ADDENDUM TO: A CROSS-REFERENCED INDEX TO CURRENT (1971-1972) BIOLOGICAL AND BIOLOGY-RELATED RESEARCH ON CHESAPEAKE BAY

by

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INTRODUCTION

The U.S. Army Corps of Engineers, in their Chesapeake Bay Resource Study, needs to establish both a "dynamic benchmark" of existing biological conditions and a foundation for the capability to predict the future effects of rapidly accelerating urbanization and industrial development and other resource management decisions on the biota of Chesapeake Bay. To meet that need it is mandatory to know the extensiveness and intensiveness of research activities.

This index was prepared to summarize, identify, and cross-reference biological research in order to identify the present level of research efforts. Because of the large number of individuals and agencies involved in Bay research, the initial indexing effort was limited to the following sources for which project descriptions existed: RANN-supported research at the University of Maryland and Virginia Institute of Marine Science, The Rhode River Project, and current research (non-RANN) efforts of the Natural Resources Institute and the Virginia Institute of Marine Science. Four documents formed the primary sources, these are designated by Roman numerals as follows:

Vol. I -- The Chesapeake Bay: University of Maryland Research Outlines for the National Science Foundation Program in Research Applied to National Needs, for the Period July, 1971 - June 30, 1972, L. Eugene Cronin, R. Lamar Green and Robert W. Krauss, Principal Investigators.

Vol. II -- 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, William J. Hargis, Jr., Director. RANN (IRRPOS) Project Report No. 4 & Sea Grant Program Report No. 4 in cooperation with Langley Research Center, National Aeronautics and Space Administration, Special Scientific Report No. 49 of the Virginia Institute of Marine Science Gloucester Point, Virginia 23062, June 1971.

Vol. III - Research on the Bay: Staff and Projects Related to the Resources of Chesapeake Bay. Natural Resources Institute, University of Maryland, Chesapeake Biological Laboratory, Seafood Processing Laboratory. Reference No. 71-30: L. Eugene Cronin, Director.

Vol. IV -- Rhode River Estuary: Volume II - Interdisciplinary Research on a Watershed-Estuarine System of the Chesapeake Bay. Submitted to National Science Foundation by Smithsonian Institution in Association with the Johns Hopkins University and University of Maryland.

Note: The Rhode River project (Volume IV alone) is composed of research proposals rather than project abstracts, and initial indexing was prepared from that source. A later description of Rhode River projects has come to our attention and has been designated as Volume IV-A. This document is: "The Rhode River Research Program, January 1972." Listings in Volume IV have been cross-referred to those listed in Volume IV-A.

The present volume, the addendum, was composited by circulating project abstract forms (see pp. 57-60 of initial index) to all researchers and agencies who were known to us and who were not included in the initial effort. This additional effort produced 116 new project abstracts or about 43 percent more projects than those listed previously. The toal number of indexed projects for both indices is 384. The list is still probably not complete; nevertheless we are confident that between the original index and the addendum the large majority of Bay biological research has been inventoried.

Much of the text given in the initial index also applies to the addendum and will not be repeated here; the reader is referred to that introduction. Two important differences between the initial and addendum indices need to be explained. First is the letter-number combinations assigned to identify each project in the addendum; these are equivalent to the volume-page designations of the initial index. The alphabetic portion is a (funded) institutional abbreviation, thus "ODU-2" signifies "Old Dominion University - project description 2." Projects are listed alphabetically by project number with the institution name heading its group of projects (Section II).

A second distinction is that the addendum has a third section which contains all new project descriptions in their entirety. This adds considerable bulk to the report but also places all Bay projects (in excess of the original four source volumes) between two covers. If the descriptions were not reproduced here, they would not be available to interested individuals. Project descriptions (Section III) are in the same order as they are listed in Section II.

Acknowledgements

Many people cooperated in making project summaries and other information available; their help is appreciated. Particular thanks are due to Cathy Kerby and Frank Cockrell, who supplied information or suggested agency names and locations. Gordon Wollman and Don Meyers provided invaluable assistance by making preliminary copies of inventory information available to us. Cheryl Whitaker patiently typed and corrected the addendum; her assistance is acknowledged.

SECTION I

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SECTION II

LIST OF PROJECTS

PROJECT NUMBER	PROJECT TITLE	INVESTIGATORS
ACADEMY OF NATURAL SCIENCES OF PHILADELPHIA, BENEDICT ESTUARINE LABORATORY		
ANSP-1	Planktonic Primary Productivity in the Chesapeake Bay Estuarine System	K. Mountford R. S. Mullen
ANSP-2	Taxonomy, Seasonality, and Abundance of Plankton in the Patuxent River - from Chesapeake Bay to Freshwater	R. A. Mulford
ANSP-3	Taxonomy, Seasonality, and Abundance of Plankton in the Potomac River in the Vicinity of the Morgantown Steam Electric Station	R. A. Mulford
ANSP-4	Taxonomy, Seasonality, and Abundance of Plankton in the Chesapeake Bay in the Vicinity of the Calvert Cliffs Nuclear Power Plant	R. A. Mulford
ANSP-5	Blue Crab	G. Abbe
ANSP-6	Oyster Tray Studies	G. Abbe
ANSP-7	Oyster Bed Studies	G. Abbe
ANSP-8	Substrate Studies	G. Abbe
ANSP-9	Radionuclide Determinations in the Vicinity of Calvert Cliffs, Maryland	R. I. McLean
ANSP-10	Concentration and Seasonality and Distribution (Horizontal and Vertical) of Water Chemical Species in the Chesapeake Bay in the Vicinity of Baltimore Gas & Electric Nuclear Power Plant	W. I. Simmonds, Jr.
ANSP-11	Concentration and Seasonality of Water Chemical Species in the Potomac River in the Vicinity of the Morgantown Fossil-Fueled Electric Station	W. I. Simmonds, Jr.
ANSP-12	Concentration, Seasonality, and Distribution (Horizontal and Vertical) of Water Chemical Species in the Patuxent River from Chesapeake Bay to Freshwater	W. I. Simmonds, Jr.

PROJECT NUMBER	PROJECT TITLE	INVESTIGATORS
CHESAPEAKE BAY FOUNDATION, INC.		
CBF-1	Spa Creek Pollution Study	N. G. Dimsdale
COLLEGE OF WILLIAM AND MARY		
CWM-1	Temperature Fluctuations in the Substratum	C. P. Mangum W. R. Rhodes S. Otwell
CWM-2	Adaptations to Low Oxygen Conditions in Marine Invertebrates	C. P. Mangum
DEPARTMENT OF THE ARMY - EDGEWOOD ARSENAL		
DOD-EA-1	Studies of the Metabolism of Chemicals in Plants	E. G. Worthley C. D. Schott P. F. Robinson
ENVIRONMENTAL PROTECTION AGENCY		
EPA-1	Monitoring of Synthetic Pollutants in Estuaries	P. A. Butler
GEORGETOWN UNIVERSITY		
GU-1	Metabolism of Mercury Compounds in Microorganisms	R. R. Colwell
GU-2	Systematic Study of the Genus Vibrio and Related Organisms	R. R. Colwell
GU-3	Vibrio parahaemolyticus in Chesapeake Bay - Isolation, Incidence and Pathogenicity	R. R. Colwell
GU-4	Ecology and Biochemistry of Marine Bacterial Viruses	P. K. Chen
DEPARTMENT OF INTERIOR - GEOLOGICAL SURVEY		
Int-GS-1	Effects of Water Quality Changes on Estuarine Biota	R. L. Cory
JOHNS HOPKINS UNIVERSITY		
JHU-1	Cooling Water Discharge Project	J. C. Geyer L. D. Jensen

PROJECT NUMBER	PROJECT TITLE	INVESTIGATORS
JHU-2	Continuous Seismic Reflection Profiling Study of the Chesapeake Bay	J. R. Schubel D. W. Pritchard
JHU-3	Study to Assess the Importance of Gas Bubbles in the Marked Attenuation of Seismic Energy by Some Fine-Grained Sediments	D. W. Pritchard J. R. Schubel
JHU-4	The Tracing of Sand in the Chesapeake Bay Along the North Calvert Cliffs Shore of Calvert County, Maryland	T. H. Slaughter
JHU-5	Research and Study of the Chesapeake Bay	R. H. Roy R. F. Beers
JHU-6	Assessment of Information and Design of Research Program for Chesapeake Bay	M. G. Wolman
JHU-7	Framework for Resource Evaluation and Economics of Engineering Alternatives	J. C. Geyer S. Hanke J. Boland
JHU-8	Chesapeake Bay Research Planning	R. H. Roy
JOHNS HOPKINS UNIVERSITY - CHESAPEAKE BAY INSTITUTE		
JHU-CBI-1	Sedimentological Study of Modern Pollen in an Estuarine Environment	G. S. Brush J. R. Schubel
JHU-CBI-2	Support of Research Vessel Operations	D. W. Pritchard
STATE OF LOUISIANA - STATE WILDLIFE & FISH COMMISSION		
La-SWFC-1	Investigations into the Problems Associated with the Capture, Holding, Stripping, Hatching, and Rearing of Chesapeake Bay Striped Bass	A. M. Williams
La-SWFC-2	Establishment of the Chesapeake Bay Striped Bass in Louisiana	A. M. Williams
La-SWFC-3	Determination of Survival and Migrational Habits of Chesapeake Bay Striped Bass	A. M. Williams
STATE OF MARYLAND - DEPARTMENT OF CHESAPEAKE BAY AFFAIRS		
Md-CBA-1	Biologic and Environmental Control of Eurasian Milfoil (Myriophyllum spicatum L.) in Chesapeake Bay	J. H. Manning

PROJECT NUMBER	PROJECT TITLE	INVESTIGATORS
Md-CBA-2	Suspended Sediments in the Upper Chesapeake Bay - Evaluation of Methods for Size Analysis of Suspended Materials	J. H. Manning J. R. Schubel
Md-CBA-3	The Temporal and Spatial Variations in Concentration and Particle Size Distribution of Suspended Materials in the Upper Chesapeake Bay	J. H. Manning J. R. Schubel
Md-CBA-4	Comparison of Optical Properties with Direct Measurements of Concentration and Size Distribution of Suspended Materials	J. H. Manning J. Williams J. R. Schubel D. W. Pritchard
Md-CBA-5	To Investigate the Process of Bottom Sedimentation by Tidal Scour	J. H. Manning
Md-CBA-6	To Determine the Properties of the Suspended Sediment Population of Chesapeake Bay	J. H. Manning
Md-CBA-7	Determine Effects of Reservoirs Along Susquehanna River on Sediment Being Discharged into Chesapeake Bay at Havre de Grace, Md.	J. H. Manning J. R. Schubel
STATE OF MARYLAND - DEPARTMENT OF WATER RESOURCES		
Md-DWR-1	Water Quality Investigation -- Hart and Miller Islands Disposal Area	J. T. Allison
STATE OF MARYLAND - FISH AND WILDLIFE ADMINISTRATION		
Md-FWA-1	Economic Survey of Fish and Wildlife Resources and Evaluation	J. C. Horvath B. F. Halla B. M. Florence
Md-FWA-2	Pilot Marsh Study	W. R. Carter, III H. J. Speir C. H. Linert
Md-FWA-3	Survey of Anadromous Fish Spawning Areas	J. O'Dell J. Gabor H. J. King
Md-FWA-4	Estuarine Finfish Management	J. G. Boone R. F. Scott

PROJECT NUMBER	PROJECT TITLE	INVESTIGATORS
Md-FWA-5	Fish Diseases	B. L. Holden S. Dyer
Md-FWA-6	Molluscan Mortality Studies	F. W. Sieling
Md-FWA-7	Effects of Suspended Sediment on Hatching of Fish Eggs and Development of Larvae	J. R. Schubel
Md-FWA-8	Estimation of Sediment Flux - Upper Chesapeake Bay	J. R. Schubel
Md-FWA-9	Sources and Characteristics of Suspended Sediment	J. R. Schubel
Md-FWA-10	Sediment Budget for Upper Chesapeake Bay	J. R. Schubel
Md-FWA-11	Agglomeration of Suspended Particles	J. R. Schubel
Md-FWA-12	Blue Crab Study in Chesapeake Bay	S. D. Sulkin
NATIONAL AERONAUTICS & SPACE ADMINISTRATION		
NASA-1	Development of Chesapeake Bay Ecological Test Site for Remote Sensing Applications	J. F. Bettle
NATIONAL OCEANOGRAPHIC & ATMOSPHERIC ADMINISTRATION - NATIONAL MARINE FISHERIES SERVICE		
NOAA-NMFS-1	Physical and Chemical Characteristics of the Upper Chesapeake Bay	W. N. Shaw
NOAA-NMFS-2	Potential Oyster Setting Capacity - Local Areas	W. N. Shaw D. L. McQuay
NOAA-NMFS-3	Ecology and Distribution of Oysters and Clams	W. N. Shaw
NOAA-NMFS-4	Shellfish Mortality - Chesapeake Bay	C. A. Farley A. Rosenfield
NOAA-NMFS-5	Pathology - Epizootiology	C. A. Farley
NOAA-NMFS-6	Microbiology of Marine and Estuarine Invertebrates	R. R. Colwell

PROJECT NUMBER	PROJECT TITLE	INVESTIGATORS
OLD DOMINION UNIVERSITY		
ODU-1	Plankton Composition and Distribution in the Lower Chesapeake Bay, the James River Estuary, and Coastal Waters at the Mouth of the Bay	H. G. Marshall
ODU-2	Analyses of Water and Sediment Downstream of Hydraulic Dredging in the Elizabeth River	D. D. Adams
ODU-3	Navy Environment - Dynamics of Tidal Sand Waves	J. C. Ludwick D. J. Swift
DEPARTMENT OF INTERIOR - PATUXENT WILDLIFE RESEARCH CENTER		
PWRC-1	Control of Eurasian Watermilfoil: Distribution, Life History, and Ecology of Eurasian Watermilfoil	J. H. Steenis
PWRC-2	Control of Eurasian Watermilfoil: Development of Methods for Control of Eurasian Watermilfoil	J. H. Steenis
PWRC-3	Development of New Methods for Fall and Winter Appraisals of Annual Productivity of Waterfowl: Development of New Methods for Fall and Winter Appraisals of the Annual Productivity of the Blue and Snow Goose	J. J. Lynch
PWRC-4	Development of New Methods for Fall and Winter Appraisals of the Annual Productivity of Waterfowl: Development of New Methods for Fall and Winter Appraisals of the Annual Productivity of the Canada Goose	J. J. Lynch
PWRC-5	Improvement and Management of Coastal Cordgrass Marshes for Waterfowl and Other Wildlife	J. H. Steenis
PWRC-6	Description and Identification of Wetland Resources: Field Guide to Marsh and Water Plants of Eastern United States and Canada	N. Hotchkiss F. M. Uhler

PROJECT NUMBER	PROJECT TITLE	INVESTIGATORS
PWRC-7	Effects of Ingested and Implanted Lead Shot and Substitutes for Lead Shot on Waterfowl: Relative Toxicity of Lead Shot and Substitute Shot to Waterfowl	R. Andrews J. Longcore L. Locke G. Bagley
PWRC-8	Ecological Studies of Atlantic and Gulf Coastal Estuaries of Importance to Waterfowl: Reconnaissance Surveys, Information Search and Organizations	J. A. Kerwin
PWRC-9	Ecological Studies of Atlantic and Gulf Coastal Estuaries of Importance to Waterfowl: Trends in Abundance, Distribution, and Composition of Vegetation in Chesapeake Bay	J. A. Kerwin
PWRC-10	The Effects of Environmental Pollution on Waterfowl and Their Habitat: Environmental Pollutants in Field-Collected Black Duck Eggs	J. R. Longcore
PWRC-11	The Effects of Pesticides on Waterfowl and Their Habitat: Reproductive Success of Black Ducks Fed DDE in the Diet	J. R. Longcore F. B. Samson T. Whittendale
PWRC-12	The Effects of Pesticides on Waterfowl and Their Habitat: Residues of Pesticides in Field-Collected Black Duck Eggs	J. R. Longcore F. B. Samson
PWRC-13	Waterfowl Management Through Water-Level Control: Selection and Propagation of Waterfowl Food and Cover Plants	F. M. Uhler F. B. McGilvrey
PWRC-14	Waterfowl Management Through Water-Level Control	F. M. Uhler F. B. McGilvrey
PWRC-15	Improvement of Artificial Nesting Structures for Waterfowl	F. M. Uhler F. B. McGilvrey
PWRC-16	Improvement of Artificial Nesting Structures for Waterfowl: Imprinting Ducks to Artificial Nesting Structures	F. B. McGilvrey F. M. Uhler

PROJECT NUMBER	PROJECT TITLE	INVESTIGATORS
PWRC-17	Improvement of Artificial Nesting Structures for Waterfowl: Field Test of Predator-Proof Nesting Structures for Black Ducks	F. B. McGilvrey
PWRC-18	Development of Methods for Reducing Disturbance to and Predation on Waterfowl	F. M. Uhler F. B. McGilvrey
PWRC-19	Physical, Chemical, and Biological Factors Affecting Waterfowl Conditions in the Back Bay-Currituck Sound Area	J. A. Kerwin
PWRC-20	Evaluation of the Effect of the Ocean Water Intrusion into Back Bay, Virginia, and Currituck Sound, North Carolina, on the Waterfowl and Freshwater Fish Habitat	J. A. Kerwin
PWRC-21	Osprey Reproduction and Pollution in the Chesapeake Bay Region	S. N. Wiemeyer
SMITHSONIAN INSTITUTION - U.S. NATIONAL MUSEUM		
SI-NM-1	Sea Nettle Studies in Chesapeake Bay - Life History and Ecology	L. P. Schultz
SI-NM-2	Vascular Flora of Chesapeake Bay Region	S. G. Shetler D. Higman
UNIVERSITY OF MARYLAND - DEPARTMENT OF AGRICULTURAL ENGINEERING		
UM-AE-1	Engineering Principles as Applied to Oyster Processing Problems	F. W. Wheaton
UNIVERSITY OF MARYLAND - DEPARTMENT OF AGRONOMY		
UM-Agron-1	Morphological, Physical, Chemical, and Mineralogical Characteristics of Some Tidal Marsh Soils in the Patuxent Estuary	J. C. Baxter D. F. Bezdicek J. E. Foss
UNIVERSITY OF MARYLAND - DEPARTMENT OF BOTANY		
UM-Bot-1	Flora of Maryland	R. G. Brown
UM-Bot-2	Dark Carbon Fixation in Plankton and Benthos	R. A. Galloway

PROJECT NUMBER	PROJECT TITLE	INVESTIGATORS
UM-Bot-3	The Biochemistry of Light-Enhanced Acetate Uptake in Ulva	R. A. Galloway
UM-Bot-4	Effects of Sunlight on Pigmentation in Ulva	R. A. Galloway
UM-Bot-5	Lichen Flora	B. J. Grigg
UM-Bot-6	Floristics and Ecology of Assateague Island	E. A. Higgins R. D. Rappleye R. G. Brown
UM-Bot-7	Physiological Classification of Phytoplankton	R. W. Krauss
UM-Bot-8	Preparations of a Collection of the Phytobenthos of Chesapeake Bay	R. W. Krauss
UM-Bot-9	Energetics and Spectral Adaptations in Marine Algae	E. P. Karlander
UM-Bot-10	Physiology and Biochemistry of Nematodes and Nematode-Host Relationships	L. R. Krusberg
UM-Bot-11	Bryophyte Flora	A. B. Owens
UM-Bot-12	Sterols of Macroscopic Chesapeake Bay Algae	G. W. Patterson
UM-Bot-13	Seed Dormancy in Salt-Marsh Plants	R. D. Rappleye
UM-Bot-14	Positive Effects of Thermal Addition on Phytoplankton	C. Sorokin
UM-Bot-15	Extracellular Secretions Influencing the Environment	C. Sorokin
UM-Bot-16	Basic Research on Effects of Salt Deposition on Vegetation Near the Pepco Plant at Chalk Point, Md.	H. G. Gauch
UNIVERSITY OF MARYLAND - COLLEGE OF ENGINEERING		
UM-CE-1	Use of Waste Heat for Fish Farming	J. M. Marchello
UM-CE-2	Processing of Marine Products	J. M. Marchello J. W. Gentry K. K. Almenas

PROJECT NUMBER	PROJECT TITLE	INVESTIGATORS
UM-CE-3	Biological Degradation of Oil Spills	J. W. Gentry
UNIVERSITY OF MARYLAND - DEPARTMENT OF CHEMISTRY		
UM-Chem-1	Biochemistry of Estuarine Ecosystem with Emphasis on Heavy Metals and Shellfish	M. Keeney S. Lakshmanan D. L. Martin H. J. Rose J. Sampugna
UNIVERSITY OF MARYLAND - SCHOOL OF MEDICINE		
UM-Med-1	A Physical, Chemical, and Toxicological Study of the Nematocyst Fluid of Chrysaora quinquecirrha	J. W. Burnett
UNIVERSITY OF MARYLAND - DEPARTMENT OF MICROBIOLOGY		
UM-Micro-1	Isolation of Hyphomicrobiales in the Patuxent	R. M. Weiner
UM-Micro-2	Microbial Ecology of Chesapeake Bay	R. R. Colwell J. Carney J. D. Nelson, Jr. T. Staley
UNIVERSITY OF MARYLAND - WATER RESOURCES RESEARCH CENTER		
UM-WRRC-1	Investigation of the Public and Private Interests in the Development of the Chesapeake Bay Area	J. W. Longest D. F. Tuthill R. Henkel R. Harper D. R. Thompson A. Bird
UNIVERSITY OF RICHMOND		
UR-1	Observations on Three Species of Jellyfishes from Chesapeake Bay with Special Reference to Their Toxins	N. E. Rice W. A. Powell
WESTINGHOUSE OCEAN RESEARCH LABORATORY		
WORL-1	A Regional Study of the Chester River and an Evaluation of Stresses on the Biological Communities	T. O. Munson H. D. Palmer K. T. S. Tzdu W. D. Clarke

SECTION III

PROJECT DESCRIPTIONS

ANSP-1

Benedict Estuarine Laboratory
Academy of Natural Sciences,
Philadelphia
Benedict, Maryland 20612

PROJECT TITLE: PLANKTONIC PRIMARY PRODUCERS IN THE CHESAPEAKE BAY ESTUARINE SYSTEM

PRINCIPAL INVESTIGATOR:

Kent Mountford - Ph.D.

Collaborator(s): Richard S. Mullen - B.S.

OBJECTIVES:

1. To measure plankton photosynthesis in several diverse components of the Chesapeake estuarine system; and by microscopy, pigment analysis, and experimental manipulation, identify the organisms responsible for the bulk of primary productivity.

2. To extract representative indigenous Chesapeake phytoplankters into laboratory culture and examine their responses separately and in combination to various environmental changes.

3. To develop a system using photosynthesis, plankton data, and digital computer manipulation that will assist in assessing water quality in undisturbed and modified estuaries.

STATUS:

We are continuing, and refining, field measurements of productivity on the Patuxent River, Potomas River, and middle Chesapeake Bay. This work has been carried on since 1967 using the light-dark bottle method of in situ hydrographic data are routinely gathered with these measurements. The data are being prepared for computerization.

A number of phytoplankters are now in culture. We are beginning to grow stocks and have begun tentative manipulations of such variables as light, temperature, and vitamin enrichment. This work was begun in January, 1972.

The refinement and implementation of a characterization system is a long-term goal. I have done considerable (four years) groundwork in a previous position, and hope to translate my experience to the Chesapeake environment.

FINANCIAL SUPPORT:

Department of Limnology funds are allocated by budget. The Academy of Natural Sciences receives support from endowments, memberships, and outside contracts including two in this area with PEPCO and Baltimore Gas & Electric.

ANSP-2

Benedict Estuarine Laboratory
Academy of Natural Sciences,
Philadelphia
Benedict, Maryland 20612

PROJECT TITLE: TAXONOMY, SEASONALITY AND ABUNDANCE OF PLANKTON IN THE PATUXENT RIVER - FROM CHESAPEAKE BAY TO FRESH WATER

PRINCIPAL INVESTIGATOR:

Richard A. Mulford

OBJECTIVES:

1. To determine taxonomy and annual cyclicity of planktonic species.
2. To quantitatively ascertain annual species populations.
3. To assess species migrations from mouth of river to fresh water.

STATUS:

Two and one-half years data collected on a monthly schedule.

FINANCIAL SUPPORT:

Limnology Department, Academy of Natural Sciences
Potomac Electric Power Company

ANSP-3

Benedict Estuarine Laboratory
Academy of Natural Sciences,
Philadelphia
Benedict, Maryland 20612

PROJECT TITLE: TAXONOMY, SEASONALITY, AND ABUNDANCE OF PLANKTON IN THE POTOMAC RIVER IN THE VICINITY OF THE MORGANTOWN STEAM ELECTRIC STATION

PRINCIPAL INVESTIGATOR:

Richard A. Mulford

OBJECTIVES:

1. To determine taxonomy and annual cyclicity of planktonic species.
2. To quantitatively ascertain annual species populations.

STATUS:

One year pre-operational and one year post-operational data collected monthly.

FINANCIAL SUPPORT:

Limnology Department, Academy of Natural Sciences
Potomac Electric Power Company

ANSP-4

Benedict Estuarine Laboratory
Academy of Natural Sciences,
Philadelphia
Benedict, Maryland 20612

PROJECT TITLE: TAXONOMY, SEASONALITY, AND ABUNDANCE OF PLANKTON IN THE CHESAPEAKE BAY IN THE VICINITY OF THE CALVERT CLIFFS NUCLEAR POWER PLANT

PRINCIPAL INVESTIGATOR:

Richard A. Mulford

OBJECTIVES:

1. To determine taxonomy and annual cyclicity of planktonic species.
2. To quantitatively ascertain annual species populations.

STATUS:

Two and one-half years pre-operational data collected monthly.

FINANCIAL SUPPORT:

Limnology Department, Academy of Natural Sciences
Baltimore Gas and Electric Company

ANSP-5

Benedict Estuarine Laboratory
Academy of Natural Sciences,
Philadelphia
Benedict, Maryland 20612

PROJECT TITLE: BLUE CRAB

PRINCIPAL INVESTIGATOR:

George Abbe - Biologist

OBJECTIVES:

To observe the movements, distribution, size and sex ratios of the blue crab population in the areas of power plants and determine whether or not the thermal discharges have an effect of any of the above.

STATUS:

1. Potomac
   a. Two years pre-operational and two years post-operational data collected so far.
2. Chesapeake Bay
   a. Four years pre-operational data collected so far.

FINANCIAL SUPPORT:

Potomac - Potomac Electric Power Company
Chesapeake Bay - Baltimore Gas and Electric Company

ANSP-6

Benedict Estuarine Laboratory
Academy of Natural Sciences,
Philadelphia
Benedict, Maryland 20612

PROJECT TITLE: OYSTER TRAY STUDIES

PRINCIPAL INVESTIGATOR:

George Abbe - Biologist

OBJECTIVES:

To determine growth rates, mortality, and fouling problems associated with various age oysters held in trays at various locations in the Patuxent and Potomac Rivers and the Chesapeake Bay. Trays are located both in and out of the area of thermal effect of electrical generating plant discharge.

STATUS:

Observations have been made quarterly on the Patuxent since 1963; on the Potomac since 1968, and on the Bay since 1970.

FINANCIAL SUPPORT:

Patuxent - Potomac Electric Power Company
Potomac - Potomac Electric Power Company
Bay - Baltimore Gas and Electric Company

ANSP-7

Benedict Estuarine Laboratory
Academy of Natural Sciences,
Philadelphia
Benedict, Maryland 20612

PROJECT TITLE: OYSTER BED STUDIES

PRINCIPAL INVESTIGATOR:

George Abbe - Biologist

OBJECTIVES:

1. To observe changes within certain oyster beds located near the Morgantown power plant (Potomac River), Chalk Point power plant (Patuxent River), and the Calvert Cliffs power plant (Chesapeake Bay) as a result of thermal discharges.

2. Oysters are analyzed statistically on a semiannual basis for size, condition, and associated organisms.

STATUS:

Work on Patuxent beds since 1962.
Work on Potomac beds since 1967.
Work on Bay beds since 1968.

FINANCIAL SUPPORT:

Patuxent - Potomac Electric Power Company
Potomac - Potomac Electric Power Company
Bay - Baltimore Gas and Electric Company

ANSP-8

Benedict Estuarine Laboratory
Academy of Natural Sciences,
Philadelphia
Benedict, Maryland 20612

PROJECT TITLE: SUBSTRATE STUDIES

PRINCIPAL INVESTIGATOR:

George Abbe - Biologist

OBJECTIVES:

1. To determine what are the normal seasonal changes that take place in the epifaunal communities at various locations in the Patuxent and Potomac Rivers and the Chesapeake Bay.

2. Determine biomass production at different locations on a seasonal basis.

3. Determine if the structure of the community or the biomass is affected by thermal discharge.

STATUS:

Potomac - Data somewhat erratic since 1968 due to loss of support structures in the winter.
Patuxent - Continuous monthly collections since 1967.
Chesapeake Bay - Continuous monthly collections since 1970.

FINANCIAL SUPPORT:

Potomac - Potomac Electric Power Company
Patuxent - Potomac Electric Power Company
Chesapeake Bay - Baltimore Gas and Electric Company

ANSP-9

Academy of Natural Sciences of
Philadelphia
Benedict Estuarine Laboratory
Benedict, Maryland 20612

PROJECT TITLE: RADIONUCLIDE DETERMINATIONS IN THE VICINITY OF CALVERT CLIFFS, MARYLAND.

PRINCIPAL INVESTIGATOR:

Richard I. McLean

OBJECTIVES:

1. To determine existing background radiation levels in the vicinity of the proposed nuclear power plant at Calvert Cliffs, Maryland.

2. To determine the extent and effect of a possible increase in radiation levels as a result of power plant operations.

STATUS:

Presently analyzing water, sediment and biological samples for current background radiation levels using gross beta determinations as a relative index. Future work involves gamma spectrum analysis and possible tritium level determinations.

FINANCIAL SUPPORT:

Baltimore Gas and Electric Company.

Academy of Natural Sciences of
Philadelphia
ANSP-10 Benedict Estuarine Laboratory
Benedict, Maryland 20612

PROJECT TITLE: CONCENTRATION AND SEASONALITY AND DISTRIBUTION (HORIZONTAL AND VERTICAL) OF WATER CHEMICAL SPECIES IN THE CHESAPEAKE BAY IN THE VICINITY OF BALTIMORE GAS & ELECTRIC NUCLEAR POWER PLANT.

PRINCIPAL INVESTIGATOR:

Willard I. Simmonds, Jr.

OBJECTIVES:

1. To determine concentrations and seasonality of water chemical species.

2. To ascertain concentration variations in their vertical and horizontal distribution.

3. To relate nutrient water chemical species with planktonic organisms (collaborator, Richard A. Mulford, Planktologist).

STATUS:

Two and one-half years pre-operational data collected on a monthly basis.

FINANCIAL SUPPORT:

Limnology Dept., Acad. of Nat. Sci. of Phila.
Baltimore Gas & Electric Co.

ANSP-11

Academy of Natural Sciences of
Philadelphia
Benedict Estuarine Laboratory
Benedict, Maryland 20612

PROJECT TITLE: CONCENTRATION AND SEASONALITY OF WATER CHEMICAL SPECIES IN THE POTOMAC RIVER IN THE VICINITY OF THE MORGANTOWN FOSSIL-FUELED ELECTRIC STATION.

PRINCIPAL INVESTIGATOR:

Willard I. Simmonds

OBJECTIVES:

1. To determine concentrations and seasonality of water chemical species.

2. To ascertain concentration variations in their vertical distribution.

3. To relate nutrient water chemical species with planktonic organisms (collaborator, Richard A. Mulford, Planktologist).

STATUS:

One year pre-operational and one year post-operational data collected monthly.

FINANCIAL SUPPORT:

Limnology Dept., Acad. of Nat. Sci. of Phila.
Potomac Electric and Power Co.

ANSP-12

Academy of Natural Sciences of
Philadelphia
Benedict Estuarine Laboratory
Benedict, Maryland 20612

PROJECT TITLE: CONCENTRATION, SEASONALITY, AND DISTRIBUTION (HORIZONTAL AND VERTICAL) OF WATER CHEMICAL SPECIES IN THE PATUXENT RIVER FROM CHESAPEAKE BAY TO FRESH WATER.

PRINCIPAL INVESTIGATOR:

Willard I. Simmonds

OBJECTIVES:

1. To determine concentrations and seasonality of water chemical species.

2. To ascertain concentration variations in their vertical and horizontal distribution.

3. To relate nutrient water chemical species with planktonic organisms (collaborator, Richard A. Mulford, Planktologist).

STATUS:

Two and one-half years data collected on a monthly schedule.

FINANCIAL SUPPORT:

Limnology Dept., Acad. of Nat. Sci. of Phila.
Potomac Electric & Power Co.

CBF-1

Chesapeake Bay Foundation, Inc.
17 State Circle, Box 1709
Annapolis, Maryland 21404

PROJECT TITLE: SPA CREEK POLLUTION STUDY

PRINCIPAL INVESTIGATOR:

Nancy G. Dimsdale, Staff Biologist

Collaborators:

High School, College and Graduate Students

OBJECTIVES:

1. Identify type and degree of pollution (bacterial, chemical, sedimendation, eutrophication).

2. Identify source(s) of pollution (industrial, urban, runoff, sewage, etc).

3. Reduce or prevent such pollution.

STATUS:

The project was started in February, 1972, and is scheduled to end one year from that date. Available data on the Creek and related data was gathered. Water samples are being collected at 5 regular locations in the Creek, twice a week. These are being analyzed for coliform bacteria. In addition we plan to sample storm water runoff and analyze other water samples for heavy metals, phosphate, chlorophyll a, oil, etc. Currents, tidal action and stream flow will be measured and evaluated this summer. Biological evaluation of the quality of animal and plant life in the Creek will be made.

FINANCIAL SUPPORT:

Salaries paid by the Chesapeake Bay Foundation. We are presently seeking additional support for equipment and personnel.

CWM-1

College of William and Mary
Department of Biology
Williamsburg, Virginia 23185

PROJECT TITLE: TEMPERATURE FLUCTUATIONS IN THE SUBSTRATUM

PRINCIPAL INVESTIGATOR:

Charlotte P. Mangum - Associate Professor of Biology

Collaborator(s):

William R. Rhodes - Marine Scientist, Virginia Institute of Marine Science
Steve Otwell - Student

OBJECTIVES:

To depict the diurnal temperature fluctuations that occur in the habitats of infaunal animals.

STATUS:

The importance of short term acclimation response to temperature change is difficult to evaluate because we have so few data describing the magnitude and frequency of temperature cycles in the natural environment. We have initiated recordings of temperature at three levels in the substratum in an intertidal habitat.

FINANCIAL SUPPORT:

National Science Foundation (NSF GB-6884; NSF GB-20335).

CWM-2

College of William and Mary
Department of Biology
Williamsburg, Virginia 23185

PROJECT TITLE: ADAPTATION TO LOW OXYGEN CONDITIONS IN MARINE INVERTEBRATES

PRINCIPAL INVESTIGATOR:

Charlotte P. Mangum - Associate Professor of Biology

COLLABORATORS:

Philip Coyer
Marie Condon
Jose Torres
Lynn Amende
Students

OBJECTIVES:

1. To characterize the response of aerobic metabolism to changing oxygen levels.
2. To determine survival times.
3. To understand the role of respiratory pigments in oxygen storage and transport.
4. To understand the complex interactions between temperature, blood pH, and aerobic metabolism.

STATUS:

The response of invertebrate animals to declining oxygen in the environment is typically conformity rather than regulation of respiratory processes. And yet many animals do not exhaust the supply of oxygen available to them; instead they switch over to anaerobic processes at an oxygen level well above zero. The mechanism of this response is not understood, nor is its adaptive significance clear. The level at which switchover occurs is clearly lowered by pre-exposure to low oxygen conditions, a response which is obviously compensatory.

The role of hemoglobin in oxygen storage for slow release under conditions of oxygen deprivation has recently been demonstrated (Comp. Biochem. Physiol. 36:211; Amer. Sci. 58:641). However, the influence of blood pH and its temperature dependence on oxygen equilibria of invertebrate respiratory pigments has not been adequately evaluated.

FINANCIAL SUPPORT:

National Science Foundation (NSF GB-20335, Biological Oceanography)

DOD-EA-1

Department of the Army
Biomedical Laboratory
Plant Ecology
Edgewood Arsenal, Md. 21010

PROJECT TITLE: STUDIES OF THE METABOLISM OF CHEMICALS IN PLANTS

PRINCIPAL INVESTIGATORS:

Elmer G. Worthley, Ph.D., Research Biologist
C. Donald Schott, Biologist

Collaborator:

Paul F. Robinson, Research Physiologist

OBJECTIVES:

1. Making survey of biota of Edgewood Arsenal including Carroll's Island.

2. Studying effects of potential environmental pollutants on the ecosystem and selected plants and animals.

STATUS:

This is an ongoing project which is nearing the end of its second year of existence. Scope and purpose as stated above are not expected to change in the near future.

FINANCIAL SUPPORT:

Department of the Army

EPA-1

Environmental Protection Agency
Gulf Breeze Laboratory
Sabine Island
Gulf Breeze, Florida 32561

PROJECT TITLE: MONITORING OF SYNTHETIC POLLUTANTS IN ESTUARIES.

PRINCIPAL INVESTIGATOR (COORDINATOR):

Philip A. Butler, Research Consultant

Collaborators:

Approximately 20 public and private marine laboratories.

STATUS:

This program, initiated in July 1972, is a follow-up of the estuarine monitoring program conducted in the period 1965 - 1972, utilizing molluscs as the bioassay animal. This new program will utilize yearling herbivorous and carnivorous endemic fish collected at 6-month intervals. Estuaries in the principal drainage basins of coastal United States and its territories will be sampled in 1972 to establish environmental background levels of pollution. In polluted estuaries sampling will be increased in type and frequency to determine the pollution sources.

The samples will be analyzed by the Environmental Protection Agency Pesticide Laboratory at Bay St. Louis, Mississippi. Samples will be screened for the following compounds: chlorinated hydrocarbon pesticides; organosphosphorus pesticides; polychlorinated biphenyls; atrazine; ethylenethiourea compounds; phenoxy herbicides; arsenic, cadmium, lead, and mercury; phthalates.

FINANCIAL SUPPORT:

National Marine Fisheries Service
Environmental Protection Agency

*GU-1

Georgetown University
Graduate School
3800 Reservoir Rd., N.W.
Washington, D. C. 20007

PROJECT TITLE: METABOLISM OF MERCURY COMPOUNDS IN MICROORGANISMS.

PRINCIPAL INVESTIGATOR:

Dr. R. R. Colwell

SUMMARY OF PROJECT:

The proposed research work will provide needed information on microbial metabolism of mercury compounds in nature. The total numbers of bacteria in areas of Chesapeake Bay presently being sampled will be measured and that fraction capable of growth on mercury compounds will be determined. Bacteria growing on mercury substrates will be identified and effects of mercury on the ultrastructure (cell walls and membranes) of bacteria will be examined. Research will be focussed on bacteria from Chesapeake Bay with reference strains also included. The mode of assimilation, accumulation and/or degradation of mercury compounds will be emphasized. Samples of Chesapeake Bay water, sediment, animals and plants will be screened for bacteria capable of growth on and metabolism of mercury compounds. Bacteria capable of growth, with and without prior enrichment on media made up with a variety of mercury compounds, including methyl mercury, will be studied. Analysis of metabolic pathways involved in the utilization, accumulation and/or degradation of mercury compounds will be undertaken. Whether or not these compounds are incorporated into bacterial cell components will be determined. Ultrastructural studies of the effects of mercury compounds on the tissues of Callinectes sapidus, the Chesapeake Bay Blue Crab, will be done.

FINANCIAL SUPPORT:

Environmental Protection Agency, Office of Water Programs.

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Source: Science Information Exchange, Inc.

*GU-2

Georgetown University
Graduate School
3800 Reservoir Rd., N.W.
Washington, D. C. 20007

PROJECT TITLE: SYSTEMATIC STUDY OF THE GENUS VIBRIO AND RELATED ORGANISMS.

PRINCIPAL INVESTIGATOR:

R. R. Colwell

SUMMARY OF PROJECT:

Numerical Taxonomy, DNA base composition analyses, DNA-DNA and DNA-RNA hybridizations, and electrophoretic analyses of enzymes will be employed in a systematic study of the genus Vibrio and related organisms to provide clarification of the natural relationships within this genus. The relationships within other genera, including Spirillum and Pseudomonas and between Vibrio and other genera will also be examined by these methods. The isolation, identification and classification of Vibrio spp., including Vibrio parahaemolyticus, from nature, specifically the estuaries of Chesapeake Bay, through computer analysis of taxonomic data will be continued. DNA base composition data, serological analyses and DNA/RNA studies will be used to verify and amplify the computer diagnoses. The achievement of a multi-leveled approach to taxonomy, from molecular structure to ecological interrelationships, is highly significant in terms of automated computer identification and classification of the bacteria, whatever the source or history of the strains, and may prove to be a major advance in diagnostic bacteriology. The multi-faceted approach to taxonomy has been termed "polyphasic taxonomy." Thus, the genus Vibrio and related genera will be subjected to intensive taxonomic study to integrate the biochemical, genetic and phenetic information and thereby obtain a polyphasic taxonomy of the genus and to provide a model, or pilot, study of the computer method for identification and classification of freshly isolated strains of bacteria from nature.

FINANCIAL SUPPORT:

National Science Foundation, Div. of Biological & Med. Sci.

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Source: Science Information Exchange, Inc.

*GU-3

Georgetown University
School of Arts
3800 Reservoir Rd., N.W.
Washington, D. C. 20007

PROJECT TITLE: VIBRIO PARAHAEMOLYTICUS IN CHESAPEAKE BAY - ISOLATION, INCIDENCE AND PATHOGENICITY.

PRINCIPAL INVESTIGATOR:

R. R. Colwell

SUMMARY OF PROJECT:

This project will continue an investigation of the incidence and pathogenicity of the bacterial pathogen Vibrio parahaemolyticus in marine and estuarine animals, with particular emphasis on the Chesapeake Bay blue crab, Callinectes sapidus. The animals, sediment and water will be sampled periodically and any resulting bacteria will be identified. Information on the natural flora of estuarine and marine invertebrate animals will be collected in a format suitable for computer analysis so as to provide a basis for understanding the interaction amongst the micro-organisms constituting the commensal flora. The pathogenicity of any Vibrio parahaemolyticus isolates for crabs, shrimp and mice will be determined.

FINANCIAL SUPPORT:

National Science Foundation, Div. of Natl. & Internat. Prg.

*
Source: Science Information Exchange, Inc.

Georgetown University
School of Arts
3800 Reservoir Rd., N.W.
Washington, D. C. 20007

*GU-4

PROJECT TITLE: ECOLOGY AND BIOCHEMISTRY OF MARINE BACTERIAL VIRUSES.

PRINCIPAL INVESTIGATOR:

P. K. Chen

SUMMARY OF PROJECT:

This grant supports studies on the ecology and biochemistry of marine viruses isolated from Chesapeake Bay and sampling areas in the Atlantic Ocean using techniques recently developed in pollution studies of fresh waters. Furthermore, previously characterized marine bacteriophages such as NCMB 384 and 385, obtained from the Collection of Marine Bacteria, Aberdeen, Scotland and under study at Georgetown University since 1964, are included in the research program. The research is designed to determine the biochemistry of these phages and the newly isolated viruses obtained and to develop efficient techniques for isolating marine phages so that the ecology and biochemistry of the model viruses and the newly isolated phages will be better known and understood.

FINANCIAL SUPPORT:

National Science Foundation, Div. of Environmental Sciences.

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Source: Science Information Exchange, Inc.

*Int-GS-1

U. S. Dept. of the Interior
Geological Survey
Water Resources Division
Washington, D. C. 20242

PROJECT TITLE: EFFECTS OF WATER QUALITY CHANGES ON ESTUARINE BIOTA.

PRINCIPAL INVESTIGATOR:

R. L. Cory

SUMMARY OF PROJECT:

The Patuxent River is one of the few rivers entering Chesapeake Bay that presently is more or less free from cultural influences. In the near future rapid change is expected to result from urbanization in the upper basin and operation of a large generating plant at Chalk Point, which will significantly alter the temperature of the water in that vicinity. At times the heated water released into the estuary will be equal to or greater than the fresh water inflow.

The objective of this project is to understand the effects of such release in the physical, chemical, and biological character of a tidal river by studying the yearly and seasonal attachment, rates of growth and mortality of attached organisms, and associated physical factors, including salinity. Interrelations between the environment and aquatic biota will be determined for the normal hydrologic condition and the heated condition over a period of about two years for each.

FINANCIAL SUPPORT:

Interior Department, Geological Survey.

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Source: Science Information Exchange, Inc.

Benthic invertebrate samples have been collected from several stations located near the three primary sites since spring 1968, by means of a modified standard Petersen dredge. All samples have been sorted, the organisms have been identified, and the data is now being punched onto computer cards. Approximately 65 taxa, about one half of which are Chironomidae, have been identified from both the North Carolina and Virginia sites; and over 100 taxa have been identified from the more diverse estuarine site in Delaware. The final report will discuss the population dynamics of the benthic community in relation to water quality, depth, substrate, salinity, and temperature specifically in the discharge canal itself, and the mixing areas of the receiving water.

Fisheries studies at the primary sites were so designed as to sample all the various life stages of fishes found in the receiving water. Consequently, ichthyoplankton towing, beach seining, D-trapping, electrofishing, gill netting, and rotenoning were employed where applicable. Data gathered from these samples has been punched onto computer cards and is undergoing statistical analysis. The results will indicate what species of fish are found in the receiving waters, at which life stage(s), and how these species and stages are distributed in relation to the thermal discharge. In addition to these general studies, thermal tolerances of some species of fish eggs have been investigated; and an attempt was made to hold fish in pens in the heated water of the discharge to study their growth rates as compared to fishes held in waters at ambient temperature. More recently, supersaturation of fish blood with nitrogen gas has been noticed in several species of fish in the discharge canal at the North Carolina site, and the relation of this phenomenon to the high ΔT of this plant has been under investigation, using a gas chromatograph. The techniques of measuring dissolved gases in fish blood by means of the gas chromatograph has been established and should be helpful in this study.

With regard to the physical aspects of the EEI RP-49 project, work on a basis for computer simulation of thermal discharges in three dimensions has been considerably advanced, and initial application of a preliminary version of such a model to a plant sited on a river has been completed. The modeling technique is based on the fundamental equations of motion for incompressible viscous fluids together with the principles of conservation of mass, salt, and heat. The main objective to applying these principles to the problem of three dimensional flow near a thermal discharge is to provide a means for identifying the roles of jet momentum, plume buoyancy, turbulent diffusion, surface cooling, and wind induced flow in the distribution of heat in a dynamically varying receiving water body. Ultimately, it is hoped to extend this work to cover widely fluctuating conditions at sites exhibiting relatively complex flow conditions without losing the general character of the applicability of the model.

A second report is being prepared which describes and investigates a model of temperature responses in the environment which are associated with the operation of thermo-electric power generating stations. This

PHYSICAL OBJECTIVES:

1. To provide continuing physical data analyses for correlation with the above biological studies, including monitoring physical parameters and assisting with statistical and hydrological interpretations of biological data.

2. To investigate the use of field dye diffusion studies in cooling water discharges to evaluate turbulent diffusion parameters and velocity gradients.

3. To investigate the applicability of aerial infrared imagery techniques for use by industry as an aid to or substitute for ground based water temperature surveys.

4. To develop a base for computer models for dynamic simulation of temperature distributions in receiving water bodies under the influence of fluctuating flow and meterologic conditions.

5. To develop operations research techniques for investigating problems of optimization, involving location and sizing of multiple power plants in large river basins or estuaries.

STATUS:

Field work has been completed, and at present, data is being analyzed for a final report due June 30, 1972. It will include results of three years of regularly scheduled sampling at the James River site (in addition, there are five other sites under this study, but only this site is on a Chesapeake Bay tributary). The other sites are Indian River, Delaware; Lake Norman, North Carolina; Wabash River, Indiana; Lake St. Croix, Minnesota; and Sacramento and San Joaquin River delta in California. The effects of a thermal discharge on the phytoplankton, zooplankton, benthos, ichthyoplankton and adult fishes will be described:

Since October 1969, ^{14}C primary production studies have been conducted on a bimonthly basis at the three primary sites (Va., N.C., and Del.). These studies have involved experiments with samples collected from intake and discharge waters, as well as from various stations in the receiving water body. Studies on phytoplankton in the cooling water are designed to ascertain both the mechanical effects of passage through the condenser system, as well as thermal elevation.

Zooplankton studies have concentrated on the effects of relatively sudden temperature rises caused by entrainment of zooplankters into the cooling water system. Chlorination to control biofouling is employed at two of the three primary sites, and its effect on zooplankton has been studied. Motility of entrained organisms vs. that of the organisms captured in the intake is the criterion used in these two studies. Several problems of sampling and holding live zooplankters during microscopic examination have been encountered, and more work is being done to solve these potential sources of error. Ultimately, an overall statement can be made regarding the effect of the power plant operation on the zooplankton populations of the receiving waters.

Benthic invertebrate samples have been collected from several stations located near the three primary sites since spring 1968, by means of a modified standard Petersen dredge. All samples have been sorted, the organisms have been identified, and the data is now being punched onto computer cards. Approximately 65 taxa, about one half of which are Chironomidae, have been identified from both the North Carolina and Virginia sites; and over 100 taxa have been identified from the more diverse estuarine site in Delaware. The final report will discuss the population dynamics of the benthic community in relation to water quality, depth, substrate, salinity, and temperature specifically in the discharge canal itself, and the mixing areas of the receiving water.

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With regard to the physical aspects of the EEI RP-49 project, work on a basis for computer simulation of thermal discharges in three dimensions has been considerably advanced, and initial application of a preliminary version of such a model to a plant sited on a river has been completed. The modeling technique is based on the fundamental equations of motion for incompressible viscous fluids together with the principles of conservation of mass, salt, and heat. The main objective to applying these principles to the problem of three dimensional flow near a thermal discharge is to provide a means for identifying the roles of jet momentum, plume buoyancy, turbulent diffusion, surface cooling, and wind induced flow in the distribution of heat in a dynamically varying receiving water body. Ultimately, it is hoped to extend this work to cover widely fluctuating conditions at sites exhibiting relatively complex flow conditions without losing the general character of the applicability of the model.

A second report is being prepared which describes and investigates a model of temperature responses in the environment which are associated with the operation of thermo-electric power generating stations. This

model is a piece-wise computer simulation system, limited at present to closed cooling water systems. However, the techniques developed should eventually be applicable to a much larger class of cooling systems.

Further, a special study of the Indian River estuary was begun in November, 1970. The physical aspects of the Indian River study are planned to provide a series of temperature models of increasing complexity applied to the same set of data, the objective being to show the improvement in detail gained relative to effort required to proceed from a "preliminary estimate type of analysis through the most sophisticated analysis that can be developed".

In summary, the project terminates June 30, 1972, and at present, data analysis and write-up are progressing. A final report will completely summarize the work performed and only alluded to here.

The following reports and publications have been completed under this project. A complete listing of reports and publications is available from the principal investigators.

1. Wurtz, C. B. and C. E. Renn (1965). WATER TEMPERATURES AND AQUATIC LIFE. EEI Publication 65-901. (99 pages. Available from EEI. Price $2.00. Termed Report No. 1, Cooling Water Discharge Project)

2. Edinger, J. E. and J. C. Geyer (1965). HEAT EXCHANGE IN THE ENVIRONMENT. EEI Publication 65-902. (259 pages. Available from EEI. Price $2.50. Termed Report No. 2, Cooling Water Discharge Project)

3. Geyer, J. C., J. E. Edinger, W. L. Graves and D. K. Brady (1968). FIELD SITES AND SURVEY METHODS. EEI Publication 68-901. (124 pages. Available from EEI. Price $2.35. Report No. 3, Cooling Water Discharge Project)

4. Jensen, L. D., R. M. Davies, A. S. Brooks and C. D. Meyers (1969). THE EFFECTS OF ELEVATED TEMPERATURES UPON AQUATIC INVERTEBRATES. EEI Publication 69-900. (243 pages. Available from EEI. Price $4.00. Report No. 4, Cooling Water Discharge Project)

5. Brady, D. K., W. L. Graves and J. C. Geyer (1969). SURFACE HEAT EXCHANGE AT POWER PLANT COOLING LAKES. EEI Publication 69-901. (154 pages. Available from EEI. Price $2.85. Report No. 5, Cooling Water Discharge Project)

6. Marks, D. H. and R. A. Borenstein (1970). AN OPTIMAL SITING MODEL FOR THERMAL PLANTS WITH TEMPERATURE CONSTRAINTS. EEI Publication 70-902. (95 pages. Available from EEI. Price $2.00. Report No. 6, Cooling Water Discharge Project)

FINANCIAL SUPPORT:

Edison Electric Institute

*JHU-2

Johns Hopkins University
Graduate School
Charles & 34th
Baltimore, Maryland 21218

PROJECT TITLE: CONTINUOUS SEISMIC REFLECTION PROFILING STUDY OF THE CHESAPEAKE BAY.

PRINCIPAL INVESTIGATORS:

J. R. Schubel
D. W. Pritchard

SUMMARY OF PROJECT:

A high resolution continuous seismic reflection profiling study will be made to determine the shallow sub-structure of the sedimentary record in the Chesapeake Bay. The specific objectives of the work program are: (1) to determine the course and depth of the ancestral river valley system; (2) to determine the patterns of erosion and accretion throughout the Holocene; (3) to assess the long term effects of the "sediment trap" created near the head of the Bay by the net nontidal circulation; (4) to delimit the areas of accumulation of fine-grained, organic-rich sediments which may degrade the quality of the environment; (5) to assess the redistribution of spoil from overboard disposal areas; and (6) to select more suitable sites for future overboard spoil disposal.

FINANCIAL SUPPORT:

National Science Foundation, Div. of Environmental Sciences.

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Source: Science Information Exchange, Inc.

*JHU-3

Johns Hopkins University
Dept. of Oceanography
Charles & 34th Streets
Baltimore, Maryland 21218

PROJECT TITLE: STUDY TO ASSESS THE IMPORTANCE OF GAS BUBBLES IN THE MARKED ATTENUATION OF SEISMIC ENERGY BY SOME FINE-GRAINED SEDIMENTS.

PRINCIPAL INVESTIGATORS:

D. W. Pritchard
J. R. Schubel

SUMMARY OF PROJECT:

Many fine-grained estuarine sediments almost completely attenuate, in less than two meters, the energy from high resolution continuous seismic profilers. The cause of this anomalous attenuation has not been investigated, but has repeatedly been attributed to reverberation from gas bubbles produced by the biochemical degradation of organic matter, and entrapped within the interstitial water.

This hypothesis will be examined by comparing the volumes of gas bubbles entrapped within the interstitial waters of seismically opaque and seismically transparent zones of texturally similar sediments in the Chesapeake Bay. A special "gas grabber" attached to the liner of a gravity corer will collect the gas bubbles released from the sediment when the pressure is reduced upon removal of the corer from the bottom. Gas composition will be determined by gas chromatography. The sediments will be analyzed texturally, and for water content and organic carbon.

FINANCIAL SUPPORT:

National Science Foundation, Div. of Environmental Sciences.

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Source: Science Information Exchange, Inc.

*JHU-4

Johns Hopkins University
State Geological Survey
34th & Charles Streets
Baltimore, Maryland 21218

PROJECT TITLE: THE TRACING OF SAND IN THE CHESAPEAKE BAY ALONG THE NORTH CALVERT CLIFFS SHORE OF CALVERT COUNTY, MARYLAND.

PRINCIPAL INVESTIGATOR:

T. H. Slaughter

SUMMARY OF PROJECT:

Sand was collected at 5-, 4-, and 2-foot depths and from onshore, in lots of 100 to 150 lbs. The sand was colored, fluorescent dyed, and replaced at the original sites, using underwater techniques. Samples were collected at each site until the amount of traceable material diminished to a point of minimum practicable use.

An ultraviolet lamp was used to confirm the presence of dyed sand, coupled with visual inspection under a binocular microscope. The quantity of dyed material was plotted areally against time.

FINANCIAL SUPPORT:

Maryland State Government.

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Source: Science Information Exchange, Inc.

JHU-5

Johns Hopkins University
School of Engineering
Charles & 34th
Baltimore, Maryland 21218

PROJECT TITLE: RESEARCH AND STUDY OF THE CHESAPEAKE BAY

PRINCIPAL INVESTIGATORS:

R.H. Roy
R.F. Beers

SUMMARY OF PROJECT:

The research to be conducted under this project involves the initial implementation of a comprehensive research plan and research management methodology outlined in a report entitled the Chesapeake Bay: Report Planning Study, submitted to the National Science Foundation by the Johns Hopkins University, the University of Maryland and the Virginia Institute of Marine Science.

In the research program major attention will be directed toward the construction of a data bank for storage and retrieval of information classified according to an inventory methodology designed to identify all the significant entity interactions of the Chesapeake Bay, their respective processes and characteristics. Such information will assist in the management of the Bay and in delineating those areas of inadequate knowledge for which research is necessary.

A second objective is the application of systems analysis to the Bay and its components for a comprehension of its dynamics, its characteristics and its probable fate according to the choices made in the management process.

A third objective is initiation of an integrated research program in biology, physics and chemistry, economics, and sociology, behavioral sciences and institutions, including government and law.

In addition, specific problem areas and case studies will be the subject of intensive interdisciplinary research.

FINANCIAL SUPPORT:

National Science Foundation, Div. of Research Applications

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Source: Science Information Exchange, Inc.

*JHU-6

Johns Hopkins University
School of Engineering
Charles & 34th Streets
Baltimore, Maryland 21218

PROJECT TITLE: ASSESSMENT OF INFORMATION AND DESIGN OF RESEARCH PROGRAM FOR CHESAPEAKE BAY.

PRINCIPAL INVESTIGATOR:

M. G. Wolman

SUMMARY OF PROJECT:

The objective of this effort is to develop a comprehensive research plan which will provide information upon which to base decisions with respect to location, design, size and operation of power plants in the Chesapeake Bay region.

FINANCIAL SUPPORT:

Atomic Energy Commission, Reactor Devel. & Tech. Div.

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Source: Science Information Exchange, Inc.

*JHU-7

Johns Hopkins University
School of Engineering
Charles & 34th Streets
Baltimore, Maryland 21218

PROJECT TITLE: FRAMEWORK FOR RESOURCE EVALUATION AND ECONOMICS OF ENGINEERING ALTERNATIVES.

PRINCIPAL INVESTIGATORS:

J. C. Geyer
S. Hanke
J. Boland

SUMMARY OF PROJECT:

The purpose of this effort is to develop a framework for identification and evaluation of both direct economic costs and external effects associated with decisions regarding the size, location, and engineering design of central station electric generating facilities in the Chesapeake Bay Region. Particular emphasis will be given to the social and economic implications of the use of the Chesapeake Bay, and its tributary estuaries, for cooling water. This is a joint study with the Department of Natural Resources, State of Maryland.

FINANCIAL SUPPORT:

Atomic Energy Commission, Reactor Devel. & Tech. Div.

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Source: Science Information Exchange, Inc.

*JHU-8

Johns Hopkins University
School of Engineering
Charles & 34th Streets
Baltimore, Maryland 21218

PROJECT TITLE: CHESAPEAKE BAY RESEARCH PLANNING.

PRINCIPAL INVESTIGATOR:

R. H. Roy

SUMMARY OF PROJECT:

This project is an exploratory research effort which will attempt to bring together the major academic institutions in the area, the various state and federal agencies, citizens groups and local industry in order to identify the research needed to adequately serve and guide the people and institutions who will govern the utilization and conservation of the Chesapeake Bay and its associated wetlands.

The four topics for investigation are as follows: (1) an inventory of the elements which together and interactively comprise the total Bay system; (2) the formulation of statements of research objectives; (3) identification of the component parts of a comprehensive research plan and of the kinds of institutions best capable of carrying out the investigations thus delineated; and (4) a study of the central organization form best suited to administer such a program.

FINANCIAL SUPPORT:

National Science Foundation, Off. of Interdisc. Res. Prob.

*
Source: Science Information Exchange, Inc.

Johns Hopkins University
Chesapeake Bay Institute
Annapolis, Maryland

*JHU-CBI-1

PROJECT TITLE: SEDIMENTOLOGICAL STUDY OF MODERN POLLEN IN AN ESTUARINE ENVIRONMENT.

PRINCIPAL INVESTIGATORS:

G. S. Brush
J. R. Schubel

SUMMARY OF PROJECT:

Very few pollen studies have been conducted relating depositional patterns of modern pollen to source distributions and to modes, routes, and rates of pollen and sediment transport. No comprehensive estuarine study has been made. Sedimentological studies of modern pollen are necessary in a variety of environments for the accurate interpretation of ancient pollen profiles, and pollen grains are potentially valuable as natural tracers in modern sedimentation studies.

An interpretive study of modern pollen requires a substantial body of supporting botanical, hydrographical, and sedimentological data; data sufficiently complete in few environments. The required data are available for the Chesapeake Bay estuary. The following research will be conducted: mapping the pollen distributions, both in the water and in the surface sediments, over the entire length of the Chesapeake Bay; determining how closely these distributions reflect the distribution of the source vegetation; interpreting the departures of the depositional distribution from the source distribution in terms of both the settling velocities of the various pollen types and the estuarine circulation; and exploring the possibility of utilizing selected pollen types, with different settling velocities, as natural tracers.

FINANCIAL SUPPORT:

National Science Foundation, Div. of Biological & Med. Sci.

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Source: Science Information Exchange, Inc.

*JHU-CBI-2

Johns Hopkins University
Chesapeake Bay Institute
Annapolis, Maryland

PROJECT TITLE: SUPPORT OF RESEARCH VESSEL OPERATIONS.

PRINCIPAL INVESTIGATOR:

D. W. Pritchard

SUMMARY OF PROJECT:

This project provides partial operating support for the R/V WARFIELD and several small craft. These vessels are used for studies in the Chesapeake Bay and adjacent coastal waters for studies such as the following: modeling of the non-tidal flow pattern, salinity distribution and contaminant concentration of the Bay; phytoplankton and zooplankton ecology including measurements of primary productivity, related water chemistry, solar radiation and light penetration; continental shelf studies to determine the fate of water discharged from the Bay; suspended sediment studies; and dissolved chemical composition of interstitial waters in the bottom sediments.

FINANCIAL SUPPORT:

National Science Foundation, Div. of Natl. & Internat. Prg.

*
Source: Science Information Exchange, Inc.

*La-SWFC-1

State Wildlife & Fish Comm.
New Orleans, Louisiana 70130

PROJECT TITLE: INVESTIGATIONS INTO THE PROBLEMS ASSOCIATED WITH THE CAPTURE, HOLDING, STRIPPING, HATCHING, AND REARING OF CHESAPEAKE BAY STRIPED BASS.

PRINCIPAL INVESTIGATOR:

A. M. Williams

SUMMARY OF PROJECT:

Objective: To obtain at least 1 million striped bass fry from Chesapeake Bay stock. To establish method whereby large numbers of striped bass fry will be available for stocking in Louisiana.

Procedures: (1) A mobile jar hatchery will be located in the Chesapeake Bay area. Mature fish will be captured using commercial fishing tackle; attempts will be made to obtain ripe females which are in the ovulation process. In addition to this, female fish which are found to be eligible will be injected with human chorionic gonatropin. Mature males will be captured in the same manner and held in portable holding tanks until stripped. (2) Eggs obtained from these procedures will be placed in hatching jars and/or tanks until hatching. (3) When fry are at least 24 hours old they will be flown to Louisiana in a state plane.

FINANCIAL SUPPORT:

Interior Department, Bureau of Sport Fish. & Wlf., Federal Aid Division

*
Source: Science Information Exchange, Inc.

*La-SWFC-2

State Wildlife & Fish Comm.
New Orleans, Louisiana 70130

PROJECT TITLE: ESTABLISHMENT OF THE CHESAPEAKE BAY STRIPED BASS IN LOUISIANA.

PRINCIPAL INVESTIGATOR:

A. M. Williams

SUMMARY OF PROJECT:

Objective: To establish a reproducing population of Chesapeake Bay striped bass in Louisiana.

Procedures: Striped bass fry obtained from Chesapeake Bay will be stocked at the LaCoombe Fish Hatchery and in marsh areas which have varying salinities. Fish will be reared to approximately 2" to 3" in length and then stocked into areas found for striped bass. Several identification methods, such as tags, fin clips, or dying will be attempted.

FINANCIAL SUPPORT:

Interior Department, Bureau of Sport Fish. & Wlf., Federal Aid Division

*
Source: Science Information Exchange, Inc.

*La-SWFC-3

State Wildlife & Fish Comm.
New Orleans, Louisiana 70130

PROJECT TITLE: DETERMINATION OF SURVIVAL AND MIGRATIONAL HABITS OF CHESAPEAKE BAY STRIPED BASS.

PRINCIPAL INVESTIGATOR:

A. M. Williams

SUMMARY OF PROJECT:

Objectives: To determine rate of survival, migrational patterns, and reproductive successes of Chesapeake Bay stock of striped bass.

Procedures: Regular sampling efforts will be made in areas where striped bass were released. Sampling will include, but not be limited to stocking, netting, trawling, and seining.

Information such as growth rates, food habits, will be recorded on all striped bass taken.

Similar sampling efforts will be made to recover Santee Cooper fish stocked under federal aid project F-12.

FINANCIAL SUPPORT:

Interior Department, Bureau of Sport Fish. & Wlf., Federal Aid Division

*
Source: Science Information Exchange, Inc.

*Md-CBA-1

State Dept. of Ches. Bay Afrs.
Annapolis, Maryland 21404

PROJECT TITLE: BIOLOGIC AND ENVIRONMENTAL CONTROL OF EURASIAN MILFOIL (MYRIOPHYLLUM SPICATUM L.) IN CHESAPEAKE BAY.

PRINCIPAL INVESTIGATOR:

J. H. Manning

SUMMARY OF PROJECT:

Objectives: (1) To determine the abundance and distribution of Eurasian milfoil and other rooted aquatic plants in Middle River, Back River, Rhode River and adjacent creeks in Chesapeake Bay; (2) to analyze environmental conditions in these rivers, and to study factors now excluding milfoil from Back River; (3) to begin the study of milfoil disease and pathology.

Procedures: Distribution and abundance surveys will be done at regular intervals throughout the year; environmental analyses will involve routine measurements of temperature, salinity, pH, light penetration, plankton conditions, nutrient supplies, and trace elements, and other relevant parameters; studies of milfoil pathology will involve histology, pathogen culture, and laboratory transmission studies.

FINANCIAL SUPPORT:

Commerce Department, Natl. Oceanic & Atm. Admin., Natl. Marine Fisheries Service

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Source: Science Information Exchange, Inc.

*Md-CBA-2

State Dept. of Ches. Bay Afrs.
Annapolis, Maryland 21404

PROJECT TITLE: SUSPENDED SEDIMENTS IN THE UPPER CHESAPEAKE BAY - EVALUATION OF METHODS FOR SIZE ANALYSIS OF SUSPENDED MATERIALS.

PRINCIPAL INVESTIGATORS:

J. H. Manning
J. R. Schubel

SUMMARY OF PROJECT:

The objective of this study is to determine the method or combination of methods which provides the most consistent data on the size distribution of the suspended material in the Upper Chesapeake Bay, for use as a routine procedure. Large volume samples from the Upper Bay will be divided into several sub-samples. One sub-sample will be spun down in an ultra-centrifuge, and the sediment homogeneously resuspended in a reduced volume. Size distribution will be determined using the homogeneous technique in the Mine Safety Applicances Company's Particle Size Analyzer. A second sub-sample will be filtered through a 0.2 micron filter, in order to provide gross size separation. Microphotographs of the large filter, and both microphotographs and electron-micro-photographs of the smaller filter will be made. A Zeiss Particle Size Analyzer will be used to obtain size distribution. Variations of each of the above techniques will be used in which the suspended organic fraction is eliminated from the raw sample by wet incineration. This study will be carried out by J. R. Schubel, Chesapeake Bay Institute, The Johns Hopkins University.

FINANCIAL SUPPORT:

Commerce Department, Natl. Oceanic & Atm. Admin., Natl. Marine Fisheries Service

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Source: Science Information Exchange, Inc.

*Md-CBA-3

State Dept. of Ches. Bay Afrs.
Annapolis, Maryland 21404

PROJECT TITLE: THE TEMPORAL AND SPATIAL VARIATIONS IN CONCENTRATION AND PARTICLE SIZE DISTRIBUTION OF SUSPENDED MATERIALS IN THE UPPER CHESAPEAKE BAY.

PRINCIPAL INVESTIGATOR:

J. H. Manning
J. R. Schubel

SUMMARY OF PROJECT:

The objectives of this study are to determine the temporal and spatial variations in (1) the concentration; (2) particle size distribution; (3) percent organic matter; and (4) mineralogical composition of inorganic fraction. Samples will be collected at the surface, mid-depth and near the bottom at each of 31 stations in the Upper Chesapeake Bay from the mouth of the Susquehanna at Havre de Grace to just below Pooles Island, on a monthly basis. Total weight of suspended material per unit volume, and weight of inorganic fraction will be determined. Size distribution of the suspended material will be determined using the methods selected on the basis of the evaluation study conducted under another phase of this project. Work will also be initiated on mineralogical analysis of the inorganic fraction, although the major effort on this part of the program will be undertaken during the second year of the study. Field work will be carried out aboard the research vessels MAURY and LYDIA LOUISE II, of the Chesapeake Bay Institute, The Johns Hopkins University. The study will be conducted by J. R. Schubel, Chesapeake Bay Institute, The Johns Hopkins University.

FINANCIAL SUPPORT:

Commerce Department, Natl. Oceanic & Atm. Admin., Natl. Marine Fisheries Service.

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Source: Science Information Exchange, Inc.

*Md-CBA-4

State Dept. of Ches. Bay Afrs.
Annapolis, Maryland 21404

PROJECT TITLE: COMPARISON OF OPTICAL PROPERTIES WITH DIRECT MEASUREMENTS OF CONCENTRATION AND SIZE DISTRIBUTION OF SUSPENDED MATERIALS.

PRINCIPAL INVESTIGATORS:

J. H. Manning
J. Williams
J. R. Schubel
D. W. Pritchard

SUMMARY OF PROJECT:

The objective of this study is to determine the relationships between various optical properties of the waters of the Upper Chesapeake Bay and the concentration and size distribution of suspended materials in these waters. At each of 31 stations in the Upper Bay samples will be collected at three depths and at monthly intervals for determination of suspended particle concentration and size distribution, as described under another phase of this project. Duplicate samples will also be employed for light transmission and scattering measurements at each of three wave lengths. Scattering measurements will be made at 90 degrees to the light beam path using a Turner filter fluorometer. Beam transmittance measurements will be made using a Beckman DU spectrophotometer with a special narrow beam columnation attachment. In situ measurements of beam transmittance will also be made. These optical measurements will be compared with the determinations of suspended particle concentration and size distribution, with the intent of establishing a relationship between the optical parameters and the suspended particle concentration and size distribution. This study will be conducted by J. Williams, J. R. Schubel, and D. W. Pritchard, Chesapeake Bay Institute, The Johns Hopkins University.

FINANCIAL SUPPORT:

Commerce Department, Natl. Oceanic & Atm. Admin., Natl. Marine Fisheries Service

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Source: Science Information Exchange, Inc.

*Md-CBA-5

State Dept. of Ches. Bay Afrs.
Annapolis, Maryland 21404

PROJECT TITLE: TO INVESTIGATE THE PROCESS OF BOTTOM SEDIMENT BY TIDAL SCOUR.

PRINCIPAL INVESTIGATOR:

J. H. Manning

SUMMARY OF PROJECT:

The objectives of this study are to determine the rates of transport (vertical flux densities) of resuspended sediments of various grain sizes through imaginary horizontal planes at several fixed distances above the bottom. The tidal induced variations of the volume particle size distribution will also be determined at these levels.

The investigations will be carried out both in the field at selected stations in the Chesapeake Bay and in the laboratory using the Chesapeake Bay Institute flume. In the field studies a series of anchor stations will be occupied at which hourly measurements will be made of current velocity, suspended sediment concentration, temperature and salinity. The measurements will be taken at multiple depths over two or more tidal cycles. Stations will be occupied at different locations and during different tidal conditions and seasons. The flume experiments will involve measurements of the concentration of suspended sediment at fixed levels above the bottom for a series of selected current velocities.

FINANCIAL SUPPORT:

Commerce Department, Natl. Oceanic & Atm. Admin. Natl. Marine Fisheries Service.

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Source: Science Information Exchange, Inc.

*Md-CBA-6

State Dept. of Ches. Bay Afrs.
Annapolis, Maryland 21404

PROJECT TITLE: TO DETERMINE THE PROPERTIES OF THE SUSPENDED SEDIMENT POPULATION OF CHESAPEAKE BAY.

PRINCIPAL INVESTIGATOR:

J. H. Manning

SUMMARY OF PROJECT:

The objectives of this study are to determine the properties of the suspended sediment population of the Chesapeake Bay. The area of investigation will extend from the head of the Bay at Turkey Point (and in the mouth of the Susquehanna River) to the mouth of the Bay at the Virginia Capes. The following properties will be determined: (1) the spatial and temporal variations of the concentration of total suspended solids, (2) the spatial and temporal variations of the particle size distributions (both number and volume) of the suspended solids, (3) the percent of the total suspended solids accounted for by organic matter, (4) the mineralogic composition of the inorganic fraction, (5) the relative contributions to the suspended load by river flow, shore erosion, primary productivity, and by the resuspension of bottom sediments, and (6) the fraction of suspended sediment which escapes the Bay.

Samples will be collected monthly from five or more depths at each of 18 to 20 channel stations extending the full length of the Bay. The concentrations will be determined by filtration; the percent organic matter by combustion; the mineralogy by x-ray diffraction; and the size distribution with a Zeiss Particle Size Analyzer and a Mine Safety Appliance Particle Size Analyzer. These properties will be used to estimate the relative contribution by the various sources of suspended sediment.

FINANCIAL SUPPORT:

Commerce Department, Natl. Oceanic & Atm. Admin., Natl. Marine Fisheries Service.

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Source: Science Information Exchange, Inc.

*Md-CBA-7

State Dept. of Ches. Bay Afrs.
Annapolis, Maryland 21404

PROJECT TITLE: DETERMINE EFFECTS OF RESERVOIRS ALONG SUSQUEHANNA RIVER ON SEDIMENT BEING DISCHARGED INTO CHESAPEAKE BAY AT HAVRE DE GRACE, MD.

PRINCIPAL INVESTIGATORS:

J. H. Manning
J. R. Schubel

SUMMARY OF PROJECT:

The objectives of this study are to determine the effects of the Susquehanna reservoir on the sediment being discharged into the Bay by the Susquehanna River.

During the fall of 1968 samples will be collected from the water and from the bottoms of several of the reservoirs. Samples will also be collected during the spring freshet of 1969. The mineralogic composition of each of the samples will be determined microscopically and by x-ray diffraction. The size distributions will be determined by sedimentation using a standard pipette method and a Mine Safety Appliance Particle Size Analyzer. The results will be used to evaluate the role of the reservoirs in the downstream fractionation of the Susquehanna River's sediment load.

This study will be conducted by Dr. J. R. Schubel, Chesapeake Bay Institute, The Johns Hopkins University.

FINANCIAL SUPPORT:

Commerce Department, Natl. Oceanic & Atm. Admin., Natl. Marine Fisheries Service.

*
Source: Science Information Exchange, Inc.

Md-DWR-1

State of Maryland
Department of Water Resources
State Office Building
Annapolis, Maryland 21401

PROJECT TITLE: WATER QUALITY INVESTIGATION-HART AND MILLER ISLANDS DISPOSAL AREA

PRINCIPAL INVESTIGATOR:

James T. Allison

OBJECTIVE:

Establish a monitoring program (physical, chemical and biological parameters) to obtain background and statistical information which will enable future meaningful monitoring of the effects of dike construction and spoil disposal in the diked areas, and allow appropriate action to be taken as required during construction of the dike and placement of spoils within it.

STATUS:

One sampling run has been conducted in cooperation with the EPA-Annapolis Field Office. Water and bottom samples were collected at nine stations for chemical analysis. Bottom samples were analyzed for benthic invertebrates (identification and counting) by EPA Annapolis Field Office.

FINANCIAL SUPPORT:

Department of Water Resources.

Md-FWA-1

Fish and Wildlife Administration
State Office Building
Annapolis, Maryland 21401

PROJECT TITLE: ECONOMIC SURVEY OF FISH AND WILDLIFE RESOURCES AND EVALUATION

PRINCIPAL INVESTIGATORS:

Dr. J. C. Horvath - Project Leader
B. F. Halla - Forest Wildlife Project Leader
B. M. Florence - Estuarine Section Leader

OBJECTIVES:

To determine the economic value of fish and wildlife resources and the demand for fish and wildlife oriented recreation.

STATUS:

From November 1, 1971 to June 30, 1972 - Interview questionnaire finalized; to be used shortly. Data will then be coded, programmed, analyzed, and published.

FINANCIAL SUPPORT:

United States Department of the Interior
Maryland Fish and Wildlife Administration

Md-FWA-2

Fish and Wildlife Administration
State Office Building
Annapolis, Maryland 21401

PROJECT TITLE: PILOT MARSH STUDY

PRINCIPAL INVESTIGATORS:

W. R. Carter, III - Biologist III
Harley J. Speir - Biologist II
Charles H. Linert - Biologist I

OBJECTIVES:

1. Determination of the species of anadromous fish associated with four types of wetlands (wooded swamps, fresh marsh, salt meadow, regularly flooded salt marsh).
2. Seasonal variability of occurrence of wetland associated anadromous fish.
3. Estimation of the standing crop of wetlands associated anadromous fish.
4. Study relationships of anadromous fishes with their wetland dependent competitors, predators, and forage species.
5. Baseline study of the chemical and physical characteristics of the water adjacent to wetlands.
6. Association of the chemical and physical characteristics of the wetland aquatic habitat with the species of anadromous fishes found.

STATUS:

One season of field work has been completed. Compilations of relative abundance have been made for several arrangements of data. Computer programming is being done currently. In the coming year, further field work on the Choptank River is scheduled. An annual report covering accomplishments will be released in January 1973.

FINANCIAL SUPPORT:

State of Maryland.
Bureau of Sport Fisheries and Wildlife (PL 89-304).

Md-FWA-3

Fish and Wildlife Administration
State Office Building
Annapolis, Maryland 21401

PROJECT TITLE: SURVEY OF ANADROMOUS FISH SPAWNING AREAS

PRINCIPAL INVESTIGATORS:

Jay O'Dell, Project Leader - Biologist
John Gabor - Biologist
Howard James King - Biologist

OBJECTIVES:

1. Conduct an inventory of streams in the State to determine which support or have potential to support spawning runs of anadromous fish.
2. Determine problem areas and streams where major corrections or mitigating devices may improve conditions for spawning of anadromous species.
3. Devise test and evaluate methods for correction of problem areas associated with anadromous fish passage and spawning.

STATUS:

The program was initiated in March 1968. During 1968, -69, -70 portions of 188 streams in twenty-four drainage systems were investigated, with blockage removal completed on thirty-six streams. Nearly four thousand investigations for anadromous species were conducted on 495 streams, verifying anadromous presence in 196 streams. Water quality investigations were conducted on all streams investigated for anadromous species, which included all standard parameters. An inventory of impoundments in 18 Maryland tidewater counties resulted in 262 existing barriers being inventoried.

During 1970-71 physical, biological, and water quality sampling was conducted on all major streams along the Maryland portion of the Potomac River, upriver to Washington, D. C.

A federal aid completion report was completed for activities through August 31, 1970. A report on the Potomac River phase of work is in preparation.

Areas of investigation for 1972-73 will be the upper Chesapeake Bay drainage. The study will include physical, biological, and chemical investigation of Chesapeake Bay and all principal tributaries.

FINANCIAL SUPPORT:

National Marine Fisheries Serivce
State of Maryland

Md-FWA-4

Fish and Wildlife Administration
State Office Building
Annapolis, Maryland 21401

PROJECT TITLE: ESTUARINE FINFISH MANAGEMENT

PRINCIPAL INVESTIGATORS:

Joseph G. Boone - Biologist III
Roy F. Scott - Biologist II

OBJECTIVES:

Management of finfishes inhabiting Maryland tidal waters.

STATUS:

Activities relate to survey and inventory type investigations of population size and age structure of important fish species. Annual investigations include: (1) Summer shore seining survey for relative abundance of young-of-year striped bass, white perch, shad, spot, and other species. (2) Sampling of commercial landing for age-growth of important fish species. (3) Examination of commercial landings by species, capture gear, and capture area. (4) Monitoring of striped bass spawning by plankton sampling. Anticipated projects additional to the above during the next year include a temporary striped bass hatchery at Vienna, Maryland during the spring of 1972 and a preliminary check of pesticide residues in striped bass gonads.

FINANCIAL SUPPORT:

Maryland Department of Natural Resources

Md-FWA-5

Fish and Wildlife Administration
State Office Building
Annapolis, Maryland 21401

PROJECT TITLE: FISH DISEASES

PRINCIPAL INVESTIGATORS:

Barbara L. Holden - Fisheries Biologist
Shelley Dyer - Biologist

OBJECTIVES:

1. To investigate reports of fish mortalities in the State of Maryland.
2. To study parasites and diseases and pathology as they relate to fish kills.
3. To perform field and laboratory bioassays and associated histology as they relate to fish kills.

STATUS:

Although the State has been investigating fish kills for decades, it was not until the summer of 1970 that it became a separate project with responsibilities delegated to specific individuals. During the fiscal year 1971. there were 43 fish kills, 17 were attributed to pollution, 9 to naval test blasts, 4 to sportsmen and commercial discards, 3 to natural causes, and 7 unknown causes. This year's kills will include many more kills due to natural causes. We have begun a series of bioassays and expect to continue this summer. We are expanding our disease and parasite investigations.

FINANCIAL SUPPORT:

State of Maryland

*Md-FWA-6

State Fish & Wildlife Admin.
State Office Bldg.
Annapolis, Maryland 21404

PROJECT TITLE: MOLLUSCAN MORTALITY STUDIES

PRINCIPAL INVESTIGATOR:

F. W. Sieling

SUMMARY OF PROJECT:

Technical objectives: Determine molluscan parasite distribution; compare mortality and infection rates of oysters from non-enzootic and enzootic, Minchinia nelsoni, areas; compare off-bottom with on-bottom oyster culture.

Examine molluscan samples which are collected on a semi-annual basis from several designated areas of Chesapeake Bay and tributaries, as well as those collected from non-scheduled areas at times of reported mortalities.

Three year classes of oysters from a non-enzootic area will be introduced into Manokin River. These will be monitored quarterly for mortality rates and for parasite prevalence level determinations. Spat from these areas will be introduced into other M. nelsoni enzootic areas to further test the disease resistance-susceptibility hypothesis and will also be monitored on a quarterly basis.

Seasonal spatfall in Manokin River will be monitored, rafts with suspended shell cultch will be maintained, and the relative efficiencies, merits, and disadvantages of spat capture using off-bottom cultch and on-bottom cultch will be compared.

FINANCIAL SUPPORT:

Commerce Department
Natl. Oceanic & Atm. Admin.
Natl. Marine Fisheries Service

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Source: Science Information Exchange, Inc.

*Md-FWA-7

State Fish & Wildlife Admin.
Annapolis, Maryland 21404

PROJECT TITLE: EFFECTS OF SUSPENDED SEDIMENT ON HATCHING OF FISH EGGS AND DEVELOPMENT OF LARVAE.

PRINCIPAL INVESTIGATOR:

J. R. Schubel

SUMMARY OF PROJECT:

Study objective: To determine the effects of suspended sediments on fish eggs and larvae, the importance of resuspension of such eggs toward their development and then to make recommendations concerning dredging and spoil disposal during spawning-incubation-nursery periods.

Job objective: To determine the effects of suspended sediment on the development and hatching process of various sport fish and prey fish eggs and larvae.

Procedures: The effects of the concentration of size distribution of the suspended sediment on the distribution, development, and behavior of anadromous fish eggs and larvae will be determined by a series of field and laboratory studies.

Field studies will characterize the most important spawning areas in the upper Chesapeake Bay and Chesapeake and Delaware Canal in terms of the concentration and size distribution of suspended solids, and in terms of the transparency of the water. Water samples, collected from a large number of stations in the upper Chesapeake and C & D Canal, will be filtered through 0.6 micron APD membrane filters. The transparency of the water will be determined with a modified Clarke submarine photometer. Field determinations will be made of hatching success in areas characterized by different concentration of suspended sediment by stocking hatching boxes, and monitoring the development of the eggs. The results will be compared to those from controlled laboratory experiments.

Laboratory studies will be made using an apparatus designed and constructed during the previous contract period. The apparatus, utilizing a reciprocating paddle, allows the maintenance of uniform suspensions of different concentrations of fine-grained sediment in a number of aquaria over extended periods of time. The suspensions are automatically renewed gradually to prevent any buildup of waste products. Hatching success will be determined and the rates and normalcy of development monitored in the various suspensions for a number of different species of fish.

FINANCIAL SUPPORT:

Interior Department, Bureau of Sport Fish. & Wlf., Federal Aid Division.

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Source: Science Information Exchange, Inc.

*Md-FWA-8

State Fish & Wildlife Admin.
Annapolis, Maryland 21404

PROJECT TITLE: ESTIMATION OF SEDIMENT FLUX - UPPER CHESAPEAKE BAY.

PRINCIPAL INVESTIGATOR:

J. R. Schubel

SUMMARY OF PROJECT:

Study objective: To determine the sources, characteristics and flux of suspended sediments in upper Chesapeake Bay. (Md-FWA-9,10 have pervasive objectives of the total project. Because of the intensive effort devoted to these objectives during the past several years, little time or support are required, but the properties must be monitored in conjunction with the work done under the other project objectives. Md-FWA-8 will have the greatest effort and costs expended toward its objective.)

Job objective: To collaborate with physical oceanographers on the intensive upper Bay current study to estimate the flux of sediment through two continuous Bay segments extending from the head of the Bay to 39°10'N.

Procedures: Beginning in late summer of 1971 an intensive physical oceanographic field program will be initiated in the upper Chesapeake Bay. The study, supported by the Corps of Engineers, will involve tidal measurements, current measurements, and temperature and salinity determinations at two cross-sections in the main body of the Bay, and at a number of sections in selected tributaries. Measurements will be made during periods of both high and low riverflow.

We propose to make detailed concurrent observations of the suspended sediment population during each of the physical oceanographic study periods. Determinations will be made of the concentration of total suspended solids, the percent of the total mass accounted for by combustible organic matter, and the particle size distribution (both number and mass). These data will be combined with the current measurements to estimate the horizontal flux of suspended sediment through two contiguous segments extending from the head of Chesapeake Bay to about 39°10'N. The contributions from the important tributaries will also be determined. The data will be utilized to formulate a sediment budget for the upper Bay for each of the study periods.

FINANCIAL SUPPORT:

Interior Dept., Bureau of Sport Fish. & Wlf., Federal Aid Division.

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Source: Science Information Exchange, Inc.

*Md-FWA-9

State Fish & Wildlife Admin.
Annapolis, Maryland 21404

PROJECT TITLE: SOURCES AND CHARACTERISTICS OF SUSPENDED SEDIMENT.

PRINCIPAL INVESTIGATOR:

J. R. Schubel

SUMMARY OF PROJECT:

Study objective: To determine the sources, characteristics and flux of suspended sediments in upper Chesapeake Bay. (Md-FWA-9,10 have pervasive objectives of the total project. Because of the intensive effort devoted to these objectives during the past several years, little time or support are required, but the properties must be monitored in conjunction with the work done under the other project objectives. Md-FWA-8 will have the greatest effort and costs expended toward its objective.)

Job objective: To determine the sources and characteristics of suspended sediments.

Procedures: Determinations will be made of the rates of transport (vertical flux densities) of resuspended sediments of various grain sizes through imaginary horizontal planes at several fixed distances above the bottom. The tidal induced variations of volume particle size distribution will also be determined at these levels.

The investigations will be carried out both in the field at selected stations in Chesapeake Bay and in the laboratory using the Chesapeake Bay Institute flume. In the field studies a series of anchor stations will be occupied at which hourly measurements will be made of current velocity, suspended sediment concentration, temperature and salinity. The measurements will be taken at multiple depths over two or more tidal cycles. Stations will be occupied at different locations and during different tidal conditions and seasons. The flume experiments will involve measurements of the concentration of suspended sediment at fixed levels above the bottom for a series of selected current velocities.

FINANCIAL SUPPORT:

Interior Department, Bureau of Sport Fish. & Wlf., Federal Aid Division.

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Source: Science Information Exchange, Inc.

*Md-FWA-10

State Fish & Wildlife Admin.
Annapolis, Maryland 21404

PROJECT TITLE: SEDIMENT BUDGET FOR UPPER CHESAPEAKE BAY.

PRINCIPAL INVESTIGATOR:

J. R. Schubel

SUMMARY OF PROJECT:

Study objective: To determine the sources, characteristics and flux of suspended sediments in upper Chesapeake Bay. (Md-FWA-9,10 have pervasive objectives of the total project. Because of the intensive effort devoted to these objectives during the past several years, little time or support are required, but the properties must be monitored in conjunction with the work done under the other project objectives. Md-FWA-8 will have the greatest effort and costs expended toward its objectives.)

Job objective: To estimate the relative contributions to the suspended load by river flow, shore erosion, primary productivity, and the resuspension of bottom sediments and to use these data to formulate a sediment budget.

Procedures: Data on shore erosion, fluvial sediment discharge, primary productivity and resuspension of bottom sediments gathered during the past 6 years will be combined with the distributions of suspended sediment over the same period, and with information on circulation to formulate a sediment budget for this segment of the Bay. Methods used in gathering these data have been described in other S.I.E. reports. An attempt will be made to check the sedimentation rate estimated by this method through a comparison of depths recorded on old and recent boat sheets along two or three cross-sections. Suspended solids accounted for by organic matter, (4) the mineralogic composition of the inorganic fraction, (5) the relative contributions to the suspended load by river flow, shore erosion, primary productivity, and by the resuspension of bottom sediments, and (6) the fraction of suspended sediment which escapes the Bay.

Samples will be collected from five or more depths at each of 18 channel stations extending the full length of the Bay. Supplementary samples will be collected in the upper Bay during periods of high river flow. The concentration will be determined by filtration; the percent organic matter by combustion; the mineralogy by X-ray diffraction; and the size distribution with a Zeiss Particle Size Analyzer and a Mine Safety Applicance Particle Size Analyzer. These properties will be used to estimate the relative contributions by the various sources of suspended sediment.

FINANCIAL SUPPORT:

Interior Dept., Bureau of Sport Fish. & Wlf., Federal Aid Division.

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Source: Science Information Exchange, Inc.

*Md-FWA-11

State Fish & Wildlife Admin.
Annapolis, Maryland 21404

PROJECT TITLE: AGGLOMERATION OF SUSPENDED PARTICLES.

PRINCIPAL INVESTIGATOR:

J. R. Schubel

SUMMARY OF PROJECT:

Study objective: To determine the sources, characteristics and flux of suspended sediments in upper Chesapeake Bay. (Md-FWA-9,10 have pervasive objectives of the total project. Because of the intensive effort devoted to these objectives during the past several years, little time or support are required, but the properties must be monitored in conjunction with the work done under the other project objectives. Md-FWA-8 will have the greatest effort and costs expended toward its objectives.)

Job objective: To determine the state of agglomeration of suspended sediment, and to assess the importance of selected filter feeding zooplankton in the agglomeration and ultimate deposition of these fine-grained particles.

Procedures: To determine the state of agglomeration of the particles suspended throughout the water column in different segments of the Bay; to assess the role played by certain filter feeding organisms in determining the degree of agglomeration; and to determine possible tidal variations in the degree of agglomeration in the zone near the bottom where the concentration of suspended particles varies markedly over a tidal cycle.

"Undisturbed mono-particle-layer" samples of sediment will be collected from the water with special samplers. The particles will be examined in detail with a light microscope, an electron microscope, and a scanning electron microscope. The tidal variation of the state of agglomeration near the bottom will be determined from samples collected at half-hourly intervals over a tidal cycle: These samples will be supplemented with larger samples for determination of the concentration of suspended sediment, and with measurements of current velocity, temperature, and salinity.

Laboratory experiments are being designed to determine the effects of selected filter feeding organisms on the state of agglomeration fine-grained suspended particles, and on the size (settling velocity) distribution of the particles and their sedimentation rate.

*Md-FWA-11

Water samples will be collected from Chesapeake Bay and treated with an ultrasonicator to disperse the suspended particles and destroy all agglomerates. Each water sample will be split in half, placed in separate containers and gently agitated with a reciprocating paddle. Small samples will be extracted from each container, and the suspended solids sized and their degree of agglomeration determined. A number of selected filter-feed (Text Truncated - Exceeds Capacity).

FINANCIAL SUPPORT:

Interior Department, Bureau of Sport Fish. & Wlf., Federal Aid Division.

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Source: Science Information Exchange, Inc.

*Md-FWA-12

State Fish & Wildlife Admin.
State Office Bldg.
Annapolis, Maryland 21404

PROJECT TITLE: BLUE CRAB STUDY IN CHESAPEAKE BAY

PRINCIPAL INVESTIGATOR:

Dr. S.D. Sulkin

SUMMARY OF PROJECT:

Objective: Primary objectives are to develop accurate means to measure abundance, catch per unit of effort and natural mortality rates.

Monthly sampling for juvenile and adult crabs will be conducted throughout the year on previously established transect stations in the vicinity of Cove Point, Md., where the greatest concentration of wintering juvenile crabs in the entire Bay was observed in 1968-1969. In addition to the transect stations, a different area of the Bay system will be studied each month. Trawl (with a 1/2-inch mesh liner) and lined and unlined dredges will be utilized for collecting crabs at various depths and substrates. The gear will be towed at a constant rate and will be standardized with VIMS methods. Periodically, cooperative cruises will be made by CBL and VIMS personnel. Gear modifications will be discussed jointly and new experimental gear will be used on a collaborative basis by the participants. Bi-weekly push-net sampling will be conducted in the Patuxent River at established stations and possibly at other locations. The effect on the catch of environmental factors such as tidal stages, substrate types, temperature and salinity will be evaluated. Hydrographic factors, distribution and habitat preferences will be recorded and analyzed.

FINANCIAL SUPPORT:

Commerce Department
Natl. Oceanic & Atm. Admin.
Natl. Marine Fisheries Service

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Source: Science Information Exchange, Inc.

*NASA-1

U. S. Natl. Aero. & Space Adm.
Wallops Station
Wallops Island, Virginia

PROJECT TITLE: DEVELOPMENT OF CHESAPEAKE BAY ECOLOGICAL TEST SITE FOR REMOTE SENSING APPLICATIONS.

PRINCIPAL INVESTIGATOR:

J. F. Bettle

SUMMARY OF PROJECT:

A broad, long-range program will be pursued to establish and develop the Chesapeake Bay as an area in which many potential applications of remote sensing from aircraft and spacecraft can be evaluated and calibrated, in particular those involving land-sea interfaces. Efforts and plans will be directed at making the Bay area a multidisciplinary test site about which a substantial information center can be developed. This information will be acquired from subsurface, surface, aircraft, and eventual earth resources satellite observations. Information resulting from work within, and the exchange and interaction between, these program objectives will strongly aid in the development of techniques for understanding and managing ecological parameters in the Chesapeake Bay area. The development of the site will provide a test-bed for earth resource experiments and a calibration and ground truth area for earth survey space systems. The developed technology can be extended to other geographical areas on an operational basis. The investigator shown above is the Project Monitor whose telephone is 703-824-3411.

FINANCIAL SUPPORT:

Natl. Aeronautics & Space Adm., Space Sci. & Applications Off., Wallops Station.

*
Source: Science Information Exchange, Inc.

*NOAA-NMFS-1

Natl. Marine Fisheries Service,
NOAA
Biological Laboratory
Oxford, Maryland 21654

PROJECT TITLE: PHYSICAL AND CHEMICAL CHARACTERISTICS OF THE UPPER CHESAPEAKE BAY.

PRINCIPAL INVESTIGATOR:

W. N. Shaw

SUMMARY OF PROJECT:

Physical characteristics (temperature, current speed and direction, tidal fluctuations, exchange rates and volumes) of local waters and in large man-made salt water ponds are being and will be determined. Chemical characteristics (salinity, oxygen, phosphate, nitrate, etc.) of local waters and in artificial ponds will also be determined. Information provides baselines to evaluate effects of environmental extremes on commercial shellfish in natural waters and in laboratory experiments.

FINANCIAL SUPPORT:

Commerce Department, Natl. Oceanic & Atm. Admin., Natl. Marine Fisheries Service.

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Source: Science Information Exchange, Inc.

*NOAA-NMFS-2

Natl. Marine Fisheries Service,
NOAA
Biological Laboratory
Oxford, Maryland 21654

PROJECT TITLE: POTENTIAL OYSTER SETTING CAPACITY - LOCAL AREAS

PRINCIPAL INVESTIGATORS:

W. N. Shaw
D. L. McQuay

SUMMARY OF PROJECT:

This project is concerned with the setting capacity of oysters in local waters, principally the Tred Avon River, Broad Creek, and Harris Creek, on the Eastern Shore of Chesapeake Bay in Maryland. Yearly, stations are established in each area, and during the oyster setting season (June to October) collectors in the form of oyster shells and asbestos flexboards are put out at each station. Total amount of setting and period of setting intensity are measured by counting daily and weekly the number of oyster spat on these collectors. In addition, the amount of fouling competitors for space is studied.

Studies on the rafting of shells to catch seed oysters are being conducted. Rafts are being placed in areas where setting intensity has been high. Shells on strings and in bags are being suspended from the rafts during the setting season. Once the seed is caught they are removed from the rafts and suspended from a rigid structure to grow to market size. The long line method to catch and grow seed oysters is to be tested in several areas.

FINANCIAL SUPPORT:

Commerce Department
Natl. Oceanic & Atm. Admin.
Natl. Marine Fisheries Service

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Source: Science Information Exchange, Inc.

*NOAA-NMFS-3

Natl. Marine Fisheries Service,
NOAA
Biological Laboratory
Oxford, Maryland 21654

PROJECT TITLE: ECOLOGY AND DISTRIBUTION OF OYSTERS AND CLAMS

PRINCIPAL INVESTIGATOR:

W.N. Shaw

SUMMARY OF PROJECT:

The natural populations of commercial shellfish in local areas have been delimited. Zooplankton and phytoplankton levels in shellfish producing areas are being determined and the organisms involved are being identified. The effects of physical and chemical factors on plankton, and on larval, juvenile, and adult stages of commercial shellfish are being determined. Qualitative and quantitative observations are being made on the invertebrate animals in local areas, and numbers and living habits related to effects on commercial species. Food webs, within the small estuarine tributaries of Chesapeake Bay, are being established. Ecological studies in large man-made salt water ponds have been undertaken, and all information, from natural and artificial situations, will be related to maintenance of shellfish in these ponds.

FINANCIAL SUPPORT:

Commerce Department
Natl. Oceanic & Atm. Admin.
Natl. Marine Fisheries Service

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Source: Science Information Exchange, Inc.

*NOAA-NMFS-4

Natl. Marine Fisheries Service,
NOAA
Biological Laboratory
Oxford, Maryland 21654

PROJECT TITLE: SHELLFISH MORTALITY - CHESAPEAKE BAY

PRINCIPAL INVESTIGATORS:

C.A. Farley
A. Rosenfield

SUMMARY OF PROJECT:

An investigation into the possible causes of shellfish (oyster) mortality in Chesapeake Bay has been initiated.

Intensive sampling of several areas in the Maryland portion of Chesapeake Bay indicated that relatively high mortality levels and MSX (multinucleate sphere of unknown taxonomic position) incidence occurred with regularity in the higher saline waters of Chesapeake Bay near the Virginia-Maryland boundary. Consequently, biweekly monitoring of this area for oyster mortality levels and disease incidence in sampled oysters, as well as to record ecological conditions was begun in April 1961, and continues to present.

Laboratory projects include histological comparisons between the normal and pathological conditions of sampled oysters, isolation and culture of protistan parasites, transmission experiments, identification and life cylce studies of heretofore unrecognized or unidentified pathogens, and histochemical studies aimed toward the elucidation of the biochemical changes that occur in both the parasite and host tissues during infection, and to discover possible rapid and differential diagnostic techniques for parasites in shellfish tissue.

FINANCIAL SUPPORT:

Commerce Department
Natl. Oceanic & Atm. Admin.
Natl. Marine Fisheries Service

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Source: Science Information Exchange, Inc.

*NOAA-NMFS-5

Natl. Marine Fisheries Service,
NOAA
Biological Laboratory
Oxford, Maryland 21654

PROJECT TITLE: PATHOLOGY - EPIZOOTIOLOGY

PRINCIPAL INVESTIGATORS:

C.A. Farley

SUMMARY OF PROJECT:

The pathological, parasitological, epizootiological, and cytochemical relationships of diseases in oysters are being studied. Receiving greatest attention with regard to the above is the haplosporidan, Minchinia nelsoni, an oyster parasite associated with massive oyster mortalities in Delaware and Chesapeake Bays. With the repeated discovery of definitive life cycle stages, its life history within the oyster has now been proposed. A system for determining stages of infection has been developed and is being utilized for interpretation of epizootiological data. Comparative studies are being made of epizootiological patterns in four populations of oysters in Pocomoke Sound, Maryland. Methods are being developed for determining DNA-RNA patterns in hosts and parasites and is receiving intensive study. Studies are also being made of causes of mortality in oysters from the west coast of the United States, British Columbia, and France and are being compared with local mortality causes.

FINANCIAL SUPPORT:

Commerce Department
Natl. Oceanic & Atm. Admin.
Natl. Marine Fisheries Service

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Source: Science Information Exchange, Inc.

*NOAA-NMFS-6

Natl. Marine Fisheries Service,
NOAA
Biological Laboratory
Oxford, Maryland 21654

PROJECT TITLE: MICROBIOLOGY OF MARINE AND ESTUARINE INVERTEBRATES

PRINCIPAL INVESTIGATOR:

R.R. Colwell

SUMMARY OF PROJECT:

A study of the natural bacterial flora of oysters and associated invertebrate animals has been initiated. Animals from specified areas of Chesapeake Bay and off the Atlantic Coast are being sampled, using specified aseptic techniques to determine the quantitative and qualitative bacteriological flora of the animals. The normal commensal flora of oysters is being determined by examination of the shell liquor, body flesh, and intestine.

Standard bacteriological procedures are being followed for sampling, testing, and analysis. However, newer techniques of diagnosis and taxonomy will be applied, including the high-speed computer methods and the nucleic acid analyses, techniques developed and/or adapted by the Principal Investigator in previous published research.

Ancillary studies of the environment of the animals, i.e., water and mud samples, are also being undertaken. Unique features of the bacterial populations which are observed will be studies in detail.

The work is being undertaken at Georgetown University with the active collaboration of personnel at the Biological Laboratory, Bureau of Commercial Fisheries, U.S. Fish and Wildlife Service, Oxford, Maryland.

FINANCIAL SUPPORT:

Commerce Department
Natl. Oceanic & Atm. Admin.
Natl. Marine Fisheries Service

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Source: Science Information Exchange, Inc.

ODU-1

Old Dominion University
Department of Biology
Norfolk, Virginia 23508

PROJECT TITLE: PLANKTON COMPOSITION AND DISTRIBUTION IN THE LOWER CHESAPEAKE BAY, THE JAMES RIVER ESTUARY, AND COASTAL WATERS AT THE MOUTH OF THE BAY

PRINCIPAL INVESTIGATOR:

Harold G. Marshall - Professor

OBJECTIVES:

Determine composition and distribution patterns of phytoplankton and zooplankton populations.

STATUS:

Study areas include Hampton Roads, the Elizabeth River, and the Lafayette River. Results of seasonal studies will be completed shortly. The collections made at the mouth of the Bay are part of an extensive study along the entire East Coast.

FINANCIAL SUPPORT:

National Science Foundation

ODU-2

Old Dominion University
Institute of Oceanography
Norfolk, Virginia 23508

PROJECT TITLE: ANALYSES OF WATER AND SEDIMENT DOWNSTREAM OF HYDRAULIC DREDGING IN THE ELIZABETH RIVER

PRINCIPAL INVESTIGATOR:

Donald D. Adams - Assistant Professor

OBJECTIVES:

1. To determine the dispersion of sediments by hydraulic dredging.

2. To understand the dispersion of the trace metals lead, mercury, and zinc resulting from hydraulic dredging.

STATUS:

We have completed the sampling program in the Elizabeth River behind the USCE Goethals' dredging operations. We are still in the process of analyzing the samples for the concentrations of lead, mercury, and zinc both in the water and sediment.

The results of this six months study will be released as a technical report to the U. S. Army Corps of Engineers, Norfolk.

FINANCIAL SUPPORT:

U. S. Army Corps of Engineers

*ODU-3

Old Dominion University
Institute of Oceanography
Norfolk, Virginia 23508

PROJECT TITLE: NAVY ENVIRONMENT -- DYNAMICS OF TIDAL SAND WAVES.

PRINCIPAL INVESTIGATORS:

J. C. Ludwick
D. J. Swift

SUMMARY OF PROJECT:

A better understanding of sand waves and associated bottom features at the entrances to tidal estuaries is applicable to Naval problems related to mine implantation and defense, harbor improvements, maintenance of ship navigation channels in areas of shoals, and amphibious warfare plans and operations. This research may also lead to the ability to predict local environmental conditions through remotely sensed or otherwise acquired information on tidal sand waves.

This research will investigate the growth and shifting of submerged sand banks in the tidal entrance to Chesapeake Bay, Virginia, and their relationships to the migrations of the sand waves which surmount the banks and occupy the channels between banks. This investigation will be conducted along three lines of attack -- field sampling and laboratory analysis of the sediments of a sand bank area, field observation and measurement of the associated currents, and study of the distribution of sand waves, their morphology, and their changes with the tides.

A large scale map of the study area has been constructed as a base for plotting the detailed bathymetric survey data that are being obtained. Measurements being obtained of tidal bottom currents are being plotted in flood time velocity and ebb time velocity curves to depict tidal excursions and water circulation.

FINANCIAL SUPPORT:

Department of Defense, Office of Naval Research, Arlington, Va.

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Source: Science Information Exchange, Inc.

PWRC-1

Bureau of Sport Fisheries and Wildlife
Patuxent Wildlife Research Center
Laurel, Maryland 20810

PROJECT TITLE: CONTROL OF EURASIAN WATERMILFOIL: DISTRIBUTION, LIFE HISTORY, AND ECOLOGY OF EURASIAN WATERMILFOIL.

PRINCIPAL INVESTIGATOR:

John H. Steenis

OBJECTIVE:

To study the distribution, life history, and ecology of Eurasian watermilfoil in its different environments.

STATUS:

This report covers the calendar year 1971.

Eurasian watermilfoil is now throughout most of the United States and Canada. It has spread chiefly by vegetative propagation from nodes of leafy stems and shoots, but also produces seeds that can germinate under water.

It grows in either sterile or fertile waters of medium to high alkalinity. It does not grow in acid waters that test less than 10 ppm methyl orange alkalinity. It can grow in fresh water or saline waters up to 40 percent sea salinity (about 12 ppt). There are other factors such as turbidity and currents (tidal or stream) that limit the growth of this exotic plant more severely than they do some of the native submersed species. Under certain circumstances, native species of submersed aquatics such as wildcelery, redheadgrass, and wigeongrass can establish themselves in adverse sites. However, if growing conditions improve, Eurasian watermilfoil may encroach and crowd out the native plants.

FINANCIAL SUPPORT:

U. S. Department of the Interior, Bureau of Sport Fisheries and Wildlife.

PWRC-2

Bureau of Sport Fisheries and Wildlife
Patuxent Wildlife Research Center
Laurel, Maryland 20810

PROJECT TITLE: CONTROL OF EURASIAN WATERMILFOIL: DEVELOPMENT OF METHODS FOR CONTROL OF EURASIAN WATERMILFOIL.

PRINCIPAL INVESTIGATOR:

John H. Steenis

OBJECTIVE:

To develop economical and safe methods for control of Eurasian watermilfoil under various environmental conditions and to evaluate the effectiveness of promising new weed control methods, mainly the use of chemicals, as they are developed in the future.

STATUS:

This report covers the calendar year 1970.

Selective herbicidal treatment of Eurasian watermilfoil usually lasts from 3 to 5 years if entire embayments can be treated. This has been demonstrated in studies on Chesapeake Bay and Currituck Sound. Recently, extensive operational treatments by TVA on the Guntersville Reservoir, Tennessee, successfully eradicated milfoil.

Biological control of Eurasian watermilfoil by an aquatic larva of a moth (Paraponyx stratiotat) has shown promise in Yugoslavia. Plans are under way to carefully evaluate the specificity of this moth to control the watermilfoil without damaging other submersed aquatic plants. Preventing harm to fish and wildlife will be one of the major considerations in any evaluation of biological control methods.

The following paper by John Steenis was presented at the annual meeting of the Weed Science Society of America in Montreal, Canada, February 1970: "Specifications for tidal dispersal of 2,4-D for the control of Eurasian watermilfoil."

FINANCIAL SUPPORT:

U. S. Department of the Interior, Bureau of Sport Fisheries and Wildlife.

Bureau of Sport Fisheries and
Wildlife
PWRC-3 Patuxent Wildlife Research Center
Laurel, Maryland 20810

PROJECT TITLE: DEVELOPMENT OF NEW METHODS FOR FALL AND WINTER APPRAISALS OF ANNUAL PRODUCTIVITY OF WATERFOWL: DEVELOPMENT OF NEW METHODS FOR FALL AND WINTER APPRAISALS OF THE ANNUAL PRODUCTIVITY OF THE BLUE AND SNOW GOOSE.

PRINCIPAL INVESTIGATOR:

John J. Lynch

OBJECTIVES:

1. To determine whether fall and winter groupings of birds, and plumage differences between young of the year and older birds are reliable indicators of productivity.

2. To develop, from these indicators, methods whereby summer nest success can be determined by survey of fall and winter populations.

3. To compare annual productivity as determined by the above surveys with that forecast from the nesting grounds.

STATUS:

This report covers the calendar year 1971.

Snows and blues that migrated briskly to the Gulf coast had a 1971 nesting that was barely adequate. Only 25 percent of these geese that had reached Louisiana and Texas by mid-November were 1971-hatched young, and their broods averaged 2.0 goslings. But the fall migration of these Central-Mississippi Flyway geese is becoming so slow in recent years that birds seen in early winter Gulf appraisals may represent only a fraction of flyway populations. The full picture of 1971 productivity among these snows and blues will not be available until appraisals of late migrants are completed (in February 1972). Appraisals of greater snow geese and Atlantic brant wintering along the east coast indicate a nearly complete nesting failure in the Eastern Arctic this summer.

Earlier in 1971, field appraisal of 1970 productivity among these geese were completed. The Final Report of 1970 operations (issued July 15, 1971) attempted to construct population histories of snows and blues during the period 1966-70. These histories, which reconcile (where possible) information from Productivity Appraisals with census figures from Midwinter Inventories, help put all our survey data on these birds in better perceptive.

PWRC-3

FINANCIAL SUPPORT:

U. S. Department of the Interior, Bureau of Sport Fisheries and Wildlife.

PWRC-4

Bureau of Sport Fisheries and Wildlife
Patuxent Wildlife Research Center
Laurel, Maryland 20810

PROJECT TITLE: DEVELOPMENT OF NEW METHODS FOR FALL AND WINTER APPRAISALS OF ANNUAL PRODUCTIVITY OF WATERFOWL: DEVELOPMENT OF NEW METHODS FOR FALL AND WINTER APPRAISALS OF THE ANNUAL PRODUCTIVITY OF THE CANADA GOOSE.

PRINCIPAL INVESTIGATOR:

John J. Lynch

OBJECTIVES:

1. To determine whether the average group in fall and winter flocks is a reliable indicator of productivity.

2. To develop fall and winter surveys that will determine annual productivity from average group size.

STATUS:

This report covers the calendar year 1971.

Since young-of-the-year Canada geese cannot be visually separated by plumage differences, productivity appraisals are limited to average group counts. These assume that groups of non-family birds are relatively constant in size and that a high 'average-group' count indicates a good production year with many large families. The integrity of winter goose families, which is basic to the validity of the average-group appraisal, is now being studied by the use of neck-collared family groups in various localities.

FINANCIAL SUPPORT:

U. S. Department of the Interior, Bureau of Sport Fisheries and Wildlife.

Bureau of Sport Fisheries and
Wildlife
PWRC-5 Patuxent Wildlife Research Center
Laurel, Maryland 20810

PROJECT TITLE: IMPROVEMENT AND MANAGEMENT OF COASTAL CORDGRASS MARSHES FOR WATERFOWL AND OTHER WILDLIFE.

INVESTIGATOR:

John H. Steenis

OBJECTIVE:

To develop control procedures for cordgrasses that are economical and are not harmful to wildlife and to determine how to apply these procedures in conjunction with other techniques, mainly use of gut plugs, for improvement of coastal marshes for waterfowl and other wildlife.

STATUS:

This report covers the calendar year 1970.

Previous studies have shown that dalapon can be used effectively to control the salt-marsh cordgrasses. Now the objective is to determine how this technique can be used to improve waterfowl habitat by creating an interspersion of marsh and open water in solid stands of grass. The most promising results to date have occurred in mature marshes with "pulpy" bottoms. The plugging of tidal guts in those areas would retain shallow, open water at low tides. Such sites would be ideally suited for the growth of wigeongrass, an excellent waterfowl food.

In August 1970, a few more "pulpy-bottomed" cordgrass marshes in Delaware were sprayed with dalapon.

A paper by John Steenis and Robert Beck, entitled "Control of cordgrass in tidal marshes," was presented at the annual meeting of the Northeastern Weed Science Society in New York City in January 1970.

FINANCIAL SUPPORT:

U. S. Department of Interior, Bureau of Sport Fisheries and Wildlife.

Bureau of Sport Fisheries and
Wildlife
PWRC-6 Patuxent Wildlife Research Center
Laurel, Maryland 20810

PROJECT TITLE: DESCRIPTION AND IDENTIFICATION OF WETLAND RESOURCES: FIELD GUIDE TO MARSH AND WATER PLANTS OF EASTERN UNITED STATES AND CANADA (Final Report).

INVESTIGATORS:

Neil Hotchkiss
Francis M. Uhler

OBJECTIVES:

1. To picture and describe, as they grow, most readily identifiable marsh and water plants of eastern United States.

2. To prepare publications, e.g., Circular 187 "Pondweeds and Pondweedlike Plants of Eastern North America" for major groups of aquatic plants.

3. To summarize the information presented in the series of circulars into a compact, durable field guide in which simple, realistic drawings will be the main means of identification.

STATUS:

This report covers the calendar year 1970.

A Resource Publication: "Common marsh plants of the United States and Canada," was edited, reviewed, and sent to GPO. It will be available for distribution early in 1971.

FINANCIAL SUPPORT:

U. S. Department of Interior, Bureau of Sport Fisheries and Wildlife.

PWRC-7

Bureau of Sport Fisheries and Wildlife
Patuxent Wildlife Research Center
Laurel, Maryland 20810

PROJECT TITLE: EFFECTS OF INGESTED AND IMPLANTED LEAD SHOT AND SUBSTITUTES FOR LEAD SHOT ON WATERFOWL: RELATIVE TOXICITY OF LEAD SHOT AND SUBSTITUTE SHOT TO WATERFOWL.

INVESTIGATORS:

Ralph Andrews
Jerry Longcore
Louis Locke
George Bagley

OBJECTIVE:

To determine relative toxicity of lead shot and substitute shot to waterfowl.

STATUS:

This report covers the calendar year 1970.

Since soft iron is the only promising candidate for replacing lead shot, this study has been rather inactive in 1970. Various studies relating to toxicity of lead shot and proposed substitute materials have been compiled in manuscript form. A test showed that "grandchildren" of "lead-tolerant" mallards still show greater resistance to lead poisoning than do mallards from the general population.

In the spring of 1969, four pairs of second generation offspring of lead-dosed survivors and four pairs of normal game-farm mallards were allowed to nest in pens. From the offspring produced, 29 ducks from each of the two groups were subsequently dosed with eight number 6 lead. All ducks were maintained on a whole-yellow-corn diet. Results of this test are summarized in Table 1. The offspring of lead-dosed parents again had a significantly higher survival rate ($P < 0.002$) (Fisher exact probability test). Fluoroscopic examination of test ducks showed that shot retention for the two groups was similar and that the shot were eroded considerably 2 weeks after dosing. The results of this test showed that the particular strain of ducks had a higher tolerance to lead, since considerable lead was made available for absorption yet mortalities were fewer among the offspring of lead-dosed parents. Furthermore, this test showed that the resistance to lead poisoning was carried through the third generation of ducks.

FINANCIAL SUPPORT:

U. S. Department of Interior, Bureau of Sport Fisheries and Wildlife.

Bureau of Sport Fisheries and
Wildlife
PWRC-8 Patuxent Wildlife Research Center
Laurel, Maryland 20810

PROJECT TITLE: ECOLOGICAL STUDIES OF ATLANTIC AND GULF COASTAL ESTUARIES OF IMPORTANCE TO WATERFOWL: RECONNAISSANCE SURVEYS, INFORMATION SEARCH AND ORGANIZATIONS.

INVESTIGATOR:

James A. Kerwin

OBJECTIVES:

1. Obtain field experience in data collection methods which may be applied toward more specific and refined surveys.

2. Assemble and analyze existing pertinent information.

3. Draw up an organizational plan so that all cooperating agencies and individuals will be channeling their efforts in a uniform manner.

STATUS:

This report covers the calendar year 1971.

Progress on this work unit involved more literature search and updating of the existing estuarine research. In addition, a 700-card plus bibliography on tidal wetland research and management is near completion.

FINANCIAL SUPPORT:

U. S. Department of Interior, Bureau of Sport Fisheries and Wildlife.

Bureau of Sport Fisheries and
Wildlife
PWRC-9 Patuxent Wildlife Research Center
Laurel, Maryland 20810

PROJECT TITLE: ECOLOGICAL STUDIES OF ATLANTIC AND GULF COASTAL ESTUARIES OF IMPORTANCE TO WATERFOWL: TRENDS IN ABUNDANCE, DISTRIBUTION, AND COMPOSITION OF VEGETATION IN CHESAPEAKE BAY.

INVESTIGATOR:

James A. Kerwin

OBJECTIVES:

1. To measure annual trends in abundance, composition, and distribution of submersed aquatic plants.

2. To determine the major environmental factors (i.e., salinity and turbidity) affecting changes in the abundance and composition of aquatic vegetation.

STATUS:

This report covers the calendar year 1971.

In 1970, a pilot study of submerged aquatic vegetation in the Chester River showed feasibility of the study. This year, the entire Maryland portion of Chesapeake Bay, excluding the Potomac River was surveyed. All shoal-waters less than 8 feet in depth (mean low water), encompassed an area approximately 400,000 acres in size, were sampled.

Sampling stations were randomly selected based on latitude and longitude lines. Essentially, the plan was a randomized line intercept method. Stratification was employed where possible and exposed shoal water areas were separated from tributary river systems. Six hundred and fifty-three samples were gathered during the peak development of the aquatic plants (August-September). The boat crew consisted of two men in a 17-foot Boston Whaler. Sampling was conducted clockwise around the bay starting at mouth of Potomac River. Nautical charts were used to locate sample plots on the shoal areas in depths of water 8 feet or less (low tide values). Scale of 1:80,000 were found to be inadequate for locating sample plots due to lack of detail.

Samples were taken with modified oyster tongs that have a metal plate welded to the "teeth" and the lower "biting" edge sharpened to effectively remove entire plants (since roots and tubers are important foods). Each grab consisted of the plants growing on 1 square foot of bottom. Three grabs were taken at each sampling station, so each sample actually consisted of vegetation growing on 3 square feet of bottom. Approximately 20-25 stations could be sampled in a day.

FINANCIAL SUPPORT:

U. S. Department of Interior, Bureau of Sport Fisheries and Wildlife.

PWRC-10

Bureau of Sport Fisheries and Wildlife
Patuxent Wildlife Research Center
Laurel, Maryland 20810

PROJECT TITLE: THE EFFECTS OF ENVIRONMENTAL POLLUTION ON WATERFOWL AND THEIR HABITAT: ENVIRONMENTAL POLLUTANTS IN FIELD-COLLECTED BLACK DUCK EGGS.

INVESTIGATOR:

J. R. Longcore

OBJECTIVE:

To determine residues of polychlorinated biphenyls and selected heavy metals in black duck eggs collected from Atlantic Coastal States and Eastern Canada.

STATUS:

This report covers the calendar year 1971.

Eggs collected from 13 Atlantic Coastal States (see PWRC-12) and Canada representing 61 black duck clutches have been processed for chemical analyses to determine PCB's and certain heavy metals.

PCB's analyses is now under way in the PWRC Chemistry Section.

Preliminary evaluations of multielement scan techniques for heavy metals employing neutron activation analysis are under way. A freeze-dry sample of a black duck egg has been submitted to two different commercial laboratories to obtain a reading on comparability of findings between the laboratories. A wet weight sample has also been sent to one of the labs for "wet-to-freeze-dry" comparison.

Egg samples will be sent for heavy metal analysis when these preliminary findings have been studied.

FINANCIAL SUPPORT:

U. S. Department of the Interior, Bureau of Sport Fisheries and Wildlife.

Bureau of Sport Fisheries and
Wildlife
PWRC-11 Patuxent Wildlife Research Center
Laurel, Maryland 20810

PROJECT TITLE: THE EFFECTS OF PESTICIDES ON WATERFOWL AND THEIR HABITAT: REPRODUCTIVE SUCCESS OF BLACK DUCKS FED DDE IN THE DIET.

INVESTIGATORS:

J. R. Longcore
F. B. Samson
T. Whittendale

OBJECTIVES:

1. To compare reproductive activity of black ducks fed DDE in the diet with reproductive activity of similarly penned black ducks fed a clean diet. Reproductive activity will be based on the following criteria: egg production, egg fertility, hatchability, and survival of ducklings to 7 days.

2. To determine the effect of DDE on eggshell thickness and eggshell cracking.

3. To relate DDE residues in eggs, ducklings, and parent black ducks to reproductive success and eggshell changes.

STATUS:

This report covers the calendar year 1971. Research was completed in 1970.

A paper entitled "DDE thins eggshells and lowers reproductive success of captive black ducks" was published in the Bulletin of Environmental Contamination and Toxicology, 6(6):485-490, 1971.

In conjunction with the study, eggshells obtained from both controls and dosed birds were analyzed for mineral content. Findings were summarized (along with similar data from mallard eggshells) in a paper "Changes in mineral composition of eggshells from black ducks and mallards fed DDE in the diet," by J. R. Longcore, F. B. Samson, J. F. Kreitzer, and J. W. Spann; published in the Bulletin of Environmental Contamination and Toxicology, 4(4):345-350, 1971.

FINANCIAL SUPPORT:

U. S. Department of the Interior, Bureau of Sport Fisheries and Wildlife.

PWRC-12

Bureau of Sport Fisheries and
Wildlife
Patuxent Wildlife Research Center
Laurel, Maryland 20810

PROJECT TITLE: THE EFFECTS OF PESTICIDES ON WATERFOWL AND THEIR HABITAT: RESIDUES OF PESTICIDES IN FIELD-COLLECTED BLACK DUCK EGGS.

INVESTIGATORS:

J. R. Longcore
F. B. Samson

OBJECTIVES:

1. To collect a representative sample of black duck eggs from Atlantic Coast States and eastern Canadian Provinces.

2. To determine residues of various organochlorine pesticides in the black duck eggs.

STATUS:

This report covers the calendar year 1971.

Through the fine cooperation of state, provincial, and federal waterfowl field biologists in Northeastern United States and Eastern Canada, 111 intact black duck eggs were collected along the Atlantic coast from Maryland to New Brunswick and at several inland locations. Those eggs represented 61 different clutches and came from 13 different states or provinces.

One egg, chosen randomly from each clutch, has been submitted to the PWRC Chemistry Section for determination of chlorinated hydrocarbon pesticides. The analyses are near completion.

Thicknesses and weights of the eggshells have been obtained.

FINANCIAL SUPPORT:

U. S. Department of the Interior, Bureau of Sport Fisheries and Wildlife.

Bureau of Sport Fisheries and
Wildlife
PWRC-13 Patuxent Wildlife Research Center
Laurel, Maryland 20810

PROJECT TITLE: WATERFOWL MANAGEMENT THROUGH WATER-LEVEL CONTROL: SELECTION AND PROPAGATION OF WATERFOWL FOOD AND COVER PLANTS.

INVESTIGATORS:

Francis M. Uhler
Frank B. McGilvrey

OBJECTIVE:

To discover waterfowl foods and determine their growth requirements for use in improving feeding and nesting grounds in acid, dark-stained, and turbid waters and in sewage lagoons.

STATUS:

This report covers the calendar year 1970.

Nearly all waterfowl food plants have specific requirements of water depth or soil moisture that permit survival, or produce optimum growth. Such conditions have been studied by the Patuxent Center's wetlands biologists in many parts of the United States and Canada. These observations serve as the basis for experimental production of such plants in the manmade ponds, marshes, and meadows at the Center. Here desired moisture conditions are maintained by the use of simple watergates provided with sturdy oak splashboards to regulate the water levels.

Field observations on the feeding activities of wood ducks, supplemented by examinations of the contents of their digestive tracts, have indicated that several members of the arum family (Araceae) supply locally important sources of food for these ducks in the fresh swamps of the eastern half of the United States. These include the arrow-arum or "tuckahoe" (Peltandra virginica), goldenclub (Orontium aquaticum), and skunkcabbage (Symplocarpus foetidus). The seeds and other parts of all these plants contain minute calcium oxalate crystals that make them very peppery to human taste, and apparently render them unacceptable to most species of waterfowl. Wood ducks, however, are known to gorge on the seeds of all of them, and in the early spring they frequently snip segments of the succulent leaves of the skunkcabbage. All three tolerate considerable acidity and thrive best in very shallow water or on saturated soil. The arrow-arum grows best in sunny sites but the other two require considerable shade. All of them are easily propagated by transplanting early in the spring and thrive on the Patuxent Center's wetlands. The arrow-arum produces one of the

heaviest yields of seeds of any known duck food. The seeds are easy to obtain when the large, club-shaped fruits begin to disintegrate in the early autumn. They often begin to sprout before winter, and can be used for widespread planting by imbedding in saturated soil as soon as harvested.

FINANCIAL SUPPORT:

U. S. Department of the Interior, Bureau of Sport Fisheries and Wildlife.

Bureau of Sport Fisheries and
Wildlife
Patuxent Wildlife Research Center
Laurel, Maryland 20810

PWRC-14

PROJECT TITLE: WATERFOWL MANAGEMENT THROUGH WATER-LEVEL CONTROL:

INVESTIGATORS:

Francis M. Uhler
Frank B. McGilvrey

OBJECTIVE:

To develop and test methods for providing attractive waterfowl feeding, breeding, and nesting grounds by management of impoundments. Effects of management of 16 Center impoundments are measured by:

1. Recording water levels
2. Waterfowl censuses
3. Vegetation transects
4. Water analysis

STATUS:

This report covers the period from December 1, 1970 to November 30, 1971.

Rainfall was high during the summer and fall of 1971 and all impoundments remained at or near full pool in contrast to general preceding years. Knowles Unit 3 and Cash Lake were drawn down but the abnormally heavy rains prevented anticipated growth of vegetation.

Based on weekly inventories, use of Patuxent impoundments (in terms of waterfowl-days) totaled almost 266,000. There has been a continuous decline since the peak of 294,000 reached in 1969. Use by wood ducks and Canada geese increased however, to record highs of 122,000 and 58,000 days, respectively. Mallard use fell to 20,000 days, the lowest of record. Peak mallard use of 52,000 days was in 1967. Very few migrant mallards were present in fall due to relatively poor feeding conditions and the removal of the game-farm flock at Mallard Pond that had "decoyed" wild birds. Black duck use declined to 44,000; down from 73,000 in 1970 and 87,000 in 1969. Use by migrant waterfowl generally depends on weather and feeding conditions. Ring-necked duck, the most plentiful migrant, doubled last year's total to 11,000 days, the highest since 1966. All other species used Patuxent impoundments at about the same level as in 1970.

PWRC-14

FINANCIAL SUPPORT:

U. S. Department of the Interior, Bureau of Sport Fisheries and Wildlife.

PWRC-15

Bureau of Sport Fisheries and
Wildlife
Patuxent Wildlife Research Center
Laurel, Maryland 20810

PROJECT TITLE: IMPROVEMENT OF ARTIFICIAL NESTING STRUCTURES FOR WATERFOWL:

INVESTIGATORS:

Francis M. Uhler
Frank B. McGilvrey

OBJECTIVE:

To develop methods for improving the construction of boxes, platforms, and islands for nesting waterfowl.

STATUS:

This report covers the calendar year 1971.

Eight years of investigation concerning starling use of wood duck nest boxes culminated with a paper: "A starling-deterrent wood duck box," in the Journal of Wildlife Management, 35(4):793-797, October 1971. The box is made of stovepipe, like the vertical box, but mounted horizontally, and with a 4- x 11-inch semicircular opening at one end. Popular Wildlife Leaflet 458, "Improvement of nest structures for wood ducks" is being revised to include information based on this study.

Field testing to determine use of the horizontal box in contrast to traditional wooden and metal vertical boxes was continued for a second year at the Eastern Neck National Wildlife Refuge near Rock Hall, Maryland. Starling nest starts increased from 30 in 1970 to 50 in 1971, all in vertical boxes. Twenty-one of 23 wooden boxes were used by the starlings (12 of them twice). Thirteen of 14 metal vertical boxes were used by starlings (four of them twice). Fourteen nest starts by wood ducks were rather evenly distributed; six in wooden boxes, three in vertical metal boxes, and five in horizontal metal boxes. All vertical boxes were removed at the end of the nesting season. The study will continue for 2 more years with only the horizontal boxes.

FINANCIAL SUPPORT:

U. S. Department of the Interior, Bureau of Sport Fisheries and Wildlife.

Bureau of Sport Fisheries and
Wildlife
Patuxent Wildlife Research Center
Laurel, Maryland 20810

PWRC-16

PROJECT TITLE: IMPROVEMENT OF ARTIFICIAL NESTING STRUCTURES FOR WATERFOWL: IMPRINTING DUCKS TO ARTIFICIAL NESTING STRUCTURES.

INVESTIGATORS:

Frank B. McGilvrey
Francis M. Uhler

OBJECTIVE:

To determine if ducks that normally nest on the ground can be imprinted to use artificial nesting structures.

STATUS:

This report covers the calendar year 1971.

Three years of study (1967-1969) showed that many hand-reared black duck hens and some of their offspring would nest in elevated cylinders. This phase of the study was reported in a paper: "Conditioning black ducks to nest in elevated cylinders," presented at the 1971 Northeast Wildlife Conference held in Portland, Maine. The second phase of the study is concerned with what happens to the population without additional annual releases of hand-reared birds.

Most nesting starts in cylinders occurred in 1969, the third and last year that hand-reared black ducks were released. There were 58 cylinder nest starts in 1969, 45 in 1970, and 42 in 1971. Forty-six broods hatched in 1969, 40 in 1970, and 32 in 1971. The 1971 production was greatly reduced by a fungus that infected many eggs and either killed the embryos just prior to hatching or killed the ducklings soon after hatching. Only 25 young reached flight stage in 1971, in contrast to 150 in 1970.

In spite of the 1970 rearing success, no yearlings were captured in nest boxes in 1971. Of the 30 hens caught on nests in cylinders, five were wild-hatched hens (not hand-reared releases). Of the 25 hand-reared hens, four were 5 years old, 15 were 4 years old, and six were 3 years old. Fall trapping at a baited site revealed 38 hand-reared hens in contrast to 60 captured in 1970. No more than four cylinder-nesting hens disappeared between fall 1970 and fall 1971. Many of the hand-reared hens nest on the ground despite conditioning. The numbers of these declined from 31 in the fall of 1970 to 20 at the end of the 1971 season. Sixty-nine hand-reared drakes were recaptured in the fall of 1971, indicating a significantly higher survival rate for males.

PWRC-17

Bureau of Sport Fisheries and Wildlife
Patuxent Wildlife Research Center
Laurel, Maryland 20810

PROJECT TITLE: IMPROVEMENT OF ARTIFICIAL NESTING STRUCTURES FOR WATERFOWL: FIELD TEST OF PREDATOR-PROOF NESTING STRUCTURES FOR BLACK DUCKS.

INVESTIGATOR:

Frank B. McGilvrey

OBJECTIVE:

To determine if a breeding population of black ducks can be established by releasing hand-reared black ducks that have been conditioned to use elevated, predator-proof nesting structures.

STATUS:

This report covers the calendar year 1971.

The studies on impoundments at PWRC (PWRC-16) have given encouraging results. This field test was initiated at the Back Bay National Wildlife Refuge near Virginia Beach, Virginia, in the fall of 1970. Fifty nest cylinders of the type used at Patuxent were erected on one of the Back Bay impoundments.

One-hundred and seventy-five black ducks hatched and reared at Patuxent were transported to Back Bay in November 1970. They were held in a covered, predator-proof pen until the end of February 1971 and then released on the impoundment with the nesting cylinders.

None of the nesting cylinders was used in 1971. Pairs of marked black ducks were observed, but there was very little indication of any attempted nesting. Most of the birds loafed in small flocks throughout the nesting season.

The study will be continued for 2 more years.

FINANCIAL SUPPORT:

U. S. Department of the Interior, Bureau of Sport Fisheries and Wildlife.

PWRC-18

Bureau of Sport Fisheries and
Wildlife
Patuxent Wildlife Research Center
Laurel, Maryland 20810

PROJECT TITLE: DEVELOPMENT OF METHODS FOR REDUCING DISTURBANCE TO AND PREDATION ON WATERFOWL.

INVESTIGATORS:

Francis M. Uhler
Frank B. McGilvrey

OBJECTIVE:

To develop methods for reducing disturbance to and predation on waterfowl.

STATUS:

This report covers the calendar year 1971.

Waterfowl production on Patuxent impoundments dropped slightly from the all time high of 1970. Two hundred and twelve broods hatched in 1971; 226 the previous year. Species composition of broods was (1970 totals in parentheses): 117 wood ducks (122), 41 black ducks (57), 26 mallards (30), 27 geese (16), and one hooded merganser (1). Production was down among all species of ducks, but goose production increased to a record high. Approximately 1,750 young waterfowl hatched, a decrease of 150 from 1970. About 650 of those that hatched in 1971 reached flight stage; about 850 did in 1970. Both wood ducks and Canada geese had a good year for raising young but black duck and mallard production were greatly reduced. This was due largely to a fungus infection of eggs in nesting cylinders that resulted in death of many ducklings shortly after they hatched.

The impact of annual releases of hand-reared wood ducks on the local breeding population was summarized in a paper presented at the 1971 Southeast Wildlife Conference, "Increasing a wood duck nesting population by release of pen-reared birds."

FINANCIAL SUPPORT:

U. S. Department of the Interior, Bureau of Sport Fisheries and Wildlife.

PWRC-16

FINANCIAL SUPPORT:

U. S. Department of the Interior, Bureau of Sport Fisheries and Wildlife.

PWRC-19

Bureau of Sport Fisheries and Wildlife
Patuxent Wildlife Research Center
Laurel, Maryland 20810

PROJECT TITLE: PHYSICAL, CHEMICAL, AND BIOLOGICAL FACTORS AFFECTING WATERFOWL CONDITIONS IN THE BACK BAY-CURRITUCK SOUND AREA.

INVESTIGATOR:

James A. Kerwin

OBJECTIVES:

1. To identify the primary physical, chemical, and biological factors responsible for the reduction in waterfowl use of the Back Bay-Currituck Sound area.

2. To determine procedures for increasing waterfowl use of the area while retaining or improving fishery values.

3. To determine the feasibility of applying these procedures on an operational basis.

STATUS:

This report covers the calendar year 1970.

Field work for this study was completed several years ago. Four volumes of data summaries were prepared, but project biologists transferred to other assignments before final report was completed. Now a manuscript draft has been prepared and is awaiting review and editing.

FINANCIAL SUPPORT:

U. S. Department of the Interior, Bureau of Sport Fisheries and Wildlife.

Bureau of Sport Fisheries and
Wildlife
PWRC-20 Patuxent Wildlife Research Center
Laurel, Maryland 20810

PROJECT TITLE: EVALUATION OF THE EFFECT OF THE OCEAN WATER INTRUSION INTO BACK BAY, VIRGINIA, AND CURRITUCK SOUND, NORTH CAROLINA, ON THE WATERFOWL AND FRESH-WATER FISH HABITAT.

INVESTIGATOR:

James A. Kerwin

OBJECTIVES:

1. To measure the effect of the ocean-water intrusion on the distribution and productivity of the aquatic vegetation.

2. To determine the extent and duration of physical and chemical changes in the waters, soils, and plants that may result from the ocean-water intrusion.

3. To determine the response of the waterfowl and fish populations to the changes in environmental factors.

STATUS:

This report covers the calendar year 1970.

Field work for this study was completed several years ago. Four volumes of data summaries were prepared, but project biologists transferred to other assignments before final report was completed. Now a manuscript draft has been prepared and is awaiting review and editing.

FINANCIAL SUPPORT:

U. S. Department of the Interior, Bureau of Sport Fisheries and Wildlife.

PWRC-21

U. S. Department of the Interior
Bureau of Sport Fisheries and
Wildlife
Patuxent Wildlife Research Center
Laurel, Maryland 20810

PROJECT TITLE: OSPREY REPRODUCTION AND POLLUTION IN THE CHESAPEAKE BAY REGION.

PRINCIPAL INVESTIGATOR:

Stanley N. Wiemeyer, Research Biologist

OBJECTIVES:

1. To determine the reproductive success of ospreys on the Lower Potomac River, and other areas if feasible, so that comparisons can be made between areas within the Chesapeake Bay Region and with other populations in the United States.

2. To determine what changes in population levels and reproductive success have occurred since the 1930's, prior to the use of organochlorine pesticides.

STATUS:

I have completed two years of field work on the Lower Potomac River. Reproductive success of ospreys in this area has been reported in: Wiemeyer, S. N. 1971. Reproductive success of Potomac River ospreys - 1970. Chesapeake Science 12(4):278-280; and Wiemeyer, S. N. Reproductive success of Potomac River ospreys - 1971. In Proceedings, North American Osprey Research Conference, Williamsburg, Virginia, February, 1972. (In press). Possible causes of the markedly reduced rate of reproductive success are being investigated. Osprey eggs and tissues collected on the study area are being analyzed for various environmental pollutants. Eggshells are being examined to determine if thinning has occurred.

FINANCIAL SUPPORT:

U. S. Department of the Interior, Bureau of Sport Fisheries and Wildlife

*SI-NM-1

Smithsonian Institution
U.S. National Museum
Washington, D.C. 20560

PROJECT TITLE: SEA NETTLE STUDIES IN CHESAPEAKE BAY, LIFE HISTORY AND ECOLOGY

PRINCIPAL INVESTIGATOR:

Dr. L.P. Schultz

SUMMARY OF PROJECT:

The purpose of this study is to find out as much as possible about the life history and ecology of the summer sea nettle (Chrysaora) in Chesapeake Bay with the view to eventually controlling its abundance.

FINANCIAL SUPPORT:

Smithsonian Institution, Museum of Natural History

*
Source: Science Information Exchange, Inc.

*SI-NM-2

Smithsonian Institution
U.S. National Museum
Washington, D.C. 20560

PROJECT TITLE: VASCULAR FLORA OF CHESAPEAKE BAY REGION

PRINCIPAL INVESTIGATORS:

S.G. Shetler
D. Higman

SUMMARY OF PROJECT:

The Principal Investigator is nominal supervisor of the work on floristics and vegetation survey dealing with vascular plants which is being carried out by Daniel Higman at the Chesapeake Bay Center for Field Biology under the sponsorship of the Smithsonian Office of Ecology. (The Center is jointly administered by the Smithsonian Institution, University of Maryland, and the Johns Hopkins University.) This work involves preparation of a checklist of vascular plants and accompanying vegetation maps. Over a period of time the P.I. expects to collaborate in the publication of checklists and descriptive papers about the vascular flora of the Center and the surrounding Chesapeake Bay region, and to conduct certain population studies of a taxonomic and/or ecologic nature, working with indigenous populations at the Center.

FINANCIAL SUPPORT:

Smithsonian Institution, Museum of Natural History

*
Source: Science Information Exchange, Inc.

UM-AE-1

University of Maryland
Agricultural Engineering Dept.
College Park, Maryland 20742

PROJECT TITLE: ENGINEERING PRINCIPLES AS APPLIED TO OYSTER PROCESSING PROBLEMS

PRINCIPAL INVESTIGATOR:

Frederick W. Wheaton - Research Associate

OBJECTIVES:

1. To refine the engineering analysis of oyster processing, handling and harvesting.

2. To study the reaction of oysters to the application of energy in various forms and to study new principles, procedures, and laboratory equipment related thereto which may enhance labor productivity or overall oyster operations.

3. To study the effects of energy on oysters when applied in sequential increments using equipment units developed for energy application under objective 2.

STATUS:

This project has been an ongoing project for the last four years. Results from the project have been published in the Proceedings of the National Shellfish Association 60:75-85, 1970, in the Transactions of the American Society of Agricultural Engineers 14, No. 1, 187-192, 1971 and in numerous government reports.

Present work is concerned with development of principles which may be applicable to the shucking of oysters.

FINANCIAL SUPPORT:

Maryland Fish and Wildlife Administration
National Marine Fisheries Service, NOAA

UM-Agron-1

University of Maryland
Department of Agronomy
College Park, Maryland 20742

PROJECT TITLE: MORPHOLOGICAL, PHYSICAL, CHEMICAL, AND MINERALOGICAL CHARACTERISTICS OF SOME TIDAL MARSH SOILS IN THE PATUXENT ESTUARY.

PRINCIPAL INVESTIGATORS:

John C. Baxter, Junior Instructor
Dr. David F. Bezdicek, Assistant Professor
Dr. John E. Foss, Associate Professor

OBJECTIVES:

1. Study the field and laboratory characteristics of tidal marsh soils in order to develop a soil classification scheme of these soils.

2. To study the relationships between soil properties and vegetative types in the tidal marsh area.

3. Study the clay mineralogy of tidal marsh sediments.

STATUS:

The field study of soil-plant relationships has been completed. Aerial photographs were used as an integral part of this phase of the study. Laboratory characterization of approximately 50 soil profiles in the Patuxent estuary is nearing completion. Those analyses completed include: particle size; organic carbon; available nutrients (K_2O, P_2O_5, Ca, Mg); pH; and total Ca, P, K, and Mg. The remaining chemical analyses and clay mineralogy will be completed within three months.

FINANCIAL SUPPORT:

State funds.

UM-Bot-1

University of Maryland
Department of Botany
College Park, Maryland 20742

PROJECT TITLE: FLORA OF MARYLAND.

PRINCIPAL INVESTIGATOR:

Russell G. Brown, Professor

OBJECTIVE:

To document and publish comprehensive information on the Maryland flora.

STATUS:

The Woody Plants of Maryland, (R. G. Brown) published in early 1972 includes all the trees and shrubs known to grow around the Bay drainage area of Maryland. This is an illustrated, descriptive manual that gives information as to the general area of the State in which each species is found, its habitat or ecological niche, and brief information regarding its utilization by wildlife. More field observation and study is needed in order to determine the abundance of some of the less common species.

A similar illustrated manual is planned, cooperating with Dr. James Reveal, on the Herbaceous Plants of Maryland of which the first draft is already written. The upland herbaceous flora is well known but additional study is being conducted regarding species in the wetlands around the Bay in order to further understand their ecological roles. Mrs. Elizabeth Higgins' report on Assateague, Flora and Ecology of Assateague, is the beginning of this study. Other students have done their graduate research in estuaries or uplands adjacent to the Bay and their theses or reports will furnish additional valuable information which will be pertinent for completing the herbaceous plant studies.

FINANCIAL SUPPORT:

Department of Botany

UM-Bot-2

University of Maryland
Department of Botany
College Park, Maryland 20742

PROJECT TITLE: DARK CARBON FIXATION IN PLANKTON AND BENTHOS.

PRINCIPAL INVESTIGATOR:

Raymond A. Galloway, Professor

OBJECTIVE:

To establish the relationship of cell age to dark carbon dioxide fixation capacity and to elucidate the mechanism of fixation.

STATUS:

The ability of plants to non-photosynthetically fix carbon was firmly established in the 1930's with succulent plants such as Sedum. It has since been reported in several unicellular green organisms important in the phytoplankton of fresh and brackish waters. Inasmuch as these organisms are often found in a high degree of synchrony in nature, the phenomenon has been studied from the point of view of cell age. Fixation changes markedly and in a complex way with the age of cells. The results would indicate that the organisms studied may well have a different pathway for fixation than that established for higher plants. The nature of this mechanism is currently under investigation. Research effort was initiated in 1964 and will be continued.

Two papers have been published: Carbon dioxide-induced delay of cellular development in two Chlorella species. J. Physiol. 2:117-120 (1966), and Some effects of high CO_2 content on autospore release and number in Chlorella. J. Phycol. 6:222-224 (1970). A third paper is in preparation, Variation in dark carbon dioxide fixation as a function of cell age in Chlorella.

FINANCIAL SUPPORT:

NASA
Department of Botany

UM-Bot-3

University of Maryland
Department of Botany
College Park, Maryland 20742

PROJECT TITLE: THE BIOCHEMISTRY OF LIGHT-ENHANCED ACETATE UPTAKE IN ULVA.

PRINCIPAL INVESTIGATOR:

Raymond A. Galloway, Professor

OBJECTIVE:

To elucidate the mechanism by which acetate, which is absorbed only very slowly by Ulva in the dark, is taken in rapidly in the light, and to establish the fate of the acetate.

STATUS:

It has been established that increasing light intensity from 60 foot-candles through 1000 foot-candles results in increased acetate uptake. The action spectrum of the phenomenon, between 450 μm and 750 μm conforms to the action spectrum for photosynthesis in Ulva. The uptake process is sensitive to DCMU, is not sensitive to 10^{-14} MUO_2^{++}, and is formed by low CO_2 concentrations, all of which point to a relationship with the photosynthetic mechanism.

A paper was presented at the annual meeting of the Phycological Society of America in August, 1971 and a publication for this society's journal is in preparation. Research on this project was begun in 1968 and will be continued.

FINANCIAL SUPPORT:

Department of Botany

UM-Bot-4

University of Maryland
Department of Botany
College Park, Maryland 20742

PROJECT TITLE: EFFECTS OF SUNLIGHT ON PIGMENTATION IN ULVA.

PRINCIPAL INVESTIGATOR:

Raymond A. Galloway, Professor

OBJECTIVE:

To characterize the changes in the photosynthetic pigmentation observed in Ulva which occur as a function of light intensity and duration.

STATUS:

Marked shifts in the ratio of chlorophyll a to chlorophyll b, and in total chlorophyll content as well, have been observed on a diurnal cycle in Ulva. The influence of light intensity and light duration as this pigment shifts, the means by which the pigment shifts are wrought, and their significance are currently being investigated. Research effort on this project is now in preliminary stages.

FINANCIAL SUPPORT:

Department of Botany

UM-Bot-5

University of Maryland
Department of Botany
College Park, Maryland 20742

PROJECT TITLE: LICHEN FLORA.

PRINCIPAL INVESTIGATOR:

Barbara J. Grigg, Instructor

OBJECTIVE:

To complete a collection and checklist of Maryland lichen species.

STATUS:

Research effort in this area consists of collection and identification of Maryland lichen species with the intention of assembling a reference collection. The collection will serve as a standard for student use and compilation of a checklist and key to common species with emphasis on use in plant morphology and distribution studies. Information gained from this research provides a greater understanding of the ecological role of lichen flora. Data resulting from the continuing Maryland studies also contribute to a larger detailed study of the lichen family, Gradphidaceae, in Eastern North America which will be issued as a separate publication.

FINANCIAL SUPPORT:

Department of Botany

UM-Bot-6

University of Maryland
Department of Botany
College Park, Maryland 20742

PROJECT TITLE: FLORISTICS AND ECOLOGY OF ASSATEAGUE ISLAND.

PRINCIPAL INVESTIGATORS:

Elizabeth A. Higgins, Instructor
Robert D. Rappleye, Associate Professor
Russell G. Brown, Professor

OBJECTIVE:

To catalog the vascular plants of Assateague Island.

STATUS:

A catalog of the vascular plants of Assateague Island, Maryland-Virginia was completed in January, 1971. The catalog contains 441 species representing 89 families. The species are found in four distinct plant communities which grow in bands parallel to the ocean. A dune-grass community behind the ocean beach; a shrub community divided into mesic and xeric zones; an arboreal community dominated by Pinus taeda (one area where the island is very wide an extensive deciduous forest occurs), and on the bayside, the entire island is covered by a salt marsh. Further studies on the ecology of Assateague and similar sand-spit islands are underway.

FINANCIAL SUPPORT:

Department of Botany

UM-Bot-7

University of Maryland
Department of Botany
College Park, Maryland 20742

PROJECT TITLE: PHYSIOLOGICAL CLASSIFICATION OF PHYTOPLANKTON.

PRINCIPAL INVESTIGATOR:

Robert W. Krauss, Professor and Head of Botany

OBJECTIVE:

To determine the physiological requirements and characteristics of species of phytoplankton of Chesapeake Bay.

STATUS:

The species of phytoplankton in the Chesapeake Bay are poorly known either from a taxonomic or physiological point of view. It is important to understand their nutritional and environmental requirements so that predictions of response to changes can be made. Responses to changed environments can either increase or decrease a species of positive or negative importance to man. Research effort on this project was initiated in 1964 and will be continued.

One paper has been completed on Scenedesmus and a monograph of the marine Chlorella is being readied for publication.

FINANCIAL SUPPORT:

Department of Botany

UM-Bot-8

University of Maryland
Department of Botany
College Park, Maryland 20742

PROJECT TITLE: PREPARATIONS OF A COLLECTION OF THE PHYTOBENTHOS OF CHESAPEAKE BAY.

PRINCIPAL INVESTIGATOR:

Robert W. Krauss, Professor and Head of Botany

OBJECTIVE:

To prepare a herbarium of the benthic algae of Chesapeake Bay.

STATUS:

Three years of collections are providing basis for a benthic flora of the Bay. The objective is to prepare a herbarium of the benthic algae of Chesapeake Bay. It is essential to establish distribution patterns both seasonally and in area, of the benthic algae growing in the Chesapeake Bay in order to understand the standing crop and its fluctuations.

FINANCIAL SUPPORT:

Department of Botany

UM-Bot-9

University of Maryland
Department of Botany
College Park, Maryland 20742

PROJECT TITLE: ENERGETICS AND SPECTRAL ADAPTATIONS IN MARINE ALGAE.

PRINCIPAL INVESTIGATOR:

Edward P. Karlander, Associate Professor

OBJECTIVE:

To determine energy flows and spectral changes in algae and other plants of the Chesapeake Bay System.

STATUS:

Plants respond and adapt to changes in their environment within the limits of their genetic constitution. Determination of these adaptations and responses is of considerable fundamental and predictive value. This research is concerned with the adaptations in morphology, pigmentation and energy conversions in relation to phytoplankton and benthic algae of the Chesapeake Bay System. Our recent investigations have documented adaptations in sexuality, morphology, primary production, growth, and pigmentation in phytoplankton as responses to shifts in the environmental parameters of light (quality and quantity), temperature, salinity, and nutrition. Current studies show that a number of these parameters have interesting interactions. Research on this project was begun in 1968 and will be continued.

FINANCIAL SUPPORT:

Department of Botany

UM-Bot-10

University of Maryland
Department of Botany
College Park, Maryland 20742

PROJECT TITLE: PHYSIOLOGY AND BIOCHEMISTRY OF NEMATODES AND NEMATODE-HOST RELATIONSHIPS.

PRINCIPAL INVESTIGATOR:

Lorin R. Krusberg, Professor

OBJECTIVE:

To investigate the lipids and their metabolism in certain plant-parasitic and free-living nematodes.

STATUS:

Plant-parasitic nematodes are important plant pests. In some cases the damage they cause to crops is spectacular, resulting in crop failure, but more often their parasitism results in a lowered vitality and yield of the crop. Because of their wide host ranges and persistence, biological and cultural control methods have not been generally very successful. Nematodes of most species of plant parasites can survive in soil in the absence of host plants for more than a year, many for a number of years, and a few can survive in a desiccated state for years. Hence, the current principal method for controlling nematode infestations is the use of chemical nematocides. Use of these pesticides, however, seems sure to come under attack since some are halogenated hydrocarbons which may leave undesirable residues in the soil and others are carbonate or organic phosphate materials which usually have high mammalian toxicity, thus their use is limited. Knowledge of nematode lipids and their metabolism might reveal clues to aid in developing better methods of nematode control than are now practiced which are not ecologically detrimental. Research on this project was begun in 1960 and will be continued.

FINANCIAL SUPPORT:

Department of Botany
U. S. Department of Agriculture

UM-Bot-11

University of Maryland
Department of Botany
College Park, Maryland 20742

PROJECT TITLE: BRYOPHYTE FLORA.

PRINCIPAL INVESTIGATOR:

Anna Belle Owens, Instructor

OBJECTIVE:

To complete a collection and checklist of Maryland moss species.

STATUS:

Research concerned with taxonomy and distribution of the Bryophyte flora of Maryland will add to an existing checklist. Information and collections gained from this research effort serve as resource material for use in department studies in morphology and provide additional specimens for the herbarium. Ultimately, a key and description of the more common species will be prepared for use by students and, also, persons in the fields of education and recreation. Data resulting from this continuing study will provide for a greater understanding of the ecological role of the moss flora and related groups in Maryland.

FINANCIAL SUPPORT:

Department of Botany

UM-Bot-12

University of Maryland
Department of Botany
College Park, Maryland 20742

PROJECT TITLE: STEROLS OF MACROSCOPIC CHESAPEAKE BAY ALGAE.

PRINCIPAL INVESTIGATOR:

Glenn W. Patterson, Associate Professor

OBJECTIVE:

To gain an understanding of the quantity and importance of lipids in plants of the Chesapeake Bay.

STATUS:

Three green algae and seven red algae collected in Chesapeake Bay were examined for sterol and lipid content. All green algae contained 28 iso-fucosterol, an unusual sterol in plants, as well as smaller quantities of cholesterol. All red algae contained cholesterol as the primary sterol but one species also contained a significant amount of desmosterol. Both sterols and lipids are found in these macroscopic algae in lower quantities than in phytoplankton. These macroscopic algae are viewed as being a source of the dietary cholesterol requirement that many marine invertebrates are presumed to have. Work was initiated in 1969 and is continuing in order to correlate lipid requirements of invertebrates with probable dietary sources of these lipids.

FINANCIAL SUPPORT:

Department of Botany

UM-Bot-13

University of Maryland
Department of Botany
College Park, Maryland 20742

PROJECT TITLE: SEED DORMANCY IN SALT-MARSH PLANTS.

PRINCIPAL INVESTIGATOR:

Robert D. Rappleye, Associate Professor

OBJECTIVE:

To determine seed germination characteristics of the salt-marsh plant, Kosteletzkya virginica.

STATUS:

The unique vegetation of the salt marshes which occupy much of Maryland's "wetlands" is determined to a large extent by the abilities of the species comprising that community to reproduce under the conditions prevailing there. Reproduction of most species of higher aquatic plants there depends to a major degree on the germination characteristics of their seeds. Little information exists which will permit prediction of successful germination of marsh species. In an effort to develop a model for germination requirements of such plants, studies have been undertaken with Kosteletzkya virginica. It has been demonstrated that there is a circadian rhythm, there are at least two mechanisms involved in seed dormancy, and various seed treatments can override both.

Since it is apparent that the age of the seed at harvest has an effect on the germination response, it is necessary to make more careful collections of the seeds. At the time the plant blooms, the flowers are tagged on the day each flower is open and then the capsules systematically harvested. This requires tagging approximately 12,000 flowers. A comparison of seed germination characteristics is being made of seed obtained from plants grown at a wide variety of salinities. Detailed studies of marsh-stored seeds are being made in an attempt to correlate laboratory findings with those observed in the field. Since the seeds used so far were obtained near the northern limit of distribution, southern-grown seed should be studied to see if they have the same germination characteristics. Research on this project was begun in 1968 and will continue for approximately 2 years.

FINANCIAL SUPPORT:

Department of Botany

UM-Bot-14

University of Maryland
Department of Botany
College Park, Maryland 20742

PROJECT TITLE: POSITIVE EFFECTS OF THERMAL ADDITION ON PHYTOPLANKTON.

PRINCIPAL INVESTIGATOR:

Constantine Sorokin, Research Professor

OBJECTIVE:

To assess the occurrence and performance of phytoplanktonic organisms with upper temperature limits for their existence above those of their present natural habitats and to determine the acceptable levels of temperature addition in regard to phytoplanktonic forms.

STATUS:

Research on this project was started in 1968. Phytoplanktonic organisms with tolerance to high temperatures are searched for, isolated in axenic cultures, and studied in regard to their morphology, metabolic activity, and overall performance. A possibly large assemblage of high-temperature forms are kept in living condition and can serve as a source for seeding natural waters where the discharges from power plants raise temperatures above present levels. Observations on endurance and performance of the newly introduced forms are essential in regard to effects of thermal discharges from power plants and other industrial installations on the primary productivity of natural waters and their capacity to sustain higher forms of life.

FINANCIAL SUPPORT:

Department of Botany

UM-Bot-15

University of Maryland
Department of Botany
College Park, Maryland 20742

PROJECT TITLE: EXTRACELLULAR SECRETIONS INFLUENCING THE ENVIRONMENT.

PRINCIPAL INVESTIGATOR:

Constantine Sorokin, Research Professor

OBJECTIVES:

To investigate the nature, occurrence, and biological significance of substances liberated by phytoplanktonic organisms and thus to determine the role of phytoplanktonic organisms in affecting their environment.

STATUS:

Supernatants from cultures of phytoplanktonic organisms grown under controlled conditions are separated from the cells and investigated in regard to the nature and levels of substances liberated by the organisms into their media. Biological effects of the supernatants are studied particularly in regard to their effects on growth and performance of the organisms and to changes brought about by the organisms in their media. The effects on pH and buffering properties of the media are evaluated in regard to the magnitude of the changes and possible effects of the changes in buffering capacity of the media on the performance and endurance of phytoplanktonic organisms. Research effort on this project was begun in 1969 and will be continued.

FINANCIAL SUPPORT:

Department of Botany

UM-Bot-16

University of Maryland
Department of Botany
College Park, Maryland 20742

PROJECT TITLE: BASIC RESEARCH ON EFFECTS OF SALT DEPOSITION ON VEGETATION NEAR THE PEPCO PLANT AT CHALK POINT, MD.

PRINCIPAL INVESTIGATOR:

Hugh G. Gauch, Professor

OBJECTIVES:

To analyze the leaves of plants for salt levels -- especially plants of commercial importance and to study native species (a) to determine whether certain ones might be especially sensitive to salt deposition and (b) to determine whether salt deposition alters the native flora.

STATUS:

Research effort on this project will start in July, 1972, when funding is expected to become available. By mid-1974, when the third power unit at the PEPCO plant at Chalk Point, Maryland, goes into operation, an unknown amount of crystalline salt or salt spray will emanate from the cooling tower. Amount and distribution of salt from the tower cannot be estimated with certainty in advance. Intensity of power plant operation and vagaries of weather will affect both of the afore-mentioned parameters of salt deposition. With regard to various types of pollution which have been considered in detail in recent years, the absence of "bench marks" for past concentrations of nitrate and phosphate in waters, for example, has made it difficult -- if not impossible -- to evaluate current analyses for these constituents in waters, plants, soils, and foodstuffs. In order to evaluate, following mid-1974, the effect of dispersed salt from the PEPCO cooling tower, it is imperative that background data be obtained prior to its going into operation.

Certain species will be established and maintained in the permanent plots which will be established by investigators in the Department of Agronomy. Data will be obtained on these species before and after operation of the cooling tower. The effects of applied salt sprays on selected species of plants in the greenhouse and on various species of plants growing outdoors will be studied. This will be a basic study of the effect of salt sprays on plants. Specialists in Agricultural Engineering can provide expertise regarding production and control of droplet size, fall-out distribution of sprays, and other pertinent information on spraying.

Periodic leaf sampling of species of commercial importance will be conducted. These samples will come from a series of sites radiating from the proposed cooling tower, so that data can be obtained in the future from the same sites and species. Samples will be brought to the laboratory, dried, ground, and analyzed for chloride. Then the data will be statistically evaluated with respect to average concentrations of chloride in leaves of various species of plants.

FINANCIAL SUPPORT:

Maryland Water Resources Research Center.

UM-Chem-1

University of Maryland
Chemistry Department
College Park, Maryland 20740

PROJECT TITLE: BIOGEOCHEMISTRY OF ESTUARINE ECOSYSTEM WITH EMPHASIS ON HEAVY METALS AND SHELLFISH

PRINCIPAL INVESTIGATORS:

M. Keeney
S. Lakshmanan
D.L. Martin
H.J. Rose
J. Sampugna

SUMMARY OF PROJECT:

A study of biogeochemistry of estuaries with emphasis on the effects of metal ion and organic pollution on the oyster of the Chesapeake Bay. Selected oyster beds will be analyzed for metal elements and organic compounds in the substrate, silt and fluid portions. Oysters from the same beds will be analyzed for metal content. Mechanisms of retention and storage of metals by the oyster will be studied. A detailed characterization of the lipids in oyster flesh and organs and comparative study of lipid characteristics as functions of age, season and location will be made.

FINANCIAL SUPPORT:

Interior Department, Office of Water Resources Res.

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Source: Science Information Exchange, Inc.

Chemical Engineering Department
College of Engineering
University of Maryland
College Park, Maryland 20742

UM-CE-1

PROJECT TITLE: USE OF WASTE HEAT FOR FISH FARMING

PRINCIPAL INVESTIGATOR:

Joseph M. Marchello - Professor and Head

OBJECTIVES:

1. To explore the use of industrial waste heat in fish farming.

2. To explore the use of sewage plant effluents in fish farming to grow fish food.

STATUS:

This is a continuation of the work of Martino and Marchello (1) ("Using Waste Heat for Fish Farming", Ocean Industry, p. 36-39, April 1968) on using industrial waste heat for fish farming, with special emphasis on application to the Chesapeake Bay. Laboratory and computational analysis indicated that waste heat may be used to lift nutrient-rich bottom water to within range of sunlight and thereby significantly increase fish yields.

An important process in the marine life cycle is the transport of nutrients from the ocean floor to the surface to produce phytoplankton, the basic component of food in the ocean. This process is brought about by the vertical mixing of the water due to thermal and other gradients. In 1967 Emery and Iselin (2) stated that they knew of no experimental project in the United States to farm the ocean. Groves (3) and others have estimated the fish production rate increases associated with various flow rates to the surface.

We have conducted bench scale studies of thermo-nutrient pumping and projected the corresponding flows for marine installation. In nutrient pumping the cooling water from a seashore power or industrial plant is injected at the botton of a large vertical pipe open to permit nutrient rich water from the bottom to flow up as it mixes with the warm water from the plant. A detailed analysis was conducted of the rate of nutrient water pumping for different rates of heat exchanger effluent and for various vertical pipe sizes and water depths.

FINANCIAL SUPPORT:

Department of Chemical Engineering

Chemical Engineering Department
College of Engineering
University of Maryland
College Park, Maryland 20742

UM-CE-2

PROJECT TITLE: PROCESSING OF MARINE PRODUCTS

PRINCIPAL INVESTIGATORS:

Joseph M. Marchello - Professor and Head
James W. Gentry - Assistant Professor
K. K. Almenas - Assistant Professor

OBJECTIVES:

1. To develop engineering design information for fish protein concentrate manufacture.

2. To develop engineering design information for extraction of drugs, minerals and vitamins from sea plant and animal life.

STATUS:

For several years we have been studying processes for the manufacture of fish protein concentrate. Generally this human food supplement is made from fish and fish parts that are not normally eaten. The processing methods, at least by isopropyl alcohol extraction, yield a wholesome powder or paste that recently has received FDA approval for human use. Our efforts to date have been in conjunction with the National Marine Fisheries Service, Fishery Products Technology Laboratory at College Park (report in press).

To date our efforts in making fish protein concentrate have centered on the engineering details of several promising processes. Among these are the isopropyl alcohol extraction of hake and menhaden type fish and biological (digestive) processes for protein concentration and for methods of improving fish meal (animal feed) processing.

Expansion would include such things as extraction of drugs from the sea and from plant and animal life which often serves to concentrate specific substances. Recent findings such as the fact that large molecules like DDT are concentrated in biological systems offers the exciting possibility that these processes can be put to useful purposes in meeting a number of our needs for minerals, vitamins and other valuable chemicals.

FINANCIAL SUPPORT:

NOAA (Bureau of Commercial Fisheries)
Department of Chemical Engineering

Chemical Engineering Department
College of Engineering
University of Maryland
College Park, Maryland 20742

UM-CE-3

PROJECT TITLE: BIOLOGICAL DEGRADATION OF OIL SPILLS

PRINCIPAL INVESTIGATOR:

James W. Gentry - Assistant Professor

OBJECTIVES:

1. To develop a procedure for predicting the optimum microbe composition required to degrade various petroleum crudes and products.

2. To experimentally evaluate computer models of species interactions in a multisubstrate system.

STATUS:

The project was begun during the present year. Present work deals with the development of computational procedures to describe the interaction of competing species in a multi-substrate system. The initial phase of the study is to delineate between several suggested models. The mathematical model will be checked by two types of experiments--a laboratory scale experiment involving microbe colonies with a single aqueous soluble substrate and secondly field studies using an apparatus similar to that of Bartha.

FINANCIAL SUPPORT:

Department of Chemical Engineering

UM-Med-1

University of Maryland
School of Medicine
Division of Dermatology
Lombard and Greene Sts.
Baltimore, Maryland 21201

PROJECT TITLE: A PHYSICAL, CHEMICAL AND TOXICOLOGICAL STUDY OF THE NEMATOCYST FLUID OF CHRYSAORA QUINQUECIRRHA

PRINCIPAL INVESTIGATOR:

Joseph W. Burnett, M.D. - Associate Professor of Medicine in Dermatology

Collaborator(s): David G. Cargo, Research Associate, Chesapeake Biological Laboratory
Elijah Adams, Ph.D., Professor and Head, Department of Biological Chemistry, University of Maryland School of Medicine, Baltimore, Maryland
Gary J. Calton, Ph.D., Research Associate, Division of Dermatology, University of Maryland School of Medicine, Baltimore, Maryland

OBJECTIVES:

1. To purify the nettle's nematocyst toxins.
2. To investigate the pharmacological actions of these compounds with particular reference to their action on skin and nerves.
3. To compare these toxins with those of other venomous jellyfish.
4. To devise methods of protecting man from the nettle's sting.

STATUS:

During the past five years at least eleven toxins have been detected within the nettle's nematocyst. Some of these agents have detrimental effects on heart, nerves, smooth muscle and skeletal muscle. They also lyse blood cells, ulcerate skin, and rupture small structures within cells called lysosomes. Some of the toxins are lethal to smaller animals.

The anatomy, chemical composition, and basic immunology of these tentacles and their toxins has been investigated. Current studies of better toxin purification methods and techniques of immunizing animals against the nettle's sting are being conducted.

FINANCIAL SUPPORT:

University of Maryland School of Medicine
U. S. Department of Commerce

UM-Micro-1

Department of Microbiology
University of Maryland
College Park, Maryland 20742

PROJECT TITLE: ISOLATION OF HYPHOMICROBIALES IN THE PATUXENT

PRINCIPAL INVESTIGATOR:

Ronald M. Weiner, Assistant Professor

OBJECTIVES:

1. To study the distribution of Hyphomicrobium.

2. To isolate representative genera.

3. To evaluate possible influences of Hyphomicrobium on the ecosystem.

STATUS:

It has been shown, by a number of workers, that bacteria belonging to the Order Hyphomicrobiales play significant roles in their respective ecosystems:

1. Ubiquitous in nature, Hyphomicrobium deposit manganese in pipelines, thereby clogging them.

2. They have been successfully modified to denitrify (this is significant because increased use of nitrate fertilizers and consequent increase of nitrate levels in waters poses a pollution problem).

3. Scattered reports indicate that some species may be associated with disease in man and shellfish.

4. The majority of species in this order metabolize one-carbon compounds, including toxic products such as methanol, urea and cyanide.

Several members of the Hyphomicrobiales have been studied in this laboratory for the past year and a half. One project concerns the capability of a species isolated from sewage to degrade various concentrations of cyanide. Expertise derived from present work will be applied to the isolation and characterization of local species. The main thrust of this biological inventory is concerned with the heavily stressed Patuxent River. Starting July 1, 1972, samples will be innoculated weekly into enrichment media from stations just offshore and in the main channel. Isolates will be identified and catalogued.

FINANCIAL SUPPORT:

None

UM-Micro-2

Department of Microbiology
University of Maryland
College Park, Maryland 20742

PROJECT TITLE: MICROBIAL ECOLOGY OF CHESAPEAKE BAY.

PRINCIPAL INVESTIGATOR:

Dr. Rita R. Colwell, Professor

RESEARCH ASSOCIATE:

Dr. Jayne Carney

POSTDOCTORAL FELLOWS:

Dr. John D. Nelson, Jr.
Dr. Thomas Staley

OBJECTIVES:

1. To develop a computer identification procedure for Chesapeake Bay microorganisms (bacteria, viruses, etc.).

2. To determine the incidence, biology, pathogenicity, and ecology of Vibrio parahaemolyticus in Chesapeake Bay.

3. To determine the numbers and kinds of mercury-tolerant bacteria in Chesapeake Bay and the bacterial metabolism of mercury in situ.

4. To study hydrocarbon metabolism in marine and estuarine bacteria.

5. To determine effects of temperature, salinity, and hydrostatic pressure on marine and estuarine bacteria.

6. To determine the survival of human pathogens in the estuarine and marine environment.

7. To isolate, characterize, and identify microbial pathogens active against estuarine and marine animals.

STATUS:

Research in microbial ecology of the Chesapeake Bay has been underway since 1963. Bacteria associated with healthy and diseased oysters, clams and blue crabs have been isolated, characterized and identified. A computer library of microbial ecology data has been established and an investigator-data bank querying system is now being established. Vibrio parahaemolyticus was isolated from diseased blue crabs in Chesapeake Bay and has been found to be a common inhabitant of several areas in the Bay. A variety of other research projects relating to the objectives stated above are also underway.

FINANCIAL SUPPORT:

National Science Foundation
National Sea Grant Program
Office of Naval Research
Environmental Protection Agency

(A contract with the Bureau of Commercial Fisheries, now the National Marine Fisheries Service, Biological Laboratory, Oxford, Maryland, was instrumental in establishing the research program in the early stages.)

University of Maryland
Water Resources Research Ctr.
Shriver Laboratory
College Park, Maryland 20742

UM-WRRC-1

PROJECT TITLE: INVESTIGATION OF THE PUBLIC AND PRIVATE INTERESTS IN THE DEVELOPMENT OF THE CHESAPEAKE BAY AREA

PRINCIPAL INVESTIGATORS:

J. W. Longest
D. F. Tuthill
R. Henkel
R. Harper
Dr. Thompson
A. Bird

SUMMARY OF PROJECT:

Application of social systems and interorganizational interactions theory to the problems of Chesapeake Bay resource development. This involves an interdisciplinary research approach to analysis of the existing organizations' and agencies' responsibilities and interests in Chesapeake Bay development. It will involve evaluation of the present resources and programs adequacy for dealing with the priority problems of Bay development and preservation. Recommendations will be made for alternative approaches to Bay development for meeting specified short-run and long-range goals. Implementation of the major objectives will require identification of problems and opportunities of Bay development, organizational interests and responsibilities, and present and alternative approaches to Bay development.

FINANCIAL SUPPORT:

Interior Department
Office of Water Resources Res.

*
Source: Science Information Exchange, Inc.

WORL-1

Westinghouse Ocean Research
Laboratory
P. O. Box 1771
Annapolis, Maryland 21404

PROJECT TITLE: A REGIONAL STUDY OF THE CHESTER RIVER AND AN EVALUATION OF STRESSES ON THE BIOLOGICAL COMMUNITIES.

PRINCIPAL INVESTIGATORS:

Dr. T. O. Munson, Manager, Aquatic Biology
Dr. H. D. Palmer, Manager, Aquatic Physical Sciences
Dr. K. T. S. Tzou, Senior Scientist
Dr. W. D. Clarke, Chief Scientist

OBJECTIVES:

1. To determine the levels of chlorinated hydrocarbons in water, bottom sediments and biota of the Chester River.

2. To study the processes by which these materials are distributed through the aquatic environment.

3. To evaluate the effects of these materials on soft-shell clams and oysters.

STATUS:

The study was begun in November 1971 and has concerned itself with hydrological, geological, biological, and biochemical investigations of the Chester River drainage. The emphasis has been on relating the findings in these different disciplines to gain a better understanding of the sources, paths of distributions and sinks for chlorinated hydrocarbons in the river system. Future work will be directed toward obtaining a complete year's cycle of measurements and field work and expanding the program to other portions of the Upper Bay.

FINANCIAL SUPPORT:

Department of Natural Resources of the State of Maryland
Westinghouse Electric Corporation

University of Richmond
UR-1 Richmond, Virginia 23173

PROJECT TITLE: OBSERVATIONS ON THREE SPECIES OF JELLYFISHES FROM CHESAPEAKE BAY WITH SPECIAL REFERENCE TO THEIR TOXINS.

PRINCIPAL INVESTIGATORS:

Nolan E. Rice, Professor of Biology
W. Allan Powell, Professor of Chemistry

OBJECTIVES:

1. Comparison of nematocysts from three species: Chrysaora quinquecirrha, Cyanea capillata, and Aurelia aurita.

2. Isolation of toxins of these species and determination of chemical nature.

3. Study toxicity of these toxins.

STATUS:

Work has been completed on C. quinquecirrha and published in Biological Bulletin, 1970, 139:180-187. Paper on C. capillata has been submitted for publication. Work is now in progress on A. aurita. In addition, chemical studies are being continued on the toxins of the three species.

FINANCIAL SUPPORT:

Virginia Academy of Science
University of Richmond