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Research on Chesapeake Bay and contiguous waters of the Chesapeake Bight of the Virginian Sea at the Virginia Institute of Marine Science, Gloucester Point, Virginia and Wachapreague, Virginia 1972 Edition

W J. Hargis Jr.
Virginia Institute of Marine Science

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RESEARCH ON CHESAPEAKE BAY AND CONTIGUOUS WATERS OF THE CHESAPEAKE BIGHT OF THE VIRGINIAN SEA
1972 Edition

at the
VIRGINIA INSTITUTE OF MARINE SCIENCE
GLOUCESTER POINT, VIRGINIA

and
WACHAPREAGUE, VIRGINIA

William J. Hargis, Jr.
Director

SPECIAL SCIENTIFIC REPORT NO. 66
of the
VIRGINIA INSTITUTE OF MARINE SCIENCE
Gloucester Point, Virginia 23062

SEPTEMBER 1972
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RESEARCH ON CHESAPEAKE BAY
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GLOUCESTER POINT, VIRGINIA
AND
WACHAPREAGUE, VIRGINIA

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Director

Special Scientific Report No. 66
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September 1972
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Beverly L. Laird accomplished the coordination,typing, and expediting necessary to bring this compilation about. Dr. Maurice P. Lynch provided editorial and coordination advice.
STAFF AND PROJECTS RELATED TO THE
ENvironments AND RESOURCES OF
THE CHESAPEAKE BAY
AND
ADJACENT WATERS OF THE CONTINENTAL SHELF

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.

A list of those projects described in the 1971 report which have been completed or terminated for various reasons is appended with annotation to indicate reports developed or reason for termination.

This report and the VIMS organization list are considered up-to-date as of August, 1972. In instances where personnel were known to be joining the staff after this date, they have been added.

It is our present intention to update this report on an annual basis so as to better inform planners and managers of research in progress and to facilitate research coordination and planning in Chesapeake Bay.
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W. P. Duggan, M.S., Assistant Marine Scientist
Joseph W. Caruthers, Laboratory Technician
William M. Peirson, B.S., Laboratory Technician
Jean Watkinson, Laboratory Technician

* No longer with VIMS. See Appendix I.
DIVISION OF FISHERIES SCIENCE AND SERVICES

W. Jackson Davis, Ph.D., Assistant Director and Division Head
Edwin B. Joseph, Ph.D., Assistant Director*
Alice Lee Tillage, Secretary

Applied Marine Biology, Department of

Dexter S. Haven, M.S., Department Head and Senior Marine Scientist
Gloria Buckland, Secretary
J. G. Loesch, Ph.D., Associate Marine Scientist
James P. Whitcomb, M.A., Assistant Marine Scientist
Paul C. Kendall, B.S., Research Assistant
Reinaldo Morales-Alamo, B.S., Research Assistant
Thomas E. Kellum, Jr., Laboratory Technician
Cheryl L. Peddicord, Laboratory Technician
B. F. Walker, Jr., Laboratory Technician
Ken S. Walker, Laboratory Technician
Kathleen Harleston, B.S., Graduate Assistant*
Peter F. Larsen, M.S., Graduate Assistant
Dennis T. Walsh, B.S., Graduate Assistant

Crustaceology, Department of

W. A. Van Engel, Ph.M., Department Head and Senior Marine Scientist
Louise DeBolt, Secretary
Mark E. Chittenden, Ph.D., Associate Marine Scientist
Paul A. Haefner, Jr., Ph.D., Associate Marine Scientist
Robert Harris, B.S., Laboratory Specialist
James Lesofsky, B.S., Laboratory Technician
H. Ellen Hunter, B.A., Graduate Student
Chae E. Laird, B.A., Graduate Student (NSF Trainee)
Paul A. Sandifer, B.S., Graduate Student*
Lewis R. Shotton, B.A., Graduate Assistant
Roy T. Terretta, B.A., Graduate Assistant
Douglas H. Wood, B.S., Graduate Assistant

Ichthyology, Department of

W. Jackson Davis, Ph.D., Division Head and Acting Department Head
Louise DeBolt, Secretary
Walter J. Hogman, Ph.D., Associate Marine Scientist
John V. Merriner, M.S., Associate Marine Scientist
John A. Musick, Ph.D., Associate Marine Scientist

* No longer with VIMS. See Appendix I.
Ichthyology, Department of

William R. Rhodes, M.S., Assistant Marine Scientist
C. E. Richards, M.A., Assistant Marine Scientist
W. H. Kriete, Jr., B.S., Research Assistant
W. L. Wilson, Laboratory Specialist
Jane H. Ashberry, Laboratory Technician
James A. Bristow, Laboratory Technician
Joice S. Davis, Laboratory Technician
Deane Estes, B.S., Laboratory Technician
James C. Owens, Laboratory Technician
G. R. Thomas, Laboratory Technician
Kenneth W. Able, B.S., Graduate Assistant
Richard G. Burbidge, M.S., Graduate Assistant*
Labbish N. Chao, M.A., Graduate Assistant
Walter Eanes, B.S., Graduate Assistant*
Edward P. Gardner, B.A., Graduate Student
Lynn Haines, M.A., Graduate Assistant*
J. Howard Kerby, M.S., Graduate Assistant
Sally B. Leonard, B.S., Graduate Assistant*
Joanne Lyczkowski, B.A., Graduate Assistant*
John D. McEachran, M.A., Graduate Assistant
Linda F. Mercer, B.S., Graduate Assistant
Henry L. Meyer, B.S., Graduate Assistant
Gregg N. Murray, B.S., Graduate Assistant
W. Steven Otwell, B.S., Graduate Assistant
Scott Rhodes, B.S., Graduate Assistant*
James E. Weaver, M.S., Graduate Assistant

Malacology, Department of

Jay D. Andrews, Ph.D., Department Head and Senior
Marine Scientist
Louise DeBolt, Secretary
E. Michael Frierman, B.S., Research Assistant
Curtis C. Leigh, Laboratory Specialist
James A. Brown, Laboratory Technician
James C. Harris, Laboratory Technician
Juanita G. Walker, Laboratory Technician

DIVISION OF BIOLOGICAL OCEANOGRAPHY

William J. Hargis, Jr., Ph.D., Institute Director and
Acting Division Head

Invertebrate Ecology, Department of

Donald F. Boesch, Ph.D., Associate Marine Scientist
Dale R. Calder, Ph.D., Associate Marine Scientist

* No longer with VIMS. See Appendix I.
Invertebrate Ecology, Department of (Cont'd)

Richard C. Swartz, Ph.D., Associate Marine Scientist*
Marvin L. Wass, Ph.D., Associate Marine Scientist
David H. Rackley, B.S., Graduate Student

Microbiology-Pathology, Department of

Frank O. Perkins, Ph.D., Department Head and Senior Marine Scientist
Rita Brown, Secretary
John L. Dupuy, Ph.D., Associate Marine Scientist
Frederick Y. Kazama, Ph.D., Associate Marine Scientist
Victoria R. Gibson, M.A., Assistant Marine Scientist
Franklin D. Ott, Ph.D., Associate Marine Scientist
Samuel Rivkin, B.S., Research Assistant
Donald Byrne, B.A., Laboratory Specialist
Patsy Berry, Laboratory Technician
Terrence Getchell, A.A., Laboratory Technician
Linda Keating, B.A., Laboratory Technician
D. M. Knutson, Laboratory Technician
Kathleen L. Schornstein, B.A., Laboratory Specialist
Charles Sutton, Laboratory Technician
Nancy Troneck, A.B., Laboratory Technician
James P. Amon, M.A., Graduate Assistant
John J. Manzi, M.S., Graduate Assistant
Paul E. Stofan, M.A., Graduate Assistant
Arthur Zachary, M.A., Graduate Assistant

Parasitology, Section of

David E. Zwerner, M.A., Acting Section Head and Assistant Marine Scientist
Ilan E. Paperna, Ph.D., NSF Senior Foreign Scientist Fellow
Adrian R. Lawler, M.A., Graduate Assistant*
E. Lynn Suydam, M.A., Graduate Assistant
Sandy Jarvis, Laboratory Technician

Bacteriology, Section of

John L. Wood, Ph.D., Associate Director and Section Head
Aleta Ott, Ph.D., Assistant Marine Scientist
Martha Rhodes, M.S., Laboratory Specialist

* No longer with VIMS. See Appendix I.
Planktology, Department of

George C. Grant, Ph.D., Associate Marine Scientist
John E. Olney, B.S., Laboratory Specialist
Linda McEachran, Laboratory Technician
Burton B. Bryan, B.A., Graduate Assistant
Fred Jacobs, B.S., Graduate Assistant

DIVISION OF PHYSICAL SCIENCE AND COASTAL ENGINEERING

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

Physical Oceanography and Hydraulics, Department of

C. S. Fang, Ph.D., Department Head and Senior Marine Scientist
Shirley Crossley, Laboratory Technician
Paul V. Hyer, Ph.D., Associate Marine Scientist
Albert Y. Kuo, Ph.D., Associate Marine Scientist
Bruce Nielson, Ph.D., Associate Marine Scientist
Evon P. Ruzecki, M.S., Associate Marine Scientist
Christopher Welch, Ph.D., Associate Marine Scientist
Robert L. Bolus, M.S., Assistant Marine Scientist*
Mark N. Silbert, M.S., Assistant Marine Scientist*
S. N. Chia, M.S., Research Assistant
Robert Lobecker, B.S., Research Assistant
S. N. Wang, M.S., Research Assistant*
Ronald Ayres, B.S., Laboratory Specialist
Chester A. Constransitch, Laboratory Specialist
W. L. Matthews, Laboratory Specialist
Larry Oliver, A.A., Laboratory Specialist
Susan Sturm, B.S., Laboratory Specialist
Kenneth J. Worrell, Laboratory Specialist
James Cumbee, A.A., Laboratory Technician
Ronald Cook, Laboratory Technician
Don Black, Laboratory Technician
Clyde Hunt, A.A., Laboratory Technician
Edward Lawrence, Laboratory Technician
S. R. Snyder, Laboratory Technician
Tom Tyska, Laboratory Technician
Michael L. Crane, B.S., Graduate Student
Mary Ann Orzech, B.S., Graduate Assistant
Robert Pickett, M.S., Graduate Student*
S. William Saunders, B.S., Graduate Student
Jerome P. Sovich, B.S., Graduate Assistant
Hsien Eddie Wu, B.S., Graduate Assistant

* No longer with VIMS. See Appendix I.
Geological Oceanography, Department of

Robert J. Byrne, Ph.D., Department Head and Senior Marine Scientist
Cindy Otey, Secretary
Victor Goldsmith, Ph.D., Associate Marine Scientist
William G. MacIntyre, Ph.D., Associate Marine Scientist
Maynard M. Nichols, Ph.D., Associate Marine Scientist
Craig L. Smith, Ph.D., Associate Marine Scientist
William Athearn, B.S., Assistant Marine Scientist
John D. Boon, III, M.A., Assistant Marine Scientist
Paul Bullock, M.A., Assistant Marine Scientist
Hayden H. Gordon, M.S., Assistant Marine Scientist
David G. Tyler, M.S., Assistant Marine Scientist
Gary Anderson, B.S., Research Assistant
Carl H. Hobbs, M.S., Research Assistant
Michael E. Penny, B.A., Research Assistant
Galen S. Thompson, B.S., Research Assistant
Edward Hogge, Laboratory Technician
Ray O'Quinn, A.A., Laboratory Technician
Bonnie Weaver, Laboratory Technician
Joseph T. DeAlteris, B.A., Graduate Assistant
Robert Elder, B.S., Graduate Student*
Carey Ingram, A.B., Graduate Student*
Carol A. Lake, B.S., Graduate Assistant
James L. Lake, B.A., Graduate Assistant
C. Warren Norton, B.A., Graduate Assistant
Asbury H. Sallenger, Jr., B.A., Graduate Assistant
Donald K. Stauble, M.S., Graduate Assistant
John C. Windsor, B.S., Graduate Assistant

Instrument Shop (Serves entire Institute)
John D. Boon, III, M.A., Assistant Marine Scientist
William C. Hale, Laboratory Specialist
William R. Thrift, Jr., Laboratory Technician

Systems Analysis (Serves entire Institute)
Richard W. Moncure, B.S., Computer Systems Analyst
Mary Jane Hanrahan, Laboratory Technician

* No longer with VIMS. See Appendix I.
DIVISION OF ENVIRONMENTAL SCIENCE AND ENGINEERING

Michael E. Bender, Ph.D., Assistant Director and Division Head
Morris L. Brehmer, Ph.D., Assistant Director*
Judy G. Hudgins, Secretary

Ecology-Pollution, Department of
Robert J. Huggett, M.S., Acting Department Head and Assistant Marine Scientist

Environmental Biology, Section of
Michael E. Bender, Ph.D., Assistant Director and Acting Section Head
Robert Jordan, Ph.D., Associate Marine Scientist
Robert Diaz, M.S., Assistant Marine Scientist
Douglas Markle, M.A., Laboratory Technician
Thomas D. Cain, B.S., Graduate Assistant*
Michael A. Cavell, B.S., Graduate Assistant
Robert E. Croonenberghs, B.S., Graduate Assistant
David M. Dressel, B.S., Graduate Student*
Thomas K. Duncan, B.A., Graduate Assistant
Marvin E. Hedgepeth, B.S., Graduate Assistant
Carl H. Hershner, B.S., Graduate Assistant
Jeffrey L. Hyland, B.S., Graduate Assistant
Robert J. Orth, B.S., Graduate Assistant*
Richard K. Peddicord, B.S., Graduate Assistant
Michael D. Richardson, M.A., Graduate Assistant*
Peter F. Sheridan, B.A., Graduate Assistant
Edward J. Tennyson, Jr., M.S., Graduate Assistant
Robert W. Virnstein, M.S., Graduate Assistant
Charles A. Wenner, M.A., Graduate Assistant
Phillip D. Witherington, M.S., Graduate Student (NDEA Fellow)

Environmental Chemistry, Section of
Rudolf Bieri, Ph.D., Section Head and Senior Marine Scientist
Richard Hill, Ph.D., Associate Marine Scientist
Melvin Nolan, Ph.D., Associate Marine Scientist
John Lunz, M.S., Assistant Marine Scientist
H. D. Slone, M.S., Assistant Marine Scientist

* No longer with VIMS. See Appendix I.
New Students entering the graduate program for Fall, 1972. Departmental choices are pending.

Donald M. Byrne
A. Carter Cooke
A. Deane Estes
Leonard J. Kushins
Fwu Ding Lin
John F. Quensen III
George R. Sedberry
Rosalie M. Vogel
Thomas C. Wieland
DIVISION OF SPECIAL PROGRAMS AND SCIENTIFIC SERVICES
PROJECT TITLE: CHESAPEAKE BAY RESEARCH PLANNING AND MANAGEMENT

INVESTIGATORS:

William J. Hargis, Jr., Institute Director
John L. Wood, Associate Director and Sea Grant Coordinator
Maurice P. Lynch, Associate Marine Scientist and RANN Coordinator
Michael E. Bender, Assistant Director
W. Jackson Davis, Assistant Director
John M. Zeigler, Assistant Director

PROJECT SUMMARY:

This study 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 systems.

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

STATUS: Continuing.

FINANCIAL SUPPORT:

National Oceanic and Atmospheric Administration (Office of Sea Grant Programs)
National Science Foundation (RANN Program)
Virginia Institute of Marine Science
PROJECT TITLE: IMPROVED MANAGEMENT AND UTILIZATION OF ESTUARINE RESOURCES

INVESTIGATORS:

William J. Hargis, Jr., Institute Director
John L. Wood, Associate Director and Sea Grant Coordinator

PROJECT SUMMARY:

This project represents the Sea Grant Program at VIMS supported in calendar year 1972. Subprojects include:

(1) Sea Grant Program administration, planning, and coordination.
   (a) Administer Sea Grant Program and plan for future.
   (b) Coordinate and integrate the Sea Grant Program with other programs at VIMS.

(2) Research on biological resources.
   (a) Improvement of fisheries for crustaceans.
   (b) Improvement of fisheries for molluscs.
   (c) Management of larvae, supply of food.
   (d) Microbiology and pathology of commercially important species.

(3) Research on environmental resources.
   (a) Study of ocean wave refraction for Virginia's coastline.
   (b) The mineral resources of the Continental Shelf off Chesapeake Bay.

(4) Advisory Services.
   (a) Extension Agent services.
   (b) Publications and public information.

STATUS: Active. See the subprojects listed under various Departments.

FINANCIAL SUPPORT:

National Oceanic and Atmospheric Administration
(Office of Sea Grant Programs)
Virginia Institute of Marine Science
PROJECT TITLE:  CHESAPEAKE BAY RESEARCH - A COORDINATED RESEARCH PROGRAM OF THE CHESAPEAKE RESEARCH CONSORTIUM, INC.

INVESTIGATORS:

William J. Hargis, Jr., Institute Director
Maurice P. Lynch, Associate Marine Scientist and RANN Coordinator
Melvin Nolan, Associate Marine Scientist and Emissions and Additions Program Manager
William Queen *, Wetlands Program Manager

PROJECT SUMMARY:

The Chesapeake Research Consortium, Inc., consisting of the Virginia Institute of Marine Science, The Johns Hopkins University, Smithsonian Institution, and the University of Maryland, are cooperating to conduct a baywide study of Chesapeake Bay, concentrating on two areas, (1) Wetlands, Shorelines, and Shallows, and (2) Emissions and Additions to the System.

Principal aims of this project are to provide management groups and users of the Bay system with information relative to their needs. Formation of CRC, Inc. has provided an unparalleled pool of interdisciplinary expertise to study problems of Baywide magnitude.

STATUS: Active. Specific subprojects are listed under the various departments.

FINANCIAL SUPPORT:

National Science Foundation (RANN Program)
Chesapeake Research Consortium, Inc.
Virginia Institute of Marine Science

* Dr. William Queen, University of Maryland
PROJECT TITLE: INVENTORY OF EXISTING DATA BASES IN CHESAPEAKE BAY

INVESTIGATORS:

William J. Hargis, Jr., Institute Director
John J. Norcross, Senior Marine Scientist
John B. Pleasants, Assistant Marine Scientist
Maurice P. Lynch, Associate Marine Scientist and RANN Coordinator

PROJECT SUMMARY:

This project is an outgrowth and replacement of the Inventory Extension Project initiated by the Chesapeake Research Consortium, Inc.

The purpose of this project is to develop an accurate and complete inventory of coastal zone data available in the Chesapeake Economic Area.

STATUS: Active. That portion of this project which deals with data related to the Emissions and Additions and the Wetlands, Shorelines, and Shallows Programs is a subproject of "Chesapeake Bay Research" of the Chesapeake Research Consortium, Inc.

FINANCIAL SUPPORT:

National Science Foundation (RANN Program)
Chesapeake Research Consortium, Inc.
National Oceanographic Data Center (pending)
Virginia Institute of Marine Science
PROJECT TITLE: MARINE ENVIRONMENTS AND RESOURCES RESEARCH AND MANAGEMENT SYSTEM (MERRMS) PROJECT

INVESTIGATORS:

William J. Hargis, Jr., Institute Director
John B. Pleasants, Assistant Marine Scientist

PROJECT SUMMARY:

This project includes several activities, including:

(1) Development of a special management and research library of charts, aerial photography, data reports, and papers for use in planning and management of marine resources and in research, itself.
(2) Development of hardware and software for handling such information.
(3) Design of evaluation methods.
(4) Development of a predictive capability relative to effects of alterations of wetlands, shorelines, or shallows, and emissions and additions to the Bay system.

This project encompasses two other activities, Development of an Information System and the Organizational or Institutional Studies phase. Project MERRMS is designed to enable technical advisors to make better environmental impact statements and predictions for planners and managers as well as to assist research administrators in following progress of research and in designing better and more relevant environmental and resource-use research.

This project will be made compatible with similar activities elsewhere. Initial emphasis has been on the lower half of the Bay and its tributaries. Immediate utility and application is assured in that the Institute, as part of its official duties, makes environmental impact statements and advisory statements to the planning and management activities agencies of the Commonwealth and to others. This project is also a pilot project for a baywide or series of baywide management related information systems under the sponsorship of CRC, Inc.

STATUS: Active. This is a subproject of "Chesapeake Bay Research" of the Chesapeake Research Consortium, Inc.
FINANCIAL SUPPORT:

National Science Foundation
(RANN Program)
Virginia Institute of Marine Science
PROJECT TITLE:  THE CHESAPEAKE BAY BIBLIOGRAPHY

INVESTIGATOR:

Susan O. Barrick, Head Librarian
John B. Pleasants, Assistant Marine Scientist

PROJECT SUMMARY:

This project is designed to provide an initial bibliography and periodic updating of studies related to the estuarine portion of the Chesapeake Economic Region. To provide as rapid utility of this project as possible, incremental portions of the bibliography are prepared and disseminated. Volume I, The James River, was prepared and distributed with support from IRRPOS, Sea Grant, and NASA, Langley Research Center. Volume II, The Lower Bay, was prepared and distributed with support from NSF-RANN and CRC, Inc. Present efforts are aimed at extending the scope of the bibliography to include the upper Bay.

STATUS:  Active.

FINANCIAL SUPPORT:

National Science Foundation
(RANN Program)
Chesapeake Research Consortium, Inc.
Virginia Institute of Marine Science
PROJECT TITLE: **A STUDY OF COMMONS LAND IN VIRGINIA**

INVESTIGATORS:

William J. Hargis, Jr., Institute Director
Maurice P. Lynch, Associate Marine Scientist
Ted F. Smolen, Assistant Marine Scientist

PROJECT SUMMARY:

This project is an attempt to locate, through historical and legal studies, the original and present boundaries of state-owned commons land in Virginia, particularly those commons lands consisting of wetlands.

STATUS: Active. This is a subproject of "Chesapeake Bay Research" of the Chesapeake Research Consortium, Inc.

FINANCIAL SUPPORT:

National Science Foundation  
(RANN Program)  
Virginia Institute of Marine Science
PROJECT TITLE: EFFECTS OF A MAJOR FLOOD ON THE CHESAPEAKE BAY SYSTEM (OPERATION AGNES)

INVESTIGATORS:

William J. Hargis, Jr., Institute Director and Ad Hoc Coordinator, Bay-Wide Studies--Operation Agnes
W. Jackson Davis, Assistant Director and VIMS Coordinator--Operation Agnes
Richard Hill, Associate Marine Scientist, Department of Ecology-Pollution

PROJECT SUMMARY:

The objective of this study is to describe and explain the effects of the flood resulting from Tropical Storm Agnes in June 1972 on the Chesapeake Bay System. The study is a joint effort of the Chesapeake Bay Research Council*, with VIMS working mainly in the lower Bay, its tributaries, and on the Continental Shelf.

Description of changes in hydrography is being accomplished by measuring salinity, turbidity, dissolved oxygen, and temperature on frequent slack-water runs during the period of freshwater influence. Water flux is being measured on transects of the rivers and in Chesapeake Bay. Coupled with measurement of water flux is analysis of transport of sediments, nutrients, pesticides, and heavy metals.

Study of sedimentological effects is to be based on more than 10,000 samples that have been collected in the lower Bay and its tributaries, on turbidity measurements, and on remote sensing data.

Biological investigations have been aimed at description of immediate effects, such as displacement or death or organisms, and at effects which will not be apparent for a few months to a few years, such as disruption of reproduction. The planktonic, benthonic, and nectonic communities are being monitored to determine the nature and extent of changes.

STATUS: Active.

FINANCIAL SUPPORT: (to VIMS)

Logistics support has been provided by elements of the U. S. Navy, U. S. Army, U. S. Coast Guard, and the National Aeronautics and Space Administration.
FINANCIAL SUPPORT (Cont'd):

National Oceanic and Atmospheric Administration
National Science Foundation
U. S. Army Corps of Engineers
National Marine Fisheries Service
Environmental Protection Agency (pending)
Food and Drug Administration
Virginia Institute of Marine Science

* Chesapeake Bay Research Council includes Chesapeake Bay Institute, Chesapeake Biological Laboratory, and the Virginia Institute of Marine Science.
PROJECT TITLE:  CONTROL MEASURES FOR CHESAPEAKE BAY JELLYFISHES

INVESTIGATORS:

Paul L. Zubkoff, Department Head and Senior Marine Scientist
Dexter S. Haven, Head of Department of Applied Marine Biology
Reinaldo Morales-Alamo, Research Assistant, Department of Applied Marine Biology
Dale R. Calder, Associate Marine Scientist, Department of Invertebrate Ecology
Kenneth L. Webb, Associate Marine Scientist, Department of Environmental Physiology
Robert E. L. Black, Associate Marine Scientist, Department of Environmental Physiology

PROJECT SUMMARY:

The phases for the project period April 1972 - March 1972 include the following objectives;

(1) To further clarify the problems of identification of the several life stages of the abundant jellyfishes of Chesapeake Bay,
(2) To investigate further the process of strobilation as a possible weak link in the jellyfish life cycle for control of natural populations,
(3) To explore the utility of natural toxins and diseases as control agents,
(4) To identify substances that are capable of inhibiting strobilation, inducing it out of season, or causing direct mortality to any stage of the life cycle, and
(5) To clarify further the ecological role of jellyfishes with special reference to their position in the food chain.

STATUS:  Active.

FINANCIAL SUPPORT:

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

* Dr. Robert E. L. Black, also Professor of Biology, College of William and Mary, Williamsburg, Virginia.
PROJECT TITLE: STATUS OF ENVIRONMENTS AND RESOURCES OF THE JAMES RIVER

INVESTIGATORS:

William J. Hargis, Jr., Institute Director
John B. Pleasants, Assistant Marine Scientist

PROJECT SUMMARY:

Designed to develop an understanding of the current status of the environments and resources of the tidal James, this project will result in a series of reports to NASA-Langley to be used in their studies of James River.

STATUS: Active. An interim report has been made to NASA. This report is now in editorial review.

FINANCIAL SUPPORT:

National Aeronautics and Space Administration (Langley Research Center)
Virginia Institute of Marine Science
PROJECT TITLE: TRANSPORT AND MOVEMENTS OF OYSTER LARVAE IN THE JAMES RIVER

INVESTIGATORS:

Langley H. Wood*
William J. Hargis, Jr., Institute Director

PROJECT SUMMARY:

A study of the mechanisms of movement and transport of larval stages of Crassostrea virginica in the James estuary, a two-layered estuarine system. Samples have been collected and analyzed; corollary laboratory experiments on factors affecting movements of larvae have been completed; and reports are currently being prepared.

STATUS: Completed. Awaiting final publication.

FINANCIAL SUPPORT:

Department of the Interior
(Bureau of Commercial Fisheries)
Virginia Institute of Marine Science

*Langley H. Wood, Sweet Briar College, Sweet Briar, Virginia
PROJECT TITLE: A REVIEW OF STATES' MINERAL LEASING POLICIES AND LEGISLATIVE PROPOSALS FOR THE STATE OF VIRGINIA

INVESTIGATORS:

Maurice P. Lynch, Associate Marine Scientist
William J. Wardrop, Graduate Assistant

PROJECT SUMMARY:

A review of the mineral leasing practices on submerged lands within the exclusive jurisdiction of the various states is underway. A best estimate of the potential mineral resources within the territorial waters of the Commonwealth of Virginia and plans for their development is being made. Construction of model legislation to facilitate the administration and leasing of these resources is the eventual goal of this project.

STATUS: This project represents Wardrop's thesis research.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science
PROJECT TITLE: MARINE EXTENSION SERVICE

INVESTIGATORS:

Bruce W. Mattox, Department Head and Chief Economist
Robert K. Dias, Extension Agent

PROJECT SUMMARY:

Problems of the seafood industry are being determined and efforts to solve several are underway. Major effort is being expended in the following areas:

(1) Irregular supplies of product.
   (a) New markets for over-abundant species are being sought.
   (b) Help with location of supplies to processing firms when local supplies are short.

(2) Uses of unexploited and under-exploited species sought.

(3) Means of diversification in seafood industry investigated.
   (a) Promotion of pot fishery for Black Sea Bass is being investigated for out of season occupation for crab dredge boats and party fishing boats.
   (b) Sand shrimp fishery is also being investigated for the same reasons.

(4) Mechanization is being stressed.
   (a) An oyster steaming plant has been pushed for sea side Eastern Shore.

(5) New methods of aquaculture are being introduced to the industry.

(6) New fishing gear is being investigated.
   (a) Floating pound nets.
   (b) Modified Sea Bass pots.

STATUS: Active.

FINANCIAL SUPPORT:

National Oceanic and Atmospheric Administration
(Office of Sea Grant Programs)
Virginia Institute of Marine Science
PROJECT TITLE: DEVELOPMENT OF YOUNG BLUEFISH (POMATONUS SALTATRIX) AND DISTRIBUTION OF EGGS AND YOUNG IN VIRGINIAN COASTAL WATERS

INVESTIGATORS:

John J. Norcross, Department Head and Senior Marine Scientist
William H. Massmann *

PROJECT SUMMARY:

This paper describes the development of young bluefish by line drawings and descriptive text. The distributions of eggs and larvae are related to distributions of water properties. Possible pathways of transport of eggs and young are discussed.

STATUS: The final draft of the manuscript has been completed and awaits review by one of the authors.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science

PROJECT TITLE: TRANSPORT OF OYSTER LARVAE IN THE JAMES ESTUARY: DEVELOPMENT OF METHODS

INVESTIGATORS:

John J. Norcross, Department Head and Senior Marine Scientist
Langley H. Wood*
William J. Hargis, Jr., Institute Director

PROJECT SUMMARY:

The goal of this project was a statistical evaluation of two methods used for sorting and counting bivalve larvae contained in plankton samples collected from the James River. It was found that a new method, developed by VIMS, yielded greater accuracy than the traditional method commonly employed by planktologists.

STATUS: Completed. A manuscript has been developed and is currently awaiting review by VIMS' editorial staff. It is a subproject of "Transport and Movements of Oyster Larvae in the James River."

FINANCIAL SUPPORT:

Department of the Interior
(Bureau of Commercial Fisheries)
Virginia Institute of Marine Science

*Langley Wood, Sweet Briar College, Sweet Briar, Virginia
PROJECT TITLE: THE BATHYMETRIC DISTRIBUTION OF PHYTOPLANKTON IN VIRGINIAN COASTAL WATERS

INVESTIGATORS:

Richard A. Mulford*
John J. Norcross, Department Head and Senior Marine Scientist

PROJECT SUMMARY:

A submersible pump was used to collect phytoplankton samples at depth across the Continental Shelf. Species composition, abundance, and seasonal succession were noted.

STATUS: Completed. Awaiting final publication.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science

*Richard A. Mulford, Benedict Estuarine Laboratory, Benedict, Maryland.
PROJECT TITLE: STUDIES ON MARICULTURE OF BAY SCALLOP, ARGOPECTEN IRRADIANS

INVESTIGATORS:

William P. Duggan, Assistant Marine Scientist
Michael Castagna, Associate Marine Scientist

PROJECT SUMMARY:

The purpose of this project is to develop methods that are practical to the seafood industry to farm bay scallops from brood stock to marketable product. Phases include:

1. Develop inexpensive culture methods for handling eggs and growing larvae,
2. Develop practical methods of growing post set juveniles to size adequate for field planting, and
3. Develop protection and containment methods adequate and practical for growing scallops to market size.

STATUS. Active. A cooperative experiment with industry is being conducted. The following papers have been published:


FINANCIAL SUPPORT:

National Oceanic and Atmospheric Administration (Office of Sea Grant Programs)
Virginia Institute of Marine Science
PROJECT TITLE: STUDIES ON MARICULTURE OF HARD CLAM, MERCENARIA MERCENARIA

INVESTIGATORS:
Michael Castagna, Associate Marine Scientist
William P. Duggan, Assistant Marine Scientist

PROJECT SUMMARY:
The objective of this project is to develop methods that are practical to the seafood industry to farm hard clams from brood stock to marketable product.

Phases include:
(1) Develop culture methods to spawn and grow clams from eggs to juveniles,
(2) Develop methods of growing post set juveniles to a size large enough for field plantings, and
(3) Develop protection methods to grow clams in the field to market size without serious predation losses.

STATUS: Active. Cooperative experiments with the industry are presently being run. Papers which have been published include:
(2) Hard clam culture method developed at VIMS. Marine Resources Advisory Series,No. 4, June 1970.

FINANCIAL SUPPORT:
National Oceanic and Atmospheric Administration (Office of Sea Grant Programs)
Virginia Institute of Marine Science
DIVISION OF FISHERIES SCIENCE AND SERVICES
PROJECT TITLE: EASTERN SHORE ECONOMIC STUDY OF SEAFOOD INDUSTRY

INVESTIGATORS:

William J. Hargis, Jr., Institute Director
W. Jackson Davis, Assistant Director

PROJECT SUMMARY:

Phases for this project are:

(1) Review of natural systems and evaluation of living marine resources of Accomack and Northampton counties, consideration of relevant activities and potentialities for enhancement and development, consideration of special problems relating to use, repletion, and conservation of those resources, and

(2) Elements of marine ecology of Eastern Shore.

STATUS: Active. A report has been submitted to the Virginia Department of State Planning and Community Affairs. This report is in editorial review preparatory to general distribution.

FINANCIAL SUPPORT:

Virginia Department of State Planning and Community Affairs
U. S. Department of Commerce
(Economic Assistance Administration)
National Oceanic and Atmospheric Administration
(Office of Sea Grant Programs)
Virginia Institute of Marine Science
PROJECT TITLE: AN INVESTIGATION INTO COMMERCIAL ASPECTS OF THE HARD CLAM FISHERY AND DEVELOPMENT OF COMMERCIAL GEAR FOR THE HARVEST OF MOLLUSKS

INVESTIGATORS:

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

PROJECT SUMMARY:

Objectives of this project are:

(1) Investigate the distribution of hard clams in the lower Chesapeake Bay region and other nearby localities with a hydraulic esculator dredge,
(2) Sample hard clams in relatively deep water with a hydraulic tow dredge in the lower Chesapeake Bay region,
(3) Study rates of growth in various sectors of the lower Chesapeake Bay region,
(4) Evaluate hard clam farming in the York River,
(5) Determine predators of small hard clams, and
(6) Modify a Maryland type hydraulic esculator for the harvest of oysters.

STATUS: Active.

FINANCIAL SUPPORT:

National Oceanic and Atmospheric Administration
(National Marine Fisheries Service)
Virginia Institute of Marine Science
PROJECT TITLE:  CONTROL MEASURES FOR CHESAPEAKE BAY JELLYFISHES: NUTRITION STUDIES

INVESTIGATORS:

Dexter S. Haven, Department Head and Senior Marine Scientist
Reinaldo Morales-Alamo, Research Assistant
Paul L. Zubkoff, Head of Department of Environmental Physiology

PROJECT SUMMARY:

The feeding habits of the immature forms of the jellyfishes are unknown. With the possible exception of "force feeding" of brine shrimp nauplii to laboratory reared ephyrae (Aurelia, Cyanea, Chrysaora, and Rhopilema), the uptake of natural foods is not defined.

We propose to identify the feeding habits and possible mechanisms of digestion of newly liberated Chrysaora ephyrae and immature medusae by examining the contents of the gastrovascular cavities. If appropriate quantities of materials are isolated from the gastrovascular cavity, extractions for total lipids will be made using the Bligh-Dyer procedure. The fatty acid constituents of the gastrovascular cavity contents in the jellyfish will be examined.

STATUS:  Active. This is a subproject of "Control Measures for Chesapeake Bay Jellyfishes."

FINANCIAL SUPPORT:

National Oceanic and Atmospheric Administration
(National Marine Fisheries Service)
Virginia Institute of Marine Science
PROJECT TITLE: A STUDY OF THE MOLLUSCAN POPULATIONS IN THE PORTSMOUTH TO NEWPORT NEWS BRIDGE TUNNEL AREA

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 objective of this project is to investigate clam and oyster populations in a mile-wide corridor from Newport News Point to Portsmouth, Virginia.

The methods to be used will be:
(1) In deep water, sample at randomly chosen stations in representative areas with a patent long rig to determine density per unit area of hard clams, oysters, and shell,
(2) Survey area in shallow water with oyster tongs, and
(3) Determine sediment type and regulation with a diver survey.

STATUS: Active. Field work was completed in July, 1972.

FINANCIAL SUPPORT:
Virginia Department of Highways
Virginia Institute of Marine Science
PROJECT TITLE:  A STUDY OF THE MOLLUSCAN POPULATION TO THE NORTH OF THE NEWPORT NEWS SHIPBUILDING AND DRYDOCK COMPANY

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 objective of this project is to investigate clam and oyster populations in the area to be filled just upriver from the Newport News Shipbuilding and Drydock Company shipyards.

The methods to be used will be:

(1) Sample at randomly chosen stations with a hydraulic tow dredge within the one-half square mile area,
(2) Determine density of clams and oysters per unit area, and
(3) Determine sediment type.

STATUS: Active. Field work is scheduled for completion in August, 1972.

FINANCIAL SUPPORT:

Newport News Shipbuilding and Drydock Company
Virginia Institute of Marine Science
PROJECT TITLE: SURVEY OF PUBLIC OYSTER GROUNDS IN THE STATE OF VIRGINIA AND MONITORING SPAT FALL

INVESTIGATOR:

Dexter S. Haven, Department Head and Senior Marine Scientist

PROJECT SUMMARY:

This study monitors the public oyster racks in Virginia to evaluate quantities of shell, oysters, and spat. Data are recorded in terms of spat, shells, or oysters per bushel. Data are also collected on predictors 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 30 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 and mailed to over 1500 persons.

STATUS: Active.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science
PROJECT TITLE: A STUDY OF THE VIRGINIA OYSTER INDUSTRY

INVESTIGATORS:

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

PROJECT SUMMARY:

An in-depth study is being prepared which covers all phases of the Virginia oyster industry from 1931 to 1971.

STATUS: Active.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science
PROJECT TITLE: SEASONAL AND ECOLOGICAL SUCCESSION OF BENTHIC MACROINVERTEBRATES IN NATURAL SUBSTRATES

INVESTIGATORS:

Joseph G. Loesch, Associate Marine Scientist
Peter F. Larsen, Graduate Assistant

PROJECT SUMMARY:

The purpose of this study is:

(1) To establish existence and manner of succession in the benthic marine environment, and
(2) To determine the means of recolonization of a "new" substrate, i.e., by setting of larvae or by immigration from adjoining areas.

The methods to be used include the following:

(1) A series of cores containing natural substrate that has been voided of living organisms will be placed on several environments.
(2) The cores will be pulled up at periodic intervals and analyzed. The fauna associated with each core will be compared with the other cores and with the community which is known to exist in each area.
(3) Subtopics related to the above include the determination of:
   a. The depth of the various components of the benthic community.
   b. Periodicity and density of setting of benthic fauna.
   c. Survival rates of larvae in several sediment types.

STATUS: This project represents Larsen's dissertation research.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science
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 Assistant

PROJECT SUMMARY:

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

STATUS:  This project represents Lucy's dissertation research.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science
PROJECT TITLE: STUDY OF THE EFFECTS OF LOW OXYGEN TENSIONS ON MOLLUSCS

INVESTIGATORS:

Dexter S. Haven, Department Head and Senior Marine Scientist
Dennis T. Walsh, Graduate Assistant

PROJECT SUMMARY:

The purpose of this study is:

(1) To establish effects of various oxygen tensions on survival of larvae of clams and oysters,
(2) To establish effects of possible lethal effects of low oxygen on adults, and
(3) To establish effects of low oxygen on filtering and pumping rates of molluscs.

The methods to be used include:

(1) Stripping oxygen out of the water with nitrogen gas,
(2) Holding molluscs in specially designed chambers,
(3) Measuring filtering rates with a Coulter electronic particle counter, and
(4) Measuring pumping rates with the "dye" method.

STATUS: This project represents in part Walsh's thesis research. It is a subproject of the Emissions Program of "Chesapeake Bay Research" of the Chesapeake Research Consortium, Inc.

FINANCIAL SUPPORT:

National Science Foundation
(RANN Program)
Virginia Institute of Marine Science
PROJECT TITLE: DEVELOPMENT OF ESTIMATES OF RELATIVE ABUNDANCE OF JUVENILE AND ADULT CRABS

INVESTIGATORS:

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

PROJECT SUMMARY:

Monthly trawl surveys are made using R/V Pathfinder at stations in the York (9 stations), James (6 stations), and Rappahannock (7 stations) rivers, and Chesapeake Bay (2 stations) 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 is obtained at each station.

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

Data is tabulated and transferred to IBM cards which will allow computer processing.

STATUS: This project is funded by the Sea Grant Program at the present, but is a continuing, long-term project.

FINANCIAL SUPPORT:

National Oceanic and Atmospheric Administration
(Office of Sea Grant Programs)
Virginia Institute of Marine Science
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., Associate Marine Scientist

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: The fieldwork and data analysis have been completed. A manuscript is now in preparation.

FINANCIAL SUPPORT:

National Oceanic and Atmospheric Administration
(Office of Sea Grant Programs)
Virginia Institute of Marine Science
PROJECT TITLE: DEVELOPMENT OF TECHNIQUES FOR PREDICTION OF BLUE CRAB STOCKS

INVESTIGATORS:

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

PROJECT SUMMARY:

The objective of this program is to use estimates of relative abundance obtained from trawl surveys to make predictions of blue crab stocks.

VIMS' current and historical trawl survey data have been analyzed to describe the effects of stations (salinity), seasons, temperature, dissolved oxygen, and tidal conditions on the catch and distribution of blue crabs.

Experimental trawl and dredge survey programs are being conducted to improve sampling techniques and to provide knowledge prerequisite to interpretation of trawl survey data.

STATUS: A manuscript based on historical data and describing the distribution of blue crabs in the York, James, and Rappahannock rivers is in preparation. This is being funded in part by the Sea Grant Program. Other phases of this project are considered as long-term and continuing.

FINANCIAL SUPPORT:

National Oceanic and Atmospheric Administration
(Office of Sea Grant Programs)
Virginia Institute of Marine Science
PROJECT TITLE: EXPLORATION OF METHODS FOR IMPROVING THE PRODUCTION OF SOFT CRABS, CALLINECTES SAPIDUS

INVESTIGATORS:

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

PROJECT SUMMARY:

The objective of this study is to define the criteria for the efficient production of soft crabs. The study is involved with the following:

(1) Demonstrating to industry the feasibility of shedding crabs in tanks laid out on piers or over land, with running or re-circulated salt water.
(2) Developing plans for physical plants.
(3) Developing guidelines for acceptable levels of water quality: temperature, salinity, speed of water flow, dissolved oxygen, dissolved nitrogenous substances, pH, for example.
(4) Developing guidelines for quality and quantity of crabs that can be held.
(5) Developing a program for studying mortalities among crabs, to explain their causes and, ultimately, to control them.

STATUS: This is a continuing project, presently funded in part by the Sea Grant Program.

FINANCIAL SUPPORT:

National Oceanic and Atmospheric Administration
(Office of Sea Grant Programs)
Virginia Institute of Marine Science
PROJECT TITLE: A STUDY OF THE FEASIBILITY OF PRODUCING MARKETABLE QUANTITIES OF SOFT ROCK CRABS, CANCER IRRORATUS, IN VIRGINIA

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

PROJECT SUMMARY:
The potential production of soft rock crabs during winter is being studied. The immediate objective is to determine whether there are external signs which would indicate the stage of the molt cycle of the crab. The long-term objective is to define the levels of water quality, the physical plant required for most successful production, and the quality and quantity of rock crabs that can be used.

STATUS: A manuscript describing various aspects of the biology of the molting cycle is in preparation. This is a continuing project, presently funded in part by the Sea Grant Program.

FINANCIAL SUPPORT:
National Oceanic and Atmospheric Administration
(Office of Sea Grant Programs)
Virginia Institute of Marine Science
PROJECT TITLE: BLUE CRAB BIBLIOGRAPHY

INVESTIGATORS:

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

PROJECT SUMMARY:

Revision of the bibliography on the blue crab, Callinectes sapidus and other species of the genus Callinectes has been temporarily set aside while other studies are being conducted. The revision will result in publication of a working KWIC index or an annotated bibliography, or both.

STATUS: Continuing.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science
PROJECT TITLE: **BIOLOGY OF CRANGON SEPTEMSPINOSA**

INVESTIGATORS:

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

PROJECT SUMMARY:

Information on various aspects of the biology of the sand shrimp is presently available for populations in the waters of Newfoundland, Maine, and Delaware. Investigation of Chesapeake Bay stocks has been initiated to detect latitudinal differences in temperature and salinity tolerance, osmotic regulation, reproductive biology, age and growth, and relationships that exist with other carideans (*Palaemonetes* spp., *Hippolyte* spp., e.g.).

Field sampling of both shallow and deeper waters of the southern part of Chesapeake Bay and the York River is being undertaken to locate and determine size of available stocks.

STATUS: Various aspects of the biology of this shrimp will be studied as the situation dictates. Continuing.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science
Virginia Institute of Marine Science
Crustaceology Department

PROJECT TITLE: ECOLOGY OF EMERITA TALPOIDA AND THE INFLUENCE OF ENVIRONMENTAL FACTORS ON THE DISTRIBUTION OF LARVAE

INVESTIGATORS:

W. A. Van Engel, Department Head and Senior Marine Scientist
H. Ellen Hunter, Graduate Student

PROJECT SUMMARY:

It is proposed to determine the distribution of larvae of Emerita talpoida in the ocean and nearshore in the water column and in sediments; to study the juvenile and adult community structure on the ocean beaches; to examine mechanisms contributing to the onshore movement of larvae; to study the salinity tolerance of larvae.

STATUS: This project represents Hunter's thesis research.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science
PROJECT TITLE: **OXYGEN CONSUMPTION OF THE BLUE CRAB, CALLINECTES SAPIDUS RATHBUN**

INVESTIGATORS:

Paul A. Haefner, Jr., Associate Marine Scientist
Chae E. Laird, Graduate Student

PROJECT SUMMARY:

The project's objectives are to determine the effects of sex, weight, acclimation temperature, acclimation salinity, acute temperature changes, and acute salinity changes on the oxygen consumption of the blue crab, *Callinectes sapidus*. Of secondary interest are the effects of the stages of the molt cycle, injury and desiccation on the oxygen consumption, the behavioral manifestations of hypoxia, and gill ventilation rates.

STATUS: This project represents Laird's thesis research.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science
National Science Foundation (Traineeship)
National Oceanic and Atmospheric Administration
(Office of Sea Grant Programs)
PROJECT TITLE: DISTRIBUTION, ABUNDANCE, AND ECOLOGY OF THE ROCK CRAB (CANCER IRRORATUS) IN VIRGINIA COASTAL WATERS

INVESTIGATORS:

Paul A. Haefner, Jr., Associate Marine Scientist
Lewis R. Shotton, Graduate Student

PROJECT SUMMARY:

Cancer irroratus is abundant in the Chesapeake Bay during the cold months. As warm weather approaches, it is hypothesized that C. irroratus migrates first to deeper water within the Bay and then into the ocean. Also, there is a noticeable absence of female C. irroratus in the Bay population during the winter months.

This project is concerned with determining aspects of the general biology and ecology of the rock crab in nearshore waters of the coast of Virginia. Studies are being made of the relative abundance, distribution, average size and size range, stages of the molting cycle, and reproductive biology of crabs caught in pots and trawls.

STATUS: This project represents Shotton's thesis research.

FINANCIAL SUPPORT:

National Oceanic and Atmospheric Administration
(Office of Sea Grant Programs)
Virginia Institute of Marine Science
PROJECT TITLE: RELATIVE GROWTH, REPRODUCTION, AND DISTRIBUTION OF THE ROCK CRAB, CANCER IRORATUS, IN CHESAPEAKE BAY

INVESTIGATORS:

W. A. Van Engel, Department Head and Senior Marine Scientist
Roy T. Terretta, Graduate Assistant

PROJECT SUMMARY:

This research is concerned with determining aspects of the general biology and ecology of the rock crab in the Chesapeake Bay in winter. Studies have been made of the relative abundance, distribution, average size and size range, stages of the molting cycles, and reproductive biology of rock crabs caught in the winter dredge fishery for blue crabs.

STATUS: This project represents Terretta's thesis research.

FINANCIAL SUPPORT:

National Oceanic and Atmospheric Administration (Office of Sea Grant Programs)
Virginia Institute of Marine Science
PROJECT TITLE: LOCAL DISTRIBUTION OF XANTHID CRABS AND THEIR ADAPTATIONS FOR LIFE IN THE INTERTIDAL ZONE

INVESTIGATORS:

W. A. Van Engel, Department Head and Senior Marine Scientist
Douglas H. Wood, Graduate Assistant

PROJECT SUMMARY:

Five species of xanthids occur within the York River estuary. Research will be conducted on the influence of depth, habitat type, salinity, temperature, time of day, season and tide stage, among others, on the differential distribution of these species. Laboratory studies will be made to learn of the possible existence of control mechanisms, such as geotaxis, phototaxis, and habitat preference. Morphologic studies and tests of tolerance to different levels of salinity and desiccation will be made.

STATUS: This project represents Wood's thesis research.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science
PROJECT TITLE: FEASIBILITY OF INCREASING STRIPED BASS POPULATIONS BY STOCKING OF UNDER-UTILIZED NURSERY GROUNDS

INVESTIGATORS:

John V. Merriner, Associate Marine Scientist
Walter J. Hogman, Associate Marine Scientist
William R. Rhodes, Assistant Marine Scientist
C. E. Richards, Assistant Marine Scientist
W. H. Kriete, Jr., Research Assistant

PROJECT SUMMARY:

Principal objectives include the following:

1. Selection of one or more tributaries having suitable nursery grounds for striped bass, but inadequate or unutilized spawning grounds (completed),
2. Experimental stocking of a selected tributary and assessment of survival and growth of stocked striped bass,
3. Refinement and adoption of existing techniques for rearing striped bass larvae, and assessment of optimal size for stocking,
4. Experimental stocking of additional tributaries,
5. Evaluation of stocking in under-utilized nursery grounds of Virginia as a management tool, and
6. Estimation of expected benefits from its implementation.

Also included in this project is the monitoring of age composition and mortality within lower Chesapeake Bay striped bass populations, continuing previous studies.

STATUS: Active.

FINANCIAL SUPPORT:

Bureau of Sport Fisheries and Wildlife
Virginia Institute of Marine Science
PROJECT TITLE: BIOLOGY AND MANAGEMENT OF RIVER HERRING AND SHAD

INVESTIGATOR:

W. Jackson Davis, Head, Division of Fisheries Biology and Acting Department Head

PROJECT SUMMARY:

Objectives of this project are:

(1) To measure fishing effort and estimate catch per unit of effort in the fishery for river herring and shad in lower Chesapeake Bay and its tributaries,

(2) To estimate mortality rates and population sizes of each species of Alosa in each of four river systems,

(3) To determine an index of the number of juveniles in the nursery of each river system each year, and to evaluate the index as a predictor of fishing success in future years,

(4) To elucidate the relative importance to alosids of various kinds of food organisms and the significance of interrelationships, such as predator-prey interactions, by describing the community structure and trophic dynamics of the nurseries,

(5) To develop reliable methods of hatching fertilized eggs of Alosa spp., of culturing the larvae through the sac-fry stage to metamorphosis, and of holding juveniles under laboratory conditions,

(6) To measure the ability of various life history stages to withstand the changes in water quality that can be expected from pollution, riparian development, and other environmental changes, and

(7) To find a practical method of identifying adult Alosa spp. with their parent streams.

STATUS: Active.

FINANCIAL SUPPORT:

National Oceanic and Atmospheric Administration
(National Marine Fisheries Service)
Virginia Institute of Marine Science
PROJECT TITLE: AN ANALYSIS OF THE WHITE MULLET (MUGIL CUREMA) IN VIRGINIA

INVESTIGATORS:

C. E. Richards, Assistant Marine Scientist
Michael Castagna, Associate Marine Scientist

PROJECT SUMMARY:

This project is a study of growth, predation, and distribution of the white mullet, Mugil curema, in Virginia including Chesapeake Bay and Seaside Eastern Shore.

STATUS: Active. Seaside data is complete and written in report form. Chesapeake Bay data is being assimilated but presently is on a "hold" or standby basis for more data.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science
PROJECT TITLE: UROPHYCIS BIOLOGY

INVESTIGATORS:

John 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.

A racial study of U. chuss for the International Commission on North Atlantic Fisheries is approximately 50% complete.

STATUS: Active.

FINANCIAL SUPPORT:

National Marine Fisheries Service
Virginia Institute of Marine Science

* D. Cohen, National Marine Fisheries Service
PROJECT TITLE: **COMMUNITY ECOLOGY OF OFFSHORE DEMERSAL FISHES**

INVESTIGATOR:

John A. Musick, Associate Marine Scientist

PROJECT SUMMARY:

This project is a study of community relationships among fishes of the continental shelf, based upon trawl catches of the R/V Sea Breeze and Albatross IV. Analysis of distribution by season, temperature, and depth for all species and dominance affinity among stations is complete. Diversity analyses and Fager's analysis are in progress.

STATUS: Active.

FINANCIAL SUPPORT:

- National Marine Fisheries Service (collection)
- Virginia Institute of Marine Science (collection and analysis)
PROJECT TITLE: COMMUNITY ECOLOGY OF ESTUARINE DEMERSAL FISHES

INVESTIGATORS:

John A. Musick, Associate Marine Scientist
Douglas Markle, Graduate Assistant

PROJECT SUMMARY:

A four year field program of monthly stratified sampling of the lower York River by trawl is underway. This sampling will provide pre- and post-operational data for determination of effects (if any) of VEPCO plant enlargement on community structure.

Analysis of trends in seasonal species dominance and diversity of fish taken in monthly Bay-River trawl surveys has been completed to provide comparative long-term trends.

STATUS: Active. The Bay-River analyses are complete.

FINANCIAL SUPPORT:

Virginia Electric and Power Company
Virginia Institute of Marine Science
PROJECT TITLE: COBIA TAGGING STUDY

INVESTIGATOR:

C. E. Richards, Assistant Marine Scientist

PROJECT SUMMARY:

Twenty cobia were tagged, with five returns after 24-1121 days out. All returns were from Chesapeake Bay and within 36 nautical miles of release and all by sport gear.

STATUS: Continuing.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science
PROJECT TITLE: **ANALOG COMPUTATION AND FISH POPULATION STUDIES**

INVESTIGATOR:

C. E. Richards, Assistant Marine Scientist

PROJECT SUMMARY:

This project is involved with simulation of population dynamics.

STATUS: Continuing.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science
PROJECT TITLE: RED DRUM (SCIAENOPS OCELLATA) AGE, GROWTH, AND DISTRIBUTION

INVESTIGATOR:

C. E. Richards, Assistant Marine Scientist

PROJECT SUMMARY:

Data tabulation and analysis are underway for age-growth study for Sciaenops ocellata. Tagging of adult channel bass to estimate mortality, distribution, and to corroborate age-growth estimates is being done.

STATUS: Active.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science
PROJECT TITLE: BLACK DRUM (POGONIAS CROMIS) AGE, GROWTH, AND DISTRIBUTION

INVESTIGATOR:

C. E. Richards, Assistant Marine Scientist

PROJECT SUMMARY:

The age, growth, and distribution analyses of black drum (Pogonias cromis) have been completed.

STATUS: Report is in the process of editorial review.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science
PROJECT TITLE: ASPECTS OF THE LIFE HISTORY AND COMMENSAL BEHAVIOR OF A NEW SPECIES OF THE GENUS LIPARIS (CYCLOPTERIDAE) FROM THE WESTERN NORTH ATLANTIC

INVESTIGATORS:

John A. Musick, Associate Marine Scientist
Kenneth Able, Graduate Student

PROJECT SUMMARY:

A new species of cyclopterid fish in the genus Liparis differs from its congener in a number of morphological characters and in the commensal association which it establishes with the mollusk, Placopecten magellanicus. Past references to this association which have referred to other species of Liparis have apparently been in error. More than 6000 specimens collected from scallops between Nova Scotia and Cape Hatteras are this new species. Spawning occurs in the spring. The eggs are demersal and adhesive. The pelagic larvae descend to the bottom at about 10 mm in length and enter live Placopecten. Laboratory and field observations indicate the Liparis occupies scallops during the day and forages at large at night. Sexual maturity is attained in one year. The species has spawned in the laboratory, and the eggs and yolk-sac larvae have been documented. Also, plankton collections have yielded yolk-sac and later larval stages and small juveniles.

STATUS: This project represents Able's dissertation research. Write-up of this data is partially completed.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science
PROJECT TITLE:  A STUDY OF THE AGE AND GROWTH OF THE BLACK SEA BASS, CENTROPRISTIS STRIATA (LINNAEUS)

INVESTIGATORS:

John V. Merriner, Associate Marine Scientist
Robert K. Dias, Graduate Student

PROJECT SUMMARY:

Monthly samples of black sea bass will be collected off Virginia Beach using hook and line. Field observations will include condition of gonads, coloration, and sex. In the laboratory, specimens will be analyzed by the otolith method. Stomach contents will be qualitatively examined, and fecundity will be estimated by gravimetric methods. Other species collected in addition to black sea bass will be identified and enumerated.

STATUS:  This project represents Dias' thesis research. The study began in May, 1972, and is expected to be completed in one year.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science
PROJECT TITLE: ELECTROPHORETIC ANALYSIS OF STRIPED BASS SUB-POPULATIONS IN CHESAPEAKE BAY

INVESTIGATORS:

John V. Merriner, Associate Marine Scientist
Edward P. Gardner, Graduate Student

PROJECT SUMMARY:

Striped bass young-of-the-year will be sampled in the James, York, and Rappahannock Rivers for electrophoretic analysis. Tissue samples will be processed by starch gel methodology and various enzyme systems assessed for polymorphisms applicable to racial analysis. Results of analysis will be applied to the management of populations within each river.

STATUS: This project represents Gardner's thesis research.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science
PROJECT TITLE: BIOLOGY AND DISTRIBUTION OF SEVEN SPECIES OF SKATES (RAJA) OF THE CONTINENTAL SHELF OF THE EAST COAST OF NORTH AMERICA (CAPE HATTERAS TO THE GULF OF ST. LAWRENCE)

INVESTIGATORS:

John A. Musick, Associate Marine Scientist
John D. McEachran, Graduate Assistant

PROJECT SUMMARY:

All of the data to be used in this study has been collected and transferred to IBM cards. The National Marine Fisheries Service Laboratory at Woods Hole, Massachusetts has furnished the data on skates collected during groundfish surveys from 1965 through 1970. These data consist of printouts and IBM cards which list coordinates, depths, and temperatures where skates were captured and length frequencies and total weights of each species of skate at each station. The Woods Hole Lab also permitted participation in eight groundfish cruises from March 1969 to March 1970. During these cruises, 300 specimens of the species Raja erinacea and R. ocellata were collected for a taxonomic study, and 1500 stomachs from six species of skates were obtained for food studies.

Additional data were obtained from the Fisheries Research Board of Canada, St. Andrews Station. The station furnished distribution data on skates collected on groundfish surveys off Nova Scotia from 1958 to 1970. Groundfish surveys of northern Scotian Baulks were made during the summer of 1970. Specimens of five species of skates were obtained from this cruise.

All 300 specimens of the sibling species have been examined, and the taxonomic study should be completed within several months. About one-third of the stomachs have been examined, and contents have been sorted into major taxa. A program for determining mean abundance of each species by degree temperature and depth stratum has been written, and other programs needed for the distributional study are on file at VIMS. The data analysis should be completed in six months.

STATUS: This project represents McEachran's dissertation research. Write-up is partially complete.

FINANCIAL SUPPORT:

National Oceanic and Atmospheric Administration
(National Marine Fisheries Service)
Fisheries Research Board of Canada
Virginia Institute of Marine Science
PROJECT TITLE: THE COMPARATIVE ECOLOGY OF TWO SPECIES OF PIPEFISH IN THE YORK RIVER

INVESTIGATORS:

W. Jackson Davis, Head, Division of Fisheries Biology and Acting Department Head
Linda Mercer, Graduate Assistant

PROJECT SUMMARY:

The objectives of this study are to study the distribution of the two species of pipefish, Syngnathus fuscus and S. floridiae, occurring in the York River, to compare their reproduction, growth, and feeding habits, and to determine the associated species and relative abundance.

The study will be carried out over a 12-month period. Samples will be collected once a month at approximately 20 stations selected randomly from the mouth of the York River to Penniman Spit. The R/V Brooks will be used to sample with a 16-foot otter trawl along with seining in the shallows. Ancillary data will be obtained from the monthly river surveys made by the Alosa and striped bass projects.

STATUS: This project represents Mercer's thesis research. Field collecting and sorting and identification of collections are complete. Statistical analysis of data is in progress.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science
PROJECT TITLE: A COMPARATIVE STUDY OF THE RETENTION AND ESCAPEMENT CHARACTERISTICS OF POUND NETS AS A FUNCTION OF POUND-HEAD MESH SIZE

INVESTIGATORS:

John V. Merriner, Associate Marine Scientist
Henry L. Meyer, Graduate Assistant

PROJECT SUMMARY:

Pound nets of various pound-head mesh sizes in the lower Chesapeake Bay will be sampled for spot, butterfish, thread herring, weakfish, and menhaden, from which external body dimensions will be obtained; retention characteristics of the different mesh sizes and life fishes required in the experimental phase will also be obtained from the samples. Live fish will be placed in seven experimental nets of varying mesh size to determine retention and escapement characteristics of the nets for each of the five major scrap species listed above. The objective is to determine whether or not there is an optimum mesh size which can be utilized in a pound net head that will allow the largest percentage of unmarketable scrap-fish to escape while still retaining the marketable fish.

STATUS: This project represents Meyer's thesis research. It is a subproject of "Biology and Management of River Herring and Shad."

FINANCIAL SUPPORT:

National Oceanic and Atmospheric Administration
(National Marine Fisheries Service)
Virginia Institute of Marine Science
PROJECT TITLE: EFFECTS OF METHOXYCHLOR ON THE CONDITIONING OF STRIPED BASS TO AN OLFACTOR Y STIMULUS

INVESTIGATORS:

John A. Musick, Associate Marine Scientist
Gregory Murray, Graduate Assistant

PROJECT SUMMARY:

Three groups of striped bass will be used— one control and two experimental groups. The two experimental groups will be exposed to concentrations of 5 and 10 ppb methoxychlor. One-half of each group will be positively-conditioned to the introduction of an odor. The other half will be negatively-conditioned. Differences in response to the stimulus and time required for conditioning will be looked for. Some histological work may be done.

STATUS: This project represents Murray's thesis research. Research has been temporarily suspended until student completes active duty in the U. S. Army. To be continued.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science
PROJECT TITLE: FOOD, FEEDING HABITS, GROWTH RATES, AND ENERGY TRANSFORMATIONS IN JUVENILE ALEWIFE (ALOSA PSEUDOHARENGUS) IN THE JAMES RIVER AT HOPEWELL, VIRGINIA

INVESTIGATORS:

W. Jackson Davis, Head, Division of Fisheries Biology
and Acting Department Head
James E. Weaver, Graduate Student

PROJECT SUMMARY:

The objectives of this project are to determine:

(1) Food and feeding habits of juvenile alewife,
(2) Growth of juvenile alewife, and
(3) An annual energy budget for juvenile alewife by assessing ingestion, egestion, respiration, and possibly excretion rates.

Preliminary work will include:

(1) Designation of sampling areas,
(2) A 24-hour study to determine:
   (a) Feeding periodicity and
   (b) General aspects of food preferences to determine the equipment and procedures for assessment,
   (c) Collection of living alewife to precede with laboratory experiments on ingestion, egestion, and respiration rates.

STATUS: This project represents Weaver's dissertation research. It is in its preliminary stage.

FINANCIAL SUPPORT:

National Science Foundation (Traineeship)
Virginia Institute of Marine Science
PROJECT TITLE: BREEDING AND TESTING OF SUPERIOR LINES OF OYSTERS WITH RESISTANCE TO DISEASES, ESPECIALLY MSX AND DERMOCYSTIDIUM

INVESTIGATORS:

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

PROJECT SUMMARY:

An epizootic of MSX (*Minchinia nelsoni*) in 1959 decimated private and public beds in lower Chesapeake Bay in about two years. Annual cycles of infection and mortality on oyster beds and in trays of oyster were determined, and a series of publications describing areas of occurrence and timing of epizootics has been completed.

Search for resistant stocks led to discovery of acquired immunity by early exposure in MSX areas regardless of selection or lack of exposure of parents. Further proof of this type of immunity and continued breeding for genetic immunity are in progress.

The program has been broadened to include selection for quality oysters with emphasis on growth, shape, and disease resistance. This is a long-term project, for oysters must be grown two to four years before progeny testing and selection clearly indicate the superior oysters for subsequent breeding. The program includes monitoring several rivers for changes of susceptibility of stocks, intensity and distribution of diseases, especially in seed areas, and intensity of epizootics each year.

The objective is to obtain highly selected lines of brood stocks for hatchery, pond, and eventually open water culture.

STATUS: Oysters resistant to MSX have been used to breed third and fourth generation progeny with resistance. Selection for growth and size has been followed but will be intensified. Old brood stocks from 6 to 12 years old are available for breeding including some sibling lots. Progeny breeding and selection have been favored over mass breeding and selection because a relatively high resistance has already been obtained.

FINANCIAL SUPPORT:

National Oceanic and Atmospheric Administration
(National Marine Fisheries Service)
Virginia Institute of Marine Science
PROJECT TITLE: PRODUCTION OF SUPERIOR OYSTERS FOR MARICULTURE-- A GENETIC BREEDING PROGRAM

INVESTIGATORS:

Jay D. Andrews, Department Head and Senior Marine Scientist
John L. Dupuy, Associate Marine Scientist, Department of Microbiology-Pathology
Michael Frierman, Research Assistant, Department of Malacology

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 breedings 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.

When mariculture becomes necessary and economically feasible, it will be advantageous to have lines of broodstock which exhibit disease-resistance, uniformity of shape and quality for machine shucking, and early marketing (12 to 18 months). Free or cultchless spat contribute to these objectives, and their manipulation in hatcheries, nurseries, and on natural beds is a major objective.

STATUS: Active. This program, with important changes from search for disease resistance to genetic studies, has been active for about eight years. For the past year, it has been a subproject of "Chesapeake Bay Research" of the Chesapeake Research Consortium, Inc.
Virginia Institute of Marine Science
Department of Malacology

FINANCIAL SUPPORT:

National Oceanic and Atmospheric Administration
(National Marine Fisheries Service)
National Science Foundation
(RANN Program) (June 1971 - May 1972)
National Oceanic and Atmospheric Administration
(Office of Sea Grant Programs) (support
is currently being sought)
Virginia Institute of Marine Science
PROJECT TITLE: LARVAL DISTRIBUTION, ABUNDANCE, AND TRANSPORT SYSTEMS

INVESTIGATOR:

Jay D. Andrews, Department Head and Senior Marine Scientist

PROJECT SUMMARY:

Field work was completed in 1965 and counting of oyster larvae in 1966. The manuscript is about half completed. The material contains important, but controversial, findings about bivalve transport and dispersal.

STATUS: The project is completed except for the final report.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science
PROJECT TITLE:  OYSTER SETTING PATTERNS IN VIRGINIA

INVESTIGATOR:

Jay D. Andrews, Department Head and Senior Marine Scientist

PROJECT SUMMARY:

Irregular records of setting on weekly, seasonal, and annual basis were kept for a two-year period. The basic data were turned over to Mr. Haven (Department of Applied Marine Biology) in February 1970 for a comprehensive review of the oyster industry. The data has been tabulated as collected, but no explanation and summary have been written except for the first few years. The data contains information on setting patterns, fouling, changes in population, predation, and is related mostly to public beds.

STATUS:  The data are organized by rivers, and most tables have been completed. Write-up of this data is partially completed.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science
PROJECT TITLE: MSX AND SALINITY IN JAMES RIVER SEED AREAS

INVESTIGATOR:

Jay D. Andrews, Department Head and Senior Marine Scientist

PROJECT SUMMARY:

This work was completed and the manuscript written in 1965. It describes the distribution of MSX in 1964 and 1965, a year of maximum penetration of the seed area, and the effects of spring salinities in permitting oysters to reject MSX infections.

STATUS: The manuscript awaits publication in the monograph on the James River.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science
DIVISION OF BIOLOGICAL OCEANOGRAPHY
PROJECT TITLE: EXISTING CONDITIONS OF THE BIOTA OF CHESAPEAKE BAY

INVESTIGATORS:

Marvin L. Wass, Associate Marine Scientist and CRC Coordinator
Donald F. Boesch, Associate Marine Scientist
Harold J. Humm *

PROJECT SUMMARY:

This project will continue summarization of information available relative to existing biological conditions in Chesapeake Bay in relation to the resource management program of Chesapeake Bay being developed by the U. S. Army Corps of Engineers. Emphasis in the coming year will concentrate on developing improved data analysis techniques, cataloguing most significant Bay organisms, and providing summaries of the biology of some of these organisms, providing qualitative descriptions of biological communities within the Bay, documenting historical trends of biological conditions using benthic community structure, and delineation of the applicability of the Chesapeake Bay Hydraulic Model.

This project is a joint endeavor with the University of Maryland and the Smithsonian Institution within the Chesapeake Research Consortium, Inc.

STATUS: Active. An initial report was submitted to the U. S. Army Corps of Engineers and is in editorial review for general distribution.

FINANCIAL SUPPORT:

U. S. Army Corps of Engineers, Baltimore District
Chesapeake Research Consortium, Inc.
Virginia Institute of Marine Science

* Dr. Harold J. Humm, University of South Florida, St. Petersburg, Florida
PROJECT TITLE: CHECKLIST OF THE BIOTA OF CHESAPEAKE BAY

INVESTIGATOR:

Marvin L. Wass, Associate Marine Scientist

PROJECT SUMMARY:

This project is designed to review, update, and expand the VIMS Checklist of Marine Invertebrates of Virginia to include the biota of Chesapeake Bay.

STATUS: Continuing. The 1972 version of the Checklist of the Biota of Chesapeake Bay will be available for distribution in September 1972. During fiscal year 1973 this is a subproject of "Existing Conditions of the Biota of Chesapeake Bay."

FINANCIAL SUPPORT:

National Science Foundation (RANN Program)
U. S. Army Corps of Engineers, Baltimore District
Chesapeake Research Consortium, Inc.
Virginia Institute of Marine Science
PROJECT TITLE: LIFE HISTORY OF THE SCYPHOZOAN RHOPILEMA VERRILLI

INVESTIGATOR:

Dale R. Calder, Associate Marine Scientist

PROJECT SUMMARY:

The life history of the rare scyphozoan Rhopilema verrilli is being followed in the laboratory. Polyp cultures have been established from planulae isolated from known medusae. Observations have been made on polyp morphology, asexual reproduction, strobilation, and ephyra development. The complement of nematocysts in the various stages of the life cycle is being analyzed.

STATUS: Near completion.

FINANCIAL SUPPORT:

National Oceanic and Atmospheric Administration (National Marine Fisheries Service)
Virginia Institute of Marine Science
PROJECT TITLE: CONTROL MEASURES FOR CHESAPEAKE BAY JELLYFISHES: FIELD OBSERVATIONS ON STROBILATION IN CHRYSAORA QUINQUECIRRHA

INVESTIGATOR:
Dale R. Calder, Associate Marine Scientist

PROJECT SUMMARY:
A field study has been initiated in Sarah's Creek to delimit the precise conditions under which polyps of Chrysaora quinquecirrha begin strobilation in spring. Research will continue into the summer to follow the percentage of polyps strobilating at a given time and set of hydrographic conditions. Data on the number of ephyrae liberated per strobila will be kept, as well as the seasonal occurrence and percentage of ephyrae in the plankton. Conditions at the end of summer when strobilation ceases will be characterized. Attempts will be made to determine whether a given polyp strobilates more than once a year. Observations will also be recorded on podocyst formation, stolonization, and budding.

STATUS: Active. This is a subproject of "Control Measures for Chesapeake Bay Jellyfishes."

FINANCIAL SUPPORT:
National Oceanic and Atmospheric Administration
(National Marine Fisheries Service)
Virginia Institute of Marine Science
PROJECT TITLE:  STUDIES OF THE BIOPHYSICAL CHARACTERISTICS OF BACTERIAL CELL SURFACES

INVESTIGATOR:

Frank O. Perkins, Department Head and Senior Marine Scientist

PROJECT SUMMARY:

Characterization and localization of components in the cell wall and pseudocapsule of *Staphylococcus aureus* by chemical dissection and correlation with fine structure are being studied. Both sectioned and freeze etched cells are being examined. This information and the information which has been previously obtained by the principal investigator are being used to identify the components responsible for net charge characteristics and refractive indices of *S. aureus* cells. A light scattering photometer (Differential II, Science Spectrum) and an electrophoretic cell coupled to a light microscope are being used to determine the refractive index and electrostatic charge characteristics of the cells. Successive layers of pseudocapsule and cell wall are being chemically removed and the resulting changes observed.

STATUS:  Active.

FINANCIAL SUPPORT:

National Aeronautics and Space Administration
Virginia Institute of Marine Science
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 microorganisms, 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 whether they are fungi, Protozoa, achlorophyllous algae, or encompass species of all groups. Some appear to be Phycomycetes of the order Saprolegniales, others appear to be related to the Labyrinthulina of the Protozoa, and some appear to be colorless forms of chlorococcalean algae. An adequate 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:

National Science Foundation
Virginia Institute of Marine Science

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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:

Marine protozoa of the lower Chesapeake Bay with emphasis on pathogenic species are being studied. The seasonal distribution with respect to host or other substrate and the ultrastructure 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
PROJECT TITLE: ULTRASTRUCTURE OF RHIZOIDAL SYSTEMS IN MARINE MONOCENTRIC FUNGI

INVESTIGATOR:
Frank O. Perkins, Department Head and Senior Marine Scientist

PROJECT SUMMARY:
The fine structure of rhizoids in marine monocentric fungi is being studied in an attempt to elucidate the taxonomy of the heterogeneous group and to contribute to an understanding of the cell biology of primitive motility in these forms.

Rhizoids of members of this group and the labyrinthulids are similar in the mechanism by which they are formed.


FINANCIAL SUPPORT:
Virginia Institute of Marine Science
PROJECT TITLE: ULTRASTRUCTURE OF THE PARANUCLEAR BODY OF PARAMOeba PEMAQUIDENSIS

INVESTIGATOR:
Frank O. Perkins, Department Head and Senior Marine Scientist

PROJECT SUMMARY:

The fine structure of the organism or organelle found in the holozoic amoeba, Paramoeba pemaquidensis, is being studied. Mitosis in the eucaryotic portion is being examined closely, and attempts are being made to determine if the paranuclear body forms phagosomes. P. pemaquidensis may be identical to P. perniciosa, the causative agent of gray crab disease.


FINANCIAL SUPPORT:
Virginia Institute of Marine Science
PROJECT TITLE: HERPES-LIKE VIRUS INFECTING THRAUSTOCHYTRIUM SP.

INVESTIGATORS:

Frederick Y. Kazama, Associate Marine Scientist

PROJECT SUMMARY:

A DNA containing, enveloped virus has been observed in one isolate of Thraustochytrium sp. The fungus culture which yielded virus particles was obtained from a single zoospore isolated in 1970. Re-examination of electron micrographs taken in 1970 revealed particles which until recently occurred very rarely.

The virus replicates in the nucleus and becomes surrounded by the two nuclear membranes. These two membranes are lost and the particles, now in the cytoplasm, acquired a coat. They appear to acquire the envelope while traversing membranes of the Golgi complex, plasmalemma, or the vacuoles of the host cell.

The virus is highly integrated and becomes apparent only under certain conditions. Research is now being conducted to determine conditions under which the cells become permissive.


FINANCIAL SUPPORT:

National Science Foundation
Virginia Institute of Marine Science
PROJECT TITLE: FUNGI ASSOCIATED WITH DECAYING SPARTINA SP.

INVESTIGATOR:

Frederick Y. Kazama, Associate Marine Scientist

PROJECT SUMMARY:

Sampling stations have been established on the Mattaponi and the York Rivers as well as on the Eastern Shore of Virginia to determine the mycoflora of decaying Spartina sp. After isolation, the fungi will be examined to determine which are cellulose and/or pectin degraders. We expect to determine:

(1) The mycoflora of decaying Spartina sp.,
(2) The succession of fungi on decaying Spartina sp.,
(3) Which fungi are capable of degrading plant cell wall material, and
(4) The distribution of fungi associated with decaying Spartina sp. along a salinity gradient.

STATUS: Active.

FINANCIAL SUPPORT:

National Science Foundation
Virginia Institute of Marine Science
PROJECT TITLE: VARIATION IN MORPHOLOGY OF THE ENDOBIOTIC SYSTEM OF PHLYCTOCYTRIUM, A MARINE CHYTRID

INVESTIGATOR:
Frederick Y. Kazama, Associate Marine Scientist

PROJECT SUMMARY:

The most important morphological feature separating the genus Phlyctochytrium from Rhizophydiium is the presence or absence of an expanded portion of the rhizoidal system termed the apophysis. Preliminary studies indicate that the apophysis may not be a consistent feature of the Chytridiaceous fungus originally identified as Phlyctochytrium on its "natural" substrate, Bryopsis plumosa. Here, an apophysis is present, but when the fungus is grown in axenic culture on agar, the presence of the organelle is variable.

In broth culture, the apophysis is very rarely observed. It is hypothesized that the mechanical resistance of the substrate may be partially responsible for the development of the apophysis; the more resistant the substrate the more apt that an apophysis will be formed. Currently, the ultrastructure of the endobiotic system is being studied while the fungus is growing on "natural" substrates and on agar. Later, silica gels of various mechanical strengths will be prepared and the fungus inoculated on these gels. These inoculated pieces of gels will be floated on nutrient media. The answer as to whether the mechanical resistance of the substrate is responsible for apophysis formation should then be forthcoming.


FINANCIAL SUPPORT:

Virginia Institute of Marine Science
PROJECT TITLE: FATTY ACIDS OF THE ZOOSPORES OF PHLYCTOCYTHRIUM SP.

INVESTIGATORS:

Frederick Y. Kazama, Associate Marine Scientist
Paul L. Zubkoff, Senior Marine Scientist, Department of Environmental Physiology

PROJECT SUMMARY:

Recently, the zoospores of a species of Phlyctochytrium were found to be positively phototactic. Ultrastructural studies revealed a complex of membranes, lipid droplet, and an electron dense body which may be responsible for photoreception.

If the lipid droplet plays a role in photoreception, then we do not expect it to play a role in energy metabolism. Preliminary evidence indicates this to be true. Since phototaxis is extremely rare in fungi (reported in approximately five species), characterization of the photoreceptive system would be very significant. Preliminary analysis indicates some unusual long chain fatty acids as well as unusual sites of unsaturation.

STATUS: Active.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science
PROJECT TITLE:  TISSUE CULTURES OF ROCCUS SAXATILIS

INVESTIGATOR:

Frederick Y. Kazama, Associate Marine Scientist

PROJECT SUMMARY:

Using standard tissue culture techniques and commercially available growth media, we have been able to obtain primary monolayer cultures of trypsinized gonadal tissue. These cells have proven to be refractory to further subculturing, and we have not been able to establish any continuing cell lines.

STATUS:  Intermittent experiments are being conducted.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science
PROJECT TITLE: ULTRASTRUCTURE OF THE ZOOSPORES OF PHLYCTOCHYTRIUM SP., A MARINE UNIF Lagellate Fungus

INVESTIGATOR:

Frederick Y. Kazama, Associate Marine Scientist

PROJECT SUMMARY:

A marine chytrid was recently isolated from the green alga, Bryopsis plumosa. The zoospores showed a marked positive phototactic and chemotactic response. In order to determine whether there is a detectable morphological basis for these responses, an ultrastructural study has been undertaken. Preliminary observations indicate that there is present a heretofore undescribed organelle within the zoospores which may be partially responsible for the tactic responses. The organelle appears to be a fenestrated system of membranes possessing a regular hexagonal array. This organelle is located just beneath the surface of the zoospore.

Presently, the origin of the organelle as well as its eventual fate is being studied. Ultrastructural techniques such as negative staining, thin-sectioning, and freeze-etching are being used.


FINANCIAL SUPPORT:

Virginia Institute of Marine Science
PROJECT TITLE: ECOLOGICAL, LIFE HISTORY, AND ULTRASTRUCTURAL STUDIES OF MARINE FUNGI IN THE LOWER CHESAPEAKE BAY

INVESTIGATOR:

Frederick Y. Kazama, Associate Marine Scientist

PROJECT SUMMARY:

Selected biflagellate and uniflagellate fungi of the Class Phycomycetes are being studied on a continuing, long-term basis. Seasonal distributions as a function of substrate, temperature, and salinity are being observed. The cell biology, with emphasis on ultrastructure as a means of elucidating the taxonomy, is being studied. Life histories are being determined from accumulated data.

STATUS: Continuing. Publications include:

(3) Kazama, F. Ultrastructure of Thraustochytrium sp. Zoospores III. External morphology of the flagella. (in preparation)
(4) Kazama, F. Ultrastructure of Thraustochytrium sp. Zoospores IV. Cytolysomes and acid phosphatase distribution. (in preparation)

FINANCIAL SUPPORT:

National Science Foundation
Virginia Institute of Marine Science
PROJECT TITLE: SPECTRAL ANALYSIS OF PHYTOPLANKTON SPECIES OF CHESAPEAKE BAY

INVESTIGATORS:

John L. Dupuy, Associate Marine Scientist
Franklin Ott, Associate Marine Scientist

PROJECT SUMMARY:

The absorption spectra of thirty species of phytoplankton, primarily dinoflagellates, have been completed. The results indicate that this method may be able to fingerprint different species to enable the identification of species from unknown samples.

STATUS: Continuing. A publication is now in preparation.

FINANCIAL SUPPORT:

National Oceanic and Atmospheric Administration
(Office of Sea Grant Programs)
National Aeronautics and Space Administration
(equipment use)
Virginia Institute of Marine Science
PROJECT TITLE: IDENTIFICATION OF PHYTOPLANKTON SPECIES BY THE USE OF A TURNABLE LASER WITH A RADAR SCANNER

INVESTIGATORS:

John L. Dupuy, Associate Marine Scientist
Franklin Ott, Assistant Marine Scientist
Peter Mumola *

PROJECT SUMMARY:

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

STATUS: This project began 1 July 1972.

FINANCIAL SUPPORT:

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

* Peter Mumola, Langley Research Center, NASA. Hampton, Virginia
PROJECT TITLE: MANAGEMENT OF LARVAE, SUPPLY OF FOOD, AND SETTING OF LARVAE

INVESTIGATORS:

John L. Dupuy, Associate Marine Scientist
Franklin D. Ott, Assistant Marine Scientist
Samuel Rivkin, 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 (completed),
(4) Bioassay of phytoplankton isolates for foods for invertebrate larvae,
(5) Bioassay of "red water" organisms with invertebrate larvae (continuing), and
(6) The application of these methods to hatchery operation (beginning).

STATUS: Continuing. Publications include:

(2) The development of laboratory techniques for the production of cultch-free spat of the oyster, Crassostrea virginica, Chesapeake Science 13(1):45-52.
(3) The larval development of the calico scallop Aequipecten gibbus. (in preparation)

FINANCIAL SUPPORT:

National Oceanic and Atmospheric Administration
(Office of Sea Grant Programs)
Virginia Institute of Marine Science
PROJECT TITLE: THE EFFECT OF THE IONIC ENVIRONMENT OF PROTEIN SYNTHESIS IN A MARINE FUNGUS

INVESTIGATORS:

Frank O. Perkins, Department Head and Senior Marine Scientist
James P. Amon, Graduate Assistant

PROJECT SUMMARY:

An estuarine fungus has been isolated from the green alga Bryopsis and is being investigated to determine how the major cations in seawater affect protein synthesis throughout its life cycle. In addition, studies on how environmental ionic factors affect the synthesis of RNA will be studied.

Since this organism is most likely a decomposer in the marine environment, this investigation may provide insight into the role of decomposers in the variable ionic conditions prevalent in estuaries.

STATUS: A characterization of the optimal ranges of the major cations (Na+, K+, Mg++, Ca++) is nearly complete. Methods for establishing well synchronized cultures have been worked out. The profile of protein synthesis in the early life cycle is complete. Factors affecting the synthesis of one protein, lactate dehydrogenase, are presently under study. An analysis of normal baseline RNA is underway. This project represents Amon's dissertation research.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science
PROJECT TITLE: TEMPORAL AND SPATIAL HETEROGENEITY OF DIATOM POPULATIONS IN THE YORK RIVER, VIRGINIA

INVESTIGATORS:

John L. Dupuy, Associate Marine Scientist
John L. Manzi, Graduate Assistant

PROJECT SUMMARY:

A total of twelve fixed stations are sampled biweekly and monthly along the total length of the York River. Each station is sampled at slack water for standard hydrographical data (temperature, salinity, pH) at three depths (surface microlayer, 1.5, and 3.0 meters). Water samples at each depth are subsampled for phytoplankton identification and enumeration, C\textsuperscript{14}-productivity assays, nutrient analysis (NO\textsubscript{2}, NO\textsubscript{3}, PO\textsubscript{4}) and chlorophyll determinations (spectrophotometric). A number of quantitative analytical methods for identifying and describing the structure of diatom communities are being applied to these sample results. Computer programs have been or are being written to facilitate the application of ordination techniques, cluster analysis, and diversity indices to the data.

Results from preliminary analysis of data collected include distinct diatom diversity differences between the surface microlayer and subsurface populations. Attempts are being made to establish the temporal and spatial character of these diversity differences as well as to establish successional trends in vertical diatom diversity profiles. Diatom energy-depth relationships are being studied through productivity and light intensity measurements. In addition, comparisons are being made between the components of diversity and nutrient levels and physical parameters with depth at each station.

STATUS: Continuing. Ten months of data collection of the total projected fourteen month survey have been completed. This project represents Manzi's dissertation research.

FINANCIAL SUPPORT:

National Oceanic and Atmospheric Administration
(Office of Sea Grant Programs)
National Science Foundation
(RANN Program)
Virginia Institute of Marine Science
PROJECT TITLE: VARIATIONS IN SEASONAL FLUCTUATIONS AND VERTICAL DISTRIBUTIONS OF THECATE DINOFLAGELLATES AND DIATOMS IN THE Mobjack Bay AND YORK RIVER AS DETERMINED BY SPECIES OBSERVED, POPULATION DENSITY, EQUABILITY, REDUNDANCY, AND SPECIES DIVERSITY

INVESTIGATORS:

John L. Dupuy, Associate Marine Scientist
Victoria R. Gibson, Assistant Marine Scientist
Paul Stofan, Graduate Assistant

PROJECT SUMMARY:

The multi-station, multi-parameter investigation includes the preparation of a checklist of thecate dinoflagellates and diatoms observed. The annual fluctuations are being studied of species, as well as population changes described by densities, equabilities, redundancies, and species diversities. The relative importance of the dinoflagellates and diatoms in the total phytoplankton community is being examined for annual fluctuations. Variations in the vertical distribution of the phytoplankton are being determined for the surface (top 100μ), 0.5 meter, and 1.0 meter depths.

STATUS: Continuing. Sampling over a 14 month period has been completed and microscopic examination and enumeration is nearly completed. Preliminary reports include:


This is a subproject of the Emissions and Additions Program of "Chesapeake Bay Research" of the Chesapeake Research Consortium, Inc. The project in part, represents Stofan's dissertation research.

FINANCIAL SUPPORT:

National Science Foundation (RANN Program)
Virginia Institute of Marine Science
PROJECT TITLE:  BIOLOGY OF A MARINE BACTERIOPHAGE

INVESTIGATORS:

Frank O. Perkins, Department Head and Senior Marine Scientist
Arthur Zachary, Graduate Assistant

PROJECT SUMMARY:

Bacteriophages have been isolated from numerous salt marsh habitats by enrichment with a marine host bacterium. The phages are being characterized (morphology, burst size, nucleic acid, etc.), replicative cycles will be studied by thin-section electron microscopy, and host ranges will be determined. The effect of some environmental parameters on the replicative cycle will also be studied. In addition to qualitative examinations of phage distribution, quantitative sampling of selected estuarine areas will also be attempted. These studies will provide a basis for comparison of marine and freshwater bacteriophages and ultimately some insight into the types, numbers, and distribution of bacteriophages in marine waters.

STATUS: This project represents Zachary's dissertation research.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science
PROJECT TITLE: DYNAMICS OF PARASITIC ECOSYSTEMS OF ESTUARINE FISHES

INVESTIGATORS:
Ilan E. Paperna *
David E. Zwerner, Acting Section Head and Assistant Marine Scientist

PROJECT SUMMARY:

Preliminary surveys have shown that the populations of striped bass are heavily infected with Philometra sp. (probably P. rubra) in the body cavity while the gills are populated with Ergasilus labracis, Trichodina sp., and occasionally other parasites such as Lironeca ovalis and glochidia of unknown identity. Menhaden are infested with the isopod Olencira praegustator which evidently causes destruction to the branchial apparatus. The gills of menhaden additionally have Monogenea and parasitic copepods.

It is proposed to study:

1. The dynamics of parasitic populations in terms of changes of flow of parasites through a host-parasite system and the factors that control it,
2. Pathological changes in the fish associated with parasitic infection at various stages (in particular the younger age groups) and the effect of the infection on the growth and survival of the fish,
3. The impact of environmental (e.g., temperature, salinity, pollution) and physiological (e.g., starvation) stresses on the survival of the infected host, and
4. The contribution of parasitic diseases on the so-called "natural mortality" rate in fish populations.

Striped bass and menhaden juveniles (age group 0-1) will be studied from monthly seined samples from the York River and Mobjack Bay. Study of post-juvenile (age group 1+) striped bass will be done from Mobjack Bay and York River trawl samples and from the York River sport fishing program. Study of larger menhaden will be made from commercial samples (summer) and from purse seine operations based at Reedville (autumn).

STATUS: Sampling was begun in May 1972.
FINANCIAL SUPPORT:

National Science Foundation
Virginia Institute of Marine Science

* Ilan E. Paperna, NSF Senior Foreign Scientist Fellow
PROJECT TITLE: **MONOGENETIC TREMATODES OF AMPHIBIANS AND REPTILES OF VIRGINIA**

INVESTIGATORS:

- William J. Hargis, Jr., Institute Director
- David E. Zwerner, Acting Section Head and Assistant Marine Scientist
- Claude Combes *

PROJECT SUMMARY:

Very little work has been done on the monogenetic trematodes from amphibians and reptiles of Virginia. As most of our studies have been on parasites of fishes, an examination of the parasite fauna of amphibians and reptiles should prove both enlightening and interesting. Collections of 758 host individuals representing 73 species were made in 1959. At present, these parasites are being worked up, and the host-parasite data will be added to our host-specificity file.

STATUS: Collection is now in the hands of Professor Combes who will co-author with Dr. Hargis.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science

* Professor Claude Combes (Maitre de Conferences, C.S.U., Avenue de Villeneuve, 66 Perpignan, France), Co-investigator with Dr. Hargis.
PROJECT TITLE: PARASITES OF WESTERN NORTH ATLANTIC FAUNA WITH EMPHASIS ON THE CHESAPEAKE BAY AREA

INVESTIGATORS:

William J. Hargis, Jr., Institute Director
David E. Zwerner, Acting Section Head and Assistant Marine Scientist
Various personnel *

PROJECT SUMMARY:

Knowledge of the parasite fauna of marine vertebrates and invertebrates from the waters of the Virginia sea coast and Chesapeake Bay is sparse. Knowledge of the dynamics of parasite populations and their importance to the populations of free-living animals and the ecosystem in general is for the most part lacking. A qualitative survey of the parasites, mostly from fishes, is being made from the various collections made previously by section personnel, and new collections are being made to help fill in the gaps. No attempt has been made to obtain quantitative samples. The parasite section of the VIMS checklist was recently up-dated to include many new parasite records resulting from these surveys.

STATUS: Continuing.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science

* From time to time assistance from experts on various parasite groups is necessary.
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:

Little research had been done on larvae of monogenetic trematodes of North American fishes. Knowledge of the taxonomy of larvae of known adult Monogeneids 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 under a monobjective microscope. Photographs and drawings were made to facilitate study.

In 1969, a portion of the work conducted by the principal investigator during several summers at VIMS was published. Additional information resulting from these studies is being readied for publication.

STATUS: At least one more paper can be expected from the data in hand.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science

* 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.
PROJECT TITLE: STUDIES ON PARASITIC DINOFLAGELLATES OF CYPRINODONTIDS OF VIRGINIA AND NORTH CAROLINA

INVESTIGATORS:

William J. Hargis, Jr., Institute Director
Adrian R. Lawler *
Jiri Lom *
Gail Makiernan *

PROJECT SUMMARY:

The following studies are being made under this project:

1. Oodinium cyprinodontum Lawler, 1967 found on the gills of Fundulus majalis, F. heteroclitus, F. luciae, Cyprinodon variegatus, Lucania parva,
2. With Makiernan, a description of dinospore formation which is in progress,
3. With Lom, EM study of attachment and relation to host tissue,
4. With Lom, a redescription of Oodinium cyprinodontum and a discussion of its taxonomic position, which is in progress, and
5. Papers in progress by Lawler on: (a) incidence and intensity of infestation of each host species in Virginia and North Carolina, (b) seasonality of infestation, (c) life-history, and (d) other miscellaneous smaller papers.

STATUS: Three papers have been published. One is in the final stages, and several more are in progress.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science

* Dr. Adrian R. Lawler, Parasitology Department, Gulf Coast Research Laboratory, P. O. Drawer AG, Ocean Springs, Mississippi
* Dr. Jiri Lom, Institute of Parasitology, Czechoslovakia
* Gail Makiernan, George Washington University
PROJECT TITLE: POLYCLAD OYSTER ASSOCIATES

INVESTIGATORS:

William J. Hargis, Jr., Institute Director
Adrian R. Lawler *
Dexter S. Haven, Head of Department of Applied Marine Science
James P. Whitcomb, Assistant Marine Scientist, Department of Applied Marine Biology

PROJECT SUMMARY:

One paper has been published on Coronadena mutabilis (Verrill) in Virginia. A paper is planned with Haven on polyclads of the James River.

STATUS: The collection of polyclads of the James River has already been made. Continuing.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science

* Dr. Adrian R. Lawler, Parasitology Department, Gulf Coast Research Laboratory, P. O. Drawer AG, Ocean Springs, Mississippi
PROJECT TITLE: INFECTIOUS DISEASES AND PARASITES OF MARINE FISHES: THEIR SYMPTOMS AND CONTROLS, TOGETHER WITH A GLOSSARY AND A BIBLIOGRAPHY OF CONTROLS OF DISEASES OF MARINE FISHES

INVESTIGATORS:

William J. Hargis, Jr., Institute Director
David E. Zwerner, Acting Section Head and Assistant Marine Scientist
Adrian R. Lawler *

PROJECT SUMMARY:

The infectious diseases of marine fishes were investigated through review of the literature. Special emphasis was placed on the symptoms exhibited by the host and on the different methods of control of a parasite that have been used to date.

A glossary of terms applicable to fish diseases was prepared to benefit the layman. In addition, a fairly comprehensive bibliography on controls of diseases of marine fishes was included.

This work will soon be put out as a Special Scientific Report of this Institute.

STATUS: Active.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science

* Dr. Adrian R. Lawler, Parasitology Department, Gulf Coast Research Laboratory, P. O. Drawer AG, Ocean Springs, Mississippi
PROJECT TITLE: MONOGENETIC TREMATODES OF MENHADEN

INVESTIGATORS:

William J. Hargis, Jr., Institute Director
David E. Zwerner, Acting Section Head and 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, intragenic, and intrafamilial parasite distribution, and thus derive a more detailed understanding of some of the factors acting in host-parasite relationships.

This study is expected to yield information concerning:

(1) The incidence of parasites with respect to season,
(2) The time of infestation of host by the parasite,
(3) The geographical areas and biological conditions under which initial infective contact is made,
(4) The continuing relationship between juvenile and adult fishes and the infective, post-infective, and adult stages of the parasites,
(5) The use of parasites as natural tags in order to distinguish species or populations, and
(6) The aspects of ontogeny of the host-parasite relationship in the clupeids.

STATUS: This project is inactive at the present time. VIMS funds are used for maintaining the collection.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science
PROJECT TITLE: **BACTERIOLOGY OF SHELLFISH GROWING AREAS**

INVESTIGATORS:

John L. Wood, Associate Director and Section Head  
Aleta Ott, 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:

National Oceanic and Atmospheric Administration  
(Office of Sea Grant Programs)  
Virginia Institute of Marine Science
PROJECT TITLE: ZOOPLANKTON OF NORFOLK CANYON

INVESTIGATOR:

George C. Grant, Associate Marine Scientist

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 examination 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.

Nansen casts in April 1971 showed the intrusion of high-salinity, low-oxygen waters at depths of 200-300 meters. Bathymetric traces of the canyon profile were obtained, and zooplankton sampling repeated.

STATUS: At present, this project is inadequately funded and preliminary in nature. Additional support is being requested from NSF for a full ecosystem study of the Canyon.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science
PROJECT TITLE: HETERO CYCLIC COMPOUNDS AND LIPIDS ASSOCIATED WITH PLANKTON

INVESTIGATORS:

George C. Grant, Associate Marine Scientist
Paul L. Zubkoff, Head of Department of Environmental Physiology

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. This is a subproject of the Emissions and Additions Program of "Chesapeake Bay Research" of the Chesapeake Research Consortium, Inc.

FINANCIAL SUPPORT:

National Science Foundation
(RANN Program)
Virginia Institute of Marine Science
PROJECT TITLE: MULTIVARIATE STATISTICS IN TAXONOMY

INVESTIGATOR:

George C. Grant, Associate Marine Scientist

PROJECT SUMMARY:

Exploration of multivariate statistical procedures, such as discriminant functions, canonical analysis, and distance functions, in relation to possible application to problems of taxonomy is the purpose of this study. Of particular interest is the relation of "distance" between two sets of multiple measurements to taxonomic hierarchy, especially the species level.

STATUS: Presently inactive.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science
PROJECT TITLE: ROLE OF COPEPODS IN THE FOOD CHAIN OF THE LOWER YORK RIVER

INVESTIGATORS:

George C. Grant, Associate Marine Scientist
Burton B. Bryan, Graduate Assistant

PROJECT SUMMARY:

A study is being conducted of the role of copepods in a nearby estuarine food chain. Copepod production will be estimated from quantitative samples taken year-round at randomly selected stations in the lower York River (Gloucester Point to Tue Marsh Light). Gut content analysis and aquarium feeding studies of known zooplankton predators will provide information on the importance of copepods in the nutrition of each predator species.

STATUS: This project represents the preliminary aspects of Bryan's dissertation research. It is a subproject of the Emissions Program of "Chesapeake Bay Research" of the Chesapeake Research Consortium, Inc.

FINANCIAL SUPPORT:

National Science Foundation
(RANN Program)
Virginia Institute of Marine Science
DIVISION OF PHYSICAL SCIENCE AND COASTAL ENGINEERING
PROJECT TITLE: FLUX OF MATERIALS AT THE MOUTH OF CHESAPEAKE BAY

INVESTIGATORS:

Robert J. Byrne, Department Head and Senior Marine Scientist, Department of Geological Oceanography
C. S. Fang, Department Head and Senior Marine Scientist, Department of Physical Oceanography and Hydraulics
Michael E. Bender, Head, Division of Environmental Science and Engineering
Albert Y. Kuo, Associate Marine Scientist, Department of Physical Oceanography and Hydraulics
Evon P. Ruzecki, Associate Marine Scientist, Department of Physical Oceanography and Hydraulics
William G. MacIntyre, Associate Marine Scientist, Department of Geological Oceanography
Craig L. Smith, Associate Marine Scientist, Department of Geological Oceanography

PROJECT SUMMARY:

There is wide recognition of the need to know the net flux of various materials at the Bay mouth. Such studies will have direct bearing on the interpretations given to the U. S. Army Corps of Engineers Chesapeake Bay hydraulic model as it will indicate the renewal characteristics at the Bay mouth. It will, of course, give the much needed information as to the extent to which the Bay System acts as a contaminant source for the continental shelf. Flux studies should include total water chemistry, particulate materials, and pelagic biota as well as flow. The sampling design should include the effects of extreme events and seasonality.

Both VIMS and CBI have, over the recent years, performed near-entrance shelf studies, and these have served to depict the generalized hydrographic conditions on a seasonal basis. Additional work needs to be done to arrive at a sound sampling design for the determination of fluxes. The execution of flux measurements will require the pooling of all the available personnel and vessels of the Bay institutions and agencies.

The work being done for the first year has focused on acquiring information needed for a meaningful flux study design and on the formulation of a mathematical model of Bay mouth circulation. Specifically, these studies are:

(1) Field studies to verify the existence and persistence of large nearshore eddies on the sides of the Bay mouth.
PROJECT SUMMARY (Cont'd):

(2) Development of a theoretical model of the Bay mouth as a pulsating jet orifice; the model to include effects of buoyancy and regional drift currents on the shelf. This initial emphasis on model formulation is important, as it will focus attention on the sampling design needs for verification. Also programmed are those field measurements which will give gross insights into the entrainment of shelf water and the influence of stratification on entrainment.

STATUS: Active. This is a subproject of the Emissions Program of "Chesapeake Bay Research" of the Chesapeake Research Consortium, Inc.

FINANCIAL SUPPORT:

National Science Foundation
(RANN Program)
Virginia Institute of Marine Science
PROJECT TITLE: JAMES RIVER HYDRAULIC MODEL TESTS FOR THE I-664 TUNNEL-BRIDGE CROSSING

INVESTIGATORS:

C. S. Fang, Department Head and Senior Marine Scientist
B. J. Neilson, Associate Marine Scientist
A. Y. Kuo, Associate Marine Scientist
E. P. Ruzecki, Associate Marine Scientist

PROJECT SUMMARY:

Studies will be conducted on the James River model in Vicksburg, Mississippi to determine some of the environmental effects caused by each of three proposed tunnel-islands configurations. The model has been updated to include the second Hampton Roads Bridge-Tunnel crossing (both causeways and islands for I-64) adjacent to the present crossing, and the James River Bridge second crossing (minus the high center span). In addition, all tests will be duplicated to include an extension of the Craney Island dredge spoil disposal area to the west of the present area.

The first series of tests will examine the changes to the water environment. Tidal heights will be measured at four locations (Hampton Roads, Newport News, Old Point Comfort, Miles Station) which coincide with real-world tidal gauge locations. Current directions and velocities and salinities will be measured along the river channel in Hampton Roads and along four lateral transects located near the proposed islands. From these measurements, it should be possible to determine the extent and magnitude of changes due to the new islands and causeways. From these physical changes, biologists and ecologists should be able to predict something about the likely environmental effects.

The rest of the tests will be oriented towards predicting the changes in sedimentation shoaling and scouring, with particular emphasis on the immediately adjacent areas, Hampton Flats, and the shallow waters near Craney Island. One set of tests will measure the surface velocities photographically. Confetti, distributed over the water surface, will be photographed with time exposures. At the end of each illumination period, a flash will occur, giving the end point of each of these path lines. From these photographs, it will be possible to see gyres, areas of rapid fluid motion, and stagnation points. A second series of tests will attempt to predict shoaling and scouring by introducing gilsonite, a material with a density only slightly greater than that of
water, and observing where and in what quantities it settles. From the gilsonite studies, the time-lapse photos, and the current velocities and directions measured in the first tests, it is assumed that fairly accurate predictions of sediment movements and depositions can be made.

STATUS: Active.

FINANCIAL SUPPORT:

Virginia State Department of Highways
Virginia Institute of Marine Science
PROJECT TITLE: RAPPAHANNOCK RIVER MONITORING STATION

INVESTIGATORS:

C. S. Fang, Department Head and Senior Marine Scientist
W. L. Matthews, Laboratory Specialist

PROJECT SUMMARY:

Two water temperature and salinity monitoring stations have been installed on the Rappahannock River. The upstream station is mounted on Lighted Lower Structure Number 9, off Smokey Point near Waterview; the downstream station on one of the concrete piers at the south side of the channel under the Norris Bridge at Greys Point. At each station, there are two sets of temperature-salinity sensors. InterOcean Model 513 probes, one located six feet below mean low water level and the other approximately six feet above the bottom, are being used. In the case of the Smokey Point station where the water depth is 22 feet, the lower probe is at minus 16 feet; at Norris Bridge where the depth is approximately 35 feet, the lower probe is at about minus 30 feet. The sensors are mounted on trolleys which ride vertically in tracks secured rigidly to the structures on which they are mounted. In this way, the instruments may be readily withdrawn from the water for inspection and servicing by means of attached nylon lines. Each probe has its own track with a stop to prevent the trolley from descending below its proper depth.

The data from these sensors are recorded in digital form on one-quarter inch magnetic tape within a Braincon Type 710 Data Acquisition Package. Sampling rate is once every thirty minutes. Power required is plus and minus 18 volts D.C. This is provided by battery at the Smokey Point tower. At Norris Bridge, power is supplied through an appropriate conversion power supply from VEPCO A.C. sources with a battery back-up system.

STATUS: Active.

FINANCIAL SUPPORT:

U. S. Army Corps of Engineers, Norfolk District
Virginia Institute of Marine Science
PROJECT TITLE: PAMUNKEY RIVER MONITORING STATION

INVESTIGATOR:

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

PROJECT SUMMARY:

There are two stations currently installed and operating in the York River System, one on the Ferry Pier at the Virginia Institute of Marine Science, Gloucester Point, and the other at Olssons Landing on the Pamunkey River, about three and one half miles northwest of West Point. Both stations monitor water temperature and salinity continuously. The sensors are InterOcean Model 513 probes, and the recorders are Rustraks, Model 288, plus and minus 12 volt D.C. Power is supplied from local VEPCO A.C. sources through an appropriate power supply, with a 12 volt back-up battery system to take over in event of power failure.

The sensors at both the VIMS pier and at Olssons Landing are placed at six feet below mean low water. To keep the instruments in position and yet readily retrievable for inspection and servicing, they are mounted on a trolley which can run in a vertical track ridigly secured, in each case, to a piling on the pier. A length of nylon line permits the sensor to be lowered to the proper depth and to be raised whenever necessary.

STATUS: Active.

FINANCIAL SUPPORT:

Virginia Electric and Power Company
Virginia Institute of Marine Science
PROJECT TITLE: ESTUARINE MIXING AND TRANSPORT

INVESTIGATORS:

C. S. Fang, Department Head and Senior Marine Scientist
B. J. Neilson, Associate Marine Scientist

PROJECT SUMMARY:

The goal of the studies is to determine how substances introduced into the James River are mixed into the body of water and how they are transported to other points. The primary emphasis of the studies during the summer of 1972 will be the dispersion and diffusion of conservative liquid additions. These processes will be studied by following the "batch" release of the dye, Rhodamine WT. It is believed that for the portion of the James between Richmond and Hopewell (and the Appomattox River) a one-dimensional approach is appropriate. Dye concentrations will be measured at fixed points as the dye cloud passes upstream and downstream. In addition, samples will be taken from moving boats to investigate lateral variations and to obtain at least one example of concentration variation with distance at a (more or less) fixed time. Other longitudinal distribution curves will be constructed from the data collected at fixed points following the method used by Fischer. The dispersion coefficients will then be calculated by using the "change-of-moment method".

For the portion of the estuary from Hopewell to Hampton Roads, it will be necessary to use a two-dimensional approach. The dispersion of batch releases of dye will be measured by having moving boats transect the dye cloud both longitudinally and laterally at specified time intervals. The dispersion coefficient will be calculated from the changing pattern of dye concentration. In addition, the dye concentration will be monitored at one or two fixed points to determine the time of passage.

In addition to the dye studies, temperature, salinity, dissolved oxygen, BOD, and currents will be measured to model the dissolved oxygen regime. Special attention will be given to the oxygen sag near sources of organic pollution (e.g., below Richmond and Hopewell).

STATUS: Active.
FINANCIAL SUPPORT:

Environmental Protection Agency
Virginia State Water Control Board
Virginia Institute of Marine Science
PROJECT TITLE: BEHAVIOR OF WASTEWATER-ORIENTED NONCONSERVATIVE SUBSTANCES

INVESTIGATORS:

C. S. Fang, Department Head and Senior Marine Scientist
B. J. Neilson, Associate Marine Scientist

PROJECT SUMMARY:

In conjunction with the "mixing and transport" studies, the behavior of nonconservative substances, coliform bacteria in particular, will be investigated. Chlorination at selected sewage treatment plants will be halted for specified periods of time. Samples will then be collected to determine the spatial and temporal variations of the coliform count. Currents, tidal fluctuations, and other data collected in previous and concurrent studies will be used to predict likely geometries of the effluent plume throughout the tidal cycle. Sampling points and frequency of observations will be chosen using these predictions in order to obtain as accurate a picture as possible.

STATUS: Active.

FINANCIAL SUPPORT:

Environmental Protection Agency
Virginia State Water Control Board
Virginia Institute of Marine Science
PROJECT TITLE: A WATER QUALITY MANAGEMENT MODEL FOR JAMES RIVER TIDAL PORTION, VIRGINIA

INVESTIGATORS:

C. S. Fang, Department Head and Senior Marine Scientist
A. Y. Kuo, Associate Marine Scientist
P. V. Hyer, Associate Marine Scientist

PROJECT SUMMARY:

In the summer of 1971, a field program was carried out in the tidal James River. Salinity, temperature, dissolved oxygen, biochemical oxygen demand, and current speed and direction were measured at nineteen transects. These data are being used to develop and verify water quality and salinity models for the James River.

STATUS: Active.

FINANCIAL SUPPORT:

Division of Water Resources
State Water Control Board
Virginia Institute of Marine Science
PROJECT TITLE: NEARSHORE CIRCULATION PROJECT

INVESTIGATORS:

J. M. Zeigler, Head, Division of Physical Science and Coastal Engineering
C. S. Fang, Department Head and Senior Marine Scientist
Robert J. Byrne, Head of Department of Geological Oceanography
C. S. Welch, Associate Marine Scientist

PROJECT SUMMARY:

VIMS is collaborating with NASA-Wallops Island in a long term investigation of nearshore circulation. The site of the investigation is the Eastern Shore of Virginia near Wachapreague Inlet. During the current year, emphasis is being placed on instrument development. In conjunction with the instrument development, the interactions between tidal currents offshore and the inlets along the coast will be studied.

STATUS: Active.

FINANCIAL SUPPORT:

National Aeronautics and Space Administration
(Wallops Research Center)
Virginia Institute of Marine Science
PROJECT TITLE: CONTINENTAL SHELF DATA ACQUISITION DESIGN STUDY

INVESTIGATORS:

John M. Zeigler, Head, Division of Physical Science and Coastal Engineering
C. S. Fang, Department Head and Senior Marine Scientist
C. S. Welch, Associate Marine Scientist
Paul V. Hyer, Associate Marine Scientist

PROJECT SUMMARY:

Management of the Virginia Coastal Zone will require a system of regular synoptic sampling of oceanic parameters. Scientists from VIMS are collaborating with NASA-Langley Research Center in a project to design such a system using remote sensing in conjunction with remote interrogations of in situ sensors. The core of the system will be a method for directly measuring or inferring circulation of the continental shelf waters. In addition, methods of interfacing other current available data with the circulation data are being devised.

STATUS: Active.

FINANCIAL SUPPORT:

National Aeronautics and Space Administration (Langley Research Center)
Virginia Institute of Marine Science
PROJECT TITLE:  NEWPORT NEWS CIRCULATION BASE STUDY

INVESTIGATORS:

John M. Zeigler, Head, Division of Physical Science and Coastal Engineering
C. S. Fang, Department Head and Senior Marine Scientist
R. J. Byrne, Head of Department of Geological Oceanography
C. S. Welch, Associate Marine Scientist

PROJECT SUMMARY:

Part of the missions of VIMS is to act as consultant to other state agencies. In consultation with the state highway department, scientists at VIMS are studying the circulation in the close proximity of Newport News Point. The object of the study, which includes a model test in addition to the direct current study, is to predict the effect which a proposed new bridge tunnel will have on the circulation of the lower James River. In particular, the data gathered will provide information to studies of erosion due to the changed current patterns.

STATUS:  Active.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science
PROJECT TITLE: HYDROGRAPHIC STUDIES OF CHESAPEAKE BAY - COLLECTION OF HYDROGRAPHIC DATA ON CHESAPEAKE BAY AND TRIBUTARIES

INVESTIGATORS:

C. S. Fang, Department Head and Senior Marine Scientist
E. P. Ruzecki, Associate Marine Scientist
William Athearn, Assistant Marine Scientist

PROJECT SUMMARY:

Hydrographic data consisting of measurements of tidal elevation, current velocity, temperature, and salinity are being collected from the Virginia waters of Chesapeake Bay and its major tributaries within Virginia, the James, York, and Rappahannock Rivers and Pocomoke Sound. The field work is directed toward the verification of the Chesapeake Bay Hydraulic Model being built under the supervision of the Corps of Engineers, Baltimore District, in cooperation with Chesapeake Bay Institute and Chesapeake Biological Laboratory, who are working primarily within the Maryland section of the Bay system.

Field data for the Rappahannock River and Mobjack Bay have been reduced and tabulated. Preliminary data for tides, temperature, and salinity have been tabulated and furnished to the Corps of Engineers.

STATUS: Active.

FINANCIAL SUPPORT:

U. S. Army Corps of Engineers
Virginia Institute of Marine Science
PROJECT TITLE: FATE OF WASTE HEAT DISCHARGED INTO THE JAMES RIVER ESTUARY BY THE SURRY NUCLEAR POWER STATION AT HOG POINT, SURRY COUNTY, VIRGINIA

INVESTIGATORS:

C. S. Fang, Department Head and Senior Marine Scientist
Robert L. Bolus, Assistant Marine Scientist
S. N. Chia, Research Assistant

PROJECT SUMMARY:

Temperature profiles in the vicinity of the mixing zone of the heated water discharge plume are being determined. Deduced thermal patterns will be compared with those obtained from previous model studies under similar wind and flow conditions to evaluate the relevance of model studies for these purposes. The importance of winds on the movement of the thermal effluent is under particular consideration.

STATUS: Two reports have been published:


FINANCIAL SUPPORT:

U. S. Atomic Energy Commission
Virginia Institute of Marine Science
PROJECT TITLE: INVESTIGATION OF THE WATER TABLE IN A TIDAL BEACH

INVESTIGATORS:

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

PROJECT SUMMARY:

The objectives of this project are:

(1) To collect a 30- to 60-day time series of observations of:
   (a) elevations of the water table in a beach
   (b) elevations of the local ocean surface
   (c) elevations of the foreshore at reference points
   (d) the position of the top of the swash
   (e) the breaker height and trough depth
   (f) local rainfall
   (g) runup characteristics
   (h) atmospheric pressure,

(2) To analyze the field data by appropriate time-series computer programs,

(3) To document the interactions between the water table and the environmental variables that cause it to fluctuate,

(4) To document the effect of the water table on the stability of the foreshore,

(5) To elucidate the characteristics of the damped tide wave in the water table and the mechanism by which it is propagated through the sand prism, and

(6) To advance recommendations, if possible, for the control of day-to-day (non-storm) changes in tidal beaches by artificial alteration of beach water tables.

For the second year, it is proposed to:

(1) Develop a data-report for the entire time series of observations made at Fort Storm during the previous summer,

(2) Undertake regression analysis of the relationship between changes in volumes of groundwater and corresponding changes in the volume of foreshore sand, and
PROJECT SUMMARY (Cont'd):

(3) Complete the numerical analysis of the water table data.

STATUS: Active. The following publications have resulted:

(3) Investigation of the Water Table in a Tidal Beach, by C. S. Fang, S. N. Wang, and P. W. Harrison.

FINANCIAL SUPPORT:

Office of Naval Research
Virginia Institute of Marine Science
PROJECT TITLE: ESTUARINE COMPUTER MODEL OF SALINITY AND DISSOLVED OXYGEN DISTRIBUTION - RAPPAHANNOCK RIVER (DATA COLLECTION AND PROCESSING FOR STATE COOPERATIVE MATHEMATICAL MODEL)

INVESTIGATORS:

C. S. Fang, Department Head and Senior Marine Scientist
Paul V. Hyer, Associate Marine Scientist
A. Y. Kuo, Associate Marine Scientist

PROJECT SUMMARY:

Mathematical models for the prediction of salinity distribution and dissolved oxygen concentration in the upper Rappahannock River are being developed. Collection of field data sufficient for the verification of the model is being carried out. To known confidence levels, the one model will be able to predict the high water salinity distribution, given the initial salinity distribution and freshwater run-off; and the other the variation of dissolved oxygen concentration with time, given initial temperature and river discharge conditions and tidal amplitude.

The particular reach of the Rappahannock River chosen, between Fredericksburg and a little downstream from Tappahannock, is considered sufficient to establish sump conditions for the system under study and encompass the detectable influences of sanitary and industrial discharges.

STATUS: A report is in preparation.

FINANCIAL SUPPORT:

Cooperative State Agencies
(Division of Water Resources)
(State Water Control Board)
(Virginia Institute of Marine Science)
PROJECT TITLE: DEVELOPMENT OF A RAPID ACCESS DATA STORAGE AND RETRIEVAL SYSTEM

INVESTIGATOR: Richard W. Moncure, Computer Systems Analyst

PROJECT SUMMARY:

A Master Indexed Sequential Data File will be created. Rapid access will be provided through the use of keys. Maximum utilization will be made of existing data handling facilities of the System 360 Operating System and Sort/merge utilities.

A control program will be developed to provide retrieval by any parameter of combination of parameters desired. Facilities will be provided for rejecting or accepting a retrieved record based on pre-defined conditions. Options will be included to allow for sorting of retrieved data and for saving retrieved data on magnetic tape for analysis.

STATUS: Active.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science
PROJECT TITLE: STUDY OF THE PHYSICAL EFFECTS OF THERMAL DISCHARGES INTO JAMES RIVER BY SURRY NUCLEAR POWER PLANT

INVESTIGATORS:

C. S. Fang, Department Head and Senior Marine Scientist
S. N. Chia, Research Assistant

PROJECT SUMMARY:

A mathematical model is developed to predict the temperature distribution of the plume in James River which is caused by the discharging of the cooling water of VEPCO's Surry County nuclear power plant. Based on the river condition and the geometry of the James River, two and three-dimensional models will be developed. Three data collecting systems - the moving boat system, in situ (tower) system, and an over-fly system, are constructed to take field data. From the measured data, several physical parameters such as heat exchange coefficient, equilibrium temperature, and cloudiness ratio, will be evaluated such that the prediction of the model is available. Statistical analysis, analysis of variance or regression analysis, for the moving boat system data, and time-series analysis of the tower system data are also included to make the data more useful.

STATUS: This project represents Chia's dissertation research.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science
PROJECT TITLE: TWO-DIMENSIONAL JET DISCHARGING INTO AMBIENT FLUID OF UNIFORM VELOCITY

INVESTIGATORS:

A. Y. Kuo, Associate Marine Scientist
M. L. Crane, Graduate Student

PROJECT SUMMARY:

Numerical computation was performed for the flow field induced by a two-dimensional jet discharging into ambient fluid of uniform velocity. The boundary conditions simulate the flow of water from the Chesapeake Bay into the Atlantic Ocean. Coriolis parameter was included in the computation.

Steady state flow patterns have been computed for several values of the ratio of jet velocity to ambient velocity.

STATUS: This project represents Crane's thesis research. It is a subproject of the Emissions Program of "Chesapeake Bay Research" of the Chesapeake Research Consortium, Inc.

FINANCIAL SUPPORT:

National Science Foundation
(RANN Program)
Virginia Institute of Marine Science
PROJECT TITLE: **THE LONG TERM VARIATION OF SALINITY INTRUSION INTO AN ESTUARINE RIVER**

INVESTIGATORS:

A. Y. Kuo, Associate Marine Scientist
Mary Ann Orzech, Graduate Assistant

PROJECT SUMMARY:

The objective of this research is a more rigorous development of the longitudinal dispersion coefficient for a long term salinity model. This model describes the long term variation of the averaged salinity distribution over a tidal cycle along an estuarine river.

Expression for a longitudinal dispersion coefficient, averaged over a tidal cycle, have been obtained to a first order approximation. Comparison with field data is underway.

STATUS: This project represents Orzech's thesis research.

FINANCIAL SUPPORT:

Cooperative State Agencies
(Division of Water Resources)
(State Water Control Board)
(Virginia Institute of Marine Science)
PROJECT TITLE: CIRCULATION AND MIXING IN THE AREA OF THE VIRGINIA CAPES

INVESTIGATORS:

C. S. Fang, Department Head and Senior Marine Scientist
A. Y. Kuo, Associate Marine Scientist
Evon P. Ruzecki, Associate Marine Scientist

PROJECT SUMMARY:

A mathematical model of the coastal sea around Chesapeake Bay entrance and the adjacent continental shelf area which, given wind stress and heat flux on the sea surface, together with some conditions on the bottom and boundaries, should be able to describe the general distribution of currents, temperature, and salinity, is being developed. After proving satisfactory, the model can be used for oceanographic forecasting, such as invasion of long waves from the ocean, the distribution of pollutants, the effect of dredging, and beach erosion.

Preliminary field work was carried out in September and October 1971. Results of this work are being used to design further field studies directed towards determining surface velocity fields in the study area.

STATUS: This project represents Ruzecki's dissertation research. Additional support is currently being sought from NSF.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science
PROJECT TITLE: DATA COLLECTION AND PROCESSING FOR STATE COOPERATIVE MATHEMATICAL MODEL (COMPARISON OF NUMERICAL METHODS FOR THE SOLUTIONS OF THE COMPLETE EQUATION OF UNSTEADY FLOW)

INVESTIGATORS:

C. S. Fang, Department Head and Senior Marine Scientist
S. N. Wang, Research Assistant

PROJECT SUMMARY:

Computer-oriented mathematical models for numerical analysis of water movement in estuaries are being developed. These are based on the numerical integration of the complete equations of continuity, momentum, and mass balance for unsteady flow. The equations will be solved by three independent different methods, the finite difference method, finite element method, and MAC method. Identical sets of field data obtained from summer hydrographical surveys for the James River (or Rappahannock River) will be used for each of the three methods of solution.

STATUS: This project represents Wang's dissertation research.

FINANCIAL SUPPORT:

Cooperative State Agencies
(Division of Water Resources)
(State Water Control Board)
(Virginia Institute of Marine Science)
PROJECT TITLE:  **TIDAL CIRCULATION OF MOBJACK BAY**

INVESTIGATORS:

C. S. Welch, Associate Marine Scientist  
H. E. Wu, Graduate Assistant

PROJECT SUMMARY:

Mobjack Bay is a large enough body of water to have significant ellipticity in its tidal current hydrographs. These hydrographs also exhibit significant non-zero average currents at fixed meter stations. It is also small enough that optically located drifting buoys can be followed from shore. The data for this project will be gathered in the coming summer with the analysis and interpretation to be completed the following May.

STATUS:  This project represents Wu's thesis research.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science
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: Final report is being prepared.

FINANCIAL SUPPORT:
Virginia Institute of Marine Science
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% reduction of marsh area has occurred since 1852.


FINANCIAL SUPPORT:

Virginia Institute of Marine Science
PROJECT TITLE: CIRCULATION IN EASTERN SHORE MARSH-LAGOON COMPLEX

INVESTIGATOR:

Robert J. Byrne, Department Head and Senior 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.


FINANCIAL SUPPORT:

Virginia Institute of Marine Science
PROJECT TITLE: ANALYSIS AND EVALUATION OF REMOTE-SENSOR DATA FOR MARINE-SCIENCE APPLICATIONS

INVESTIGATORS:

Hayden Gordon, Assistant Marine Scientist
Michael Penney, Research Assistant

PROJECT SUMMARY:

The scope of this program is to analyze and evaluate data obtained from multispectral sensor overflights by NASA aircraft of the Chesapeake Bay entrance along the Chesapeake Bay bridge-tunnel structure and nearby estuaries to include the James, York, and Rappahannock Rivers and the wetlands of the Eastern Shore of Virginia. It also shall encompass collecting and correlating appropriate field data with the remote sensor data received from the overflights.

The ground truth data will be obtained which will include the following: (a) water temperature—surface and subsurface, (b) salinity—surface and subsurface, (c) dissolved oxygen, (d) surface oil film—biological and petroleum, (e) current speed and direction, (f) turbidity, and (g) particle suspension—organic and petroleum. Substantive evaluation of (a) detection and characterization of oil films at the Chesapeake Bay entrance, (b) description of the thermal structure of waters at the Chesapeake Bay entrance and in nearby estuaries, and (c) mapping of marsh plant communities and boundaries will also be made.

STATUS: Active.

FINANCIAL SUPPORT:

National Aeronautics and Space Administration
(Wallops Island)
Virginia Institute of Marine Science
PROJECT TITLE: WAVE REFRACTION ON THE CONTINENTAL SHELF AND SHORELINE OF VIRGINIA

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 continental shelf and shoreline for a variety of wave directions, periods, and heights with a linearized bottom friction term in the formulation. The computer output includes maximum orbital velocity at the bottom, gradient of wave power, and the longshore current at the shoreline.

STATUS: Active.

FINANCIAL SUPPORT:

National Oceanic and Atmospheric Administration
(Office of Sea Grant Programs)
National Aeronautics and Space Administration
(Langley Research Center)
Virginia Institute of Marine Science
PROJECT TITLE: SHORE EROSION IN TIDEWATER VIRGINIA

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 year period.

STATUS: Completion is expected in September, 1972. A report is in preparation. This is a subproject of the Wetlands Program of "Chesapeake Bay Research" of the Chesapeake Research Consortium, Inc.

FINANCIAL SUPPORT:

National Science Foundation
(RANN Program)
Virginia Institute of Marine Science
PROJECT TITLE: SHORELINE SITUATION REPORTS FOR VIRGINIA

INVESTIGATORS:

Robert J. Byrne, Department Head and Senior Marine Scientist
John M. Zeigler, Head, Division of Physical Science and Coastal Engineering

PROJECT SUMMARY:

The goal of this program is to supply, on a county by county basis, the baseline information which planners and management agencies will need to develop comprehensive shoreline management schemes. Our studies include:

1. Present erosion characteristics,
2. Effectiveness of shoreline protection structures,
3. Distribution of shoreline by type,
4. Biological characteristics of shoreline,
5. Existing pollution problems, and
6. Assessment of potential shoreline utilization.

STATUS: Active. This is a subproject of the Wetlands Program of "Chesapeake Bay Research" of the Chesapeake Research Consortium, Inc.

FINANCIAL SUPPORT:

National Science Foundation (RANN Program)
Virginia Institute of Marine Science
PROJECT TITLE: EFFECTIVENESS OF SEQUENTIAL PHOTOGRAPHY FOR COASTAL OCEANOGRAPHY

INVESTIGATORS:

M. M. Nichols, Associate Marine Scientist
Mahlon Kelly *

PROJECT SUMMARY:

Coastal waters and circulation are so dynamic, constantly varying in content and distribution, they are difficult to characterize and monitor. We are attempting to find some ways that the appearance of these waters in aerial photographs and satellite imagery may be used to analyze their movement. This, in turn, would show the dynamic distribution of sediment, phytoplankton, and pollutants.

We have been analyzing characteristics of water in the lower Chesapeake Bay in relation to their "appearance" from the air and on aerial photographs. Synoptic samples of surface water were obtained by helicopter at different tidal stages over an area of 1,200 square miles for analyses of salinity, suspended sediment, chlorophyll, transparency, color, and phytoplankton composition. The most striking features observed from the air are interfaces between waters of relatively low and high turbidity. These interfaces recur with tidal stage and can be traced on repetitive high altitude NASA photography taken in 1969, 1970, and 1971.

STATUS: Active. Completion is expected by September, 1972. Publications include:

(1) "Dynamic Composition of Coastal Waters Apparent in Aerial Photography," (abstract), Second National Coastal and Shallows Water Research Conference, p. 123.
(2) "Sequential Photography of Coastal Features," (abstract), Thirteenth International Conference on Coastal Engineering, Vancouver, p. 323-324.

FINANCIAL SUPPORT:

Office of Naval Research and National Oceanic and Atmospheric Administration--Spacecraft Oceanography Project
Virginia Institute of Marine Science

* Dr. Mahlon Kelly, University of Virginia, Charlottesville
PROJECT TITLE: MINERAL RESOURCES OF THE CONTINENTAL SHELF OFF CHESAPEAKE BAY

INVESTIGATOR: M. M. Nichols, Associate Marine Scientist

PROJECT SUMMARY:

This study aims to define the location, extent, and composition of potentially important mineral resources on a portion of the shelf floor off Chesapeake Bay. Sand, gravel, shell, and heavy minerals in surface sediments are being analyzed in more than 400 samples and distributional charts of potential deposits are being prepared. Results of the study should induce industry to undertake more detailed exploration and reinforce state and federal ability to plan for wise use of these resources.

STATUS: Active. Completion is expected in January, 1973. One publication has resulted: Nichols, M. M., Continental Shelf Sediments Off Chesapeake Bay, I, SSR No. 64.

FINANCIAL SUPPORT:

National Oceanic and Atmospheric Administration
(Office of Sea Grant Programs)
Virginia Institute of Marine Science
PROJECT TITLE: DEVELOPMENT OF THE TURBIDITY MAXIMUM IN A COASTAL PLAIN ESTUARY

INVESTIGATORS:

Maynard M. Nichols, Associate Marine Scientist

PROJECT SUMMARY:

The purpose of the proposed study is to determine how suspended sediment accumulates in the fresh-salt transition of an estuary to form a turbidity maximum.

The net transport of water and sediment will be examined through several cross-sections at five or more stations in a 30-mile reach of the upper Rappahannock Estuary, Virginia. Field measurements will be made at mean tide over eight tidal cycles (100 hours), at each station, first at low river inflow in August, then at low river inflow in March.

The objective of this study is to determine how the turbidity maximum is generated and maintained by dynamic processes. An attempt will be made to measure the net or residual transport of water and sediment and to calculate what excess quantity of suspended material is supplied to the maximum. A second objective is to discover what new, time-dependent tidal or exchange processes may be active in concentrating suspended sediment.

STATUS: Final report is in preparation.

FINANCIAL SUPPORT:

U. S. Department of the Army
(U. S. Army Research Office - Durham)
Virginia Institute of Marine Science
PROJECT TITLE: SEDIMENT TRANSPORT IN LOW-ORDER TIDAL MARSH CHANNELS

INVESTIGATORS:

Robert J. Byrne, Department Head and Senior Marine Scientist
John D. Boon, Assistant Marine Scientist

PROJECT SUMMARY:

The research proposed will involve a number of field studies of low-order, tidal marsh channels with the emphasis on sediment transport processes via fluid suspension. The area chosen for study is situated near Wachapreague, Virginia.

Goals of the studies include (1) specific insights into the distribution patterns of fluid velocity and suspended sediment concentration in time and space as revealed by detailed measurements; (2) comparison of these distributions with those predicted by theoretical formulations in classical fluid dynamics; (3) hydraulic geometry of marsh channels; and (4) marsh channel evolution. The latter will be investigated by computation of net suspended sediment discharge values over a tidal cycle at several channel cross-sections.

STATUS: Active. A part of this project represents Boon's dissertation research. It is a subproject of the Wetlands Program of "Chesapeake Bay Research" of the Chesapeake Research Consortium, Inc.

FINANCIAL SUPPORT:

National Science Foundation (RANN Program)
National Science Foundation Grant for Improving Doctoral Dissertation Research in the Environmental Sciences
Virginia Institute of Marine Science
PROJECT TITLE: RESPONSE CHARACTERISTICS OF TIDAL INLETS (THE EFFECT OF HYDRAULIC FORCES AND SEDIMENT SUPPLY)

INVESTIGATORS:

Robert J. Byrne, Department Head and Senior Marine Scientist
C. S. Fang, Head of Department of Physical Oceanography and Hydraulics
Joseph T. DeAlteris, Graduate Assistant

PROJECT SUMMARY:

The goal of the proposed research is to document the response of inlet configuration to short term variations in hydraulic input and littoral drift and to relate the observed responses to the relative variability of the input processes. Wachapreague Inlet, an inlet within the barrier island complex of Virginia's Eastern Shore, has been selected for study.

The study is comprised of four elements:

(1) Monitoring inlet response with respect to cross-sectional area changes and the relation of these changes to inlet currents,
(2) A study of sediment variability (spatial and temporal) and the geologic controls on the inlet,
(3) A study of the distribution of bottom shear stress in the inlet channel, and
(4) Formulation of a one-dimensional numerical flow model for the inlet channel.

STATUS: Item (2) represents DeAlteris' thesis research. Active.

FINANCIAL SUPPORT:

Office of Naval Research
Virginia Institute of Marine Science
PROJECT TITLE: A STUDY OF SAND TEXTURAL AND MINERALOGICAL CHARACTERISTICS OF THE VIRGINIA BARRIER ISLANDS

INVESTIGATORS:

Robert J. Byrne, Department Head and Senior Marine Scientist
Carey Ingram, Graduate Assistant

PROJECT SUMMARY:

The purpose of this study is to see what, if any, differences exist in sand textural characteristics and mineralogy between and within barrier islands. Furthermore, the moments of the distribution will be studied to see if it is possible to delineate the sediments of the foreshore, berm, backshore, and dune.

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

FINANCIAL SUPPORT:

Virginia Institute of Marine Science
PROJECT TITLE: ECOLOGY AND DISTRIBUTION OF FORAMINIFERIDA IN AN ESTUARINE MARSH SYSTEM

INVESTIGATORS:

M. M. Nichols, Associate Marine Scientist
Warren Norton, Graduate Assistant

PROJECT SUMMARY:

Salt marshes are known to contribute large amounts of organic matter in the form of detritus and also serve as breeding and nursery grounds for many species of fish and invertebrates. Foraminifera in marshes may serve as indicator organisms regarding the physical parameters which impinge upon them, both natural and man-made.

The present study is engaged in an attempt to delineate the foraminiferal distributions in the marshes of the James River estuary. Variation is measured both between marshes from head to mouth and within each marsh with height above mean low water. "Low" marsh and "high" marsh were differentiated wherever possible and four cores were taken in each. One of the cores was saved for sediment analysis and the other three were analysed for foraminiferal content. Thus, "within-area," "between-area," and "between-marsh" variation can be accounted for. Salinities and temperature data will be used as measured physical parameters. Vegetation types were also sampled and identified from the immediate vicinity of the core sites.

This study aims to correlate the marsh foraminiferal populations with measured environmental variables, thus establishing discrete faunas and producing a baseline from which changes due to pollution or sea level changes may be measured. Inferences will be made regarding the faunal distributions in paleomarsh sediments. Together with previous work in the James (Nichols and Norton, 1969), this study will present a complete picture of foraminiferal population patterns in a modern estuarine system.

STATUS: Expected completion date is September 1972. This project represents Norton's thesis research.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science

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PROJECT TITLE: MECHANICS OF BEACH CUSP FORMATION

INVESTIGATORS:

Robert J. Byrne, Department Head and Senior Marine Scientist
Asbury H. Sallenger, Jr., Graduate Assistant

PROJECT SUMMARY:

The goal of this study is to gain definitive field measurements of input variables and beach response during the formation of cusps (60 to 90 feet in wavelength) and to evaluate existing theories in the light of thorough field evidence. The beach under study will be smoothed artificially to remove dependence upon initial foreshore conditions.

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

FINANCIAL SUPPORT:

Virginia Institute of Marine Science
DIVISION OF ENVIRONMENTAL SCIENCE AND ENGINEERING
PROJECT TITLE: JAMES RIVER 3-C COMPREHENSIVE WATER QUALITY MANAGEMENT STUDY

INVESTIGATORS:
Michael E. Bender, Head, Division of Environmental Science and Engineering
Richard L. Hill, Associate Marine Scientist
Robert Diaz, Assistant Marine Scientist
Miles Booth, Laboratory Specialist

PROJECT SUMMARY:
Objectives are:

(1) Summarize existing biological, chemical, and water quality data for the tidal James and its tributaries,
(2) Establish the existing pattern of benthic species diversity and related parameters in the study area, sampled in autumn 1971 and summer 1972,
(3) Determine via flux studies the nutrient-assimilative capacity, for natural runoff and for secondary domestic sewage effluent discharged therein, of tidal marshy creeks in the James estuary,
(4) Update Phase 1 and repeat Phase 2, sampling in fall 1972 and late spring 1973, data analysis to include an assessment of the effects of tropical storm Agnes (late June 1972) on study variables.

STATUS: Phases 1, 2, and 3 were concurrent and are complete aside from the final report on Phase 3.

FINANCIAL SUPPORT:
Virginia State Water Control Board
Virginia Institute of Marine Science
PROJECT TITLE: A BIOLOGICAL, CHEMICAL, AND PHYSICAL STUDY OF THE LOWER YORK RIVER

INVESTIGATORS:

Michael E. Bender, Head, Division of Environmental Science and Engineering
Robert A. Jordan, Associate Marine Scientist
Robert Virnstein, Graduate Assistant
Michael Cavell, Graduate Assistant

PROJECT SUMMARY:

Objectives are:

(1) Summarize existing biological and water quality data pertaining to the study area,
(2) Assess the quality and quantity of the aquatic biota and the quality of the water within the study area for a two year period prior to the operation of an additional unit (Unit 3) at the VEPCO Yorktown Power Station,
(3) Make similar assessments for a two year period after the initial commercial operation of Unit 3.

STATUS: Phase 1 is completed. Phase 2 is in progress.

FINANCIAL SUPPORT:

Virginia Electric and Power Company
Virginia Institute of Marine Science
PROJECT TITLE: VEPCO - SURRY PRE- AND POST-OPERATIONAL STUDIES

INVESTIGATORS:

   Michael E. Bender, Head, Division of Environmental Science and Engineering
   Edward J. Tennyson, Graduate Assistant
   Marvin Hedgepeth, Graduate Assistant
   Michael Cavell, Graduate Assistant

PROJECT SUMMARY:

Pre- and post-operational studies on the benthic fauna of the James River have been conducted since May 1969. At present, these studies have been modified to the collection of benthic organisms at 16 stations on a quarterly basis. Laboratory studies have been and are being conducted on several aspects of the thermal problem by various graduate students. These studies are outlined in their reports. Field studies have been initiated on zooplankton populations to determine the levels of primary production in this reach of the James.

Further investigations in the area are presently in progress. These include methodology to establish zones of passage for migrating fishes and the effect of entrainment on larval fishes (complete).

STATUS: Active.

FINANCIAL SUPPORT:

   Virginia Electric and Power Company
   Virginia Institute of Marine Science
PROJECT TITLE: STUDY OF THE FAUNA OF THE UPPER JAMES ESTUARY

INVESTIGATORS:

Marvin L. Wass, Associate Marine Scientist, 
Department of Invertebrate Ecology 
Richard K. Peddicord, Graduate Assistant 

PROJECT SUMMARY:

The objective of this project is to quantitatively and qualitatively describe the benthic fauna of the James River, Virginia, in the region of the Virginia Electric and Power Company Surry Nuclear Power Station at Hog Island. The study will provide a basis for comparison with a future study to be made after the plant is in operation. Samples are taken with a Van Veen grab and washed through a 1.0 mm screen. Species are identified and counted in the laboratory. Hog Island is in an area of widely fluctuating salinity and thus is a rather harsh environment. Species diversity is rather low, with the dominant organism being the brackish-water clam, Rangia cuneata.

STATUS: This is a subproject of "VEPCO - Surry Pre- and Post-Operational Studies."

FINANCIAL SUPPORT:

Virginia Electric and Power Company 
Virginia Institute of Marine Science
PROJECT TITLE: GROWTH AND DISTRIBUTION OF RANGIA CUNEATA GRAY

INVESTIGATORS:

Marvin L. Wass, Associate Marine Scientist,
Department of Invertebrate Ecology
Richard K. Peddicord, Graduate Assistant

PROJECT SUMMARY:

The objective of this project is to study the distribution of Rangia cuneata in the James River, Virginia, its growth rate, and the effects of temperature and salinity on its ability to feed. The density and size distribution of populations will be determined in relation to salinity and substrate. Growth rates were be determined on the bases of linear dimensions, weight, and meat yield. Growth rates will also be related to substrate, salinity, size, and age, and interactions of these factors. Studies of the effects on temperature and salinity on filtering are being conducted in the laboratory in two parts. Clams acclimatized to summer conditions in the river have been collected and subjected to variations in temperature and salinity and filtering rates measured. During the winter months, clams were collected from the same areas when acclimatized to winter conditions and subjected to temperature and salinity variations.

STATUS: This project represents Peddicord's dissertation research. It is a subproject of "VEPCO - Surry Pre-and Post-Operational Studies."

FINANCIAL SUPPORT:

Virginia Electric and Power Company
Virginia Institute of Marine Science
PROJECT TITLE:  **EFFECTS OF ABOVE AMBIENT TEMPERATURE ON THE CHRONIC TOXICITY OF METHOXYCHLOR**

INVESTIGATORS:

Michael E. Bender, Head, Division of Environmental Science and Engineering
Edward J. Tennyson, Graduate Assistant

PROJECT SUMMARY:

The objectives of this research project are: (1) to conduct a chronic bioassay on an estuarine fish using a compound of ecological significance, i.e., to establish water quality for methoxychlor on *Fundulus heteroclitus*; (2) to evaluate several enzyme and physiological parameters which might be used to circumvent such costly and laborious long term tests; and (3) to identify the products or at least quantitate the breakdown rate of methoxychlor in fish.

Measurement of response: The major variable to be measured as a function of methoxychlor concentration in the chronic test will be reproductive success. This will entail not only eggs produced but probably more importantly fry survival. Growth will be evaluated by determining initial weight of the fish in each experimental unit, determining the weight of any fish lost from the unit, and a final weight determination on the unit after spawning. This procedure is very inaccurate, but it is believed minimal disturbance of the animals will lead to more valuable data from the reproductive studies. Oxygen consumption has been indicated by Bender and Merna (1970) as increasing as a function of pesticide concentration during long term bioassays. The mechanisms to account for this observation are not known, but it may have important physiological manifestations since, along with increased oxygen consumption, anomalies in digesting were noted. To evaluate it, in fact, oxygen consumption is affected by chronic methoxychlor exposure, the separate study described in the methods section will be conducted. Enzyme determinations on several constituents will be used to study the responses of the fish to chronic methoxychlor exposure.

STATUS: This project represents Tennyson's dissertation research. It is a subproject of "VEPCO - Surry Pre- and Post-Operational Studies."

FINANCIAL SUPPORT:

Virginia Electric and Power Company
Virginia Institute of Marine Science
PROJECT TITLE: COMPARATIVE HEMATOLOGY OF YELLOW AND SILVER EELS, ANGUILLA ROSTRATA

INVESTIGATOR:

Charles A. Wenner, Graduate Assistant

PROJECT SUMMARY:

Preliminary observations from 1971 have shown a general trend for an increase in the number of circulating red blood cells, an increase in hematocrit and hemoglobin levels in the peripheral blood of silver eels. The work to date has given impetus for further work so that statistically valid data can be obtained. Techniques have been worked out for routine fish hematology, and a photographic atlas of the peripheral blood will be prepared.

STATUS: In progress.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science
PROJECT TITLE: FOOD HABITS OF SOME LOWER CHESAPEAKE BAY FISHES

INVESTIGATORS:

Charles A. Wenner, Graduate Assistant
Peter F. Larsen, Graduate Assistant, Department of Ichthyology

PROJECT SUMMARY:

Qualitative and quantitative data on the food habits of representative fishes from local estuaries (James, York, and Rappahannock rivers) will be obtained from trawl samples. Frequency of occurrence and volume displacement of taxa will be noted and the data will be compared to existing benthic data and analyzed for overlap in food habits and competition among co-occurring species. Preliminary investigations on the food habits of the American eel, Anguilla rostrata, have shown considerable predation on the blue crab, Callinectes sapidus, and the soft clam, Mya arenaria.

STATUS: In progress.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science
PROJECT TITLE: A STUDY OF HEAVY METAL CONCENTRATION BY THE MARSH CLAM, RANGIA CUNEATA

INVESTIGATORS:

Michael E. Bender, Head, Division of Environmental Science and Engineering
Robert J. Huggett, Assistant Marine Scientist
Robert E. Croonenberghs, Graduate Assistant

PROJECT SUMMARY:

This project is designed to assess the distributions and concentrations of the heavy metals, cadmium, copper, zinc, and lead, in the brackish water clam (Rangia cuneata).

Previous studies on oysters have indicated that a natural distribution of heavy metals exists in Virginia's estuaries. Unfortunately, the eastern oyster (Crassostrea virginica) has a limited habitat due to its salinity requirements. An organism whose habitat overlaps that of the oyster's and extends into fresh water was needed. The brackish water clam seems appropriate.

The clams will be extensively sampled in the James and Rappahannock River systems and analyzed for heavy metals. The metal concentrations in the clams will be correlated to those of oysters in the overlap zones, hopefully leading to a method of detecting metal pollution over the entire estuarine segment of the rivers.

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

FINANCIAL SUPPORT:

Virginia Institute of Marine Science
PROJECT TITLE: ESTUARINE BENTHIC RECRUITMENT IN DREDGED AREAS

INVESTIGATORS:

Marvin L. Wass, Associate Marine Scientist, Department of Invertebrate Ecology
Thomas K. Duncan, Graduate Assistant

PROJECT SUMMARY:

Three areas in Hampton Roads with differing ages in respect to time of dredging were studied during a fourteen month period to assess the changes in faunal content that occur in the establishment of a benthic community.

Preliminary analysis of the data indicates that it takes at least a year from the time of dredging for the fauna to obtain an "equilibrium" number of species. However, due to changes in sediment composition, the species composition does not return to that present before dredging due to the almost complete absence of filter-feeding organisms in the dredged areas.

The greatest influx of animals occurred as expected during the spring after many of the organisms had spawned.

STATUS: Nearing completion. This project represents Duncan's thesis research.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science
PROJECT TITLE: THE EFFECTS OF OIL POLLUTION ON INTERTIDAL COMMUNITIES

INVESTIGATORS:

Michael E. Bender, Head, Division of Environmental Science and Engineering
Robert J. Huggett, Assistant Marine Scientist
Jeffrey L. Hyland, Graduate Assistant

PROJECT SUMMARY:

A quantitative analysis of the tolerances of several intertidal organisms to Bunker C Oil is being conducted under laboratory controlled conditions.

A continuous flow system for dosing organisms will be used. The study will provide information with which a better assessment of the environmental impacts a spill of this type of oil will have on the marine environment.

STATUS: Active. This study represents Hyland's thesis research.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science
PROJECT TITLE: THE UPTAKE, CONCENTRATION, AND RETENTION OF DDT BY TISSUES OF THE BLUE CRAB, CALLINECTES SAPIDUS

INVESTIGATORS:

Michael E. Bender, Head, Division of Environmental Science and Engineering
Peter F. Sheridan, Graduate Assistant

PROJECT SUMMARY:

The proposed research is centered upon the effects of water-borne DDT on major organs of the adult blue crab. The crabs will be exposed to various concentrations of DDT by a constant flow dosing apparatus for twelve hours, then placed in flowing estuarine water. Samples will be taken over a fourteen day period for each concentration and dissected to obtain claw and backfin muscles, hepatopancreas, gills, and gonads. Each organ will then be analyzed for DDT and its metabolites by electron capture gas-liquid chromatography.

STATUS: This project represents Sheridan's thesis research.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science
PROJECT TITLE: THE EFFECTS OF SALINITY AND SEX ON THE OXYGEN REQUIREMENTS OF THE BLUE CRAB, CALLINECTES SAPIIDUS

INVESTIGATORS:

Michael E. Bender, Head, Division of Environmental Science and Engineering  
Charles A. Wenner, Graduate Assistant

PROJECT SUMMARY:

A 5 x 2 factorial design will be employed (5 levels of salinity: 5, 10, 15, 20, and 25°; 2 levels of sex, male and female) to determine the lower lethal oxygen concentrations for intermolt blue crabs. Animals will be acclimated to the test salinities for one week in holding tanks and then tested individually for the lower lethal oxygen concentration by decreasing the oxygen levels in ten gallon test vessels by passing nitrogen gas through the media. Behavioral observations will be made during the course of the tests, and oxygen levels will be determined by Winkler titrations. The criteria for death will be lack of movement after mechanical stimulation.

STATUS: In progress. This project represents Wenner's dissertation research. It is a subproject of the Emissions Program of "Chesapeake Bay Research" of the Chesapeake Research Consortium, Inc.

FINANCIAL SUPPORT:

National Science Foundation  
(RANN Program)  
Virginia Institute of Marine Science
PROJECT TITLE: INVESTIGATION OF APPLICABILITY OF MICROWAVE SPECTROMETRY TO ATMOSPHERIC POLLUTION PROBLEMS

INVESTIGATORS:

Rudolf H. Bieri, Section Head and Senior Marine Scientist
Robert J. Huggett, Assistant Marine Scientist
William White *

PROJECT SUMMARY:

From a theoretical point of view, microwave spectrometry offers some advantages to the analysis of a large number of organic compounds over more conventional spectrometric methods. Main advantages are: extreme high resolution, specificity, relative ease of compound identification, and reasonable sensitivity. Especially if interfaced to a computer (allowing use of signal enhancing techniques, programmed search, and identification of compounds from a catalog stored in the memory), the analysis of complex mixtures of organic molecules without the need of sample pretreatment appears to be possible. We hope to use this method to assess the many aspects of atmospheric pollution.

STATUS: Active. This is a cooperative program with the Langley Research Center of the National Aeronautics and Space Administration, Hampton, Virginia.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science

* William White, Langley Research Center, NASA
PROJECT TITLE: BASELINE STUDY OF ORGANIC COMPOUNDS ASSOCIATED WITH MARSHES

INVESTIGATORS:

Rudolf H. Bieri, Section Head and Senior Marine Scientist
Robert J. Huggett, Assistant Marine Scientist
Harold Slone, Assistant Marine Scientist
Beverly W. Lewis *
George Wood *
Roger Snyder *
Billy Upchurch *

PROJECT SUMMARY:

This investigation is the beginning of what hopefully will lead to a comprehensive survey on the presence of organic compounds in marshes, their origin and fluxes, their ultimate fate, and their effect on marine life. Attention will first be focused on the development of analytical facilities and methods to characterize different strata of the estuarine environment. Techniques for contamination free sampling and extraction will be developed. Optional methods for qualitative and quantitative sample assessment by use of gas chromatography, solid-liquid chromatography, G.C.-mass spectrometry-computer systems, and, where amounts of samples available allow, I.R., U.V., and high resolution N.M.R. spectrometry will be developed. The number of compounds to be identified during this first phase will necessarily be limited, and for quantitative work, emphasis will be placed on reproducibility and intercalibration with other institutions.

STATUS: Active. This is a cooperative program with the Langley Research Center of the National Aeronautics and Space Administration, Hampton, Virginia.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science

* Beverly W. Lewis, Langley Research Center, NASA
* George Wood, Langley Research Center, NASA
* Roger Snyder, Langley Research Center, NASA
* Billy Upchurch, Old Dominion University, Norfolk, Virginia
PROJECT TITLE: POLYCHLORINATED BIPHENYLS IN THE ELIZABETH RIVER

INVESTIGATORS:

Robert J. Huggett, Assistant Marine Scientist
Michael E. Bender, Head, Division of Environmental Science and Engineering
Thomas E. Barnard, Assistant Marine Scientist

PROJECT SUMMARY:

Previous data on chlorinated hydrocarbon residues in shellfish have indicated a major source of polychlorinated biphenyls in the Elizabeth River.

This project is designed to pinpoint this source or sources by transplanting uncontaminated oysters at various locations in the river and by later analysis determine the samples closest to the source.

STATUS: Active.

FINANCIAL SUPPORT:

Environmental Protection Agency
(National Marine Pesticide Monitoring Program)
Virginia Institute of Marine Science
PROJECT TITLE: PESTICIDE MONITORING PROGRAM

INVESTIGATORS:

Robert J. Huggett, Assistant Marine Scientist
Michael E. Bender, Head, Division of Environmental Science and Engineering
Thomas E. Barnard, Assistant Marine Scientist

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 will be 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
PROJECT TITLE: PRE-DREDGING SEDIMENT ANALYSIS FROM CHANNELS LEADING FROM THE ChESAPEAKE BAY INTO NORFOLK AND NEWPORT NEWS HARBORS AND THE YORK AND RAPPAHANNOCK RIVERS

INVESTIGATORS:
John D. Lunz, Research Assistant
Robert J. Huggett, Assistant Marine Scientist
H. D. Slone, Assistant Marine Scientist

PROJECT SUMMARY:
A sampling program consisting of twenty-foot cores taken at two-mile intervals and short cores or grabs from one-half mile intervals was carried out at the following locations: Cape Henry channel, Thimble Shoals channel, Newport News channel-Hampton Roads, Norfolk Harbor channel-Elizabeth River, York Spit channel, York Entrance channel, and Rappahannock Shoals channel.

Long core subsamples and homogenized surface samples are being analyzed for total and volatile solids, chemical oxygen demand, total phosphorus, total Kjeldahl nitrogen, copper, zinc, lead, cadmium, and mercury.

STATUS: In progress.

FINANCIAL SUPPORT:
U. S. Army Corps of Engineers
Virginia Institute of Marine Science
PROJECT TITLE: MONITORING PHYSIOLOGICAL CHANGES IN CRASSOSTREA VIRGINICA IN RESPONSE TO ENVIRONMENTAL STIMULI

INVESTIGATORS:

John D. Lunz, Research Assistant
Grady Merriman *

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: In progress.

FINANCIAL SUPPORT:

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

* Grady Merriman, Langley Research Center, NASA, Hampton, Virginia
PROJECT TITLE: HEAVY METAL DISTRIBUTION IN BOTTOM SEDIMENTS OF THE LOWER CHESAPEAKE BAY

INVESTIGATORS:

Robert J. Huggett, Assistant Marine Scientist
Michael E. Bender, Head, Division of Environmental Science and Engineering

PROJECT SUMMARY:

A previous study on the Rappahannock River has indicated that the heavy metals copper and zinc are predictably partitioned between inorganic and organic fractions in bottom sediments. The extent of partitioning appears to be a function of both pH and salinity and their effects on adsorptive phenomena.

A thorough understanding of the controlling mechanisms for sediment metal concentration would allow better management of estuarine systems with respect to heavy metal pollution. To check the hypotheses formed from the Rappahannock River study, the James and York River sediments will be sampled and analyzed for the heavy metals. Laboratory experiments will be performed to check adsorption parameters and will be compared to the natural systems.

Since there are known unnatural metal sources in the James system, a check on the validity of these hypotheses will be available, and a mathematical model will be possible.

STATUS: Active. This is a subproject of the Emissions Program of "Chesapeake Bay Research" of the Chesapeake Research Consortium, Inc.

FINANCIAL SUPPORT:

National Science Foundation
(RANN Program)
Virginia Institute of Marine Science
PROJECT TITLE: FACTORS INFLUENCING BIOCONCENTRATION PHENOMENA IN THE AMERICAN OYSTER

INVESTIGATORS:

John D. Lunz, Research Assistant
Robert J. Huggett, Assistant 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: In progress.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science
PROJECT TITLE: **SUBLETHAL EFFECTS OF BUNKER C OIL ON A WETLAND COMMUNITY**

INVESTIGATORS:

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

PROJECT SUMMARY:

This project is designed to investigate the sublethal effects of chronic oil pollution on a salt marsh ecosystem. "Weathered" Bunker C oil will be applied to a section of marsh, and parameters such as primary productivity, community diversity, and detrital export will be monitored over a two year period. A nearby section of marsh will be utilized as a control area.

In addition, laboratory studies will evaluate the influence of Bunker C oil on respiration and other physiological parameters. Community dominants will be used in this phase of the study.

It is hoped that the study will elucidate changes in energy flow through the wetland ecosystem as caused by an environmental stressor such as oil.

STATUS: In preparation. This project represents, in part, Hershner's dissertation research.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science
PROJECT TITLE: HEAVY METALS IN SEDIMENTS AND OYSTERS

INVESTIGATORS:

Robert J. Huggett, Assistant Marine Scientist
Michael E. Bender, Head, Division of Environmental Science and Engineering
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 and Aniodic Stripping Voltametry.

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

FINANCIAL SUPPORT:

Virginia Institute of Marine Science
PROJECT TITLE: MARINA DEVELOPMENT IN THE PROPOSED YORK RIVER STATE PARK - AN APPRAISAL

INVESTIGATORS:

Kenneth L. Marcellus, Associate Marine Scientist
Gene Silberhorn, Associate Marine Scientist

PROJECT SUMMARY:

As requested by the Division of Parks, Virginia Department of Conservation and Economic Development, VIMS is preparing an appraisal of the impact which a marina in the proposed York River State Park would have on the surrounding marshland and related water systems.

The Institute will provide a map of the wetland areas within the park bounds, an estimate of the standing crop of dominant marsh plants, and an estimate of the vegetative productivity of the marsh. In addition, an estimate of the losses of vegetation due to the proposed construction of a marina will be made.

The primary objective of the study will be to assess the probable impact of the proposed park and marina complex on the marine environment of that vicinity. Suggestions for less damaging alternatives will be made when and where applicable.

STATUS: Field work is presently being initiated.

FINANCIAL SUPPORT:

Department of Conservation and Economic Development
(Division of Parks)
Virginia Institute of Marine Science
PROJECT TITLE: VIRGINIA WETLAND INVENTORY, MAPPING, AND CLASSIFICATION PROGRAM

INVESTIGATORS:

Kenneth L. Marcellus, Associate Marine Scientist
Gene Silberhorn, Associate Marine Scientist

PROJECT SUMMARY:

The Institute, as required by the Wetlands Act of 1972, is inventorying and classifying its tidal wetlands by type, and is also developing guidelines concerning the consequences of various uses of wetlands.

Bare maps of wetland area will be prepared and will delineate the boundaries of dominant vegetative species. This will provide data of great value in determining the ecological significance of particular wetlands. The wetland areas will also be ranked according to specific parameters including (1) acreage, (2) shoreline length to marsh surface area, (3) surface elevation relative to tidal range, and (4) utilization of drainage systems by marine organisms for spawning and nursery grounds, as well as utilization by other types of wildlife.

STATUS: Active.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science
PROJECT TITLE: APPLICATION OF RECOGNITION REMOTE SENSING FOR THE INVENTORY OF WETLAND VEGETATION

INVESTIGATORS:
Kenneth L. Marcellus, Associate Marine Scientist
Ruth I. Whitman *

PROJECT SUMMARY:

This project combines the resources of the Institute and the Langley Research Center of the National Aeronautics and Space Administration in an effort to develop a technique whereby wetland vegetation can be identified, inventoried, and mapped by aerial photography.

Overflights of selected wetlands, using a SH-3A research helicopter, will occur at intervals during the growing season. Photographs will be taken at various altitudes and with various focal length lenses in order to provide a set of vertically-nested or "telescoped" images of key wetland plants.

The recognition of characteristic patterns of vegetation species and the optimum season for photographing are the main objectives of the study. The technique will be tested on areas from which ground truth data has not been collected, and then an analysis of the feasibility of the technique for extensive wetland inventorying and mapping will be made.

STATUS: Active. This is a subproject of the Wetlands Program of "Chesapeake Bay Research" of the Chesapeake Research Consortium, Inc.

FINANCIAL SUPPORT:

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

* Ruth I. Whitman, Langley Research Center, NASA, Hampton, Virginia
PROJECT TITLE: POSSIBLE ROLE OF MARSHES IN PREVENTING EUTROPHICATION OF ESTUARIES

INVESTIGATORS:

Michael E. Bender, Head, Division of Environmental Science and Engineering
Harold D. Slone, Assistant Marine Scientist
Donald Axelrad, Graduate Assistant

PROJECT SUMMARY:

Completed and current estuarine studies indicate that the nutrient budget of a highly enriched tidal system cannot be followed from the source of enrichment to the mouth. Analytical and physical data indicate that nitrogen and phosphorus compounds are "lost" within the system and cannot be accounted for in soluble, suspended, or deposited forms.

As estuarine waters flood tidal marshes, the grasses, the phytoplankton, and the algae assimilate the nutrients and incorporate them as new growth. Subsequently, the plant materials may be eaten by other higher organisms or may die and be washed out of the marsh. The eventual release of their nutrients to the water via the processes of decomposition starts the cycle anew.

Preliminary results of the research indicate that river water tends to supply inorganic nitrogen to the marshes, but the marshes supply phosphates, organic nitrogen compounds, and ammonia nitrogen to the river. In addition, there appears to be a tendency for slightly more primary production to occur in marsh waters on flooding tides than on ebbing tides.

The objectives of the research are to determine, quantitatively, the forms of dissolved nitrogen and phosphorus entering and leaving marshes, the ratios of similar forms and the rates of conversion of nutrient forms unavailable for primary productivity to those forms which are available. Answers to these questions may prove highly significant in evaluating wetland areas in terms of their influence on the rates of eutrophication of estuaries.

STATUS: Active. This project is, in part, the subject of Axelrad's thesis research. It is partially supported by the Wetlands Program of "Chesapeake Bay Research" of the Chesapeake Research Consortium, Inc.
FINANCIAL SUPPORT:

Office of Water Resources Research
National Science Foundation
(RANN Program)
Virginia Institute of Marine Science
PROJECT TITLE: **MARSH PLANT PRODUCTIVITY AS A FUNCTION OF SALINITY**

INVESTIGATORS:

Kenneth L. Marcellus, Associate Marine Scientist  
Michael E. Bender, Head, Division of Environmental Science and Engineering  
Irving Mendelssohn, Graduate Assistant

PROJECT SUMMARY:

The determination of wetland value to estuaries requires a knowledge of the extent and productivity of dominant plant species. The productivity of many species has been determined, but not over their entire habitat range. Salinity does influence plant distribution, growth, and community structure as well as nutrient concentrations. Consequently, the application of production values from marshes in a specific salinity regime to all other marshes along an estuarine salinity gradient may not be valid.

Via the harvest method, the vegetation production on three marshes located in different salinity regimes is being studied. Along with vegetation data, soil samples are being collected and analyzed for their phosphorus, nitrogen, potassium, calcium, and magnesium content.

Cursory analysis of the productivity of the three marshes suggested that low salinity marshes are more productive than high salinity marshes, with marshes in mid-salinity regimes being intermediate in productivity.

A detailed analysis of the data, especially with respect to individual species and their responses to soil nutrient concentrations, will be made at the termination of the project. The results of this research problem will have immediate application in VIMS' Wetlands classification and ranking program.

STATUS: Active. This project represents Mendelssohn's thesis research. It is a subproject of the Wetlands Program of "Chesapeake Bay Research" of the Chesapeake Research Consortium, Inc.

FINANCIAL SUPPORT:

National Science Foundation  
(RANN Program)  
Virginia Institute of Marine Science
PROJECT TITLE: DETRITUS FLUX IN TIDAL MARSHES

INVESTIGATORS:

Michael E. Bender, Head, Division of Environmental Science and Engineering
Kenneth Moore, Graduate Assistant

PROJECT SUMMARY:

The "life" of marsh vegetation does not stop at the end of the growing season, although its form and appearance undergo dramatic changes. Mechanical, biological, and chemical mechanisms, through time, break the vegetation into smaller and smaller particles that eventually reach colloidal size and finally their molecular constituents.

Throughout the process of decomposition, the particles serve as energy sources for microscopic and macroscopic organisms. The mechanism of energy transfer from high salinity marshes into the marine environment has been extensively studied in more southern coastal marshes. However, the meso- and oligohaline regions of the estuaries have not been studied in great detail, especially in Virginia. Yet, a major portion of the annual fish and shellfish harvest comes from these medium to low salinity areas. As part of the estuarine research program, a study of the seasonal detritus flux in a mesohaline and an oligohaline marsh is being conducted.

The objective of this research project is to determine the import and export of detritus during complete tidal cycles at various times of the year. Samples taken at intervals of one hour are analyzed for the concentration of the dissolved and the particulate organic carbon fraction, the inorganic carbon fraction, and the ATP concentrations. Preliminary results indicate that the concentration of carbon in the water is highest at low slack tide and lowest at high slack, suggesting a net export of the material. In addition, seasonal differences in dissolved organic and particulate organic carbon are apparent; summer and early fall fluxes are much greater than mid-winter and early spring fluxes. The quantity of carbon present in particulate form exceeds that of the dissolved, and the patterns of flux as a function of tide stage are different.

The analyses for ATP, initiated in January 1972, have shown fluxes in living material in marsh water relative to the tide when carbon analyses have not presented conclusive data.
STATUS: Active. This project represents, in part, Moore's thesis research. It is a subproject of the Wetlands Program of "Chesapeake Bay Research" of the Chesapeake Research Consortium, Inc.

FINANCIAL SUPPORT:

National Science Foundation  
(RANN Program)  
Virginia Institute of Marine Science
PROJECT TITLE: STUDY OF NEARSHORE SURFACE CURRENT PATTERNS IN THE ATLANTIC OCEAN OFF DAM NECK, VIRGINIA

INVESTIGATORS:

Michael E. Bender, Head, Division of Environmental Science and Engineering
Kenneth L. Marcellus, Associate Marine Scientist
Mark Luttrell, Assistant Marine Scientist

PROJECT SUMMARY:

The intent of this study is to determine the movement and general behavior of surface currents in the Atlantic Ocean off Dam Neck, Virginia, in order that constant, seasonal, or periodically recurring drift patterns can be identified and evaluated. Ultimately, this information will facilitate prediction of onshore points of return for suspended or dissolved materials released on the Atlantic Shelf off southeastern Virginia.

Surface drifter devices are dropped at 3,000 feet interval stations up to two miles off the coast each month. By comparison of recovery location and frequency with respect to prevailing winds for the period adrift, general surface currents in the area and their dependence on atmospheric conditions can be determined.

STATUS: This project is entering its terminal phase.

FINANCIAL SUPPORT:

Hampton Roads Sanitation District Commission
Virginia Institute of Marine Science
PROJECT TITLE: NITROGEN CYCLE IN ESTUARIES AND OTHER COASTAL ZONE MARINE ENVIRONMENTS

INVESTIGATOR:

Kenneth L. Webb, Associate Marine Scientist

PROJECT SUMMARY:

The long term projected goal is to model the cyclic flow of nitrogen in shallow water marine environments, especially those estuarine in nature. Standing concentrations, flux, and turnover times of various nitrogen compounds are being determined. The influence of various environmental and biological parameters is being investigated and basic hypotheses related to the operation of the cycle are being tested. Preliminary modeling of the system is planned.

Qualitative and quantitative information on free amino acids in the York River seasonally and from numerous depths and latitudes have been assembled. Both the supplying and utilizing organisms for dissolved free amino acids have been investigated, and results have been presented in several publications. Changes in ammonia, nitrate, dissolved organic and particulate organic nitrogen in water flowing over a coral reef have been determined. This latter aspect of the work is being extended to Chesapeake Bay and the resulting hypotheses tested.

STATUS: Active.

FINANCIAL SUPPORT:

National Science Foundation
(Coral reef studies in collaboration with R. E. Johannes and W. J. Wiebe of the University of Georgia)
(Estuarine cycle support - pending)
Virginia Institute of Marine Science
PROJECT TITLE: **METABOLITES OF NORMAL AND DISEASED MARINE ORGANISMS**

INVESTIGATORS:

Paul L. Zubkoff, Department Head and Senior Marine Scientist
I. Paperna *

PROJECT SUMMARY:

The serum of marine organisms with known pathological disorders is analyzed for "low molecular weight" metabolites which may be an aid in

(1) Diagnosing the type of pathology,
(2) Identifying the organism's state of health,
(3) Establishing basic parameters for identifying the effects of a perturbed environment on the organism.

STATUS: Active.

FINANCIAL SUPPORT:

National Science Foundation
Virginia Institute of Marine Science

* I. Paperna, NSF Senior Foreign Scientist Fellow, Parasitology Section, Department of Microbiology-Pathology
PROJECT TITLE: PLANKTONIC FOOD CHAINS

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 quantitated 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: Active.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science
PROJECT TITLE: SERUM CHEMISTRY OF THE COMMERCIALLY IMPORTANT MARINE ORGANISMS

INVESTIGATORS:

Maurice P. Lynch, Associate Marine Scientist
Kenneth L. Webb, Associate Marine Scientist
James Colvocoresses, Graduate Assistant

PROJECT SUMMARY:

Variation of some of the serum constituents of the blue crab, Callinectes sapidus, is being studied for the purpose of determining if any of these various constituents can be used as indicators of physiological condition of the blue crab populations and subpopulations, if such are present, in the Chesapeake Bay.

Screening of serum constituents of other marine invertebrates (the rock crab, Cancer irroratus, and the oyster, Crassostrea virginica, in particular) is done on an irregular basis.

STATUS: Continuing. Variation of serum chloride, glucose, total protein, total ninhydrin positive substances, and osmotic concentration in the blue crab has been described in Lynch's dissertation (February 1972) entitled "Variations in Some Serum Constituents of the Blue Crab, Callinectes sapidus." This information is being submitted for publication. Variation of total lipid, sodium, potassium, magnesium, calcium, copper, zinc, mercury, and cadmium in the blue crab is presently being studied in preserved samples. Laboratory studies of specific stress effects are underway. The portion of the project dealing with variation in copper and zinc represents a portion of Colvocoresses' thesis research.

FINANCIAL SUPPORT:

National Oceanographic and Atmospheric Administration (Office of Sea Grant Programs) (1969-1971)
U. S. Public Health Service (Biomedical Sciences Support Grant to the University of Virginia) (present)
Virginia Institute of Marine Science
PROJECT TITLE: SIGNIFICANCE OF MICROFLAGELLATES IN THE OUTWELLING PHENOMENA

INVESTIGATORS:

Kenneth L. Webb, Associate Marine Scientist
Leonard Haas, Assistant Marine Scientist

PROJECT SUMMARY:

Outwelling from bays and estuaries is thought to have considerable impact upon adjacent coastal waters. Nutrients that are concentrated and recycled by estuaries come to a large degree from the ocean and, in contrast, the excess of organic productivity of the fertile estuaries is exported to the adjacent less fertile oceans. Export from bays such as on the Virginia Eastern Shore is often greater than from river-fed estuaries. Organic materials exported can be either in the form of living plankton or of detritus and contribute to the secondary productivity of the coastal waters. In other words, the exported materials may be dead, previously produced materials, or living organisms in the process of producing additional materials. It would clearly be of significance to evaluate the amount of export in outwelling, its destination (i.e., coastal waters or the next inlet downstream), and its effect upon the recipient environment. It would also be ideal if the flow of matter and energy could be described by remote sensing.

The inverse size metabolism relationship holds for most organisms for respiratory metabolism. There is also some evidence that indicates autotrophic microflagellates often dominate primary productivity even when their contribution to the total biomass is small, and that a larger fraction of this production may be released in the soluble form than from larger autotrophs. We propose to isolate a number of autotrophic flagellates of varying sizes from Eastern Shore bays, inlets, and offshore, and test the hypothesis that microflagellates are capable of higher rates of photosynthesis (fixed carbon per unit effective pigment) and greater loss rates of dissolved organics than larger organisms. Pigment signatures will also be determined of the cultured organisms, and, after the metabolically dominant forms are determined, the feasibility of remote sensing of these organisms can be tested. The ultimate aim is directed toward gathering the basic biological information needed to evaluate the impact of outwelling on Virginia coastal waters.

It has been proposed that flagellates, both pigmented and non-pigmented, associated with detritus particles are major contributors to nutrient regeneration (N, P). We propose to
PROJECT SUMMARY (Cont'd):

isolate and culture some of these organisms from export detritus particles and to investigate their mode of nutrition, i.e., whether it is from ingested bacteria or from uptake of dissolved organic matter.

STATUS: Active.

FINANCIAL SUPPORT:

National Aeronautics and Space Administration
Virginia Institute of Marine Science
PROJECT TITLE: CONTROL MEASURES FOR CHESAPEAKE BAY JELLYFISHES: BIOCHEMICAL STUDIES

INVESTIGATORS:

Paul L. Zubkoff, Department Head and Senior Marine Scientist
Alan Lin, Graduate Assistant

PROJECT SUMMARY:

The identification and quantitation of the lipid components of jellyfish polyps and newly liberated ephyrae will be continued. Studies on the proteins and lipoproteins of jellyfish membranes will continue. Studies of biosynthetic mechanisms of actively regenerating tissues of jellyfish will be continued.

STATUS: The major classes of neutral lipids have been separated by thin layer chromatography and gas liquid chromatography. This is a subproject of "Control Measures for Chesapeake Bay Jellyfishes."

FINANCIAL SUPPORT:

National Oceanic and Atmospheric Administration
(National Marine Fisheries Service)
Virginia Institute of Marine Science
PROJECT TITLE: CONTROL MEASURES FOR CHESAPEAKE BAY JELLYFISHES: DEVELOPMENTAL STUDIES

INVESTIGATOR:

Robert E. Black *

PROJECT SUMMARY:

Temperature conditioned polyps and polyps in early and late strobilation will be examined for the formation of unique subcellular structures associated with this reproductive process. These developmental studies will provide insight into the mechanisms of strobilation.

STATUS: Active. This is a subproject of "Control Measures for Chesapeake Bay Jellyfishes."

FINANCIAL SUPPORT:

National Oceanic and Atmospheric Administration (National Marine Fisheries Service)

* Dr. Robert E. Black, Professor of Biology, College of William and Mary, Williamsburg, Virginia and VIMS Summer Professor, Department of Environmental Physiology
PROJECT TITLE: CONTROL MEASURES FOR CHESAPEAKE BAY JELLYFISHES: THE ROLE OF IODINE IN STROBILATION OF JELLYFISH POLYPS

INVESTIGATORS:

Kenneth L. Webb, Associate Marine Scientist
Janet Olmon, Graduate Assistant

PROJECT SUMMARY:

The requirements and role of iodine and compounds related to iodine metabolism (thyroxine, tyrosine, and possibly others) in scyphozoan (Chrysaora quinquecirrha, Cyanea capillata, and Aurelia aurita) are being investigated by means of labelled iodine isotopes. Emphasis is being placed on comparison of uptake and metabolism of iodine in strobilating versus non-strobilating polyps in hope of elucidating triggering mechanisms of strobilation. In addition, the incorporation of iodine into the chitinous wall of podocysts is being studied.

STATUS: Active. This is a subproject of "Control Measures for Chesapeake Bay Jellyfishes." This project represents Olmon's thesis research.

FINANCIAL SUPPORT:

National Oceanic and Atmospheric Administration (National Marine Fisheries Service)
Virginia Institute of Marine Science
PROJECT TITLE: NEUTRON ACTIVATION ANALYSIS OF CHESAPEAKE BAY SEDIMENTS

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 will be subjected to a neutron flux of $2 \times 10^{11}$ neutrons cm$^{-2}$ sec$^{-1}$ for either 5 minutes or 2 hours.

The resulting gamma-ray spectra will be analyzed using NaI (Tl) crystal for the measurement of Na, Mn, La, and Sc content.

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

STATUS: Active.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science

*Walter E. Carey, Director, Nuclear Reactor Laboratory, Ohio State University, Columbus, Ohio
PROJECT TITLE: PRODUCTIVITY MEASUREMENTS OF THE LOWER CHESAPEAKE BAY

INVESTIGATORS:

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

PROJECT SUMMARY:

The primary productivity of the lower Chesapeake Bay, particularly a transect of the York Spit area and of Mobjack Bay, are under surveillance in conjunction with studies on the "red water" occurrence and development.

STATUS: Active. Preliminary reports have been presented:


This is a subproject of the Emissions and Additions Program of "Chesapeake Bay Research" of the Chesapeake Research Consortium, Inc.

FINANCIAL SUPPORT:

National Science Foundation
(RANN Program)
Virginia Institute of Marine Science
PROJECT TITLE: DISTRIBUTION AND ABUNDANCE OF DISSOLVED FREE AMINO ACIDS (DFAA) IN MARINE SYSTEMS

INVESTIGATOR:

Kenneth L. Webb, Associate Marine Scientist

PROJECT SUMMARY:

This project was designed to determine the quantities of DFAA in the marine and estuarine environments and their possible variation in time. Sampling was to be performed in the world's oceans at various depths as opportunities were presented and at weekly intervals from the VIMS pier for two years.

STATUS: Data gathering has been completed, a methods paper has been published and another utilizing the method. Data is grouped into two sections for publication: York River seasonal variation and world ocean values by depth and latitude. York River data has been presented at a national meeting.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science
PROJECT TITLE: INTERNAL MECHANISMS OF DFAA REGULATION IN MARINE ORGANISMS

INVESTIGATOR:

Kenneth L. Webb, Associate Marine Scientist

PROJECT SUMMARY:

This project is to determine some of the major relationships affecting the internal pools of free amino acids (FAA) in marine organisms. Major first emphasis is on the relationship with environmental salinity and the sources and fates of FAA that increase or decrease in concentration with salinity.

STATUS: Continuing.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science
PROJECT TITLE: THE METABOLISM OF FREE AMINO ACIDS INVOLVED IN THE ISOSMOTIC INTRACELLULAR REGULATION OF MARINE BIVALVE MOLLUSKS

INVESTIGATORS:

Kenneth L. Webb, Associate Marine Scientist
William DuPaul, Graduate Assistant

PROJECT SUMMARY:

The primary objective is to determine how free amino acids (FAA) are synthesized for isosmotic intracellular regulation in marine invertebrates. Three marine mollusks (Mercenaria mercenaria, Mya arenaria, and Spisula solidessma) all accumulate alanine when subjected to conditions of increased salinity, and this accumulation is related to the available aspartic acid. Thus, the main direction of this research project is to determine how aspartic acid is involved in the synthesis of alanine when the latter is being used as an isosmotic effector. The most practical approach to this problem involves the use of C-14 labelled compounds in delineating the metabolic pathways involved.

The research involves three parts. First, it must be determined if isolated gill tissue incubated in artificial sea water at both 18% and 30% salinity behave as gill tissue in intact animals. The FAA in isolated gill tissue will be measured after short periods of incubation in artificial sea water to determine if significant quantities of FAA can be accumulated. Also, it would be a good opportunity to determine the effects of anaerobic conditions on the process of FAA accumulation, as both Mya and Mercenaria are frequently subjected to such environmental conditions.

Second, the activities of aspartate and alanine aminotransferases will be determined, and the effect of salinity on the enzyme activities will be noted.

Lastly, gill tissues will be incubated with C-14 labelled aspartic acid. Because of the implicated decarboxylation of aspartic acid or its keto precursor oxaloacetic acid, the use of differentially labelled (C-1 and C-4) aspartic acid will be of value in tracing the metabolic pathway involved.

STATUS: This project represent DuPaul's dissertation research. All the research described above has been completed, and the results are currently being evaluated.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science
PROJECT TITLE: ULTRAPLANKTON HETEROTROPHY IN CHESAPEAKE BAY

INVESTIGATORS:

Kenneth L. Webb, Associate Marine Scientist
Leonard Haas, Assistant Marine Scientist

PROJECT SUMMARY:

Various lines of evidence indicate that a much overlooked assemblage of organisms, the ultraplankton, because of their large numbers and small size, may make a greater metabolic contribution to the plankton community than the larger net plankton which are easier to observe. Their small size, 0.5-10 microns, and fragile nature have resulted in almost a complete lack of information regarding their taxonomy, ecology, and physiology.

Although much recent work of Wright and Hobbie (Ecology, 1966, 47: 457-464), as well as others, indicates that bacteria and not algae are responsible for the uptake of dissolved organics from sea water, the ultraplankton are comparable in size to some bacteria and have similar surface-to-volume ratios. They may thus be competitive in membrane phenomena such as uptake of dissolved materials. The reports of apparently viable, pigmented phytoplankton below the photic zone (e.g., Fournier, 1966, Science 153: 1250-1252) are difficult to explain if they are not heterotrophs living on dissolved organic matter. Other reports of high numbers of non-pigmented ultraplankton in oceanic waters (e.g., Pomeroy and Johannes, Deep Sea Research 13: 971-973) suggest an important ecological role for these obviously heterotrophic organisms.

Exploratory evaluations of the role of both pigmented and non-pigmented ultraplankton in the cycling of dissolved organic matter, especially free amino acids, in estuarine waters will be made. Cultures of some of the more common species will be developed. The cultured organisms will then be evaluated both for their ability to remove C-14 labelled dissolved substrates (i.e., amino acids) from solutions containing the substrates at naturally occurring concentrations and for their ability to utilize ingested bacteria as a source of nutrition.

STATUS: This project represents Haas' dissertation research.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science
OTHER GEOGRAPHICAL AREAS
PROJECT TITLE: BIOGEOGRAPHY OF CAPE HATTERAS AREA

INVESTIGATORS:

John 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

* J. D. Lazell, Massachusetts Audubon Society
PROJECT TITLE: TRANSLATIONS OF MONOGENETIC TREMATODE LITERATURE

INVESTIGATORS:

William J. Hargis, Jr., Institute Director
David E. Zwerner, Acting Section Head and 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.

At the present time, Dr. John E. Simmons is editing two rather lengthy translations (Ivanov, 1952 and Bychowsky, 1937) for inclusion in our VIMS Translations Series.

Another long translation (Gussev, 1955) is being readied by Section personnel for publication in the not too distant future.

STATUS: Continuing.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science

* Dr. John E. Simmons, Department of Zoology, University of California, Berkeley, California
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, Acting Section Head and Assistant Marine Scientist

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 the data in the Key Sort "memory core" will conceivably yield:

(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.

By-products of this research have resulted in the translation and publication of numerous important foreign works on the Monogenea, the compilation of a bibliography, and many collections from various localities. A Ph.D. dissertation (Lawler, 1971) on the host-specificity and zoogeography of a superfamily of monogenetic trematodes has also resulted. It will be published soon as a VIMS publication.
STATUS: VIMS funds are supporting accessioning of literature on Monogenea and its processing for inclusion in the Key-Sort card system. Maintaining the library and "data bank" is a continuing operation.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science
PROJECT TITLE:  BIBLIOGRAPHY OF THE MONOGENETIC TREMATODE LITERATURE OF THE WORLD, 1758 TO PRESENT

INVESTIGATORS:

William J. Hargis, Jr., Institute Director
David E. Zwerner, Acting Section Head and 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. Since the basic Bibliography was published in September 1969, it has received wide acclaim from workers in the field. It is hoped to keep the Bibliography current with annual supplements. Supplement 1 to the Bibliography was published in February 1970, and Supplements 2 and 3 were published in March 1971 and 1972 respectively.

STATUS:  Continuing.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science

* Dr. Adrian R. Lawler, Parasitology Department, Gulf Coast Research Laboratory, P. O. Drawer AG, Ocean Springs, Mississippi
PROJECT TITLE: STUDIES ON THE MONOGENEAN FAUNA OF AFRICAN INLAND WATER FISHES

INVESTIGATOR:

Ilan E. Paperna *

PROJECT SUMMARY:

This study includes the taxonomy, description, and review of over 100 species of monogenetic trematodes. Their distribution, zoogeography, and host-parasite relationships are also covered.

STATUS: Project is in final stages of data processing.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science

* Ilan E. Paperna, NSF Senior Foreign Scientist Fellow
PROJECT TITLE: STUDIES ON DISEASES AND INFECTIONS IN FISH POPULATIONS OF EAST AFRICAN LAKES

INVESTIGATOR:

Ilan E. Paperna *

PROJECT SUMMARY:

This work includes a study of the dynamics of parasite populations in fishes, particularly fry and fingerlings, their effect on the host, survival, growth (condition factor), and pathology. An attempt to estimate the effect of parasitic infections on the rate of so-called "natural mortality" of fishes in the lake environment is made.

STATUS: Project is in final stages of data processing.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science

* Ilan E. Paperna, NSF Senior Foreign Scientist Fellow
PROJECT TITLE: PARASITIC COPEPODS FROM MARINE FISHES OF NEW ZEALAND AND AUSTRALIA

INVESTIGATORS:

William J. Hargis, Jr., Section Head and 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 New Zealand and Australia under the direction of Dr. W. J. Hargis, Jr. Parasitic copepods are as interesting as they are economically important and, though not as host specific as monogenetic trematodes, may prove valuable in studying some aspects of host-parasite relationships.

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. Processing, involving whole mounts, dissections, and systematic descriptions is underway.

STATUS: Continuing.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science

* Dr. G. C. Hewitt, Victoria University of Wellington, Wellington, New Zealand, is to co-author one or two papers with Zwerner.
PROJECT TITLE: PARASITES FROM INDIAN OCEAN FISHES WITH EMPHASIS ON MONOGENETIC TREMATODES, THEIR SYSTEMATICS, ECOLOGY, AND PHYLOGENY

INVESTIGATORS:

William J. Hargis, Jr., Section Head and Institute Director
David E. Zwerner, Assistant Marine Scientist
Robin M. Overstreet *

PROJECT SUMMARY:

Even though several Indian workers are actively engaged in work on monogenetic trematodes as well as other fish parasites, considerable ignorance exists concerning the parasite fauna of coastal and deep-sea fishes of the Indian Ocean. Increased knowledge of the Monogonea from these important areas is essential to the Parasitology Section's project on the systematics, host-specificity, zoogeography, and phylogeny of the Monogenea. Many of the trematodes from fishes of these areas will undoubtedly be new to science, and their systematic innovations will shed much light on the relations of one group to another.

Thus, from March 1963 through November 1964, our field collectors participated in IIOE cruises 1, 2, 4B, 5, and 8. Collections were made using the mass collection techniques developed by Hargis. The great amount of material resulting from these collections has to be processed for study.

An additional collection was made from waters around the island of Madagascar by Dr. Roger F. Cressey (now at the U. S. National Museum, Washington, D. C.). This material, when worked up, will make an interesting addition to our other parasites from the Indian Ocean.

Dr. Overstreet has been sent the Digenea material from cruise 4B and will work on other digenea of this collection as soon as the material can be culled out and outstanding host identifications made.

STATUS: Active.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science

* Dr. Robin M. Overstreet, Gulf Coast Research Laboratory, Ocean Springs, Mississippi
PROJECT TITLE: MONOGENETIC AND DIGENETIC TREMATODES OF THE MIDDLE CONTINENTAL SHELF OFF WEST AFRICA

INVESTIGATORS:

William J. Hargis, Jr., Section Head and Institute Director
David E. Zwerner, Assistant Marine Scientist
Robin M. Overstreet *

PROJECT SUMMARY:

Information on the parasite fauna of fishes from the western, southern, and eastern coasts of Africa is very sketchy, especially data on monogenetic trematode parasites of the deep water fishes known to be found in those areas. Knowledge of the Monogenea from this area should fill in a great deal of the gaps that exist in the taxonomy of these parasites and shed much light on host and parasite relationships, so important to our present study of host-specificity. Fortunately, the co-investigator was given the opportunity to participate in the Equalant I program, collecting fishes on cruise 2 of the R/V Geronimo in the fall of 1963.

A total of 1044 fishes was collected utilizing the mass collection technique developed by Hargis. As it now stands, 46% of the hosts have been examined yielding about 660 monogenetic trematodes, not to mention the other parasites found. 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. Work continues as funds become available.

The Digenea were shipped to Dr. Overstreet in November 1971. He will work up these specimens in conjunction with some of his own material from Africa.

STATUS: No outside funds are available to process the Monogenea from this collection. VIMS funds are used to maintain that portion of the collection here.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science

* Dr. Robin M. Overstreet, Gulf Coast Research Laboratory, Ocean Spring, Mississippi
PROJECT TITLE: PARASITES OF VERTEBRATES (MOSTLY FISHES) FROM THE ANTARCTIC AND SOUTHERN PACIFIC OCEANS WITH EMPHASIS ON THE SYSTEMATICS AND HOST-SPECIFICITY OF MONOGENETIC TREMATODES

INVESTIGATORS:

William J. Hargis, Jr., Section Head and 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 sparse. 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; Wildmill 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, three M.A. theses, and one Ph.D. dissertation have resulted.

STATUS: Works in various stages of preparation include the following in the Australian area:

STATUS (Cont'd):

(2) Three or four papers on the capsoloid Monogenea of Australia with A. R. Lawler as senior author and W. J. Hargis, Jr., as junior author on all or some of the papers.
(a) Benedeniinae of Australia,
(b) Monocotylinae of Australia,
(c) Encotyllabinae of Australia, and
(d) Rest of capsaloid species of Australia.

Reports involving Antarctica area, Palmer Station Include:

(1) Overstreet, R. M. Digenetic trematodes of fishes of the Antarctic peninsular area.
(2) Suydam, E. L. Ectoparasites of fishes of the Antarctic peninsular area. [from Suydam's (1972) M.A. thesis]

All of the Monogenea from McMurdo, Wilkes Station, and New Zealand have been worked up systematically. The Australian Monogenea, and all the ectoparasites and the digenetic trematodes from Palmer Station are receiving most of the attention now. The Chile and Drakes Passage Monogenea have not received systematic attention.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science

* Dr. William A. Dillon, Department of Biological Sciences, University of Tennessee, Martin, Tennessee
* Dr. Adrian R. Lawler, Parasitology Department, Gulf Coast Research Laboratory, Ocean Springs, Mississippi
* Dr. Robin M. Overstreet, Parasitology Department, Coast Research Laboratory, Ocean Springs, Mississippi
* Mr. E. Lynn Suydam, Rappahannock Community College, Glenns, Virginia
PROJECT TITLE: MONOGENETIC TREMATODES OF FISHES OF PUERTO RICO

INVESTIGATORS:

William J. Hargis, Jr., Section Head and Institute Director
David E. Zwerner, Assistant Marine Scientist

PROJECT SUMMARY:

In order to obtain additional knowledge of the Monogenea of fishes from the waters surrounding North America, a collection of fishes and their parasite complement was made in 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 much light on the relations of one taxon to another.

Collections were made using the mass collection technique developed by Hargis. Much of the material resulting from this collection was processed for study. Host-parasite data will be incorporated into our host-specificity file enabling us to better understand the Monogenea as a whole.

STATUS: Only a part of the monogenetic trematode specimens have been mounted for study. This collection has a low priority and work involves maintenance of the collection.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science
PROJECT TITLE: DESCRIPTION OF PAGURIDAE COLLECTED BY THE INTERNATIONAL INDIAN OCEAN EXPEDITION

INVESTIGATORS:

Marvin L. Wass, Associate Marine Scientist
Philip Witherington, Graduate Student

PROJECT SUMMARY:

This project consists of the examination and description of the specimens of Paguridae collected by the International Indian Ocean Expedition, principally by the R/V "Anton Bruun", Cruises 7, 8, and 9. These specimens were processed by the Smithsonian Oceanographic Sorting Center and shipped to Dr. M. L. Wass, VIMS. A resume of the species and collecting localities will be compiled. Descriptions of new species will be provided and a complete analysis of the zoogeographical aspects of the Indian Ocean Paguridae will be attempted.

STATUS: This project represents Witherington's dissertation research.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science
PROJECT TITLE: HYDROIDS OF CAPE COD BAY, MASSACHUSETTS

INVESTIGATOR:

Dale R. Calder, Associate Marine Scientist

PROJECT SUMMARY:

Identifications are being made on a collection of hydroids taken in Cape Cod Bay under the Systematics-Ecology Program, Marine Biological Laboratory. Descriptions and illustrations of the species are to be prepared and the zoogeographic affinities of the fauna analyzed.

STATUS: Active.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science
PROJECT TITLE: HYDROIDS FROM THE COASTAL WATERS OF GEORGIA

INVESTIGATOR:

Dale R. Calder, Associate Marine Scientist

PROJECT SUMMARY:

A collection of hydroids from Georgia waters has been obtained from the University of Georgia Marine Institute, Sapelo Island. Species identification will proceed as time permits.

STATUS: Preliminary.

FINANCIAL SUPPORT:

Virginia Institute of Marine Science
APPENDIX I

Appendix I is a listing of locations of those staff and students who are no longer with VIMS but whose work was described in the 1971 Edition of this Volume.

Staff:


Joseph, Edwin B. (Resigned July, 1971) Director, South Carolina Marine Resources Research Laboratory, Charleston.


Students:

Bayly, Maxine. (Leave of absence) Teacher, York High School, Yorktown, Virginia.

Burbidge, Richard G. (Completed requirements for Ph.D., June, 1972) Peace Corps, Chile.

Cain, Thomas D. (Completed requirements for Ph.D., June, 1972) Atomic Energy Commission, Bethesda, Maryland.

Dietz, Marsha. (Completed requirements for M.A., February, 1972) Ph.D. Program, University of Georgia, Athens.


Elder, Robert. (Completed requirements for M.A., February, 1971) U. S. Coast Guard Oceanographic Unit, Washington, D. C.


Harleston, Kathleen. (Completed requirements for M.S., August, 1971) Teacher, York Academy, Shacklefords, Virginia.

Ingram, Carey. (Leave of absence) U. S. Navy Oceanographic Office, San Diego, California.

Lawler, Adrian R. (Completed requirements for Ph.D., August, 1971) Post-doctoral fellow, Gulf Coast Research Laboratory, Ocean Springs, Mississippi.

Leonard, Sally B. (Now Sally L. Richardson; completed requirements for Ph.D., February, 1972) Oregon State University, Corvallis.

Lyczkowski, Joanne. (Completed requirements for M.A., February, 1971) Ph.D. Program, University of Maine Marine Laboratory.

Orth, Robert J. (Completed requirements for M.S., August, 1971) Ph.D. Program, University of Maryland, Solomons.

Pickett, Robert. (Completed requirements for Ph.D., August, 1971) U. S. Naval Oceanographic Office, Washington, D. C.


Richardson, Michael D. (Completed requirements for M.A., August, 1971) Ph.D. Program, Oregon State University, Corvallis.

Sandifer, Paul A. (Completed requirements for Ph.D., June, 1972) Marine Scientist, South Carolina Marine Resources Research Laboratory, Charleston.
APPENDIX II
PROJECTS COMPLETED SINCE 1971 EDITION

DEPARTMENT OF CRUSTACEOLOGY

1. Determination of Salinity Tolerance of Blueback Herring, Alosa aestivalis.


4. Morphology and Ecology of Chesapeake Bay Decapod Larvae.
   Sandifer, Paul A. "Morphology and Ecology of Chesapeake Bay Decapod Crustacean Larvae," VIMS Dissertation (University of Virginia).

5. Post-Larval Growth and Reproductive Biology of Neopanope texana Sayi.
   Swartz, Richard C. "Post-Larval Growth and Reproductive Biology of the Xanthid Crab, Neopanope texana Sayi," VIMS Dissertation (College of William and Mary).
1. Biology and Management of River Herring and Shad - II.


3. The Role of Chemical Stimuli in the Pre-Spawning Behavior of Chasmodes bosquianus.


6. Development of Citharichthys arctifrons and Etropus microstomus in Chesapeake Bay.

   Leonard, Sarah B. "Larvae and Young of the Western North Atlantic Bothid Flatfishes Etropus microstomus (Gill) and Citharichthys arctifrons Goode in the Chesapeake Bight," VIMS Dissertation (College of William and Mary).
DEPARTMENT OF ICHTHYOLOGY (Cont'd)

7. Age and Growth of the Northern Puffer, Sphoeroides maculatus, from Chesapeake Bay.

Lyczkowski, Joanne M. "Age and Growth of the Northern Puffer, Sphoeroides maculatus (Bloch and Schneider)," VIMS Thesis (College of William and Mary).


Markle, Douglas F. "Benthic Fish Associations on the Continental Slope of the Middle Atlantic Bight," VIMS Thesis (College of William and Mary).

9. Age and Growth of Silver Perch (Bairdiella chrysura).

Rhodes, Scott F. "Age and Growth of Silver Perch (Bairdiella chrysura)," VIMS Thesis (College of William and Mary).

10. Age, Growth, and Mortality of the White Perch in the James and York Rivers.


DEPARTMENT OF MICROBIOLOGY-PATHOLOGY

1. Vertical Distribution of Phytoplankton in Relation to the Effects of Surface Adsorption of Monomolecular Films.

Gibson, Victoria R. "Vertical Distribution of Estuarine Phytoplankton in the Surface Microlayer and at One Meter and Fluctuations in Abundance Caused by Surface Adsorption of Monomolecular Films," VIMS Thesis (University of Virginia).
Parasitology Section

1. Zoogeography and Host-Specificity of the Superfamily Capsaloidea.

Lawler, Adrian R. "Zoogeography and Host-Specificity of the Superfamily Capsaloidea Price, 1936 (Monogenea: Monopistocotylea)," VIMS Dissertation (College of William and Mary).

2. Ectoparasites from Fishes of Arthur Harbor, Antarctica.


DEPARTMENT OF PHYSICAL OCEANOGRAPHY AND HYDRAULICS

1. Steadiness and Repeatability in an Estuarine Hydraulic Model.


DEPARTMENT OF GEOLOGICAL OCEANOGRAPHY


2. **Storm Erosion Prediction on Virginia's Atlantic Shoreline.**


3. **Effects of Hurricane Camille on Water Structure at Bay Mouth.**


4. **Investigation of Surface Films--Chesapeake Bay Entrance.**

a. **Concentration of Chlorinated Hydrocarbon Pesticides in Surface Films.**


b. **Chemical Composition of Surface Waters (60 Micron Layer).**


5. **Dissolution Studies of Clay Minerals into Sea Water.**

Lake, Carol. "Dissolution Rates of Silica Sources in Sea Water," VIMS Thesis (College of William and Mary).

**DEPARTMENT OF APPLIED MARINE BIOLOGY**

1. **An Investigation of the Effects of Starch Supplements on the Glycogen Content of Ribbed Mussels and Hard Clams.**

1. Distribution and Structure of Benthic Communities in the Hampton Roads Area, Virginia.

Boesch, Donald F. "Distribution and Structure of Benthic Communities in a Gradient Estuary," VIMS Dissertation (College of William and Mary).

2. Benthic Macroinvertebrate Communities as Indicators of Pollution in Hampton Roads, Virginia.

Richardson, Michael D. "Benthic Macroinvertebrate Communities as Indicators of Pollution in the Elizabeth River, Hampton Roads, Virginia," VIMS Thesis (College of William and Mary).


4. VEPCO--Effects of Thermal Shock on Mollusk Larvae.

Diaz, Robert J. "Effects of Thermal Shock on Larvae of the Oyster, Crassostrea virginica (Gmelin)," VIMS Thesis (University of Virginia).

5. The Effects of Chlorine and Thermal Shock on Estuarine Copepods.


6. Gloucester County Shoreline Survey.


7. The Role of an Anadromous Fish, the Alewife (Alosa pseudoharengus, Wilson) in Pesticide Transport.

Barnard, Thomas A., Jr. "The Role of an Anadromous Fish, the Alewife Alosa pseudoharengus (Wilson) in Pesticide Transport," VIMS Thesis (College of William and Mary).
8. **Community Distribution and Structure of Benthos in a Gradient Estuary.**

Boesch, Donald F. "Distribution and Structure of Benthic Communities in a Gradient Estuary," VIMS Dissertation (College of William and Mary).

9. **Benthic Infauna of Zostera Beds.**

Orth, Robert J. "Benthic Infauna of Eelgrass, Zostera marina, Beds," VIMS Thesis (University of Virginia).
APPENDIX III

PROJECTS LISTED IN 1971 EDITION BUT NOT INCLUDED IN THIS EDITION

DEPARTMENT OF CRUSTACEOLOGY

1. Morphology of Decapod Larvae from Plankton Samples of Chesapeake Bay with Emphasis on the Distribution of Emerita talpoida and Lepidopa (Anomura).

Hunter, H. Ellen (with W. A. Van Engel). This project represented preliminary work and was terminated upon selection of a thesis research topic, "Ecology of Emerita talpoida and the Influence of Environmental Factors on the Distribution of Larvae," described in this edition.

2. Morphology and Distribution of the Decapod Megalopae of the Chesapeake Bay Area.

Laird, Chae E. (with W. A. Van Engel). This project represented preliminary work and was terminated upon selection of a thesis research topic, "Oxygen Consumption of the Blue Crab, Callinectes sapidus Rathbun" described in this edition.

DEPARTMENT OF ENVIRONMENTAL PHYSIOLOGY

1. A Multidisciplinary Study of the Scyphozoan Jellyfishes of Lower Chesapeake Bay.

Joseph, E. B., Dexter Haven, et al. This project is being continued under another title, "Control Measures for Chesapeake Bay Jellyfishes."


Zubkoff, Paul L. This project has been combined with "Productivity Measurements of the Lower Chesapeake Bay."


Webb, Kenneth L. This project has been combined with "Nitrogen Cycle in Estuarine and Other Coastal Zone Environments."
DEPARTMENT OF ENVIRONMENTAL PHYSIOLOGY

4. **Physiology of Marine Tardigrades.**

Bayly, Maxine (with K. L. Webb). This project was terminated upon Mrs. Bayly's leave of absence.

DEPARTMENT OF ICHTHYLOGY

1. **Predator-Prey Relationships, Growth Rates, and Energy Transformations in Juvenile Atlantic Menhaden (Brevoortia tyrannus) in the York River, Virginia.**

Weaver, James (with W. J. Davis). This project represented preliminary work and was terminated upon selection of a dissertation research topic, "Food, Feeding Habits, Growth Rates, and Energy Transformations in Juvenile Alewife (Alosa pseudoharengus) in the James River at Hopewell, Virginia," described in this edition.

DEPARTMENT OF MICROBIOLOGY-PATHOLOGY

1. **Ultrastructural Studies of Bacteria Grown in Aqueous and Semisolid Media with Emphasis on Intercellular Spacial Orientation in Uniform and Zero Gravity Fields.**

Perkins, Frank L. This project is being continued under another title, "Studies of the Biophysical Characteristics of Bacterial Cell Surfaces."

2. **The Life Cycle and Sporulation of Labyrinthula sp.**

Amon, James P. This project represented preliminary work and was terminated upon selection of a dissertation research topic, "The Effect of the Ionic Environment of Protein Synthesis in a Marine Fungus," described in this edition.

Parasitology Section

1. **Monogenetic Trematodes of Stromateid Fishes of the World.**

Zwerner, David E., et al. This project has been combined with other sectional projects.

Orzech, Mary Ann (with A. Y. Kuo). This project represented preliminary work and was terminated upon selection of a thesis research topic, "The Long Term Variation of Salinity Intrusion into an Estuarine River," described in this edition.

DEPARTMENT OF ECOLOGY-POLLUTION

1. Special Studies on Distribution of Heavy Metals in Lower Chesapeake Bay--RANN-NSF Program.

Bender, Michael E. and R. J. Huggett. This project is being continued under the title of "Heavy Metal Distribution in Bottom Sediments of the Lower Chesapeake Bay."

2. Coordinated, Interdisciplinary Studies on Wetlands--RANN-NSF Program.

Bender, Michael E., et al. This project is being continued under the various projects supported under the Wetlands Program of the Chesapeake Research Consortium, Inc., described in this edition.
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