Area, community structure, fishes, outer continental shelf

PROJECT TITLE: OUTER CONTINENTAL SHELF BENCHMARK STUDIES--FOOD HABITS AND TROPHIC RELATIONSHIPS OF A COMMUNITY OF FISHES FROM THE OUTER CONTINENTAL SHELF (BLM)

INVESTIGATORS:

J. A. Musick, Associate Marine Scientist
George R. Sedberry, Research Assistant

PROJECT SUMMARY:

An investigation of the food habits and food selectivity and competition among the dominant species of demersal fishes found on the Continental Shelf off New Jersey is underway. Seasonal sampling of the benthos and fishes for stomach analysis is being conducted.

STATUS: Active. A portion of this project represents Sedberry's dissertation research.

FINANCIAL SUPPORT:

U. S. Department of Interior
(Bureau of Land Management)
Virginia Institute of Marine Science

KEY WORDS: Continental shelf, fishes, food habits

PROJECT TITLE: ECOLOGY OF DEMERSAL FISHES OF NORFOLK CANYON AND ADJACENT CONTINENTAL SLOPE

INVESTIGATOR:

J. A. Musick, Associate Marine Scientist

PROJECT SUMMARY:

Seasonal otter trawl survey based on stratified random sampling. Hydrography: all fishes identified, measured, weighed. Computer diversity, species associations, etc.

STATUS: Active. Field completed. Data analysis 3/4 completed.

FINANCIAL SUPPORT:

National Science Foundation
Virginia Institute of Marine Science

KEY WORDS: Community structure, deep sea diversity, fishes, Norfolk Canyon

PROJECT TITLE: THE DISTRIBUTION AND ABUNDANCE OF MESOPELAGIC FISHES IN THE NORFOLK CANYON REGION

INVESTIGATORS:

J. A. Musick, Associate Marine Scientist
John V. Gartner, Jr., Graduate Student

PROJECT SUMMARY:

Analysis of distribution and abundance of mesopelagic fishes over the continental slope in the Norfolk Canyon region of the Atlantic Ocean. Fishes to be examined were taken by bottom trawls from 1972-1975.

STATUS: Active. This project represents Gartner's thesis research.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science
National Science Foundation

KEY WORDS: Bottom trawls, continental slope, mesopelagic fishes, Norfolk Canyon

PROJECT TITLE: SYSTEMATICS OF ALEPOCEPHALIDAE

INVESTIGATORS:

Douglas F. Markle, Research Assistant
Gerhard Krefft*
Bruce Robison**
Ken Sulak***

PROJECT SUMMARY:

The systematics of the deep-sea Alepocephalidae are being studied on a world-wide basis. Preliminary ideas on generic relationships have been formulated and in-depth generic studies are in progress.

STATUS: Continuing.

FINANCIAL SUPPORT:

National Science Foundation
A.S.I.H. Raney Award
Institut fur Seefischerei Hamburg
Johs. Schmidt's Foundation for Marine Biology
Virginia Institute of Marine Science

KEY WORDS: Fishes

*Hamburg, Germany
**University of California
***Research Associate, Duke University Marine Laboratory

PROJECT TITLE: SECOND SPECIMEN OF THE DEEP SEA ZOARCID, *PACHYCARA OBESA*

INVESTIGATORS:

Douglas F. Markle, Research Assistant
George R. Sedberry, Research Assistant

PROJECT SUMMARY:

A second specimen of the monotypic genus *Pachycara* is documented and the species redescribed.

STATUS: Active. Manuscript submitted.

FINANCIAL SUPPORT:

National Science Foundation
A.S.I.H. Raney Award
Virginia Institute of Marine Science

KEY WORDS: Fish

PROJECT TITLE: POSSIBLE EVIDENCE OF NEAR-BOTTOM SPAWNING IN THE MIDWATER FISHES, *MELANOSTIGMA ATLANTRIUM* AND *XENODERMICHTHYS COPEI*

INVESTIGATORS:

Douglas F. Markle, Research Assistant
Charles A. Wenner, Research Assistant

PROJECT SUMMARY:

Evidence accumulated from various museum collections and the VIMS Norfolk Canyon Study indicate the possibility that these midwater species use the bottom or the area near the bottom for spawning.

STATUS: Active. Manuscript in revision.

FINANCIAL SUPPORT:

National Science Foundation
Virginia Institute of Marine Science

KEY WORDS: Midwater fishes, spawning

PROJECT TITLE: REPRODUCTIVE BIOLOGY OF A DEEP SEA FISH, *GONOSTOMA ELONGATUM* (GONOSTOMATIDAE)

INVESTIGATOR:

Linda P. Mercer, Graduate Student

PROJECT SUMMARY:

Histological study of the western Atlantic gonostomatid, *Gonostoma elongatum*, is in progress to determine the mode of reproduction. Preliminary analysis of gonads indicates that the species is hermaphroditic. The North Pacific species, *Gonostoma gracile*, is a protandrous hermaphrodite in which all or most individuals reverse sex from male to female.

STATUS: Active.

FINANCIAL SUPPORT:

National Science Foundation
Virginia Institute of Marine Science

KEY WORDS: Fishes, *Gonostoma elongatum*, reproductive biology

PROJECT TITLE: AGE AND GROWTH OF MACROURID FISHES OF NORFOLK CANYON AND ADJACENT CONTINENTAL SLOPE

INVESTIGATORS:

J. A. Musick, Associate Marine Scientist
Robert Middleton, Graduate Student

PROJECT SUMMARY:

This project includes the study of age and growth of macrourid fishes of the Norfolk Canyon and the adjacent Continental Slope.

STATUS: Active. This project represents Middleton's thesis research. All field collections are completed and analysis is in progress.

FINANCIAL SUPPORT:

National Science Foundation
Virginia Institute of Marine Science

KEY WORDS: Age, deep sea fishes, growth, Norfolk Canyon

PROJECT TITLE: PARASITOLOGY OF DEMERSAL FISHES OF NORFOLK CANYON AND ADJACENT CONTINENTAL SLOPE

INVESTIGATORS:

J. A. Musick, Associate Marine Scientist
E. Lynn Suydam, Graduate Student

PROJECT SUMMARY:

Life history, host specificity and site specificity of parasites of dominant species of demersal slope fishes.

STATUS: Continuing. This project represents Suydam's dissertation research.

FINANCIAL SUPPORT:

National Science Foundation
Virginia Institute of Marine Science

KEY WORDS: Norfolk Canyon, parasites of fishes

PROJECT TITLE: REPRODUCTIVE BIOLOGY OF DEMERSAL FISHES OF NORFOLK CANYON AND ADJACENT CONTINENTAL SLOPE

INVESTIGATORS:

J. A. Musick, Associate Marine Scientist
Charles Wenner, Graduate Assistant

PROJECT SUMMARY:

Histological study of modes of reproduction in dominant species from fish communities on continental slope.

STATUS: Active. This project represents Wenner's dissertation research. All field collection completed. Data analysis 3/4 completed.

FINANCIAL SUPPORT:

National Science Foundation
Virginia Institute of Marine Science

KEY WORDS: Deep-sea reproductive biology, fishes, Norfolk Canyon

PROJECT TITLE: *UROPHYCIS* BIOLOGY

INVESTIGATORS:

J. A. Musick, Associate Marine Scientist
D. Cohen*

PROJECT SUMMARY:

Compilation of accounts of all species of *Urophycis* is underway for inclusion in Fishes of the Western North Atlantic. This effort is approximately 75% complete.

STATUS: Continuing.

FINANCIAL SUPPORT:

National Oceanic and Atmospheric Administration
(National Marine Fisheries Service)
Virginia Institute of Marine Science

KEY WORDS: Fishes, *Urophycis*

*D. Cohen, National Marine Fisheries Service

PROJECT TITLE: CATALOGUE OF THE FISHES AND HERPETOFAUNA OF THE CHESAPEAKE REGION

INVESTIGATOR:

J. A. Musick, Associate Marine Scientist

PROJECT SUMMARY:

Continual updating of knowledge of animals listed in VIMS SSR #65, particularly those parts of the fauna cited as being poorly known.

STATUS: Continuing.

FINANCIAL SUPPORT:

U. S. Army Corps of Engineers
Virginia Institute of Marine Science

KEY WORDS: Fishes, herpetofauna

PROJECT TITLE: F.A.O. SPECIES IDENTIFICATION SHEETS - ALEPOCEPHALIDAE

INVESTIGATOR:

Douglas F. Markle, Research Assistant

PROJECT SUMMARY:

A description with illustrations and key to the genera of Alepocephalidae in the western Central Atlantic is being prepared for the Food and Agriculture Organization of the United Nations.

STATUS: Active. Manuscript in preparation.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science
A.S.I.H. Raney Award

KEY WORDS: F.A.O., fishes

PROJECT TITLE: WINDMILL POINT MARSH HABITAT DEVELOPMENT STUDIES--WILDLIFE RESOURCES (WES)

INVESTIGATORS:

Marvin L. Wass, Department Head and Senior Marine Scientist
Elizabeth Wilkins, Lab Technician

PROJECT SUMMARY:

Study of wildlife, mainly avifauna at Windmill Point Site in James River. Monitoring is to be twice a month and nest searches shall be conducted during the breeding season. Study is designed to discuss avian utilization of various habitats developed and to document animal damage occurring in experimental and reference areas. The avian community will be monitored for changes in species composition, diversity, and population density. Nest sites and muskrat lodges will be plotted on base maps. Nesting and hatching success is to be determined and nesting densities are to be reported plant-type, etc.

Results to date show high numbers of birds, especially when the tide is low, but very low numbers of breeding birds per hectare. A total of 85 species have been seen on the island and reference sites but diversity is low, with 10 species comprising 87% of the numbers.

STATUS: Initiated July 1, 1976.

FINANCIAL SUPPORT:

U. S. Army Corps of Engineers
(Waterways Experiment Station)
Virginia Institute of Marine Science

KEY WORDS: Avifauna, wildlife

PROJECT TITLE: THE OPISTHOBRANCHS OF CHESAPEAKE BAY AND THE EASTERN SHORE OF VIRGINIA

INVESTIGATORS:

Marvin L. Wass, Department Head and Senior Marine Scientist
Rosalie M. Vogel, Graduate Assistant

PROJECT SUMMARY:

The opisthobranch fauna of this area, particularly in the lower Bay and Eastern Shore is poorly known. The field work for this project is essentially completed. The data are now being compiled and written up. This work is being carried out at Gloucester Point. Several animals studied are new for Virginia waters.

STATUS: This project represents Vogel's dissertation research.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science

KEY WORDS: Invertebrates, nudibranchs, opisthobranchs

PROJECT TITLE: SHIPWORM SURVEILLANCE AT GLOUCESTER POINT

INVESTIGATORS:

Marvin L. Wass, Department Head and Senior Marine Scientist
Rosalie Vogel, Graduate Assistant

PROJECT SUMMARY:

Begun in 1958, this project was originally a cooperative venture with the William F. Clapp Laboratories, but is now handled entirely by VIMS. It involves using pine boards put down for six months and controls for one month. Some information on fouling organisms is obtained along with that on borer infestation.

STATUS: Continuing. A paper has been submitted to include in the "Agnes" book being published by Johns Hopkins Press. Shipworms decreased greatly after Tropical Storm Agnes and are still not as abundant as they were prior to the storm. In particular, monthly controls have not been infested.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science

KEY WORDS: *Bankia gouldi*, invertebrates, shipworms

PROJECT TITLE: INVERTEBRATE REFERENCE MUSEUM

INVESTIGATORS:

Marvin L. Wass, Department Head and Senior Marine Scientist
Rosalie M. Vogel, Graduate Assistant

PROJECT SUMMARY:

The present phase of this project involves maintenance and improvement of the collection. The card file system has been updated and now numbers almost 1600 cards.

Many animals from the checklist have been added to the collection from private sources. The addition of material to supplement and expand the collection is continuing. Several small collections made by various individuals have been catalogued but left as a unit for aid in studying a particular area or group of animals. The accumulation of photographs of the exterior valves of local bivalves to illustrate a key is almost complete.

STATUS: Active.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science

KEY WORDS: Invertebrates

Department of Invertebrate Ecology
(Benthic Section)
Wachapreague Laboratory

PROJECT TITLE: OUTER CONTINENTAL SHELF BENCHMARK STUDIES--BENTHIC ECOLOGICAL STUDIES (BLM)

INVESTIGATORS:

Donald F. Boesch, Senior Marine Scientist
John N. Kraeuter, Associate Marine Scientist, Wachapreague Laboratory
D. Keith Serafy, Associate Marine Scientist
David J. Hartzband, Assistant Marine Scientist
Marcia A. Bowen, Assistant Marine Scientist
Jacques Van Montfrans, Assistant Marine Scientist, Wachapreague Laboratory

PROJECT SUMMARY:

Extensive studies are being conducted on the benthos, of the continental shelf and upper slope in the Middle Atlantic Bight. Macrobenthos is sampled by bottom grab at stations ranging from northern New Jersey to Virginia quarterly or semi-annually. Megabenthos and macrobenthos is sampled quarterly in a central study area off southern New Jersey and Delaware.

Stratified random sampling of megabenthos and macrobenthos in two topographically complex outer shelf areas containing oil and gas lease tracts was conducted in conjunction with sampling of demersal fishes.

The distribution of benthos is being related to hydrographic conditions, sedimentary parameters and the distribution of trace metals and hydrocarbons. Benthic communities are being related to the food habits of bottom feeding fishes being studied by investigators in the Ichthyology Department.

Recolonization field experiments are being conducted at one site in order to determine the role of disturbance in macrobenthic community structure and to assess the recovery rates of the community following perturbation and incorporation of oil in sediments.

STATUS: Active.

FINANCIAL SUPPORT:

U. S. Department of Interior
Bureau of Land Management)
Virginia Institute of Marine Science

KEY WORDS: Benthos, continental shelf, ecology, sediments

PROJECT TITLE: WINDMILL POINT MARSH HABITAT DEVELOPMENT STUDIES--BENTHIC STUDIES (WES)

INVESTIGATORS:

Donald F. Boesch, Senior Marine Scientist
Robert J. Diaz, Assistant Marine Scientist

PROJECT SUMMARY:

Benthic animals inhabiting the experimental marsh-habitat created from dredged material at Windmill Point in the James River and a reference marsh at nearby Herring Creek are being studied as part of a larger study on plants and animals and chemical constituents. Sampling is conducted seasonally in designated habitat strata within the two marshes and adjacent river. The results are being compared to those for the pre-existing benthos determined by a completed study and related to food habits of fishes inhabiting the marshes.

STATUS: Active.

FINANCIAL SUPPORT:

U. S. Army Corps of Engineers
(Waterways Experiment Station, Vicksburg, Mississippi)
Virginia Institute of Marine Science

KEY WORDS: Benthos, dredged material, freshwater, marsh, Windmill Point

Department of Invertebrate Ecology
Benthic Section

PROJECT TITLE: LONG TERM DYNAMICS IN ESTUARINE BENTHIC COMMUNITIES

INVESTIGATORS:

Donald F. Boesch, Senior Marine Scientist
Marvin L. Wass, Senior Marine Scientist
Robert J. Diaz, Assistant Marine Scientist
Robert J. Orth, Associate Marine Scientist

PROJECT SUMMARY:

Few areas have been sampled over long enough periods to determine the long-term persistence of benthic communities. Continuing monitoring of several sites has produced data sets on some Chesapeake Bay communities going back 17 years. Several communities studied intensively in the 1960's are being resampled periodically in order to produce long-term data bases with which to judge the effects environmental or climatological changes.

STATUS: Continuing. One paper recently published.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science

KEY WORDS: Benthos, dynamics, long-term studies

PROJECT TITLE: TAXONOMIC STUDIES OF MARINE AND ESTUARINE INVERTEBRATES

INVESTIGATORS:

Donald F. Boesch, Senior Marine Scientist
D. Keith Serafy, Associate Marine Scientist
Gary R. Gaston, Assistant Marine Scientist
Robert J. Diaz, Assistant Marine Scientist
Marcia A. Bowen, Assistant Marine Scientist

PROJECT SUMMARY:

Continuing research focuses on the taxonomy of invertebrate groups of special interest to the staff: peracaridean and ostracod crustaceans, echinoderms, polychaetes and oligochaetes. Much of this work is in support of ongoing ecological studies but research on the taxonomy of invertebrates of other regions, e.g. Gulf of Mexico and eastern Australia, is also being conducted.

STATUS: Continuing, long-range project.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science

KEY WORDS: Crustacea, Echinodermata, Oligochaeta, Polychaeta, taxonomy

Department of Invertebrate Ecology
Benthic Section

PROJECT TITLE: SMALL SCALE PATTERNS IN THE DISTRIBUTION OF CONTINENTAL SHELF MACROBENTHOS

INVESTIGATORS:

Donald F. Boesch, Senior Marine Scientist
Louise Dibrell, Graduate Assistant

PROJECT SUMMARY:

In conjunction with Outer Continental Shelf Benchmark Studies the small scale distribution of macrobenthic invertebrate is under investigation. A large number of ordered subsamples were taken from replicate grab samples at 8 outer shelf stations positioned to sample large scale topographic features. Patterns of distribution are being assessed by frequency distribution and autocorrelation techniques. These patterns are being interpreted in terms of sediment and microtopographic heterogeneity and potential biotic interaction.

STATUS: Active. This project represents Dibrell's thesis research.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science

KEY WORDS: Benthos, distribution patterns

PROJECT TITLE: INTERACTIONS BETWEEN A POLYCHAETE COMMENSAL AND ITS OPHIUROID HOST

INVESTIGATORS:

Donald F. Boesch, Senior Marine Scientist
Donald Weston, Graduate Assistant

PROJECT SUMMARY:

An undescribed polynoid scaleworm appears to be an obligate commensal of the ophiuroid *Micropholis atra* in lower Chesapeake Bay. The life history, behavior and chemasensory abilities of the scaleworm are under investigation in order to determine its adaptive strategy in locating its host.

STATUS: Active. This project represents Weston's thesis research.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science

KEY WORDS: Commensalism, Ophiuroidea, Polychaeta

PROJECT TITLE: IDENTIFICATION OF PHYTOPLANKTON SPECIES BY THE USE OF A TUNABLE LASER WITH A RADAR SCANNER

INVESTIGATORS:

John L. Dupuy, Department Head and Senior Marine Scientist
Nancy Windsor, Research Assistant
C. A. Brown*

PROJECT SUMMARY:

The objective of this project is the development of a methodology to utilize (1) a tunable laser for excitation of fluorescence and (2) scanning by radar to identify phytoplankton.

STATUS: Continuing.

FINANCIAL SUPPORT:

National Aeronautics and Space Administration
(Langley Research Center)
Virginia Institute of Marine Science

KEY WORDS: Laser, phytoplankton, radar

*C. A. Brown, Langley Research Center, NASA, Hampton, Virginia

PROJECT TITLE: ECOLOGICAL, LIFE HISTORY, AND ULTRASTRUCTURAL STUDIES OF MARINE PROTOZOA IN THE LOWER CHESAPEAKE BAY

INVESTIGATOR:

Frank O. Perkins, Department Head and Senior Marine Scientist

PROJECT SUMMARY:

Morphological studies are being conducted on marine Protozoa of the lower Chesapeake Bay with emphasis on pathogenic species. Seasonal distributions with respect to host or substrate are being considered. Information derived from these studies is being used to determine the life histories of the organisms.

STATUS: Continuing.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science

PUBLICATIONS:

Perkins, F. O., D. E. Zwerner, and R. K. Dias. 1975. The hyperparasite, *Urosporidium spisuli* sp. n. (Haplosporea), and its effects on the surf clam industry. J. Parasitol. 61:944-949.

Perkins, F. O. 1976. Zoospores of the oyster pathogen, *Dermocystidium marinum*. I. Fine structure of the conoid and other sporozoan-like organelles. J. Parasitol. (in press).

Perkins, F. O. 1976. Shellfish industry of Chesapeake Bay. Proceedings of the Shellfish Association of Great Britain (in press).

Perkins, F. O., P. A. Madden, and T. K. Sawyer. 1976. A scanning electron microscope study of *Urosporidium spisuli* (Haplosporea) spores. Trans. Amer. Microscope Soc. (in press).

Perkins, F. O. 1976. *Dermocystidium marinum* infection in oysters. Marine Fish. Rev. (in press).

Perkins, F. O. 1976. Fine structure of apicomplexan organelles in the oyster pathogen, *Dermocystidium marinum*. J. Protozool. 23:3A.

Perkins, F. O., P. A. Madden, and T. K. Sawyer. 1976. Surface structure of *Urosporidium spisuli* (Haplosporea) spores: a scanning electron microscope study. Trans. Amer. Micros. Soc. 95:268.

KEY WORDS: Life cycles, protozoa, ultrastructure

Department of Microbiology-Pathology
Department of Ecology-Pollution
(Environmental Biology Section)

PROJECT TITLE: ULTRAPLANKTON OF THE LOWER CHESAPEAKE BAY REGION

INVESTIGATORS:

Frank O. Perkins, Senior Marine Scientist
Kenneth L. Webb, Associate Marine Scientist
Richard L. Wetzel, Associate Marine Scientist
Steven J. Hastings, Graduate Student

PROJECT SUMMARY:

The purpose of this project is to identify the most numerous ultraplankton of the lower Chesapeake Bay region, a temperate zone estuarine environment. Four stations covering a salinity range from about 16-32 o/oo are being sampled seasonally on a transect extending from the mouth of the York River through the Chesapeake Bay Mouth. The field work consists of obtaining uncultured samples of the ultraplankton for examination by electron microscopy. Cultures are being initiated using inocula from field samples including pure cultures of the most numerous species from the study area. Numerical evaluation is being determined on the basis of ultrastructural studies of uncultured samples. An atlas of the ultraplankton of the lower Chesapeake Bay is being prepared from observations of field samples. Associated field data including carbon productivity, salinity, temperature, chlorophyll *a*, Phaeo-pigments, oxygen, nutrient concentrations (NO_3^-, NO_2^-, NH_4^+, PO_4^{-3}), adenylates, plankton respiration rates are being measured. Laboratory growth kinetic studies are being initiated on the cultures.

STATUS: Active. This project represents, in part, Hastings' thesis research.

FINANCIAL SUPPORT:

U. S. National Science Foundation
Virginia Institute of Marine Science

KEY WORDS: Chlorophyll, nutrients, phytoplankton

PROJECT TITLE: ULTRASTRUCTURAL, TAXONOMIC, AND LIFE HISTORY STUDIES OF HAPLOSPORIDAN PROTOZOA PATHOGENIC ON MARINE ANIMALS OUTSIDE THE CHESAPEAKE BAY REGION

INVESTIGATOR:

Frank O. Perkins, Department Head and Senior Marine Scientist

PROJECT SUMMARY:

Fine structure studies of haplosporidan pathogens of marine animals, particularly commercial shellfish, are being conducted on diseases found outside the Chesapeake Bay. Information is being used to better understand life cycles, ecology, and possible control of haplosporidan diseases in the Chesapeake Bay.

STATUS: Active.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science

PUBLICATIONS:

Perkins, F. O. 1976. Ultrastructure of sporulation in the European flat oyster pathogen, *Marteilia refringens*--taxonomic implications. J. Protozool. 23(1):64-74.

Perkins, F. O. and P. H. Wolf. 1976. Fine structure of *Marteilia sydneyi* n. sp.--haplosporidan disease organism of Australian oysters. J. Parasitol. 62(4):528-538.

KEY WORDS: Haplosporidan pathogens, ultrastructure

PROJECT TITLE: STUDIES OF MARINE COCCOID FUNGI AND PROTOZOA OF THE LOWER CHESAPEAKE BAY, VIRGINIA

INVESTIGATOR:

Frank O. Perkins, Department Head and Senior Marine Scientist

PROJECT SUMMARY:

Ecological, morphological, and taxonomic studies of the marine coccoid fungi and Protozoa found in the York River and Hampton Roads areas of Virginia are being conducted. A diverse group of coccoid, heterotrophic, eucaryotic micro-organisms, both free-living and parasitic, which are not uniflagellated Phycomycetes, is known to exist in the lower Chesapeake Bay and in the marine environment in general, but it is not known to exist in the lower Chesapeake Bay in the marine environment in general, but it is not known whether they are fungi, Protozoa, achlorophyllous algae, or encompass species of all groups. Some appear to be Phytomycetes of the order Saprolegniales, others appear to be related to the Labyrinthulia of the Protozoa, and some appear to be colorless forms of chlorococcalean algae. A morphological study at the light and electron microscope levels is being conducted in an effort to determine the taxonomic and phylogenetic affinities of the fungus and protozoan species in the study area. Those which appear to be chlorococcalean algae are not being studied extensively. An ecological study of selected species is also being pursued in which salinity, temperature, and temporal ranges are being determined. Both saprophytic and parasitic species are being studied from sediments, sea water, algae, invertebrates, and angiosperm detritus.

STATUS: Active.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science

PUBLICATIONS:

Perkins, F. O. 1976. Fine structure of lower marine and estuarine fungi. In: Recent advances in aquatic mycology. E. B. G. Jones, ed., Paul Elek Limited, London.

KEY WORDS: Fungi, Protozoa, ultrastructure

PROJECT TITLE: OUTER CONTINENTAL SHELF BENCHMARK STUDIES - HISTOPATHOLOGY (BLM)

INVESTIGATORS:

Craig Ruddell, Associate Marine Scientist
Frank O. Perkins, Department Head and Senior Marine Scientist
Susan Fox, Laboratory Specialist

PROJECT SUMMARY:

A histological study of benthic organisms of the outer continental shelf is being conducted. Determinations will be made as to the incidence of pathological conditions. Of major importance will be determinations of the presence or absence of neoplasms. If viral infections are indicated, ultrastructural studies of infected tissues will be conducted.

STATUS: Active. This is a subproject of "Environmental Data Acquisition and Analysis, Mid-Atlantic OCS."

FINANCIAL SUPPORT:

U. S. Department of Interior
(Bureau of Land Management)
Virginia Institute of Marine Science

KEY WORDS: Histopathology, outer continental shelf

Department of Microbiology-Pathology
Bacteriology Section

PROJECT TITLE: A STUDY OF THE RESPONSES OF SELECTED BACTERIAL AND FUNGAL POPULATIONS IN A SALT MARSH ENVIRONMENT TO CRUDE OIL SPILLAGE

INVESTIGATOR:

Howard I. Kator, Associate Marine Scientist

PROJECT SUMMARY:

The purpose of this research will be to measure the effects of crude oil spillage on microbial populations which utilize hydrocarbons and on those microbial populations significant in the mineralization of organic biopolymers. Therefore, in addition to determining the levels of aerobic bacterial and fungal heterotrophs and hydrocarbon oxidizers, populations of chitinoclastic and cellulytic microorganisms will be measured. Additionally, samples of marsh water and sediment will be used to inoculate closed flasks in simultaneity with the crude oil spill. Oil will be added to one series of flasks to measure the rate of crude oil degradation. Another series of flasks will receive oil + chitin and oil + cellulose (*Spartina*). Rates of cellulose and chitin utilization will be determined in the presence and absence of crude oil.

STATUS: Active.

FINANCIAL SUPPORT:

American Petroleum Institute
Virginia Institute of Marine Science

KEY WORDS: Bacteria, crude oil, fungi, oil spills, salt marshes

Department of Microbiology-Pathology
Bacteriology Section

PROJECT TITLE: RESPONSE OF HETEROTROPHIC AND PETROLEUM-DEGRADING BACTERIA TO OIL SPILLAGE IN A SALT MARSH

INVESTIGATORS:

Howard I. Kator, Associate Marine Scientist
Russell Herwig, Graduate Student

PROJECT SUMMARY:

During the fall of 1975, the Department of Microbiology-Pathology in cooperation with the Department of Ecology-Pollution started conducting experiments designed to find the ecological impact of two oil spills in a salt marsh. Three large transite sided enclosures were constructed. Unweathered Louisiana crude oil was spilled in one enclosure, artificially weathered South Louisiana crude in another, and the third served as a control. Thesis research involves enumerations of aerobic heterotrophic and petroleum-degrading bacteria populations from the tidal creek, intertidal, mid- and back-marsh zones. Dominant petroleum-degrading and heterotrophic bacterial isolates were selected for taxonomic grouping. Within several days following the spills, the levels of petroleum-degrading bacteria rose by several orders of magnitude relative to the control enclosure. This differential has been maintained for approximately one year.

STATUS: Active, nearing completion. This project represents Herwig's thesis research.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science
American Petroleum Institute

KEY WORDS: Bacterial degradation, bacterial taxonomy, microbial ecology, oil pollution, salt marsh

Department of Microbiology-Pathology
Parasitology Section

PROJECT TITLE: A STUDY OF CERTAIN ASPECTS OF HOST-SPECIFICITY, ZOOGEOGRAPHY, AND PHYLOGENY OF MONOGENETIC TREMATODES

INVESTIGATORS:

William J. Hargis, Jr., Institute Director
David E. Zwerner, Assistant Marine Scientist
Adrian R. Lawler*

PROJECT SUMMARY:

Ectoparasites of the order Monogenea exhibit a high order of host-specificity. As a result, it seems probable that more thorough study of the order will yield interesting information concerning host-specificity, zoogeography, and phylogeny of both hosts (fishes and some reptiles and amphibians in general) and parasites.

To accomplish this, pertinent data extracted from a comprehensive literature survey, as well as from our own taxonomic work on monogenetic trematodes collected from around the world, are recorded in a Key-Sort card catalog. Analysis of these data yields: (1) an understanding of the distribution patterns of monogeneid species; (2) elucidation of the distribution of monogenetic trematodes; (3) paleodistribution and histories of isolated populations of fishes as indicated by occurrence of monogeneids in contemporary species; (4) the possible phyletic origin and evolution of monogeneid flukes, and (5) possible applications of host-specificity patterns of monogeneids in clarifying the relations of the fish hosts.

STATUS: Continuing. A portion of this project represents Lawler's dissertation research which should come out as a VIMS publication.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science

PUBLICATION:

Lawler, A. R. Zoogeography and host-specificity of the superfamily Capsaloidea Price, 1936 (Monogenea: Monopistocotylea). VIMS Publication.

KEY WORDS: Host-specificity, monogenetic trematodes, phylogeny, zoogeography

*Dr. Adrian R. Lawler, Gulf Coast Research Laboratory, Ocean Springs, Mississippi

Department of Microbiology-Pathology
Parasitology Section

PROJECT TITLE: MONOGENETIC TREMATODES OF MENHADEN

INVESTIGATORS:

William J. Hargis, Jr., Institute Director
David E. Zwerner, Assistant Marine Scientist

PROJECT SUMMARY:

A detailed collection of juvenile and adult clupeids (primarily of the genus *Brevoortia*) was made from many stations along the Atlantic and Gulf coasts in order to check seasonal, geographic, host age variability of infestation, intraspecific, intrageneric, and intrafamilial parasite distribution, and thus derive a more detailed understanding of some of the factors acting in host-parasite relationships.

STATUS: Continuing, maintenance of collection only, additional support needed.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science

KEY WORDS: Atlantic Coast, Gulf of Mexico, menhaden, monogenetic trematodes

Department of Microbiology-Pathology
Parasitology Section

PROJECT TITLE: SURVEY OF THE DISEASES AND PARASITES OF MARINE FISHES, THEIR SYMPTOMS AND CONTROLS

INVESTIGATORS:

David E. Zwerner, Assistant Marine Scientist
Adrian R. Lawler*

PROJECT SUMMARY:

The diseases and parasites of both captive and naturally occurring marine fishes and the methods for controlling them are being studied through a review of the literature and a compilation of our own data. It is hoped to publish this information in an easily used format. Special emphasis is being placed on the symptoms exhibited by the host and on the different methods of controlling the disease agent.

A glossary of terms applicable to fish diseases is being prepared in addition to a fairly comprehensible bibliography on the controls of these diseases. A book dealing with the parasites and diseases of captive marine fishes will be prepared.

STATUS: Active.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science

KEY WORDS: Bibliography, controls, diseases, marine fishes, parasites

*Dr. Adrian R. Lawler, Gulf Coast Research Laboratory, Ocean Springs, Mississippi

Department of Microbiology-Pathology
Parasitology Section

PROJECT TITLE: STUDIES OF LARVAL MONOGENEA OF FISHES FROM THE CHESAPEAKE BAY AREA

INVESTIGATORS:

N. Kingston*
W. A. Dillon*
William J. Hargis, Jr., Institute Director

PROJECT SUMMARY:

Knowledge of the taxonomy of larvae of known adult monogenetic trematodes would provide much information on the ontogeny and phylogeny of the group and determine to a greater or lesser degree if the base of our taxonomy of adult worms is sound.

Adult monogenetic trematodes, collected from Chesapeake Bay area fishes, were placed into small dishes of sterile sea water and allowed to deposit eggs. Upon hatching, larvae were studied both alive and in fixed preparation.

In 1969, a portion of the work conducted by the principal investigator (N.K.) during several summers at VIMS was published.

STATUS: Continuing.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science

KEY WORDS: Larvae, monogenetic trematodes

*Dr. Newton Kingston, Division of Microbiology and Veterinary Medicine, Box 3354 University Station, University of Wyoming, Laramie, Wyoming (Participant in VIMS Summer Program).
Dr. William A. Dillon, University of Tennessee at Martin, Martin, Tennessee

Department of Microbiology-Pathology
Parasitology Section

PROJECT TITLE: TRANSLATIONS OF MONOGENETIC TREMATODE LITERATURE

INVESTIGATORS:

William J. Hargis, Jr., Institute Director
David E. Zwerner, Assistant Marine Scientist
John E. Simmons*

PROJECT SUMMARY:

In conjunction with a comprehensive literature survey on the host-specificity and taxonomy of the Monogenea, it has been necessary to translate many foreign works on the subject, most of them in Russian. To date, the Section has caused 45 foreign papers to be translated; 40% of these have been edited by Section personnel and published for use by other scientists.

Two lengthy translations (Ivanov, 1952, and Bychowsky, 1937) have been edited by Dr. Simmons and are being readied for publication in the VIMS Translation Series. Bychowsky, 1937 is now ready for printing.

STATUS: Active. It is planned to terminate this project when the Ivanov, 1952, and Bychowsky, 1937 translations have been published.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science

KEY WORDS: Monogenetic trematodes, translations

*Dr. John E. Simmons, Department of Zoology, University of California, Berkeley, California.

Department of Microbiology-Pathology
Parasitology Section

PROJECT TITLE: PARASITES OF WESTERN NORTH ATLANTIC FAUNA WITH EMPHASIS ON THE CHESAPEAKE BAY AREA

INVESTIGATORS:

Frank O. Perkins, Department Head and Senior Marine Scientist
David E. Zwerner, Assistant Marine Scientist
Ilan Paperna*

PROJECT SUMMARY:

Knowledge of the parasite fauna of marine vertebrates and invertebrates from the Virginia sea coast and Chesapeake Bay is sparce, as is knowledge of the dynamics of parasite populations and their importance to the populations of free-living animals and the ecosystem in general. A survey of the parasites, mostly from fishes, is being made from various previous collections, and new collections are being made to fill in the gaps. An attempt to determine pathology caused by the parasites and their effect on the condition of fishes is also being made. Baseline studies to better define the "healthy" or "normal" fish are underway on selected species. A histological atlas, with hematological data, will give a better handle on the condition of fishes. The parasite section of the VIMS checklist was recently up-dated to include new parasite records from these surveys; additional up-dating is necessary now. A 14-month study of the parasites and the pathological changes they cause has been made on lower Chesapeake Bay populations of striped bass, year classes 0+ to 3, to determine how parasites affect their host and how much of the "total natural mortality" is caused or influenced by parasites. Four papers have been published and two are in preparation: one on population dynamics of parasitic copepod *Ergasilus labracis* on the gills of striped bass; and one on biology and pathogenicity of the coelom nematode *Philometra rubra*.

STATUS: Continuing.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science

PUBLICATIONS:

Paperna, I. and D. E. Zwerner. 1973. Preliminary report on the dynamics of parasitic infections in the striped bass, *Morone saxatilis* (Walbaum), from the York River. Va. Acad. Sci., 4 May 1973.

Paperna, I. and D. E. Zwerner. 1974. *Kudoa cerebralis* sp. n. (Myxosporidea, Chloromyxidae) from the striped bass, *Morone saxatilis* (Walbaum). J. Protozoology 21(1):15-19.

Paperna, I. and D. E. Zwerner. 1974. Massive leech infestation on a white catfish (*Ictalurus catus*): a histopathological consideration. Proc. Helm. Soc. Wash. 41(1): 64-67.

Paperna, I. and D. E. Zwerner. 1976. Studies on *Ergasilus labracis* Krøyer (Cyclopidea:Ergasilidae) parasitic on striped bass, *Morone saxatilis*, from the lower Chesapeake Bay. I. Distribution, life cycle, and seasonal abundance. Canadian J. Zool. 54(4):449-462.

Paperna, I. and D. E. Zwerner. 1976. Parasites and diseases of striped bass, *Morone saxatilis* (Walbaum), from the lower Chesapeake Bay. J. Fish Biol. 9:267-281.

KEY WORDS: Chesapeake Bay, marine fauna, *Morone saxatilis*, parasites, striped bass, Western North Atlantic

*Ilan E. Paperna, Heinz Steinitz Marine Biology Laboratory, Elat, Israel. (Formerly NSF Senior Foreign Scientist Fellow, Marine Science, Coll. William & Mary).

Department of Microbiology-Pathology
Parasitology Section

PROJECT TITLE: BIBLIOGRAPHY OF THE MONOGENETIC TREMATODE LITERATURE OF THE WORLD, 1758 TO PRESENT

INVESTIGATORS:

William J. Hargis, Jr., Institute Director
David E. Zwerner, Assistant Marine Scientist
Adrian R. Lawler*

PROJECT SUMMARY:

A necessary tool and natural product of any comprehensive literature review is an accurate, up-to-date bibliography. Such a bibliography has resulted from the Parasitology Section's taxonomic work on monogenetic trematodes (Platyhelminthes: Trematoda) and as a consequence of data accessioning for an analysis of the host-specificity of this interesting group of parasites. The publication of a complete bibliography on these parasites is a valuable aid to their study. The basic bibliography was published in September 1969. It is hoped to keep the bibliography current with supplements every one or two years. Supplement 1 to the bibliography was published in February 1970, and Supplements 2 and 3 were published in March 1971 and 1972 respectively and Supplement 4 is now being readied for printing.

STATUS: Continuing.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science

KEY WORDS: Bibliography, monogenetic trematode

*Dr. Adrian R. Lawler, Gulf Coast Research Laboratory, Ocean Springs, Mississippi

Department of Microbiology-Pathology
Parasitology Section

PROJECT TITLE: MONOGENETIC AND DIGENETIC TREMATODES OF MIDDLE CONTINENTAL SHELF OFF WEST AFRICA

INVESTIGATORS:

William J. Hargis, Jr., Institute Director
David E. Zwerner, Assistant Marine Scientist
Robin M. Overstreet*

PROJECT SUMMARY:

A total of 1044 fishes from the Gulf of Guinea was collected utilizing the mass collecting technique developed by Hargis. Forty-six percent of the hosts have been examined yielding about 660 monogenetic trematodes, and other parasites. This good collection from previously unexamined hosts and localities when finally worked up will do much in elucidating the systematic scheme of the Monogenea as well as providing important data for host-specificity studies.

Dr. Overstreet will work up the digenetic trematodes in conjunction with some of his own material from Africa.

STATUS: Continuing, maintenance of collection only, additional support needed.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science

KEY WORDS: Africa, digenetic trematodes, fishes, monogenetic trematodes

*Dr. Robin M. Overstreet, Gulf Coast Research Laboratory, Ocean Springs, Mississippi

Department of Microbiology-Pathology
Parasitology Section

PROJECT TITLE: PARASITIC COPEPODS FROM MARINE FISHES OF NEW ZEALAND AND AUSTRALIA

INVESTIGATORS:

William J. Hargis, Jr., Institute Director
G. C. Hewitt*
David E. Zwerner, Assistant Marine Scientist

PROJECT SUMMARY:

Numerous parasitic copepods were collected in conjunction with the Parasitology Section's survey of the monogenetic trematodes of fishes of New Zealand and Australia under the direction of Dr. W. J. Hargis, Jr.

In view of their potential aid in the study of the total parasitic fauna of fishes and for their own sake as ectoparasites, a systematic study was undertaken in conjunction with Dr. Hewitt. Processing, involving whole mounts, dissections, and systematic descriptions is underway.

STATUS: Continuing.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science

KEY WORDS: Australia, fishes, New Zealand, parasitic copepods

*Dr. G. C. Hewitt, Victoria University of Wellington, Wellington, New Zealand

Department of Microbiology-Pathology
Parasitology Section

PROJECT TITLE: MONOGENETIC TREMATODES OF FISHES OF PUERTO RICO

INVESTIGATORS:

William J. Hargis, Jr., Institute Director
David E. Zwerner, Assistant Marine Scientist

PROJECT SUMMARY:

A collection of fishes was made from the marine waters of Puerto Rico. Many of the trematodes obtained from these fishes will undoubtedly be new to science, and their systematic innovations will shed light on the relations of one taxon to another.

Collections were made using the mass collection technique developed by Hargis. Some of the material resulting from this collection was processed for study. Host-parasite data will be incorporated into our host-specificity file.

STATUS: Continuing, maintenance of collection only, additional support needed.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science

KEY WORDS: Fishes, monogenetic trematodes, Puerto Rico

Department of Microbiology-Pathology
Parasitology Section

PROJECT TITLE: PARASITES OF VERTEBRATES (MOSTLY FISHES) FROM THE ANTARCTIC AND SOUTHERN PACIFIC OCEANS WITH EMPHASIS ON THE SYSTEMATICS OF MONOGENETIC TREMATODES

INVESTIGATORS:

William J. Hargis, Jr., Institute Director
William A. Dillon*
Adrian R. Lawler*
Robin M. Overstreet*
E. Lynn Suydam*
David E. Zwerner, Assistant Marine Scientist

PROJECT SUMMARY:

Knowledge of the parasitic fauna of the marine vertebrates from the waters around Antarctica and near the surrounding land masses is very sparce. Since monogenetic trematode parasites of fishes are quite host specific and in view of the indicated ancient geographic relationships of these land masses, studies here should prove fertile and measurably increase our understanding of the paleodistribution of both host and parasite. Studies of taxonomy and host-specificity should add to our knowledge of both host and parasite phylogeny. Extensive collections of host material, for both endo- and ectoparasites, have been made from the following areas utilizing the mass collection technique developed by Hargis: McMurdo Sound, Antarctica - 1958, 1959, 1964, 1965; New Zealand - 1960; Windmill Islands, Wilkes Station, Antarctica - 1961-62; Australia - 1962; Chile and Drakes Passage - 1962; Palmer Station, Antarctica Peninsula - 1967-68. All of the collections have been processed for study (mounted on slides), and taxonomic study of the parasites is in various stages of completion. To date, eight publications and three M.A. theses have resulted.

STATUS: Active.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science

KEY WORDS: Antarctica, fishes, monogenetic trematodes, southern Pacific Ocean

*Dr. William A. Dillon, Department of Biological Sciences, University of Tennessee, Martin, Tennessee.
*Dr. Adrian R. Lawler, Gulf Coast Research Laboratory, Ocean Springs, Mississippi.
*Dr. Robin M. Overstreet, Gulf Coast Research Laboratory, Ocean Springs, Mississippi.
*Mr. E. Lynn Suydam, Rappahannock Community College, Warsaw, Virginia

PROJECT TITLE: THE ZOOPLANKTON OF LOWER CHESAPEAKE BAY

INVESTIGATORS:

George C. Grant, Department Head and Associate Marine Scientist
John E. Olney, Assistant Marine Scientist
Burton B. Bryan, Graduate Assistant
Fred Jacobs, Graduate Assistant

PROJECT SUMMARY:

A randomized, stratified monthly sampling of zooplankton from the lower Chesapeake Bay was conducted for a two-year period, August 1971 - July 1973. These samples are being successively split into aliquots - larger for less abundant taxa, smaller for more abundant taxa - for identification and enumeration. Results will be presented by major groups such as Copepoda, Chaetognatha and Cladocera, showing seasonal distribution and relation of species abundance to hydrography.

Biomass estimates include measurements of settled volume, dry weight and protein content. Biochemical constituents being measured include, in addition to protein: lipids, carbohydrates and selected analyses of fatty acids.

This project will provide background data necessary for more restricted studies of the effects of sewage emissions on secondary production.

STATUS: Continuing

FINANCIAL SUPPORT:

Virginia Institute of Marine Science

KEY WORDS: Biomass, chaetognatha, Chesapeake Bay, cladocera, copepoda, secondary production, zooplankton

Department of Planktology
Department of Environmental Physiology

PROJECT TITLE: HETEROCYCLIC COMPOUNDS AND LIPIDS ASSOCIATED WITH PLANKTON

INVESTIGATORS:

George C. Grant, Department Head and Associate Marine Scientist
Paul L. Zubkoff, Head, Department of Environmental Physiology
Fred Jacobs, Graduate Assistant

PROJECT SUMMARY:

Zooplankton obtained from monthly plankton tows of the lower Chesapeake Bay are being analyzed for biochemical constituents, including protein, carbohydrates, lipids (particularly fatty acids), and some selected pigments.

When possible, planktonic organisms which are available from cultures are also analyzed.

STATUS: Active.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science

KEY WORDS: Carbohydrates, fatty acids, lipids, protein, zooplankton

PROJECT TITLE: PLANKTONIC FISH EGGS AND LARVAE OF THE LOWER CHESAPEAKE BAY

INVESTIGATORS:

George C. Grant, Department Head and Associate Marine Scientist
John E. Olney, Research Assistant

PROJECT SUMMARY:

Information on the ichthyoplankton of the lower Chesapeake Bay is scattered and generally lacking. During a three year VIMS zooplankton survey (August 1971-August 1973, plus four quarterly cruises) approximately 15,000 eggs and larvae were removed from samples taken within the lower Chesapeake Bay. This research intends to identify these planktonic fish eggs and larvae to family, genus and species (where possible) and to use these data to prepare a more complete picture of the seasonal abundance, species composition, and spatial distribution of fish eggs and larvae within the lower Chesapeake Bay. In addition, physical parameters (salinity, temperature, dissolved oxygen) will be considered as they relate to the occurrence and distribution of Chesapeake Bay ichthyoplankton.

STATUS: Active. This project represents Olney's thesis research.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science

KEY WORDS: Ichthyoplankton

PROJECT TITLE: THE ECOLOGY OF THE CLADOCERA OF LOWER CHESAPEAKE BAY

INVESTIGATORS:

George C. Grant, Department Head and Associate Marine Scientist
Burton B. Bryan, Graduate Assistant

PROJECT SUMMARY:

The distribution and abundance of Cladocera in lower Chesapeake Bay are being described and analyzed from monthly collections obtained from August 1971 - July 1973. Field data will be employed in the design of laboratory experiments to show the influence of hydrography on fluctuations in distribution and abundance, especially for the abundant summer species *Penilia avirostris* and *Evadne tergestina*.

Four other species are encountered in lower Cheseapeake Bay: *Evadne nordmanni*, *Podon intermedius*, *P. leuckarti* and *P. polyphemoides*, the latter being present year-round.

STATUS: Active. This project represents Bryan's dissertation research.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science

KEY WORDS: Chesapeake Bay, cladocera, *Evadne*, *Penilia*, *Podon*

PROJECT TITLE: SEASONAL COMPOSITION AND BIOMASS OF ZOOPLANKTON IN THE LOWER CHESAPEAKE BAY

INVESTIGATORS:

George C. Grant, Department Head and Associate Marine Scientist
Fred Jacobs, Graduate Assistant

PROJECT SUMMARY:

This project is based on monthly zooplankton sampling over a two-year period in the lower Chesapeake Bay. Zooplankton composition within major taxonomic groups, distribution within the study area and biomass were determined. Temporal differences reveal monthly seasonal and yearly patterns in abundances of major zooplankton groups, while spatial variations have also been determined and quantified. The impact of environmental factors such as dissolved oxygen, salinity and water temperature was also examined. Furthermore the study reveals distinct winter and summer zooplankton population and comments on zooplankton community structure.

Biomass parameters include settled volumes, dry weight, and ash free dry weight. In addition, components of the dry weight, such as protein, lipid, carbohydrate and ash have been examined and expressed as percent of dry weight.

STATUS: Active. This project represents Jacobs' dissertation research.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science

KEY WORDS: Biomass, Chesapeake Bay, seasonal composition, zooplankton

PROJECT TITLE: OUTER CONTINENTAL SHELF BENCHMARK STUDIES--ZOOPLANKTON AND NEUSTON (BLM)

INVESTIGATORS:

George C. Grant, Department Head and Associate Marine Scientist
John Olney, Assistant Marine Scientist
Paul Stofan, Associate Marine Scientist
Russell Short, Graduate Assistant
Peter Smyth, Graduate Assistant
Burton Bryan, Graduate Assistant
Cathy Womack, Graduate Assistant
Michael Vecchione, Graduate Assistant
Roberta Wallace, Graduate Assistant

PROJECT SUMMARY:

Twelve stations on the mid-Atlantic continental shelf are being sampled quarterly for neuston and zooplankton. Neuston is collected at three hour intervals over a 24 hour period at each station with 505 Nitex nets. The water column is sampled for zooplankton once at each station, using obliquely towed 24" bongo samplers, equipped with 202 and 505 Nitex nets.

Samples are preserved or frozen for identification, hydrocarbon and trace metal analyses, and analysis of tarballs.

STATUS: Active. This is a subproject of the project "Environmental Data Acquisition and Analysis, Mid-Atlantic OCS".

FINANCIAL SUPPORT:

U. S. Department of the Interior
(Bureau of Land Management)
Virginia Institute of Marine Science

KEY WORDS: Continental shelf, hydrocarbons, neuston, New Jersey, tarballs, trace metals, zooplankton

PROJECT TITLE: PELAGIC AMPHIPODS (AMPHIPODA: HYPERIIDEA) ON A CONTINENTAL SHELF TRANSECT IN THE MIDDLE ATLANTIC BIGHT (BLM)

INVESTIGATORS:

George C. Grant, Department Head and Associate Marine Scientist
Russell A. Short, Graduate Assistant

PROJECT SUMMARY:

Quarterly sampling off southern New Jersey on a transect extending across the continental shelf has provided collections necessary for a study of pelagic Amphipoda, a group of zooplankters poorly known in the Middle Atlantic Bight. Samples were obtained with 60 cm opening-closing bongos and with 1-meter neuston nets, and include six 24-hour neuston stations each quarter.

The study will identify the species of hyperiid amphipods found in the area, and estimate seasonal and inshore-offshore relative abundance of the identified species. Keys to identification will be prepared.

STATUS: Active. This project represents Short's thesis research.

FINANCIAL SUPPORT:

U. S. Department of the Interior (Bureau of Land Management)
Virginia Institute of Marine Science

KEY WORDS: Amphipods, continental shelf, hyperiids, Middle Atlantic Bight, neuston, zooplankton

PROJECT TITLE: THE DECAPOD LARVAE OF CONTINENTAL SHELF WATERS OF THE MIDDLE ATLANTIC BIGHT (BLM)

INVESTIGATORS:

George C. Grant, Department Head and Associate Marine Scientist
Peter O. Smyth, Graduate Assistant

PROJECT SUMMARY:

Few larvae of decapods of the continental shelf have been described, especially those from the outer shelf. This project, utilizing the sampling programs within the Bureau of Land Management contract with VIMS for assessment of the OCS environment in the Middle Atlantic Bight, will describe whatever forms can be laboratory reared from adult to larvae or from larvae to adult. Techniques for handling and rearing deep water forms on shipboard and in the laboratory will be developed.

Distribution of larvae collected in zooplankton and neuston tows will be described. Relationships of the adult (benthic) community to the planktonic larval community, and of the larval decapods to environmental parameters will also be explored.

STATUS: Active. This project represents Smyth's dissertation research.

FINANCIAL SUPPORT:

U. S. Department of the Interior (Bureau of Land Management)
Virginia Institute of Marine Science

KEY WORDS: Continental shelf, decapod larvae, Decapoda, Middle Atlantic Bight, neuston, zooplankton

PROJECT TITLE: ZOOPLANKTON OF NORFOLK CANYON AND ADJACENT CONTINENTAL SLOPE WATERS

INVESTIGATORS:

George C. Grant, Department Head and Associate Marine Scientist
John E. Olney, Research Assistant

PROJECT SUMMARY:

A qualitative and quantitative study of the as yet undescribed zooplankton communities existing in the waters of Norfolk Canyon is the purpose of this project. A preliminary series of plankton tows, 0-400 meters in depth, were obtained in August 1969 on board the R/V *Albatross IV* (NMFS). These were repeated at six-hour intervals over a 24-hour period. Initial examinations revealed the presence (in summer) of an unsuspected boreal fauna at depth.

Spring fauna was sampled in April 1971 via the R/V *Eastward* (NSF) (an attempt to reach the area in November 1969 on this vessel failed). This vessel returned to the study area in May 1972, April 1974 and July 1975.

An extensive series of surface (0-150 m) zooplankton samples, stratified diurnally and by bottom depth, was obtained in June 1973 on the R/V *Columbus Iselin* (University of Miami). Two subareas were sampled, one in the immediate Canyon area, the other over the open slope south of Norfolk Canyon.

Fall conditions were sampled in November 1974 on the R/V *Gilliss* (University of Miami), repeating the above sampling plan and adding discreet sampling at depth with the use of a ½-meter opening-closing bongo system.

Summer zooplankton was sampled in September 1975 on the R/V *Gilliss*, using 24" bongos with mesh sizes of 202 and 333 microns. Similar sampling was conducted in winter on a January 1976 cruise of the *Gilliss*.

STATUS: Active. Zooplankton work not yet funded; benthic fish studies support by NSF.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science

KEY WORDS: Continental slope, Norfolk Canyon, zooplankton

PROJECT TITLE: SAMPLING OF PHYTOPLANKTON AND ZOOPLANKTON IN QUANTITATIVE BASELINE AND MONITORING PROGRAMS

INVESTIGATORS:

George C. Grant, Department Head and Associate Marine Scientist
Paul E. Stofan, Associate Marine Scientist
Fred Jacobs, Assistant Marine Scientist

PROJECT SUMMARY:

Preparation of up-to-date guidelines for use by EPA officials in specifying sampling requirements for marine plankton surveys and monitoring programs. Separate sets of guidelines will be prepared for phytoplankton and zooplankton.

STATUS: Active.

FINANCIAL SUPPORT:

Environmental Protection Agency
Virginia Institute of Marine Science

KEY WORDS: Phytoplankton, sampling, zooplankton

PROJECT TITLE: VIRGINIA WETLANDS INVENTORY, MAPPING AND CLASSIFICATION PROGRAM (CRM)

INVESTIGATORS:

Gene Silberhorn, Associate Marine Scientist
Kenneth A. Moore, Assistant Marine Scientist
Thomas A. Barnard, Jr., Assistant Marine Scientist

PROJECT SUMMARY:

The Institute, as required by the Wetlands Act of 1972, is inventorying and classifying its tidal wetlands by type, and has developed guidelines concerning the consequences of various uses of wetlands. An illustrated guide to all tidal wetlands plants listed in the Act has been published.

Tidal wetlands within each county or city of Virginia are being inventoried. Aerial photography, topographic maps coupled with intense ground truth methods are utilized in mapping wetland areas ¼ of an acre or larger.

Marshes are designated by number and are indicated on maps. Information, such as acreage, species percentage, marsh type and other observations are recorded. The relative values of different types of marshes are explained and indicated for each marsh.

STATUS: Active.

FINANCIAL SUPPORT:

National Oceanic and Atmospheric Administration
(Office of Coastal Zone Management)
Virginia Institute of Marine Science

PUBLICATIONS (Since 1974):

Silberhorn, Gene M., George M. Dawes, and Thomas A. Barnard, Jr. 1974. Coastal wetlands of Virginia: interim report number 3. VIMS SRAMSOE No. 46.

Silberhorn, Gene M. 1974. Mathews County Tidal marsh inventory. VIMS SRAMSOE No. 47.

Silberhorn, Gene M. 1974. York County and Town of Poquoson tidal marsh inventory. VIMS SRAMSOE No. 53.

Silberhorn, Gene M. 1975. Northumberland County tidal marsh inventory. VIMS SRAMSOE No. 58.

Moore, Kenneth A. 1975. Stafford County tidal marsh inventory. VIMS SRAMSOE No. 62.

Moore, Kenneth A. 1975. King George County tidal marsh inventory. VIMS SRAMSOE No. 68.

Moore, Kenneth A. 1975. Prince William County tidal marsh inventory. VIMS SRAMSOE No. 78.
Barnard, Thomas A. 1975. City of Hampton tidal marsh inventory. VIMS SRAMSOE No. 60.
Doumlele, Damon G. 1976. Fairfax County tidal marsh inventory. VIMS SRAMSOE No. 108.
Silberhorn, Gene M. 1976. Tidal wetland plants of Virginia. VIMS Ed. Series No. 19.
Moore, Kenneth A. 1976. Gloucester County tidal marsh inventory. (in press). VIMS SRAMSOE No. 64.
Doumlele, Damon G. 1976. City of Virginia Beach marsh inventory, Vol. 1. North Landing River and Tributaries. (in press). VIMS SRAMSOE No. 118.

KEY WORDS: Inventory, mapping, marshes, wetlands

PROGRAM 4:

Coastal Zone Hydrography

And Geology

Department of Estuarine Processes and Chemical Oceanography
Department of Physical Oceanography and Hydraulics

PROJECT TITLE: WATER QUALITY AND MODELING STUDIES OF THE LOWER JAMES AND YORK ESTUARIES

INVESTIGATORS:

Bruce Neilson, Associate Marine Scientist and Acting Department Head
Albert Y. Kuo, Associate Marine Scientist
C. S. Fang, Senior Marine Scientist
Paul V. Hyer, Associate Marine Scientist
H. S. Chen, Associate Marine Scientist
Gaines Ho, Associate Marine Scientist
Arlene Rosenbaum, Assistant Marine Scientist
Linda Kilch, Research Assistant
Fred Holden, Graduate Assistant
Bernard Hsieh, Graduate Assistant

PROJECT SUMMARY:

Intensive field surveys and slack water monitoring surveys were made of several tributaries of Chesapeake Bay: the York River and the James River, including the Elizabeth River, Nansemond River and Pagan River.

Data from these surveys will be used to evaluate present water quality conditions and to calibrate mathematical models.

The model of the York River will include both horizontal dimensions and at least two vertical layers. The model of the James River will also be two-dimensional in the horizontal plane but vertically averaged. The three tributaries will be modeled with a one-dimensional model. All models are time-varying and include the following water quality measures: fecal coliforms, dissolved oxygen, biochemical oxygen demand, chlorophyll "a", and nutrients.

These models will be used to assess the relative impacts of point and non-point sources of pollution. Where necessary, waste load allocation schemes will be developed to bring ambient water quality up to the appropriate stream standards.

STATUS: Active. This project is a subproject of the Hampton Roads 208 Program.

FINANCIAL SUPPORT:

U. S. Environmental Protection Agency
Hampton Roads Water Quality Agency

KEY WORDS: Estuaries, mathematical models, waste load allocations, water quality

Department of Estuarine Processes and Chemical Oceanography
Department of Physical Oceanography and Hydraulics

PROJECT TITLE: WATER QUALITY AND MODELING STUDIES OF THE SMALL COASTAL BASINS

INVESTIGATORS:

Bruce Neilson, Associate Marine Scientist and Acting Department Head
Albert Y. Kuo, Associate Marine Scientist
Paul V. Hyer, Associate Marine Scientist
C. S. Fang, Senior Marine Scientist
Angela D'Amico, Graduate Assistant

PROJECT SUMMARY:

Intensive field surveys and slack water monitoring surveys were made of four small coastal basins on the Chesapeake Bay: Back River, Poquoson River, Little Creek Harbor and the Lynnhaven Bay system. The data from these surveys have been used to evaluate present water quality conditions and to calibrate mathematical models. The Back and Poquoson Rivers are being simulated by one-dimensional, time varying models developed under the Cooperative State Agencies program by VIMS. For Little Creek and Lynnhaven, Ketchum's tidal prism model has been modified to suit local conditions. Water quality measures modeled are: dissolved oxygen, biochemical oxygen demand, chlorophyll "a", nutrients, and fecal coliforms.

These models will be used to assess the relative impacts of point and non-point sources of pollution. Waste load allocation schemes will be developed to assure satisfactory water quality conditions in the future.

STATUS: Active. This project is a subproject of VIMS' studies for the Hampton Roads 208 program.

FINANCIAL SUPPORT:

U. S. Environmental Protection Agency
Hampton Roads Water Quality Agency

PUBLICATIONS:

Kuo, Albert Y. 1976. "A Model of Tidal Flushing for Small Coastal Basins". Proceedings of Conference on Environmental Modeling and Simulation, Cincinnati, Ohio, U. S. EPA.

Neilson, Bruce. 1976. "Water Quality in the Small Coastal Basins". Report to Hampton Roads Water Quality Agency.

KEY WORDS: Estuaries, models, tidal prism, waste load allocations, water quality

Department of Estuarine Processes and Chemical Oceanography
Department of Ecology-Pollution
(Environmental Chemistry Section)

PROJECT TITLE: OUTER CONTINENTAL SHELF BENCHMARK STUDIES - HYDROCARBON ANALYSIS (BLM)

INVESTIGATORS:

Rudolf H. Bieri, Senior Marine Scientist
Craig L. Smith, Associate Marine Scientist
William MacIntyre, Associate Marine Scientist
Chih-Wu Su, Associate Marine Scientist
Kent Cueman, Associate Marine Scientist

PROJECT SUMMARY:

This project involves the collection and analysis of a variety of samples from the Mid-Atlantic Outer Continental Shelf, including water, suspended particulates, sediments, and organisms. The hydrocarbons from each sample are solvent extracted, separated into aromatic and aliphatic fractions by column chromatography. Individual compounds and hydrocarbon classes will then be identified and quantified by the techniques of gas chromatography and mass spectroscopy.

The purpose of this project is to establish baseline or "benchmark" values of hydrocarbon concentrations in OCS samples; these values may then be later compared with data from monitoring studies conducted in the OCS area after exploration for and production of petroleum has been carried out.

STATUS: Active. This is a subproject of the project "Environmental Data Acquisition and Analysis, Mid-Atlantic OCS".

FINANCIAL SUPPORT:

U. S. Department of the Interior
(Bureau of Land Management)
Virginia Institute of Marine Science

KEY WORDS: Gas chromatography, hydrocarbons, mass spectrometry, mid-Atlantic Outer Continental Shelf Baseline Studies, petroleum

PROJECT TITLE: PHOSPHORUS EXCHANGE WITH SEDIMENTS IN A CHESAPEAKE BAY ESTUARY

INVESTIGATORS:

W. G. MacIntyre, Associate Marine Scientist
C. A. Lake, Graduate Assistant

PROJECT SUMMARY:

Phosphorus distribution in overlying and interstitial water and sediments in the vicinity of the Lamberts Point sewage treatment plant outfall in the Elizabeth River will be determined over a period of one year. Publication of this work is presently in preparation.

A laboratory phase of this project considers the significance of phosphorus adsorption on sedimentary materials in regulating the distribution of phosphorus in the sediment-water system.

The adsorption experiments involve uptake studies of phosphate and polyphosphate on four different clay minerals, on synthetic kaolinite and montmorillonite, and on Elizabeth River sediment samples. Funding for this portion has been discussed with the Office of Water Resources Research and their support is anticipated.

Utilizing data from the laboratory and field studies, a model has been attempted to enable the prediction of the partitioning of phosphorus between water and sediment given the concentration of the phosphorus compounds in the source (effluent) streams.

STATUS: Active. The laboratory work represents Lake's dissertation research.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science
Office of Water Resources Research

PUBLICATION:

Lake, C. A. 1977. Adsorption of phosphate and TPP by clay minerals and estuarine sediments. Virginia Water Resources Research Center, VPI. Bulletin No. 109.

KEY WORDS: Clay minerals, estuaries, phosphorus, sediments

PROJECT TITLE: SHORELINE SITUATION REPORTS FOR VIRGINIA (CRM)

INVESTIGATORS:

Robert J. Byrne, Department Head and Senior Marine Scientist
Carl H. Hobbs, III, Assistant Marine Scientist
Dennis W. Owen, Research Specialist
Lynne M. Rogers, Laboratory Technician
Gaynor B. Williams, Laboratory Technician

PROJECT SUMMARY:

The goal of this program is to supply, on a county-by-county basis, the baseline information which planning and managing agencies need to develop comprehensive management schemes. The shoreline situation reports supply complimentary information to the Tidal Marsh Inventories of the Wetlands Section. The reports include 1) present erosion characteristics, 2) historical average erosion rates, 3) an assessment of shore protection structures or suggestions for shore protection measures (where needed), 4) distribution of shore types, 5) distribution of present shore uses, 6) factors which might tend to constrain future development, and other factors which have local significance.

STATUS: Active. The project is part of the Commonwealth's Coastal Resources Management Program.

FINANCIAL SUPPORT:

National Oceanic and Atmospheric Administration
(Office of Coastal Zone Management)
Virginia Department of Commerce and Resources
Virginia Institute of Marine Science

PUBLICATIONS:

Shoreline Situation Reports:
Northampton County - SRAMSOE 54
Mathews County - SRAMSOE 77
Newport News - SRAMSOE 55
City of Hampton - SRAMSOE 76
Middlesex County - SRAMSOE 100
Stafford County - SRAMSOE 79
Isle of Wight County - SRAMSOE 97
Accomack County - SRAMSOE 80
York County - SRAMSOE 82
New Kent, King William, and King and Queen Counties - SRAMSOE 99
James City County - SRAMSOE 81
Henrico, Chesterfield, and Richmond - SRAMSOE - 98
Gloucester County - SRAMSOE 83
City of Suffolk - SRAMSOE 116

KEY WORDS: Aerial photography, Chesapeake Bay (and all subestuaries), Coastal Resources Management, erosion, inventory, management, shorelines

PROJECT TITLE: SHORE EROSION IN TIDEWATER VIRGINIA (CRC)

INVESTIGATORS:

Robert J. Byrne, Department Head and Senior Marine Scientist
Gary Anderson, Research Assistant

PROJECT SUMMARY:

In an effort to assess the extent of shoreline erosion of the Virginia tidewater within the Chesapeake Bay system, the topographic map series of 1850 and 1940 were used to distinguish erosion zones. Over 3,000 miles of shoreline have been studied with a statistical compilation from approximately 1,800 reaches. The parameters taken for each reach are: (1) area eroded or accreted, (2) average erosion distance and erosion rate, (3) length of shoreline, and (4) volume of material eroded or accreted. The results, which exclude the ocean shoreline, indicate over 20,000 acres have been eroded for a 100 yeare period.

STATUS: Reports will be published in 1977. This is a subproject of the Edges Program of "Chesapeake Bay Research" of the Chesapeake Research Consortium, Inc.

FINANCIAL SUPPORT:

National Science Foundation
(RANN Program)
Virginia Institute of Marine Science

KEY WORDS: Chesapeake Bay, erosion, shorelines

PROJECT TITLE: APPLICATION OF THE PERCHED BEACH CONCEPT TO SHORELINE EROSION CONTROL (SGP)

INVESTIGATORS:

R. J. Byrne, Department Head and Senior Marine Scientist
Gary Anderson, Assistant Marine Scientist

PROJECT SUMMARY:

The goal of the proposed research is to test, at field demonstration sites, the applicability of the perched beach concept to erosion control within Chesapeake Bay system. The foreshore is artificially elevated by placing a sill at the toe of the beach. Approximately twenty sites are being evaluated.

STATUS: Active.

FINANCIAL SUPPORT:

National Oceanic and Atmospheric Administration
(National Sea Grant Program)
Virginia Institute of Marine Science

KEY WORDS: Chesapeake Bay, erosion, management, planning

PROJECT TITLE: EROSION OF BARRIER ISLANDS - HISTORICAL

INVESTIGATOR:

Robert J. Byrne, Department Head and Senior Marine Scientist

PROJECT SUMMARY:

The erosion rates for the barrier islands have been determined using U. S. Coast and Geodetic Survey data from historical topographic and hydrographic surveys which were initiated in 1852. The shoreline position plots have supplied acreages lost due to erosion and zones of accretion.

STATUS: Active.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science

KEY WORDS: Barrier islands, Eastern Shore, erosion, shorelines

PROJECT TITLE: HISTORICAL AREAL CHANGES OF EASTERN SHORE MARSHES

INVESTIGATOR:

Robert J. Byrne, Department Head and Senior Marine Scientist

PROJECT SUMMARY:

The topographic surveys of 1852-70 have been compared with the planimetric surveys of 1962. These data indicate areas of marsh erosion and growth. Approximately 11 percent reduction of marsh area has occurred since 1852.

STATUS: Active. Report is in preparation.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science

KEY WORDS: Eastern Shore, erosion, marshes

PROJECT TITLE: DAM NECK OCEAN OUTFALL EVALUATION AND INTERPRETATION

INVESTIGATORS:

J. D. Boon, Associate Marine Scientist
V. Goldsmith, Associate Marine Scientist
A. Gutman, Graduate Assistant
C. Welch, Associate Marine Scientist
K. Kiley, Graduate Assistant
R. Byrne, Department Head and Senior Marine Scientist
J. Zeigler, Assistant Director and Head, Division of Physical Science and Ocean Engineering
L. Zellmer, Graduate Assistant

PROJECT SUMMARY:

This project consists of investigative work in the offshore zone at Dam Neck, Virginia where a planned 66-inch sewer outfall pipe is to be buried below the sediment-water interface. There task elements are being addressed as follows:

1) Evaluation of bottom cores for depths of cut and fill - A number of cores connected by an engineering firm for foundation analysis are being examined at VIMS to determine the past depositional environment and to look for evidence of recent mobility (cut-and-fill structures) at the top of the sediment column.

2) Analysis of existing information on wave climate - Existing data in the vicinity of the outfall site, including ship's observations, hindcast waves, and in situ observations at Virginia Beach are to be processed to determine parameters such as mean wave height, wave period, and dominant direction of wave approach. Seasonal and spatial patterns will be examined and estimates of the maximum significant wave height for the area will be derived.

3) Analysis of existing current data - Existing data from buoy-satellite tracks and in situ current meter records will be analyzed to determine tidal current fields and nontidal drift near the outfall site.

STATUS: Active. At this time draft reports have been submitted on task elements 1) and 3) with final reports pending. A final report has been submitted on task element 2). Ms. Zellmer anticipates utilization of the bottom cores for her planned master's thesis work.

FINANCIAL SUPPORT:

Malcolm-Pirnie Engineers, Inc. of Newport News
Virginia Institute of Marine Science

KEY WORDS: Coastal engineering

Department of Geological Oceanography
Department of Wetlands Research

PROJECT TITLE: DELINEATION OF COASTAL MARSH BOUNDARIES IN THE CENTRAL ATLANTIC COASTAL REGION

INVESTIGATORS:

J. D. Boon, Associate Marine Scientist
G. A. Silberhorn, Associate Marine Scientist
D. E. Ware, Research Assistant

PROJECT SUMMARY:

The purpose of the work is to determine what criteria may be used to effectively define the uppermost landward limit of characteristic tidal marshes within the U. S. Central Atlantic Coastal Region, including the states of Delaware, Maryland, Virginia, and North Carolina. A program of field study is now in progress which includes vegetational analysis (percent coverage and species importance indexing) along the transition zone between wetlands and uplands as well as elevational surveys to be eventually connected to tidal datums. The analyses are intended to develop standard limit recognition criteria for coastal marsh boundaries. This study is one of five similar projects initiated by EPA this year in selected regions of the U. S. including Alaska.

STATUS: Active.

FINANCIAL SUPPORT:

Environmental Protection Agency
(Office of Research and Development)
Virginia Institute of Marine Science

PUBLICATION:

Boon, J. D., M. Boule and G. M. Silberhorn. 1976. Delineation of Tidal Wetland Boundaries in Chesapeake Bay and its Tributaries. (draft).

KEY WORDS: Wetlands

PROJECT TITLE: CIRCULATION IN EASTERN SHORE MARSH-LAGOON COMPLEX

INVESTIGATORS:

Robert J. Byrne, Department Head and Senior Marine Scientist
John D. Boon, III, Associate Marine Scientist

PROJECT SUMMARY:

The goal of this project is to elucidate the gross circulation within the inlet-lagoon-marsh channel complex on Virginia's Eastern Shore Atlantic Coast. The studies thus far have concentrated on the northern half of the system from Wachapreague Inlet to Wallops Island. Field measurements include tidal range and phase in the system and tidal discharge in the inlets and major conveyance channels within the system. Aside from using the data to detail areas for intensive study, the field data will be used to develop formulations on the hydraulic geometry of inlets and marsh channels.

STATUS: Active.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science

KEY WORDS: Barrier islands, hydraulics, marshes

PROJECT TITLE: A FIELD STUDY OF FLUID MUD DREDGE MATERIAL: ITS PHYSICAL NATURE AND DISPERSION

INVESTIGATORS:

Maynard M. Nichols, Associate Marine Scientist
Richard Faas*

PROJECT SUMMARY:

Slurries of fluid mud released on open water sites have been observed to spread far beyond prescribed disposal limits. An 18-month study is underway to determine the significance of fluid mud in dispersal of spoil and in generating turbidity.

Field observations will be made to measure the nature, extent and thickness of fluid mud at several active disposal sites. Dynamic conditions of the environment will be established from spatial and time-series measurements of velocity, salinity, temperature, and tidal height. Potentially significant mud properties include density, shear strength, and particle size. Mobility of the mud would be monitored by strain gages and echo sounding. Data will be examined spectrally and sequentially through time-series analyses to identify controlling factors that predict mud dispersal and its potential for generating turbidity.

Results emerging from the study will provide Corps of Engineers with needed information to minimize spoil dispersal through control or avoidance with a resultant cost saving. They will strengthen Corps and state ability to recommend remedial measures and to improve evaluation of habitats and water quality.

STATUS: Active.

FINANCIAL SUPPORT:

U. S. Army Corps of Engineers
(Waterways Experiment Station, Vicksburg, Mississippi)
Virginia Institute of Marine Science

KEY WORDS: Currents, dredge materials, dredging, estuaries, mud

*Professor of Geology, Lafayette College, Pa.

PROJECT TITLE: ESTUARINE FLUID MUD: ITS BEHAVIOR AND ACCUMULATION

INVESTIGATORS:

Maynard M. Nichols, Associate Marine Scientist
Richard Faas*

PROJECT SUMMARY:

Masses of fluid mud have been observed to form in many estuaries despite rapid mixing and fast currents competent to erode and transport the mud. A 36-month study is underway to determine how fluid mud accumulates in a dynamic flow regime.

Field observations will be mounted to determine the relative importance of dynamic conditions, physical properties of the mud, and the interaction of flow and sediment, in the accumulation mud. Dynamic conditions will be established from spatial and time-series measurements of velocity, salinity, temperature and suspended sediment concentrations at three periods of contrasting energy level and sediment loading. Potentially significant mud properties include density, shear strength, water content, degree of aggregation and particle size. Mobility of the mud will be monitored by radioactive tracers and accoustical soundings. Data will be examined spectrally and sequentially through multiple regression and time-series analyses to reveal dynamic process and response relationships. Longitudinal and vertical transport will be computed to evaluate rates of supply and loss through conservation of mass and to discover what hydrosedimentologic mechanism is active in accumulation of fluid mud.

Results emerging from this study will provide engineers and hydrologists with needed practical information to plan more effective use of estuaries and to alleviate shoaling with a resultant cost saving. They will show the cause of the phenomenon and thus expand our knowledge of depositional processes in an important part of the sedimentary cycle whereby sediments pass from rivers to the sea.

STATUS: Active.

FINANCIAL SUPPORT:

U. S. Army Research Office
Virginia Institute of Marine Science

KEY WORDS: Currents, estuaries, fluid mud, sediments

*Professor of Geology, Lafayette College, Pa.

Department of Geological Oceanography
Department of Physical Oceanography and Hydraulics

PROJECT TITLE: MATHEMATICAL MODELING OF SEDIMENT MOVEMENT IN AN ESTUARY

INVESTIGATORS:

Maynard M. Nichols, Associate Marine Scientist
Albert Kuo, Associate Marine Scientist

PROJECT SUMMARY:

A numerical model is under development to stimulate the movement of water and suspended sediment in an estuarine turbidity maximum. The model is two-dimensional and time-dependent. It consists of a systematic sequence of mathematical procedures derived from the equation of motion and mass balance. Following lateral integration to obtain two-dimensional equations, the resulting equations are integrated with depth over the height of successive layers. Finite difference equations are then written for each layer and solved numerically using prescribed boundary conditions.

The model yields values for time varying tidal height, current speed, salinity and suspended sediment concentration or turbidity throughout the estuary. In turn, these variations reveal the response of salinity and the sediment distributions in the turbidity maximum to tidal current fluctuations. Residual values of each parameter are obtained by averaging respective values over a tidal cycle. By examining the time varying and the tidal average transport at landward and seaward transects, sediment transport through the turbidity maximum induced by tidal currents and density currents may be studied in detail. Results emerging from use of the model, permit analyses of hydraulic processes leading to accumulation of suspended sediment and thus to improved water quality.

STATUS: Active.

FINANCIAL SUPPORT:

Virginia Water Resources Research Center
Virginia Institute of Marine Science

KEY WORDS: Estuary, math model, turbidity maximum

Department of Geological Oceanography
Department of Ecology-Pollution
(Environmental Chemistry Section)
Department of Applied Marine Biology

PROJECT TITLE: THE ROLE OF SEDIMENTS IN THE STORAGE, MOVEMENT AND BIOLOGICAL UPTAKE OF KEPONE IN THE ESTUARINE ENVIRONMENT

INVESTIGATORS:

Maynard M. Nichols, Associate Marine Scientist
Robert Huggett, Associate Marine Scientist
Dexter Haven, Senior Marine Scientist

PROJECT SUMMARY:

This phase of research focuses on the bottom sediments, rates of transport and deposition for the purpose of providing data on sedimentary processes for inclusion in ecosystem models. The chief problems to be addressed are: What is the distribution of Kepone in the bottom sediments? What are the routes of sediment transport in the estuary? Where are the major sediment sinks in the estuary and what are the rates of sediment deposition in the sinks?

Existing data are under review to identify the distribution of potential sediment sinks for Kepone. This effort draws on historical data and is extended by interpretation.

The Kepone content within the bottom sediments will be determined by measurement of concentrations in the size fraction <62μ. Approximately 200 bottom sediment samples will be taken. The fraction <62μ will be analyzed by Coulter Counter so that associations between Kepone concentration and size distribution may be examined.

Suspended sediment movement, including vertical transport and the routes and rates of horizontal transport, would be determined both at short-time scales over a seasonal cycle and also on an annual basis from long-term sediment input-deposition data and net current. Sedimentation rates over the last 10 years would be measured at selected stations using Pb^{210} dating and depth changes on hydrographic charts. This information would be used to identify sedimentologic sinks for Kepone.

STATUS: Active.

FINANCIAL SUPPORT:

Environmental Protection Agency
Virginia Institute of Marine Science

KEY WORDS: Kepone, pollution, sediment

PROJECT TITLE: WAVE REFRACTION ON THE CONTINENTAL SHELF AND SHORELINE OF VIRGINIA (SGP)

INVESTIGATORS:

Victor Goldsmith, Associate Marine Scientist
Robert Byrne, Department Head and Senior Marine Scientist

PROJECT SUMMARY:

Wave refraction diagrams are being prepared for the entire Virginia and Chesapeake Bay continental shelf and shoreline for a variety of wave directions, periods, and heights with a linearized bottom friction term in the formulation. These data are being applied to a wide variety of problems at the request of many federal, state, and local agencies.

STATUS: Active.

FINANCIAL SUPPORT:

National Oceanic and Atmospheric Administration
(National Sea Grant Program)
Virginia Institute of Marine Science

PUBLICATIONS (as of 1974):

Goldsmith, V., Morris, W. D. and Sutton, C. H. 1976. Distribution of wave heights, bottom orbital velocities, wave energy and wave power over the shelf and along the shoreline-Part II-Wave Climate Model of the Mid-Atlantic Continental Shelf and Shoreline (Virginian Sea): VIMS SRAMSOE No. 48, 200 p. (in prep.).

Rosen, P. S., Goldsmith, V., Richardson, W. S. and Sutton, C. H. 1976. The Chesapeake Wave Climate Model for limited fetch conditions: Model Description, Verification and Application to interpretation of Shoreline Geomorphology. VIMS SRAMSOE No. 89, 200 p. (est.), in prep.

Goldsmith, V., Rosen, P. S., Gammisch, R., Hogge, E., Sutton, C. H., and Carron, M. J. 1976. VIMS-BLM Wave Climate Model of the Baltimore Canyon Trough Shelf - Shelf Wave Height and Bottom Velocity, Shoreline Wave Height and Energy: Evaluation of Results. VIMS SRAMSOE No. 106, 250 p. (est.) (in prep).

Goldsmith, V. 1976. Continental shelf wave climate models: A critical link between shelf hydraulics and shoreline processes: AAPG An. Mtg., Dallas and SEPM Spec. Publ., Nearshore Processes - Physical and Biological; VIMS Contrib. No. 708, in R. A. Davis, Jr. (ed.) SEPM Special Publication No. 23, Beach and Nearshore Sedimentation.

Sutton, C. H., Goldsmith, V., and Sallenger, A. H., Jr. 1976. Detailed Bathymetry of Selected Areas of the Inner Continental Shelf of the Virginian Sea: Wachapreague, Virginia Beach, and Southeastern Virginia: SRAMSOE No. 69.

Sallenger, A. H., Goldsmith, V. and Sutton, C. H. 1975. Bathymetric Comparisons: A manual of methodology error criteria and techniques: VIMS SRAMSOE No. 66, 36 p. plus 12 figs.

Goldsmith, V., Morris, W. D., Byrne, R. J. and Whitlock, C. H. 1974. Wave Climate Model of the Mid-Atlantic Shelf and Shoreline (Virginian Sea): Model Development, Shelf Geomorphology, and Preliminary Results: VIMS SRAMSOE No. 38, 146 p. (also available from NTIS for $5.75).

Colonell, J. M. and Goldsmith, V. 1974. Results of ocean wave-Continental Shelf interaction: 14th International Conf. on Coastal Engineering, Copenhagen, Denmark, June, 1974. p. 586-600. VIMS Contrib. No. 597.

KEY WORDS: Continental shelf, erosion, shorelines, waves

PROJECT TITLE: WAVE MODELING AND BATHYMETRIC ADVISORY SERVICE (SGP)

INVESTIGATORS:

Victor Goldsmith, Associate Marine Scientist
Carolyn H. Sutton, Research Assistant

PROJECT SUMMARY:

Furnish advice and/or wave computations both inside and outside of VIMS which are oriented to specific problems; e.g., planning of military landing operations at Fort Story, Virginia; shoreline erosion problems; National Park Service planning; Tangier Island Airport problems; and many others.

STATUS: Active.

FINANCIAL SUPPORT:

National Oceanic and Atmospheric Administration
(National Sea Grant Program)
Virginia Institute of Marine Science

KEY WORDS: Beach erosion, Outer Continental Shelf, shoreline, U. S. East Coast, wave modeling

PROJECT TITLE: OUTER CONTINENTAL SHELF BENCHMARK STUDIES--BALTIMORE CANYON TROUGH WAVE MODEL (BLM)

INVESTIGATORS:

Victor Goldsmith, Associate Marine Scientist
Peter Rosen, Assistant Marine Scientist
Carolyn H. Sutton, Research Assistant

PROJECT SUMMARY:

The Virginian Sea Wave Climate Model (Goldsmith et al., 1974, SRAMSOE No. 38) is being adopted for modeling wave conditions in areas proposed for oil and gas leasing nominations. Wave refraction diagrams will be provided for 8, 10, and 12 second waves from the northeast, east, and southeast at low tides and 10 second waves from the northeast, east, and southeast at +5 ft. tide. In addition, shelf contour diagrams of wave height and bottom velocity will be provided for these 12 conditions. Shoreline histograms of wave height will be provided for the 12 conditions. These wave data will be related to other concomitant sedimentological and biological studies. A wave atlas will be prepared and predominant wave conditions will be run on a fine grid (0.25 nm) model in a region encompassing oil and gas leases.

STATUS: Active. This is a subproject of "Environmental Data Acquisition and Analyses--Mid-Atlantic OCS."

FINANCIAL SUPPORT:

U. S. Department of Interior
(Bureau of Land Management)
Virginia Institute of Marine Science

KEY WORDS: Outer continental shelf, wave climate models

PROJECT TITLE: LONG-TERM BEACH CHANGES IN SOUTHEASTERN VIRGINIA

INVESTIGATOR:

Victor Goldsmith, Associate Marine Scientist

PROJECT SUMMARY:

Beach erosion studies have centered on southeastern Virginia from Dam Neck to the North Carolina state line. 18 permanent beach profile locations have been measured at one month intervals and before and after major storms. Most of the beach profiles are located precisely at profile stations monitored by previous observers with some of the data going back to the mid 1960's. Thus, this research program is focusing on delineating and understanding long-term shoreline trends.

STATUS: Active. Final report in 1977.

FINANCIAL SUPPORT:

U. S. Army Coastal Engineering Research Center
Virginia Institute of Marine Science

KEY WORDS: Beach changes, erosion, shorelines

PROJECT TITLE: QUALITATIVE FORECASTS OF BEACH EROSION ALONG THE UNITED STATES EAST COAST

INVESTIGATORS:

Victor Goldsmith, Associate Marine Scientist
William S. Richardson, Graduate Student and Scientist, Techniques Development Laboratory, U. S. National Weather Service

PROJECT SUMMARY:

A qualitative beach erosion forecast equation will be statistically derived for various sections of the U. S. east coast. The forecast equation will relate astronomical tide, storm surge, duration of storm, wind waves, shoreline type, and bathymetry to qualitative erosion types. These qualitative erosion types (severe, major, moderate, minor, and no erosion) will be extracted from Storm Data volumes compiled by the U. S. Environmental Data Service. Additionally, wave refraction data from the VIMS Data Bank will be used to further refine the model.

STATUS: Active. This project represents Richardson's thesis research, as well as joint research between VIMS and the Weather Service.

FINANCIAL SUPPORT:

U. S. National Weather Service
Virginia Institute of Marine Science

KEY WORDS: Beach erosion, qualitative forecast, U. S. east coast

PROJECT TITLE: RECENT HISTORICAL DEVELOPMENT OF COASTAL DUNES, WITH EMPHASIS ON THE ROLE OF MAN, ALONG CURRITUCK SPIT, VIRGINIA/NORTH CAROLINA

INVESTIGATORS:

Victor Goldsmith, Associate Marine Scientist
Harold Hennigar, Graduate Assistant

PROJECT SUMMARY:

Using aerial photos back to 1943, and National Park Service records, a history of the recent historical dune dynamics is being constructed. The role of man in dramatically influencing and changing the resulting dune geomorphology is being delineated.

STATUS: Active. This represents Hennigar's thesis research.

FINANCIAL SUPPORT:

National Aeronautics and Space Administration (Wallops Island)
Virginia Institute of Marine Science

KEY WORDS: Dunes, eolian processes, geomorphology, man, Outer Banks, shorelines

PROJECT TITLE: INTERNAL GEOMETRY, GEOMORPHOLOGY, AND ORIGIN OF COASTAL SAND DUNES ALONG CURRITUCK SPIT, VIRGINIA/NORTH CAROLINA

INVESTIGATORS:

Victor Goldsmith, Associate Marine Scientist
Peter Rosen, Assistant Marine Scientist
Elizabeth Barnett, Student
Mark Boule´, Graduate Student

PROJECT SUMMARY:

Measurements of internal bedding and structures of foredunes have been made at 12 locations between Cape Hatteras and Cape Henry. The data analyses are being used to delineate directions of dune growth, process of eolian accumulation and others.

STATUS: Active. A portion of this project will be Barnett's senior honor's thesis.

FINANCIAL SUPPORT:

National Aeronautics and Space Administration (Wallops Island)
Virginia Institute of Marine Science

KEY WORDS: Beaches, dunes, eolian, geomorphology, Outer Banks, shorelines

PROJECT TITLE: INTERACTION BETWEEN EOLIAN SAND TRANSPORT, DUNE GEOMORPHOLOGY, AND VEGETATION DENSITY

INVESTIGATORS:

Victor Goldsmith, Associate Marine Scientist
Andrew L. Gutman, Graduate Assistant

PROJECT SUMMARY:

To establish relationships between local dune winds and winds recorded at weather stations (Norfolk and Hatteras). To develop an eolian sand budget for the area. To explain the development of different dune types in different areas. To advance the science of eolian sediment transport.

STATUS: Active. This project represents Gutman's thesis research.

FINANCIAL SUPPORT:

National Aeronautics and Space Administration (Wallops Island)
Virginia Institute of Marine Science

KEY WORDS: Beaches, dunes, eolian, geomorphology, Outer Banks, shorelines

PROJECT TITLE: DELINEATION OF A WAVE CLIMATE FOR DAM NECK, VIRGINIA BEACH, VIRGINIA

INVESTIGATORS:

Victor Goldsmith, Associate Marine Scientist
Robert J. Byrne, Department Head and Senior Marine Scientist
Andrew Gutman, Graduate Assistant

PROJECT SUMMARY:

Determine wave climate in vicinity of proposed Dam Neck Ocean Sewage Outfall from six existing sources of wave data by compiling, synthesizing, displaying, and interpreting these data.

STATUS: Active, near completion. This is a subproject of "Dam Neck Ocean Outfall Evaluation and Interpretation."

FINANCIAL SUPPORT:

Malcolm-Pirnie Engineers, Newport News, Virginia
Virginia Institute of Marine Science

KEY WORDS: Continental shelf, sewage outfall, shoreline, waves

PROJECT TITLE: LEGAL CONSIDERATIONS IN THE SITING OF DREDGE MATERIAL ISLANDS (SGP)

INVESTIGATORS:

N. Bartlett Theberge, Associate Marine Scientist in Ocean and Coastal Law
John M. Zeigler, Assistant Director
K. A. Dierks, Graduate Assistant

PROJECT SUMMARY:

To maintain channels and anchorages in the port of Hampton Roads, a major facility in the mid-Atlantic region, the Corps of Engineers will dredge a minimum of 3.8 million cubic yards of material annually. Over the next 50 years from 175 to 325 million cubic yards of material will be dredged from the lower Chesapeake Bay. The present disposal facility, Craney Island, will be full by 1979. Accordingly the project will identify and analyze the legal issues germane to the siting of such a facility using the lower Chesapeake Bay as a test area. Environmental, public trust, and liability issues will be among those analyzed as well as a complete review of relations and responsibilities of various levels of government in such a project.

Through constructive legal research and analysis the project will attempt to develop an interface between existing state and federal agencies in efforts to resolve current and impending problems of dredge material disposal. Additionally recommendations will be developed regarding the adequacy of existing federal, state and local laws and ordinances for dealing effectively with problems arising from the siting of artificial material islands. Although the principal beneficiary of this project will be the Commonwealth of Virginia a framework will be developed which may be applied to similar projects in other areas.

STATUS: Active.

FINANCIAL SUPPORT:

National Oceanic and Atmospheric Administration
(National Sea Grant Program)
Virginia Institute of Marine Science

KEY WORDS: Artificial islands, Chesapeake Bay, coastal zone management, dredging, legal studies

PROJECT TITLE: COOPERATIVE STATE AGENCIES (CSA) ESTUARINE WATER QUALITY MODELING PROGRAM

INVESTIGATORS:

C. S. Fang, Department Head and Senior Marine Scientist
A. Y. Kuo, Associate Marine Scientist
P. V. Hyer, Associate Marine Scientist
A. Rosenbaum, Assistant Marine Scientist
John Jacobson, Assistant Marine Scientist
H. S. Chen, Associate Marine Scientist

PROJECT SUMMARY:

The project has produced real time dissolved oxygen models including carbonaceous and nitrogenous BOD for the James, upstream of the James River Bridge, the York, the Rappahannock, the Pagan and the Great Wicomico rivers. There are also tidal averaged salinity models of the same estuaries. A one-dimensional dynamic model has been developed for the James River. A tidal prism model and a near field model were also developed. Currently the scope of this project is expanding to include two layer modeling, especially of some smaller streams with heavy bottom sludges. A family of two dimensional models is being developed. Also planned are ecosystem models including the nutrient cycle and the growth of phytoplankton are being developed.

STATUS: Active.

FINANCIAL SUPPORT:

Virginia State Water Control Board
Virginia Institute of Marine Science

PUBLICATIONS:

Fang, C. S., A. Y. Kuo, P. V. Hyer, and W. J. Hargis, Jr. 1973. Hydrography and hydrodynamics of Virginia Estuaries, IV. Mathematical model studies of water quality in the James Estuary. VIMS SRAMSOE No. 41.

Fang, C. S., A. Y. Kuo, and P. V. Hyer. 1974. Mathematical modeling of Virginia estuaries for management. Presented at Virginia Academy of Science, Old Dominion University, Norfolk, Virginia.

Kuo, A. Y., A. Rosenbaum, P. V. Hyer, C. S. Fang, and W. J. Hargis, Jr. 1975. Hydrography and Hydrodynamics of Virginia Estuaries. VI. Mathematical model studies of water quality of the Rappahannock Estuary. VIMS SRAMSOE No. 102.

Fang, C. S. Dye-tracer studies and hydrographical survey of the Elizabeth River, Virginia. VIMS SRAMSOE.

Hyer, P. V., A. Y. Kuo, C. S. Fang, and W. J. Hargis, Jr. 1975. "Hydrography and Hydrodynamics of Virginia Estuaries. V. Mathematical model studies of water quality of the York River System". VIMS SRAMSOE No. 104.

Kuo, A. Y., J. K. Lewis, and C. S. Fang. 1976. "Hydrography and Hydrodynamics of Virginia Estuaries. VII. Mathematical model studies of water quality of the Pagan Estuary." VIMS SRAMSOE No. 107.

Kuo, A. Y. 1976. "A Model of Tidal Flushing for a Small Coastal Basin. Environmental Modeling and Simulation." U. S. Environmental Protection Agency, EPA 600/9-76-061.

KEY WORDS: Estuaries, water quality models

PROJECT TITLE: A TWO-DIMENSIONAL ECOSYSTEM MODEL FOR THE LOWER JAMES ESTUARY

INVESTIGATORS:

A. Y. Kuo, Associate Marine Scientist
G. M. Sisson, Graduate Assistant

PROJECT SUMMARY:

A two-dimensional (in horizontal plane) model is being developed for the James Estuary from the confluence of the Chickahominy to its mouth. The model includes two sub-models - the hydrodynamic sub-model stimulates the interaction of tidal wave and freshwater runoff, the water quality model stimulates the distributions of salinity, dissolved oxygen, various forms of nutrients and phytoplankton. After calibration and verification, the model will be used to study the circulation and the transport of pollutants in the lower James Estuary and Hampton Roads.

STATUS: Active. This project represents Sisson's dissertation research, College of William and Mary.

FINANCIAL SUPPORT:

Hampton Roads Water Quality Agency
Virginia Institute of Marine Science
State Water Control Board (CSA Program)

KEY WORDS: Ecosystem, hydrodynamics, numerical model, two-dimensional

Department of Physical Oceanography and Hydraulics
Department of Estuarine Processes and Chemical Oceanography

PROJECT TITLE: CHINCOTEAGUE BAY SYSTEM HYDROGRAPHICAL AND WATER QUALITY SURVEY STUDY

INVESTIGATORS:

C. S. Fang, Department Head and Senior Marine Scientist
P. V. Hyer, Associate Marine Scientist
A. Y. Kuo, Associate Marine Scientist
B. J. Neilson, Associate Marine Scientist
J. Jacobson, Assistant Marine Scientist
A. Rosenbaum, Assistant Marine Scientist

PROJECT SUMMARY:

A joint project involving the states of Virginia, Maryland, and Delaware is underway to quantify the existing water quality of and the non-point pollution sources into the Chincoteague-Sunepuxent-Isle of Wight-Assawoman Bay complex. VIMS is reviewing and analyzing existing physical, biological, and chemical data in order to design a detailed sampling program of the coastal basin. VIMS will then plan, supervise, and coordinate all field surveys as outlined in the sampling program. The data collected will be used for calibrating and verifying a water quality computer model of the Bay system for use in prevention, control, and abatement of pollution and for waste load allocation.

STATUS: Active.

FINANCIAL SUPPORT:

Maryland Department of Natural Resources
Virginia State Water Control Board
Virginia Institute of Marine Science

PUBLICATIONS:

Hyer, P. V., et al. 1975. "Index of Existing Data, Sources for Chincoteague, Sunepuxent, Assawoman and Little Assawoman Bays." Report to the Maryland Department of Natural Resources. VIMS publication.

KEY WORDS: Non-point pollution sources, waste load allocation, water quality, water quality computer model

PROJECT TITLE: EOLE BUOY DATA PROCESSING AND INTERPRETATION

INVESTIGATORS:

E. P. Ruzecki, Associate Marine Scientist
C. S. Welch, Associate Marine Scientist

PROJECT SUMMARY:

The effort is centered on examining data from drifting buoys which were released from near Chesapeake Light and other locations on the Virginia continental shelf and tracked by the French EOLE satellite. The relations between the buoy tracker, weather conditions, and hydrographic structure is being examined.

STATUS: Active.

FINANCIAL SUPPORT:

National Aeronautics and Space Administration
(Langley Research Center)
Virginia Institute of Marine Science

PUBLICATIONS:

Ruzecki, E. P., et al. "The Use of the EOLE Satellite Systems to Observe Continental Shelf Circulation," submitted to Offshore Technology Conference.

Welch, C. S. 1974. "Virginia Institute of Marine Science (VIMS)-NASA Langley Research Center (LaRC) EOLE Buoy Program,", AIAA Technical Committee on Marine Systems and Technologies Symposium on Free Drifting Buoys.

KEY WORDS: Continental shelf circulation, drifting buoys, EOLE, Lagrangian currents, remote navigation, satellite buoy tracking, wind driven circulation

PROJECT TITLE: OUTER CONTINENTAL SHELF BENCHMARK STUDIES--PHYSICAL OCEANOGRAPHY (BLM)

INVESTIGATORS:

Evon P. Ruzecki, Associate Marine Scientist
Chris Welch, Associate Marine Scientist

PROJECT SUMMARY:

Measurements of temperature, salinity, dissolved oxygen, and micronutrients (nitrites, nitrates, and phosphates) at approximately 50 stations will be used to identify water masses in the Mid-Atlantic Continental Shelf Area. Data will be presented as cross-shelf sections of temperature, salinity, disolved oxygen and density (sigma-t) and also as T-S plots for each station or group of stations.

STATUS: Active. This is a subproject of "Environmental Data Acquisition and Analysis--Mid Atlantic OCS."

FINANCIAL SUPPORT:

U. S. Department of Interior
(Bureau of Land Management)
Virginia Institute of Marine Science

KEY WORDS: Benchmark studies, outer continental shelf, physical oceanography

PROJECT TITLE: ON THE IMPORTANCE OF NORFOLK CANYON AND CONTINENTAL SHELF WATER CIRCULATIONS

INVESTIGATOR:

E. P. Ruzecki, Associate Marine Scientist

PROJECT SUMMARY:

This study is intended to determine the importance of submarine canyons as an avenue of exchange for waters between the continental shelf and continental slope areas.

STATUS: This project represents Ruzecki's dissertation research.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science

KEY WORDS: Circulation, continental shelf, continental slope, submarine canyons

PROJECT TITLE: DAM NECK CURRENT ANALYSIS

INVESTIGATORS:

C. S. Welch, Associate Marine Scientist
K. P. Kiley, Graduate Assistant

PROJECT SUMMARY:

An analysis of current meter data gathered by EG & G during summer and fall 1973 offshore from Virginia Beach, Virginia is being performed. The object of the analysis is the determination of current parameters of interest in design and construction of a sewage treatment plant outfall diffuser. Those discussed include mean current, tidal ellipses for the M_2 tide, currents during winter storms, definition of the winter storm season, and currents during hurricanes.

STATUS: Active. This project is part of the Dam Neck Outfall Foundation Studies.

FINANCIAL SUPPORT:

Hampton Roads Sanitation District Commission (through Malcolm Prince Engineers)
Virginia Institute of Marine Science

KEY WORDS: Coastal currents, current meter, Dam Neck, hurricane, response technique, tidal analysis, tidal current, Virginia Beach, winter storms

PROJECT TITLE: WIND-GENERATED INERTIAL CURRENTS

INVESTIGATORS:

C. S. Welch, Associate Marine Scientist
W. Saunders, Graduate Student

PROJECT SUMMARY:

Inertial currents in the Atlantic Ocean are being studied in an effort to better understand the way in which these currents are wind generated. Data from an array of current meters and anemometers are being used and a mathematical model is used to predict the inertial currents. This model includes the effects of the wind field over the array.

STATUS: Active. This project represents Saunders' thesis research.

FINANCIAL SUPPORT:

National Aeronautics and Space Administration
(Wallops Island Station)
Virginia Institute of Marine Science

KEY WORDS: Atlantic Ocean, inertial currents, wind generation

PROJECT TITLE: SURFACE TIDAL CIRCULATION OF MOBJACK BAY

INVESTIGATORS:

C. S. Welch, Associate Marine Scientist
Eddie Wu, Graduate Student

PROJECT SUMMARY:

Seven current meter stations' Eulerian measurements and the drifting buoys' Lagrangian observations data have been calculated. By using two different methods (direct and indirect), the comparison of the total differentiation of surface (2 ft.) current velocity with respect to time can be made.

Power spectra of current velocity measurements have been analyzed to find out the semi-diurnal and diurnal constituents for deriving the tidal ellipses of each station.

A spar buoy has been designed and the triangulation technique has also been employed for collecting the field Lagrangian data.

STATUS: Active. This project represents Wu's thesis research.

FINANCIAL SUPPORT:

National Aeronautics and Space Administration
(Wallops Island Station)
Virginia Institute of Marine Science

KEY WORDS: Estuaries, Lagrangian measurements, surface currents, tidal ellipses

PROGRAM 5:

Advisory Services Related

to Marine Resources

PROJECT TITLE: MARINE ADVISORY SERVICES (SGP, CRM)

INVESTIGATORS:

Roger D. Anderson, Department Head and Senior Marine Scientist
Robert K. Dias, Marine Advisory Specialist
Jon A. Lucy, Marine Advisory Specialist
Ronald L. Schmied, Marine Advisory Specialist
James A. Lanier, III, Information Officer
F. Lee Lawrence, Marine Scientist
Ann Greer, Information Officer
Susan C. Gammisch, Information Technician
Mary E. Sparrow, Library Assistant

PROJECT SUMMARY:

The marine advisory service program has the following objectives: (1) establish and maintain dialogue with resource users and planners, researchers, state, federal, and private institutions, and others interested in use of marine resources; (2) collect, analyze, synthesize, and disseminate information to assist in the wise utilization of marine resources; (3) maintain effective links of communication between users and researchers to enhance problem identification, establishment of priorities and timeliness of information; and (4) promote understanding and cooperation among users and managers of resources by serving as an identified clearinghouse of information and assistance, either through information transfer or direct contact.

In the past year, advisory service activities have included: (1) 4,000 contacts with commercial fishing, education, federal regulatory, seafood processing, insurance and recreation industry personnel; (2) initiation of publications on seafood processing, marine trades, plant effluents, shoreline processes, recreation and public services; (3) sponsorship and/or hosting of wetlands, recreation, education and fisheries workshops; and (4) coordination of joint research and advisory efforts in mariculture, public education, seafood processing, wetlands, shoreline processes, outer continental shelf activity and coastal zone resources.

STATUS: Continuing.

FINANCIAL SUPPORT:

National Oceanic and Atmospheric Administration
(National Sea Grant Program)
(Office of Coastal Zone Management)
Virginia Institute of Marine Science
Link Foundation
Coastal Plains Center for Marine Development Services

KEY WORDS: Advisory services

PROJECT TITLE: COASTAL PLAINS CENTER - COOPERATIVE STATES DEMONSTRATION PROGRAM

INVESTIGATORS:

Roger D. Anderson, Department Head and Senior Marine Scientist
Michael Castagna, Senior Marine Scientist
Dexter Haven, Senior Marine Scientist
Gene Silberhorn, Associate Marine Scientist

PROJECT SUMMARY:

The Cooperative States Program is an activity sponsored by the Coastal Plains Center for Marine Development Services (Wilmington, N.C.) in conjunction with the five Coastal Plains states. Each year, the Center meets with representatives of the participating states to select activities which mutually benefit the region. VIMS' most recent projects included:

1. A system to grow clams and scallops to market size was described and was demonstrated to students attending week-long short courses at the Wachapreague Laboratory.

2. An oyster harvester, using the escalator system from Maryland-type soft clam gear, was demonstrated to over 50 individuals representing state/federal agencies and private industry from over 10 states.

3. A publication, Wetlands Plants of Virginia, was printed and provided to individuals and institutions throughout the Coastal Plains region.

STATUS: Active.

FINANCIAL SUPPORT:

Coastal Plains Center for Marine Development Services
Virginia Institute of Marine Science

KEY WORDS: Advisory services, aquaculture, gear, mariculture, shellfish, wetlands

PROJECT TITLE: AN ANALYSIS OF VIRGINIA'S MARINA AND BOATYARD INDUSTRY (SGP)

INVESTIGATOR:

Jon A. Lucy, Marine Advisory Specialist and Assistant Marine Scientist

PROJECT SUMMARY:

The objective is to collect and analyze information describing the marina and boatyard industry in Virginia. Approximately 200 businesses are receiving confidential questionnaires requesting information on revenue and expenditures, employment, capacity and diversity of physical facilities, expansion of facilities and land use.

Results of the survey will provide the industry with a scale of operating conditions to which individual businesses can compare themselves. Gross revenues, employment and payroll data will give some measure of the significance of the industry in the coastal zone. The employment data will assist industry members to better assess employment opportunities.

A sub-project defining the growth, operational characteristics, and opportunities of dry stack boat storage service in Virginia, North Carolina and Maryland has been completed. The results of this study will be available soon as a Marine Resource Advisory.

STATUS: Active.

FINANCIAL SUPPORT:

National Oceanic and Atmospheric Administration
(National Sea Grant Program)
Virginia Institute of Marine Science

KEY WORDS: Advisory services, economics, land use, marinas, recreation, shorelines

PROJECT TITLE: NATIONAL AQUACULTURE INFORMATION SYSTEM (SGP)

INVESTIGATORS:

James A. Lanier, III, Information Officer
F. Lee Lawrence, Marine Scientist
Mary Sparrow, Library Assistant

PROJECT SUMMARY:

Articles pertinent to the aquaculture of freshwater, estuarine or marine organisms are located, pertinent information is entered on computer cards, and microfiche copies are prepared of articles not copyrighted or for which permission has been granted. A thesaurus of the index terms has been prepared and articles entered into the system. Efforts have been initiated to obtain material from the libraries of professional scientists specializing in aquacultural research.

STATUS: Active.

FINANCIAL SUPPORT:

National Oceanic and Atmospheric Administration
(National Sea Grant Program)
Virginia Institute of Marine Science

KEY WORDS: Advisory services, aquaculture, bibliography, data storage and retrieval, mariculture

PROJECT TITLE: MARINE ENVIRONMENT AND RESOURCES RESEARCH AND MANAGEMENT SYSTEM (MERRMS) (CRM)

INVESTIGATORS:

William J. Hargis, Jr., Institute Director
John B. Pleasants, Senior Marine Scientist
J. Claiborne Jones, Assistant Marine Scientist

PROJECT SUMMARY:

This project includes the development of informational resources. These include: (1) collecting and continually updating cartographic data which include topographic maps, aerial photographs, county and city highway maps, and National Ocean Survey navigational charts, (2) a special purpose microfiche library oriented toward management of the coastal zone with a means to distribute this information, (3) a multi-projector random access visual display system designed for rapid retrieval and display of pertinent data, and (4) hardware and software - including computer techniques - to permit rapid access and interpretation of the above information for interdisciplinary and nonspecialist users.

MERRMS is designed to provide a point source of data on the coastal zone of Virginia. It is intended to enable managers and technical advisors to rapidly review all available information on any problem in the area of concern. It is intended to act as an interpretive interface between scientific specialists and managers, and between the several scientific disciplines. Pertinent publications from the MERRMS files are provided free of charge to local Planning District Commissions to aid local planners in the development of comprehensive coastal resources management programs.

Future developments include real-time access to computerized data banks, as well as computer searches for information in microfiche and permit files.

Although the emphasis is on Virginia's coastal zone, this project covers the entire Chesapeake Bay and the Middle Atlantic Coast, with some relevant information from other areas as well.

STATUS: Continuing. This is, in part, a subproject of the Coastal Zone Management grant.

FINANCIAL SUPPORT:

National Oceanic and Atmospheric Administration (Office of Coastal Zone Management)
Virginia Institute of Marine Science

KEY WORDS: Coastal zone management, data collections, information systems, management

PROJECT TITLE: SHORELINE EROSION ADVISORY SERVICE (SGP)

INVESTIGATORS:

Gary Anderson, Assistant Marine Scientist
Robert J. Byrne, Department Head and Senior Marine Scientist
John M. Zeigler, Assistant Director

PROJECT SUMMARY:

Owners of tidal shoreline property in Virginia are supplied, on a case by case basis, with advice on techniques which may reduce or eliminate shoreline erosion.

STATUS: Continuing.

FINANCIAL SUPPORT:

National Oceanic and Atmospheric Administration
(National Sea Grant Program)
Virginia Institute of Marine Science

KEY WORDS: Advisory, Chesapeake Bay, erosion, management, planning

PROJECT TITLE: COOPERATIVE EDUCATION PROGRAM IN LAW AND MARINE SCIENCE (SGP)

INVESTIGATORS:

N. Bartlett Theberge, Associate Marine Scientist in Ocean and Coastal Law
Scott C. Whitney, Professor

PROJECT SUMMARY:

In its second year, this program is a cooperative effort between the Virginia Institute of Marine Science and the Marshall-Wythe School of Law at the College of William and Mary. It is intended to provide a forum for interdisciplinary action and produce a corps of lawyers and scientists with a broader understanding of the problems and implications of resource management. Aside from the core course of lectures by the principal investigators, guest speakers from both institutions are being presented, along with special symposia, seminars and occasional publications.

STATUS: Active and continuing.

FINANCIAL SUPPORT:

National Oceanic and Atmospheric Administration
(National Sea Grant Program)
Virginia Institute of Marine Science
Marshall-Wythe School of Law

KEY WORDS: Legal studies, marine affairs education

Department of Microbiology-Pathology
Parasitology Section

PROJECT TITLE: FISH DISEASE ADVISORY SERVICES

INVESTIGATORS:

Frank O. Perkins, Department Head and Senior Marine Scientist
David E. Zwerner, Assistant Marine Scientist

PROJECT SUMMARY:

Diagnosis of diseases (including metazoan parasite problems) and identification of abnormalities in fishes both from fresh and salt water environments are made for both the lay and scientific communities in Virginia. Advice concerning the significance of the condition, and when possible, methods to control or alleviate the problem are offered.

Information and experience gained from these advisory services are important inputs to out general "Survey of the diseases and parasites of marine fishes...".

STATUS: Continuing.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science

KEY WORDS: Advisory services, diseases, fish

PROJECT TITLE: SEMINARS AND EDUCATION PROGRAM IN MARINE AFFAIRS

INVESTIGATOR:

Roger D. Anderson, Department Head and Senior Marine Scientist

PROJECT SUMMARY:

This project is aimed at the development of seminars and educational programs, focusing on maritime history, marine resource development, humanities of the sea, and coastal zone problems. The programs and workshops, offered on an informal basis, are part of the Marine Affairs and Advisory Service activities of the Institute.

STATUS: Active.

FINANCIAL SUPPORT:

The Link Foundation
Virginia Institute of Marine Science

KEY WORDS: Advisory services, marine affairs, marine education

PROJECT TITLE: FILMSTRIP/CASSETTE PROGRAM ON VIRGINIA'S MARSHES (SGP)

INVESTIGATOR:

James A. Lanier, Information Officer

PROJECT SUMMARY:

A filmstrip and tape cassette program on the plant and animal life inhabiting Virginia's marshes is being prepared for distribution to schools and the general public. The emphasis will be on creating an awareness that marshes are unique, interesting and beautiful places worth protecting. This project reflects the interest of the Virginia Wildlife Federation and the Institute in supporting the Virginia Wetlands Act of 1972.

STATUS: Active.

FINANCIAL SUPPORT:

Virginia Wildlife Federation
National Oceanic and Atmospheric Administration
(National Sea Grant Program)
Virginia Institute of Marine Science

KEY WORDS: Advisory services, education, wetlands

PROJECT TITLE: INVENTORY OF EXISTING DATA BASES ALONG THE ATLANTIC COAST

INVESTIGATORS:

Maurice P. Lynch, Head, Division of Biological Oceanography
Paul Stofan, Associate Marine Scientist

PROJECT SUMMARY:

VIMS is attempting to develop an accurate and complete inventory of coastal zone data available in the Chesapeake Bay region and in the states of North Carolina, South Carolina and Georgia. The completed data file descriptions become part of the Environmental Data Base Directory (EDBD) System portion of the Environmental Data Service Environmental Data Index (ENDEX) effort.

The EDBD System focuses on descriptions of data files from sources outside of National Data Centers.

STATUS: Active. To be completed 31 March 1977.

FINANCIAL SUPPORT:

National Oceanic and Atmospheric Administration
(Environmental Data Service)
Virginia Institute of Marine Science

KEY WORDS: Chesapeake Bay, data bases, data inventory, Georgia, North Carolina, South Carolina

SUBJECT INDEX

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