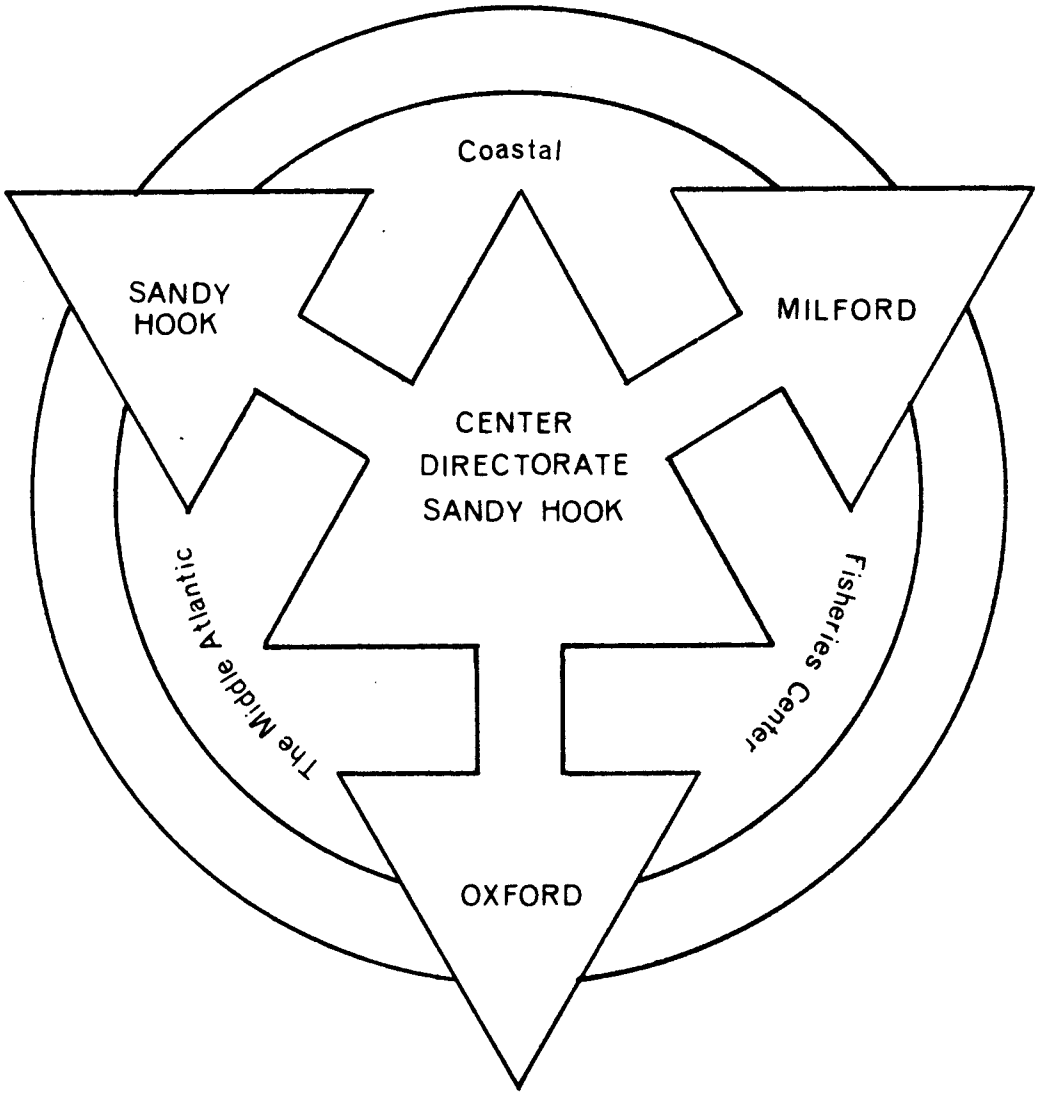
OBJECTIVES, PROGRAMS AND FACILITIES OF THE MIDDLE ATLANTIC COASTAL FISHERIES CENTER

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
Northeast Region

MIDDLE ATLANTIC COASTAL FISHERIES CENTER



Informal Report No. 115

June 1976

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I. THE MIDDLE ATLANTIC COASTAL FISHERIES CENTER

ORGANIZATION The Middle Atlantic Coastal Fisheries Center is one of a series of research centers established by the National Marine Fisheries Service, National Oceanic and Atmospheric Administration, U. S. Department of Commerce. Each of these centers represents a program consolidation and grouping of several laboratories in different geographical locations.

The Middle Atlantic Coastal Fisheries Center is a consolidation and integration of the Sandy Hook (N.J.) Marine Laboratory, the Oxford (Md.) Biological Laboratory, the Milford (Conn.) Biological Laboratory, and the former Ann Arbor (Mich.) Technological Laboratory (now based at Milford). These units (regrouped and subdivided by disciplines) function under direct line authority of the Center Director, Dr. Carl Sindermann, who is responsible to the Associate Director for Resource Research, NMFS, for broad integrated programs of research on living coastal resources. The Center is composed of a Directorate, an associated centralized Administrative Unit, and four major research units. Research facilities of the Center are located at Sandy Hook, N.J., Milford, Conn., Oxford, Md., and Greenbackville, Va. Center headquarters are at Sandy Hook.

MISSION The mission of the Center is to develop, establish, and to prosecute aggressively an integrated, multi-disciplinary research program on the biology and ecology of the living marine coastal organisms of the North Atlantic Ocean, especially in the zoogeographic area known as the Middle Atlantic Bight. This program is to be carried out in full cooperation with other interested Federal and State agencies, and with local academic and other research institutions. The research responsibilities of the major research units are as follows:

RESEARCH PROGRAMS

Ecosystems Investigations (Dr. J. B. Pearce, Director of Investigations) are primarily concerned with benthic-zooplankton food chain studies, physiological responses to toxins and organic wastes, zoogeographic distribution of benthic populations, evolution and succession of reef structures, and with surveys and analyses of the effects of man-made environmental changes on abundance and distribution of marine organisms. A major immediate responsibility is the New York Bight area, where such man-made changes are most profound.

Important aspects of ecosystems investigations concern environmental chemistry and microbiology. This work, located principally at the Milford facility, is primarily concerned with the determination of the level of chemical contaminants in marine resources, food chain organisms and in the environment of the marine animals. It is also concerned with the distribution of microorganisms in marine animals, as well as in the estuarine, inshore and marine environment with particular attention to the effects of man-made changes on the flora and the introduction and survival of potential human pathogens in the marine environment.

Resource Assessment Investigations (Dr. A. S. Merrill, Director of Investigations) are primarily concerned with assessment of abundance, distribution, and surplus yields of important coastal fish and shellfish species of the Middle Atlantic Bight and adjacent waters. Fisheries biological studies constitute an important aspect of the investigations. Included are: studies of life histories, distributions, migrations, physiology, and behavior of coastal species of the Middle Atlantic Bight and adjacent waters; statistical and geographical inventories and atlases of marine sportfish; and larval fish distribution, abundance, and physiology.

Experimental Biology Investigations (Dr. J. E. Hanks, Director of Investigations) are primarily concerned with physiological and genetic effects of pollutants on resource species, and (more recently) with molluscan aquaculture, emphasizing genetics, nutrition, and disease control. Pollution-oriented studies, utilizing an extensive chronic-exposure system, attempt to determine physiological, biochemical, and genetic effects of long-term exposure to specific pollutants. Aquaculture studies presently concentrate on nutritional aspects of algae, genetic selection of oysters, and disease control in larval molluscan culture.

Pathobiology Investigations (Dr. A. Rosenfield, Director of Investigations) are primarily concerned with pathogens which affect living marine resources, with environmental influences on marine diseases, with assessment of the impact of diseases on such resources, and with effective methods of control of diseases in mariculture.

CRITICAL PROBLEM AREAS

The Middle Atlantic Coastal Fisheries Center, because of the nature of existing staff competence and location of facilities, is admirably suited for the development and execution of integrated programs of coastal fisheries research. Among the critical problem areas to be confronted are: effects of increasing levels of pollution and other man-made environmental changes on the survival and abundance of fishes; biology, ecology, and behavior of species whose distribution or migration extend beyond State boundaries; study and surveillance of living resources of the Middle Atlantic Bight; study of trends in coastal fisheries production -- both recreational and commercial, and determination of causes for certain obvious declines in abundance and shifts in centers of abundance; and assessment of the impact of disease on marine animals.

Critical immediate problems which occupy the attention of the Middle Atlantic Coastal Fisheries Center at present include: coordination and integration of research efforts of component laboratories oriented toward a few broad programs (e.g., New York Bight Study; effects of pollutants on fish); increased emphasis on research in coastal fisheries resource problems; development of effective cooperative working relations with other research groups; and development of effective communication with all groups who can use information developed by the Center's research.

NATIONAL GOALS AND OBJECTIVES TO WHICH CURRENT MIDDLE ATLANTIC COASTAL FISHERIES CENTER RESEARCH IS RESPONSIVE:

Goal: Conserve, protect and allocate the marine fisheries resources of the United States through effective management of commercial and recreational fisheries.

I. Fisheries Management.

A. Resource Surveys/Data Analysis (Line Item)

2. Conduct MARMAP surveys, catch analyses, and prepare assessments for important resource stocks off the Mid-Atlantic coast of the United States (Objective).

-Merrill

B. Fishery Oceanography (Line Item)

13. Provide description and analyses of marine organic production systems in the Mid-Atlantic Bight (Objective).

-Pearce

14. Describe biological, physical and chemical environmental conditions and influence on the living marine resources of the Mid-Atlantic Bight (Objective).

-Pearce, Rosenfield, Hanks

Goal: Support fisheries management which considers marine recreational fisheries in proportion to their significance and maintains the resources at an optimum level to ensure their availability for equitable allocation to recreational use for food and enjoyment.

III. Marine Recreational Fisheries.

A. Marine recreational fisheries (Line Item)

3. Conduct and support research directed toward understanding the biology of recreationally important fish stocks; i.e., life history studies, interrelationships of various stocks, behavioral and ecological characteristics, environmental requirements, to permit management to develop and maintain the full potential benefits from these fishery resources. (Objective).

-Merrill, Rosenfield, Pearce, Hanks

Goal 1: Increase the national availability and quality of a broad spectrum of aquatic resources for commercial and recreational use through aquacultural research and development and through the hatcheries programs.

IV. Aquaculture/Hatcheries.

A. Aquaculture research and development (Line Item)

2. Conduct the research and development needed to establish the scientific and technical base for the extensive and/or intensive culture of selected species (Objective).

-Hanks Rosenfield

Goal: Assure that adequate consideration and protection are given to living marine and estuarine resources and their habitat requirements in proposed, on-going and completed environmental alterations.

VI. Habitat Protection.

B. Fisheries Habitat Investigations (Line Item)

2. Determine long-term fluctuations and reactions to man's activities in areas of present degradation and effects on resources, with the goal of guiding management strategies for rehabilitation. (Objective).

-Pearce Rosenfield, Hanks

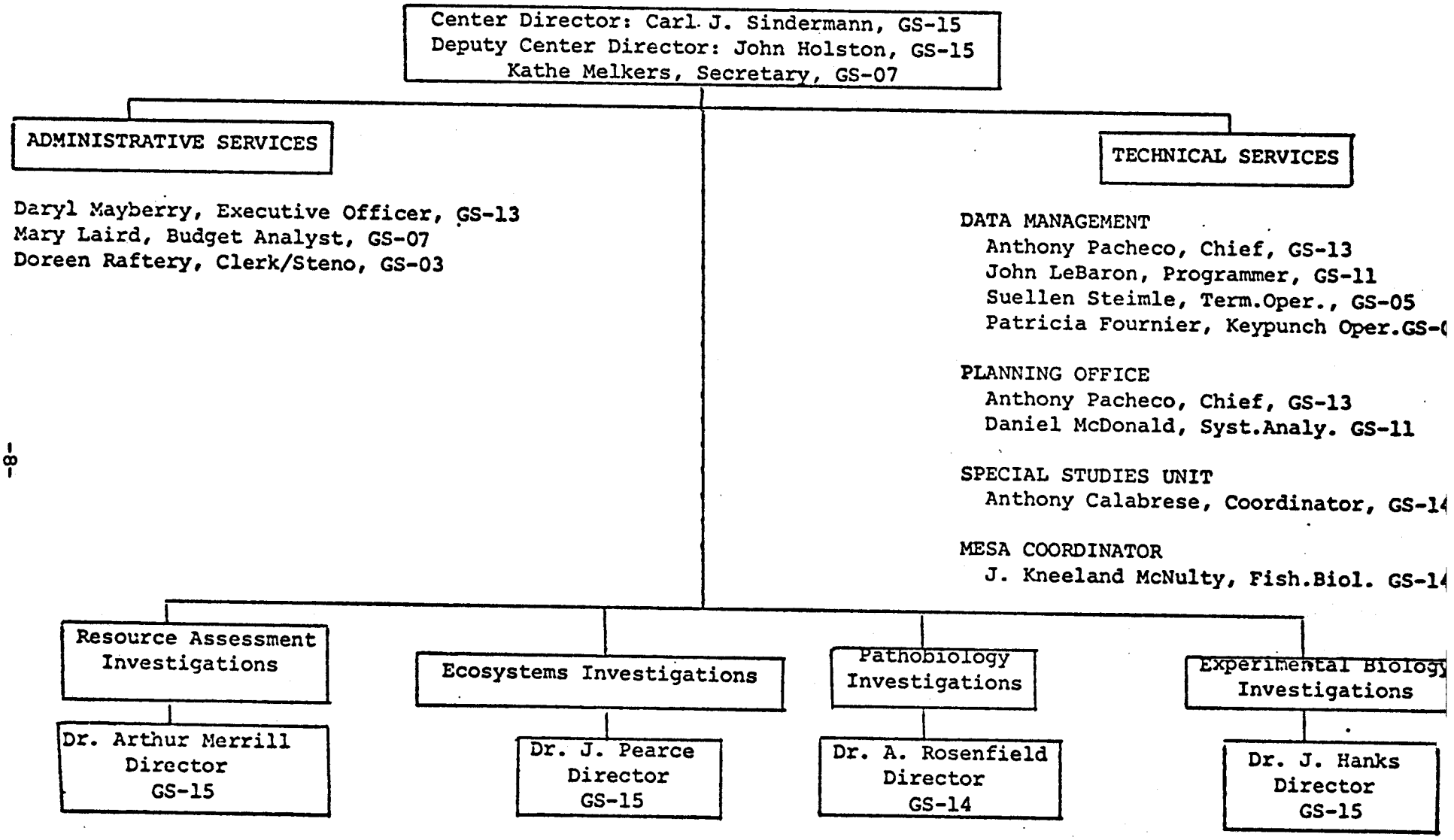
TABULATION OF TASK DEVELOPMENT PLANS AND RELATED NMFS OBJECTIVES

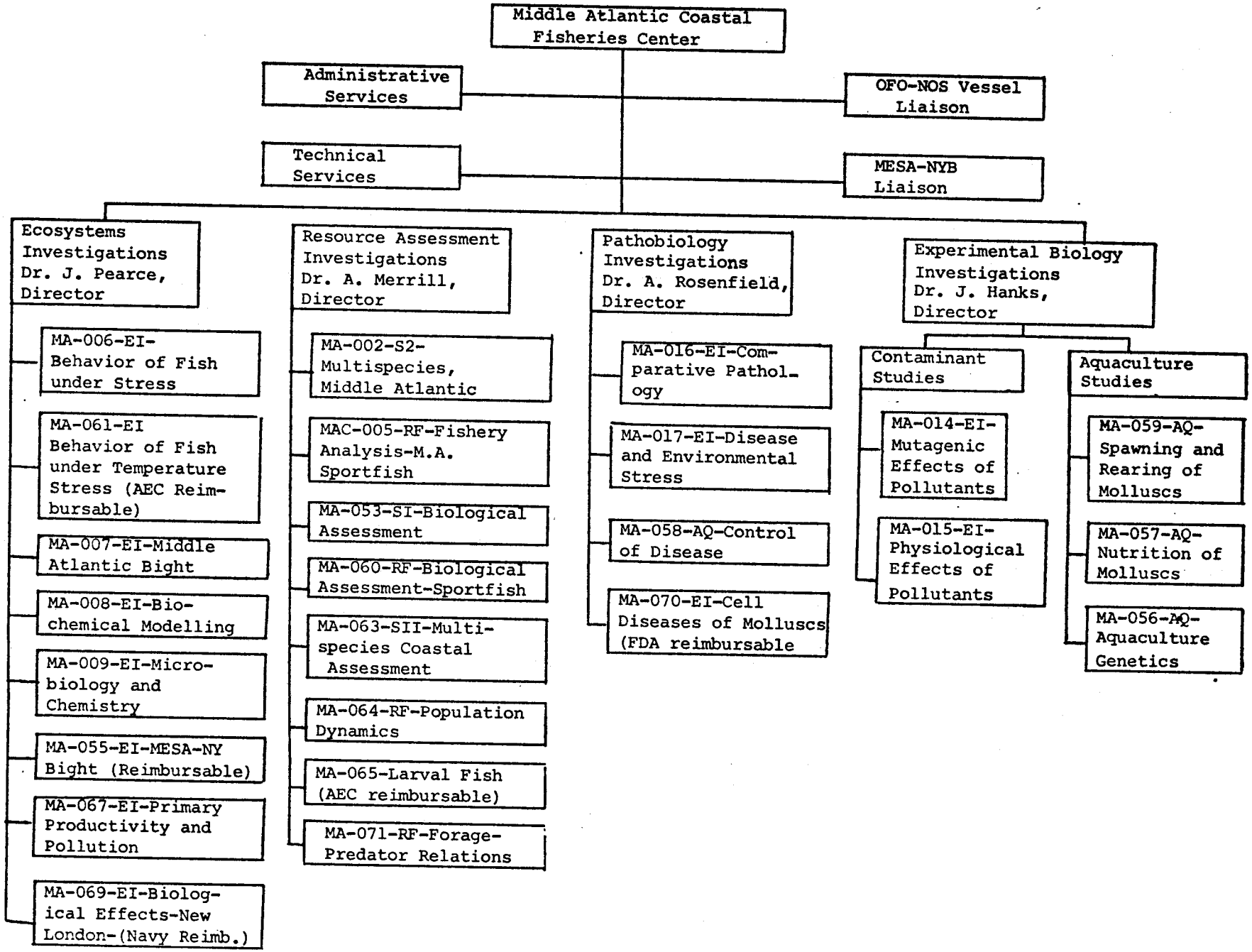
MAC-002	MARMAP SII - Multispecies - Middle Atlantic Bight	1.A.2.; (3.A.3.)[1/]
MAC-005	Fishery Analysis - Middle Atlantic Sportfish	1.A.2.; (3.A.3.)
MAC-006	Behavior of Fishes under Environmental Stress	(3.A.3.;)1.B.14; (6.B
MAC-007	Impact of Environmental Change, Middle Atlantic	1.B.14; (6.B.2.)
MAC-008	Biochemical Modeling, Middle Atlantic	1.B.14; (6.B.2.)
MAC-009	Environmental Microbiology and Chemistry, Middle Atlantic	1.B.14; (6.B.2.)
MAC-015	Physiological Effects of Pollutant Stress	1.B.14; (3.A.3) (6.B.
MAC-016	Life Studies: Comparative Pathology	1.B.14; (6.B.2.)
MAC-017	Disease and Environmental Stress	1.B.14; (6.B.2.)
MAC-053	MARMAP SI - Biological Assessment	1.A.2.
MAC-055	MESA-New York Bight Biological Oceanography	(1.B.13;)1.B.14; (6.B.
MAC-056	Aquaculture Genetics	4.A.2.
MAC-057	Aspects of Nutritional Requirements of Molluscs	4.A.2.
MAC-058	Aquacultural Control of Molluscan Disease	4.A.2.
MAC-059	Spawning and Rearing of Molluscs	4.A.2.
MAC-060	Biological Assessment - Sportfish	3.A.3; (1.A.2)
MAC-061	Behavioral Measures of Environmental Stress in Marine Fishes: Field and Laboratory Studies	1.B.14; (3.A.3); (6.B.
MAC-063	MARMAP II - Multispecies, Coastal Assessment	1.A.2.; (3.A.3.)
MAC-064	MARMAP FA - Population Dynamics	(1.A.2.;)3.A.3.
MAC-065	MARMAP SI - Larval Fish Studies (ERDA Reimbursable)	1.A.2.; (3.A.3)

[1/] () = Non-add

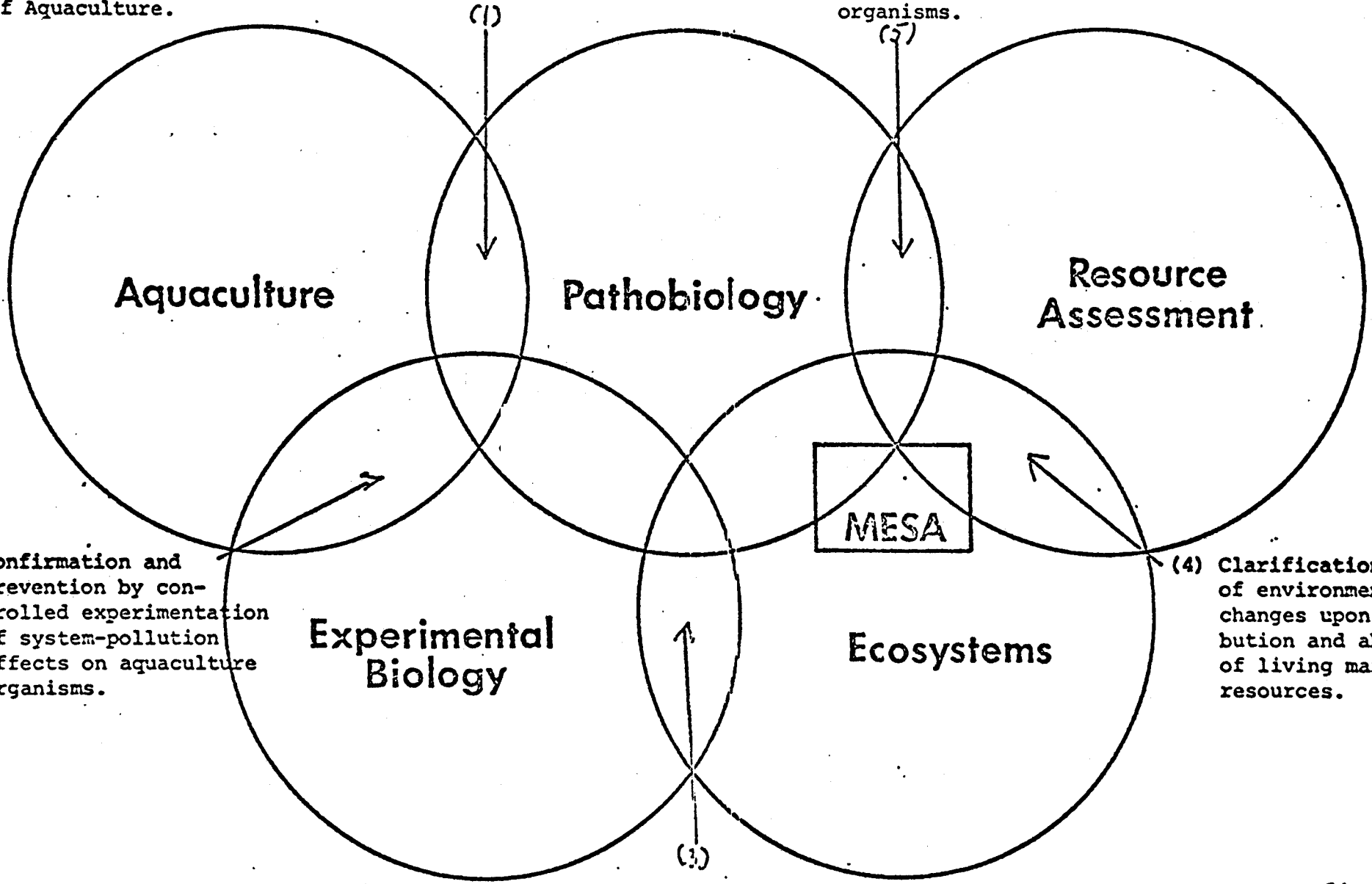
MAC-067	Primary Productivity and its Relationship to Pollution and Coastal Fisheries	1.B.13; (6.B.2.)
MAC-069	Biological Effects of Dredging and Spoil Disposal, New London, CT	6.B.2.
MAC-070	Proliferative Cell Disease in Molluscs	1.B.14.; (6.B.2.)
MAC-071	Recreational Fisheries - Forage Fish - Predator Relations	3.A.3. ; (1.A.2.)
MAC-072	Larval and Algal Technical Services	4.A.2.
MAC-073	Effect of Temperature on the Behavior of Marine Invertebrates	1.B.14.; (6.B.2.)
MAC-074	Ecological Baselines of the Outer Continental Shelf	1.B.14.; (6.B.2.)

MIDDLE ATLANTIC COASTAL FISHERIES CENTER




Middle Atlantic Coastal Fisheries Center
Administrative Services
OFO-NOS Vessel Liaison
Technical Services
MESA-NYB Liaison
Ecosystems Investigations Dr. J. Pearce, Director
MA-006-EI-Behavior of Fish under Stress
MA-061-EI Behavior of Fish under Temperature Stress (AEC Reimbursable)
MA-007-EI-Middle Atlantic Bight
MA-008-EI-Biochemical Modelling
MA-009-EI-Microbiology and Chemistry
MA-055-EI-MESA-NY Bight (Reimbursable)
MA-067-EI-Primary Productivity and Pollution
MA-069-EI-Biological Effects-New London-(Navy Reimb.)
Resource Assessment Investigations Dr. A. Merrill, Director
MA-002-S2-Multispecies, Middle Atlantic
MAC-005-RF-Fishery Analysis-M.A. Sportfish
MA-053-SI-Biological Assessment
MA-060-RF-Biological Assessment-Sportfish
MA-063-SII-Multispecies Coastal Assessment
MA-064-RF-Population Dynamics
MA-065-Larval Fish (AEC reimbursable)
MA-071-RF-Forage-Predator Relations
Pathobiology Investigations Dr. A. Rosenfield, Director
MA-016-EI-Comparative Pathology
MA-017-EI-Disease and Environmental Stress
MA-058-AQ-Control of Disease
MA-070-EI-Cell Diseases of Molluscs (FDA reimbursable
Experimental Biology Investigations Dr. J. Hanks, Director
Contaminant Studies
MA-014-EI-Mutagenic Effects of Pollutants
MA-015-EI-Physiological Effects of Pollutants
Aquaculture Studies
MA-059-AQ-Spawning and Rearing of Molluscs
MA-057-AQ-Nutrition of Molluscs
MA-056-AQ-Aquaculture Genetics

Middle Atlantic Coastal Fisheries Center
Interrelationships of Research Investigation Groups and the Relative Position of MESA – Funded Studies



(3) Confirmation by controlled experimentation of field observations as to environmental effects.

C. Recent Major Research Accomplishments:

Accomplishment:

1. Seasonal over-stressing of marine environment

Year	Investigations	Principal Investigator
1974-75	Ecosystems	Dr. J. Thomas

Seasonal occupation of a 106-station grid in the New York Bight apex for seabed oxygen consumption and bottom dissolved oxygen observations, using a Pamatmat multi-coring device, have already demonstrated, in open oceanic areas above the sewage sludge dump site and the dredge spoiling site, a marked seasonal (warm-water months) depression in seabed oxygen consumption rates and prevailing bottom dissolved oxygen concentrations of 2 ppm or lower. Work sponsored by MESA.

2. Seasonal avoidance by demersal finfish of high-carbon areas of the New York Bight

Year	Investigations	Principal Investigator

Randomized, stratified demersal finfish assessment surveys of the Middle Atlantic Bight have shown that, during the warm-water months, certain waters of the New York Bight apex enjoy a total demersal finfish biomass which is approximately 25% smaller than is observed in less impacted oceanic areas to the south and east. Sponsored, in part, by MESA.

3. Completion of (8-section) Anglers' Guide

Year	Investigations	Principal Investigator

A comprehensive guide to marine fishing along the Atlantic coast (8 sections covering all waters from Passamaquoddy Bay, Maine to Key West, Florida). The first four sections published in 1974; the second four sections will be published in the autumn of 1975.

4. Completion of comprehensive ecological study - Long Island Sound

Year	Investigations	Principal Investigator
1973-75	Ecosystems	Mr. R. Reid

A 86-page report was submitted in 1975 to the New England River Basins Commission covering a synoptic ecological (148-station) study of the length and breadth of the Sound. Comparative studies evidenced marked species shifts in benthic invertebrates. The study documented the currently prevailing sedimentary and water quality conditions. Marked environmental impacts were discerned for the western end and along the northern shoreline of the Sound.

5. "Oncogenic" processes detected in shellfish

Year	Investigations	Principal Investigator
1974	Pathobiology	Dr. P. Johnson

First electron micrographic photographs were obtained of developing "neoplastic" conditions in epithelium-derived cells.

6. Definition of epicenter of fin-rot epizootic

Year	Investigations	Principal Investigator
1974	Pathobiology	Dr. R. Murchelano

Statistically significant results of large-scale observations of trawl-caught demersal fishes demonstrate that the epicenter of fin-rot disease in flatfishes is located in the New York Bight apex and Raritan Bay complex as compared with oceanic control areas to the eastward and to the southward. High incidences are related to the seasonal migrations of winter and summer flounder. Work was done in cooperation with Resource Assessment Investigations and was sponsored by MESA.

7. Demonstrated high levels of chromosomal aberrations in fish eggs

Year	Investigations	Principal Investigator
1974-75	Expt'l Biology	Dr. A. Longwell

Work sponsored in part by MESA, demonstrated that up to 60% of fish eggs sampled from 14 neuston tows in the New York Bight evidenced gross chromosomal damage and other cytological anomalies. Work has important implications for environmental and resource assessment (MARMAP) research.

8. First quantitative pilot sportfish "catch" census completed

Year	Investigations	Principal Investigator
1974-75	Resource Assessment	Mr. A. Pacheco

A pilot study of sportfish activity effort and success in the oceanic waters off Ocean City, Md. was completed in 1974. Highly significant findings have justified similar studies during 1975 at four major New Jersey sportfish areas. This appears to be the first cost-effective approach to obtaining biological statistics on the sportfish catch - which catch in many areas may well exceed the commercial catch.

9. Phytoplankton levels (and red tides) in Raritan Bay complex

Year	Investigations	Principal Investigator
1974-75	Ecosystems	Dr. J. Thomas

Primary productivity studies, sponsored, in part, by MESA, on the Raritan Bay-Lower New York Harbor-Sandy Hook Bay complex have demonstrated that the nutrient-laden waters of the Hudson River circulate counter-clockwise in the bay complex and, within Sandy Hook Bay, support a very rich phytoplankton crop, the concentrations of which far surpass those associated with the richest of known "upwellings." Further, the phytoplankton crop is characterized by seasonal shifts in type of organism, i.e., from netplankton to nanno-plankton. These phenomena have been observed also in the New York Bight apex.

10. Completed comprehensive ecological study - Raritan Bay, N.J.

Year	Investigations	Principal Investigator
1974	Ecosystems	Mr. R. Reid

Completed a comprehensive ecological study of Raritan Bay - reoccupying historic sampling stations established twenty years ago. Comparative studies have demonstrated major shifts in benthic invertebrate species, documenting a still further decline in the quality of this marine environment.

11. New method for growing, storing, and shipping algal stock culture

Year	Investigations	Principal Investigator
1975	Expt'l.Biology	Dr. R. Ukeles

A major problem in molluscan aquaculture is maintenance and replacement of algal food, cultures and stocks. A new method has been developed, utilizing strips of paper which are soaked in nutrients and inoculated with algae, and are then placed in a moisture-laden screw-capped test tube. The organisms continue to grow during stock storage and subsequent shipment.

12. Ozone-inactivation of "red tide" organisms and toxins

Year	Investigations	Principal Investigator
1974-75	Pathobiology	Dr. R. Murchelano

Studies in the field and in the laboratory have demonstrated that exposure to ozone destroys several species of "red tide" organisms and inactivates their several neurotoxins. Studies are now in progress to determine efficacy of ozone in depuration of shellfish containing the organisms and/or their toxins. The technique is already being used in seawater intake to prevent loss of biological research and museum specimens.

13. New cytological preparation technique for mutagenic research

Year	Investigations	Principal Investigator
1974	Expt'l Biology	Dr. A. Longwell

Historically, genetic studies of marine organisms have required specialized and meticulous fixation techniques; historical samples, preserved in formalin, could not be studied. A new fixation technique has been developed which permits usage of such formalin-preserved samples and studies are now underway to determine whether presently observed high levels of chromosomal aberrations in fish eggs existed in the past century or are related to recent "high technology" industrializazion.

14. First photographs - viral replication in marine organisms

Year	Investigations	Principal Investigator
1974	Pathobiology	Dr. P. Johnson

The first electron micrographs of overwhelming viral replication in the cells of marine organisms were developed, the octagen-shaped particles are thought to be papovavirus.

15. Completed census of surf clam resource; confirming continued failure of recruitment in oceanic waters of northern New Jersey

Year	Investigations	Principal Investigator
1974	Resource Assessment	Dr. A. Merrill

A cooperative Federal/State census of surf clam stocks from Montauk, L. I. to Chincoteague, Va. and from the shoreline out to 30 fathoms demonstrated that recruitment in the New York Bight apex and in the nearby New Jersey waters is still very low while in other areas, stocks are abundant.

16. Distribution and Abundances: Middle Atlantic Finfish Species

Year	Investigations	Principal Investigator
1975	Resource Assessment	Mr. T. Azarovitz

Supplementary MARMAP-SII cruises, funded through reimbursable studies, have documented the (1) migrations of demersal finfish in the Middle Atlantic Bight, (2) the fact that up to 29% of the finfish biomass of the Middle Atlantic Bight occupy oceanic waters of five fathoms or less in depth, (3) that hakes, seasonally, migrate to the onshore waters, and (4) that the optimal SII survey cruise scheduling for the Middle Atlantic Bight is on a bimonthly basis.

17. Acantholysis in finfish affected by fin rot disease

Year	Investigations	Principal Investigator
1975	Pathobiology	Dr. J. Bodammer

Electron microscopy studies of the musculature of fish, evidencing the so-called fin rot disease, have documented the occurrence of deep "incisions" or separations of the cells comprising the striated muscles.

18. Multi-variate analysis: Factors affecting the composition of benthic communities

Year	Investigations	Principal Investigator
1976	Ecosystems	Dr. J. B. Pearce

Preliminary findings, by primary factor analysis, indicate that 97% of the variations in composition of the benthic communities of the grossly impacted New York Bight Apex can be explained by five factors, which factors probably include surficial sediment characteristics, sedimentary heavy metals burdens, sedimentary organic carbon burden, bottom-water dissolved oxygen levels, and certain physiological attributes of the organisms themselves. In an unstressed environment, the number of factors necessary to explain the variations in composition at the 60% level are at least an order of magnitude higher.

19. Quantification of benthic studies by cluster analysis

Year	Investigations	Principal Investigator
1976	Ecosystems	Dr. J.K. McNulty

Through application of the Jaccard coefficient, a measure of the similarity of dominant species in replicated samples, it has been demonstrated that, in grossly impacted areas, the limits of confidence for three to five replications are such as to assure a 95% probability of detecting a further significant change. This is the first time that studies of benthic invertebrate communities have been quantified.

20. Distribution and abundances of ocean quahog (A. islandica)

Year	Investigations	Principal Investigator
1976	Resource Assessment	Dr. A. Merrill

A combined surf clam/ocean quahog cruise demonstrated that, in waters of from 20 to 40 fathoms in depth off the coasts of Long Island and New Jersey, a very large latent resource (ocean quahogs) is available and can be harvested with present technology. The cruise also demonstrated that a healthy recruitment of younger clams to the market size clams can be expected.

II. FACILITIES OF THE CENTER

Laboratory facilities of the Center are located at Sandy Hook, New Jersey, Oxford, Maryland, and Milford, Connecticut, with a substation at Greenbackville, Virginia. The Center's ocean operations are carried out on the research stern trawler "Delaware II, as well as a number of intermediate and smaller vessels. Administration and data processing are centered at Sandy Hook, and the Delaware II is based there.

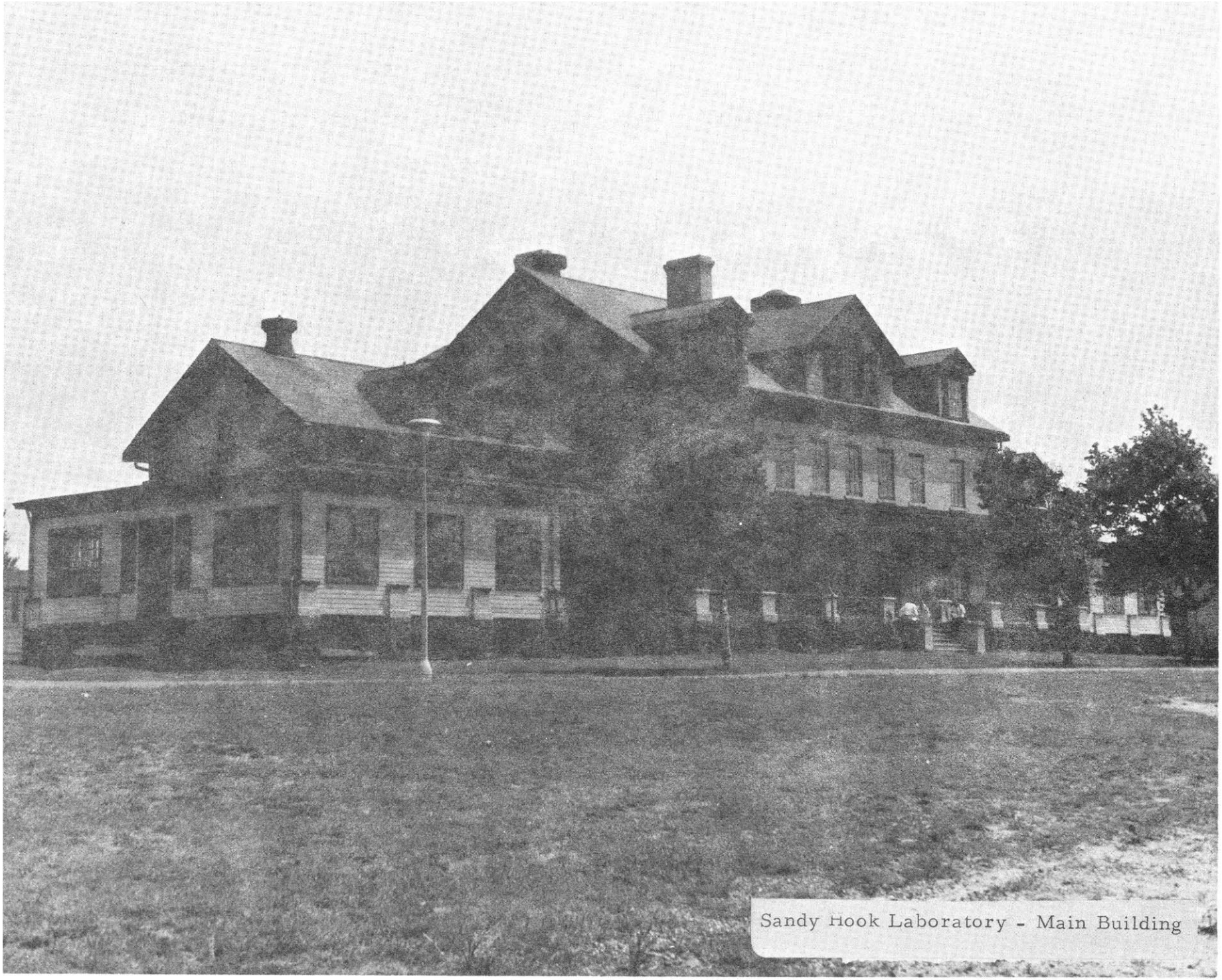
SANDY HOOK LABORATORY

This laboratory is in central New Jersey on the narrow peninsula of Sandy Hook, which separates the Atlantic Ocean from Sandy Hook Bay. The main building is a former hospital with floor area of 30,000 sq.ft. on four floors. An annex adds some 20,000 sq.ft. of laboratory and office space.

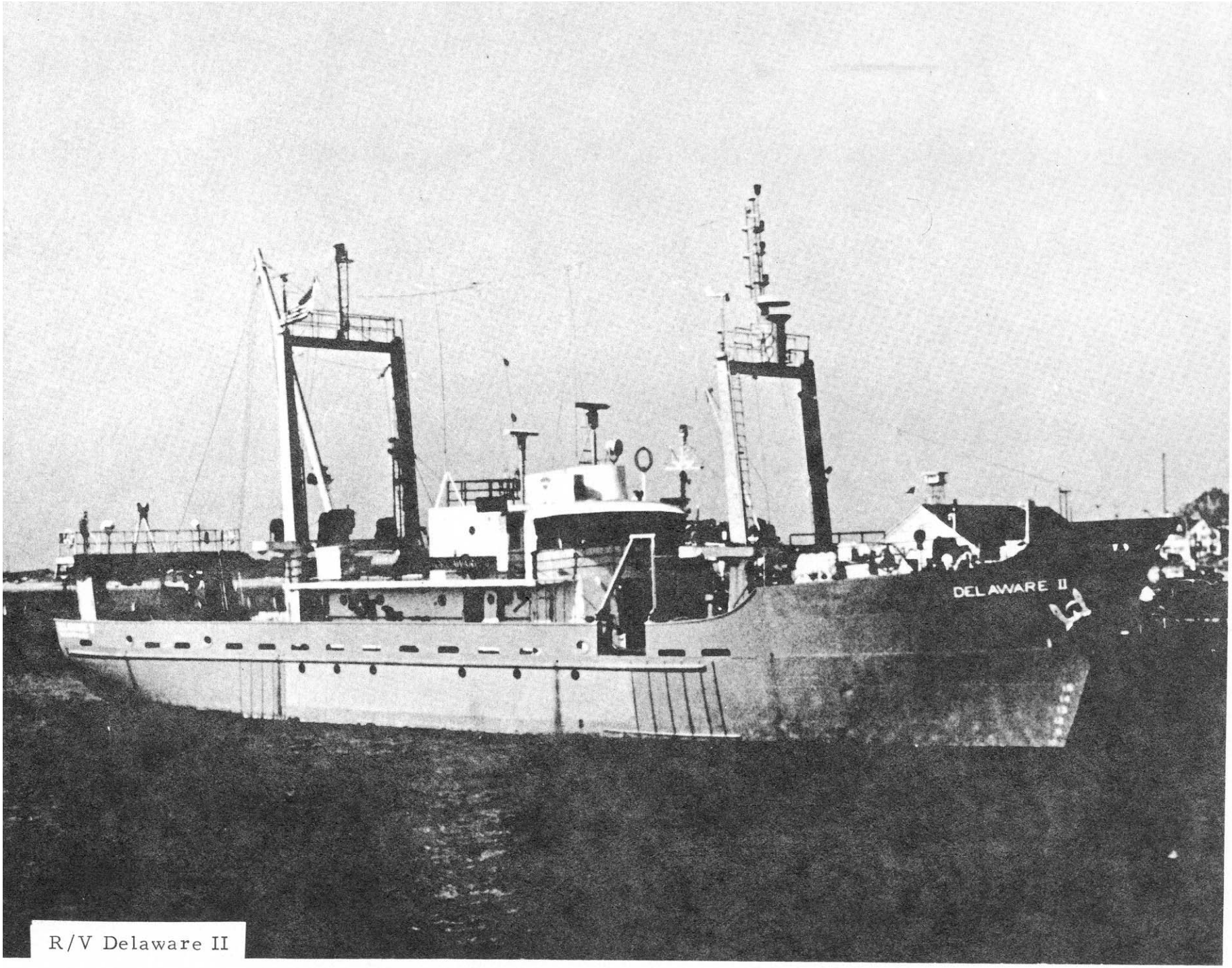
The laboratory facilities include dormitory, shops, offices, library, conference rooms, darkroom, aquaria and laboratory suites for chemistry, microbiology, fish behavior, benthic and plankton studies. There are special laboratories for phytoplankton culture, fish culture, experimental ecology of invertebrates, and for the effect of environmental factors on behavior and survival of marine organisms.

The main building is supplied with sea water pumped through a well point in the bay bottom. Aquarium facilities include a 32,000 gallon sea tank with complete environmental control for behavioral studies. Other aquaria range from 30 to 3,000 gallons capacity.

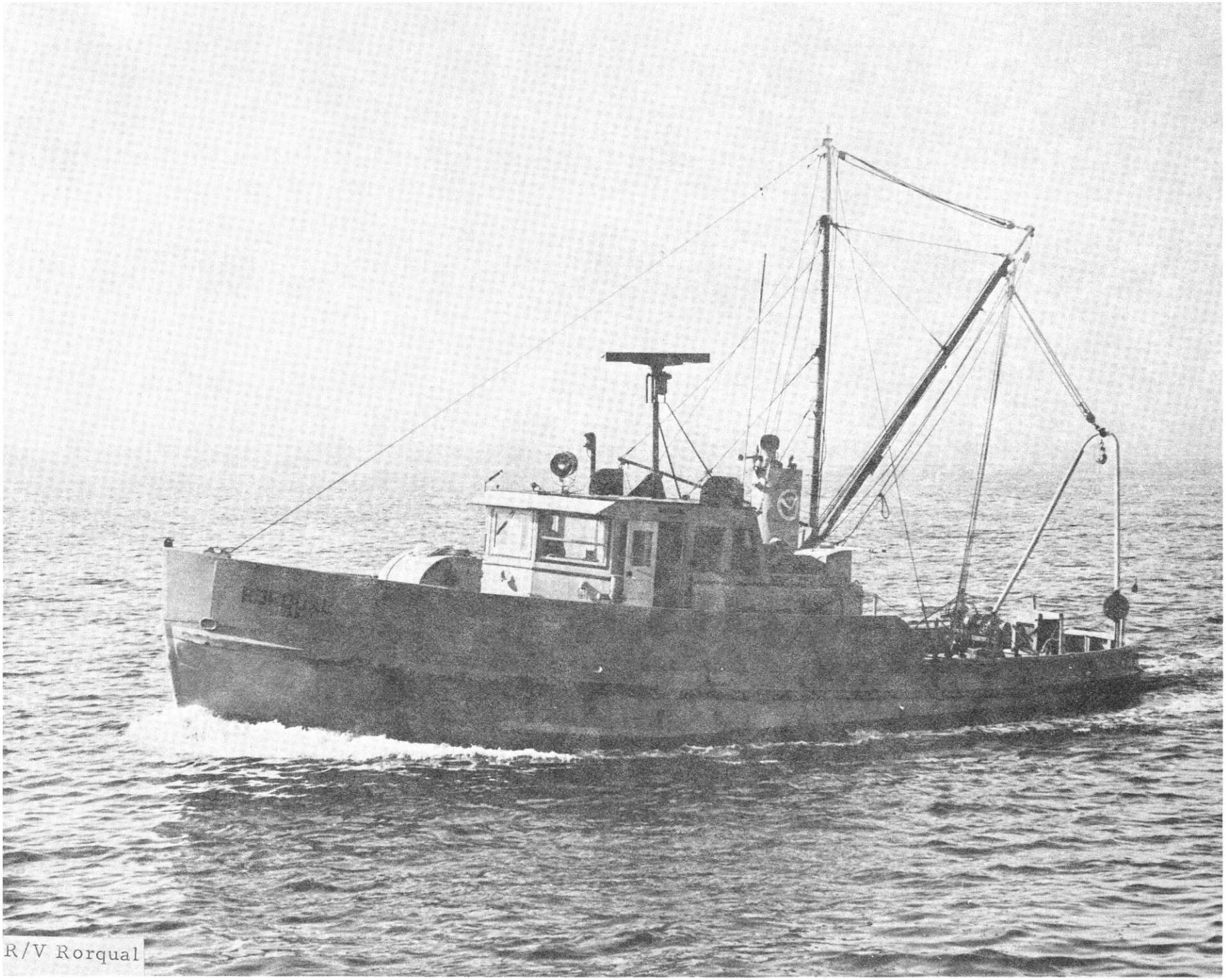
Vessels are berthed at deepwater piers near the laboratory. The docking area includes a large pier for the Delaware II and protected berths for the Rorqual and smaller boats. A pier shed combines diving locker, storage, and shore power supply.



Sandy Hook Laboratory - Main Building



R/V Delaware II



R/V Rorqual

MILFORD LABORATORY

The Milford Laboratory, established in 1931, is located on Milford Harbor, a short distance from the open waters of Long Island Sound, within a short distance of mud flats, salt marshes, salt-water embayments, and tidal estuaries with bottom types ranging from soft mud to hard sand and rock.

A modern, three-story laboratory building was completed in 1966. It has more than 28,000 square feet of floor space and contains 17 research laboratories, an experimental shellfish hatchery, administrative offices, a combined library-conference room, and a lobby-display area. Each laboratory can be supplied with up to 100 amps of electrical energy, hot and cold running sea water, hot and cold domestic water, fresh well water, natural gas, and compressed air. Eleven of the research laboratories have constant temperature water tables. Two additional rooms, one for algal stock cultures and one for mass culturing of algae can be maintained at 55°F the year round.

A tank farm of 54 fiberglas tanks, 30 feet by 4 feet by 18 inches, was completed in 1969. These tanks are used for rearing, holding, and experimentation with oysters and clams.

Research of the laboratory has concentrated on development of biological information and techniques important to mariculture. Emphasis has been placed on seed oyster production and predator control. More recent studies have emphasized the effects of pollutants on survival and well-being of marine animals -- particularly in their young stages.

The Laboratory operates a 50-foot research vessel, the Shang Wheeler. It has standard hydrographic gear and dredge equipment for sampling bottom organisms. A small laboratory on the main deck can accommodate four to six scientists.

Milford Laboratory

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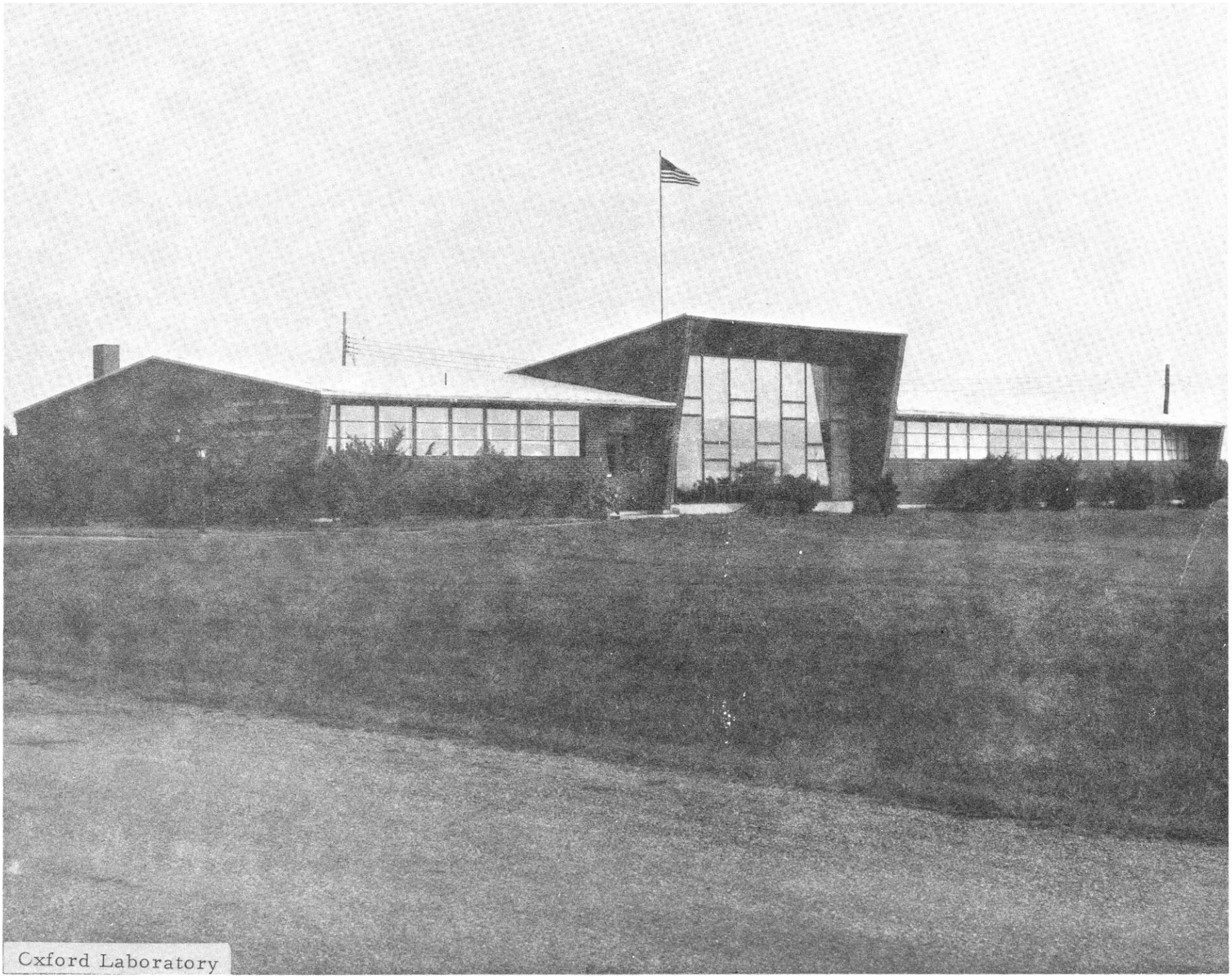
OXFORD LABORATORY

The Oxford (Md.) Laboratory is located on the eastern shore of Chesapeake Bay, probably the most important estuary on the United States east coast. The Bay is an excellent breeding, nursery, and feeding ground for many sport and commercially important fishes. In the ocean adjacent to this area and in seaside bays are surf clams, hard clams, crabs, and many fish species of recreational and commercial importance.

The laboratory, built in 1960, has 13,000 square feet of floor space for chemical, microbiological, environmental, histological, and immunological studies; and two rooms with running estuarine water supplying a series of indoor and outdoor tanks. Office space, a conference room, and an excellent library are included in the main building. Other adjacent facilities comprise a shop-storage building, a small laboratory building for visiting investigators, an animal house, a greenhouse for culturing algae, and 4 one-quarter-acre earthen ponds for shellfish culture in a controlled environment.

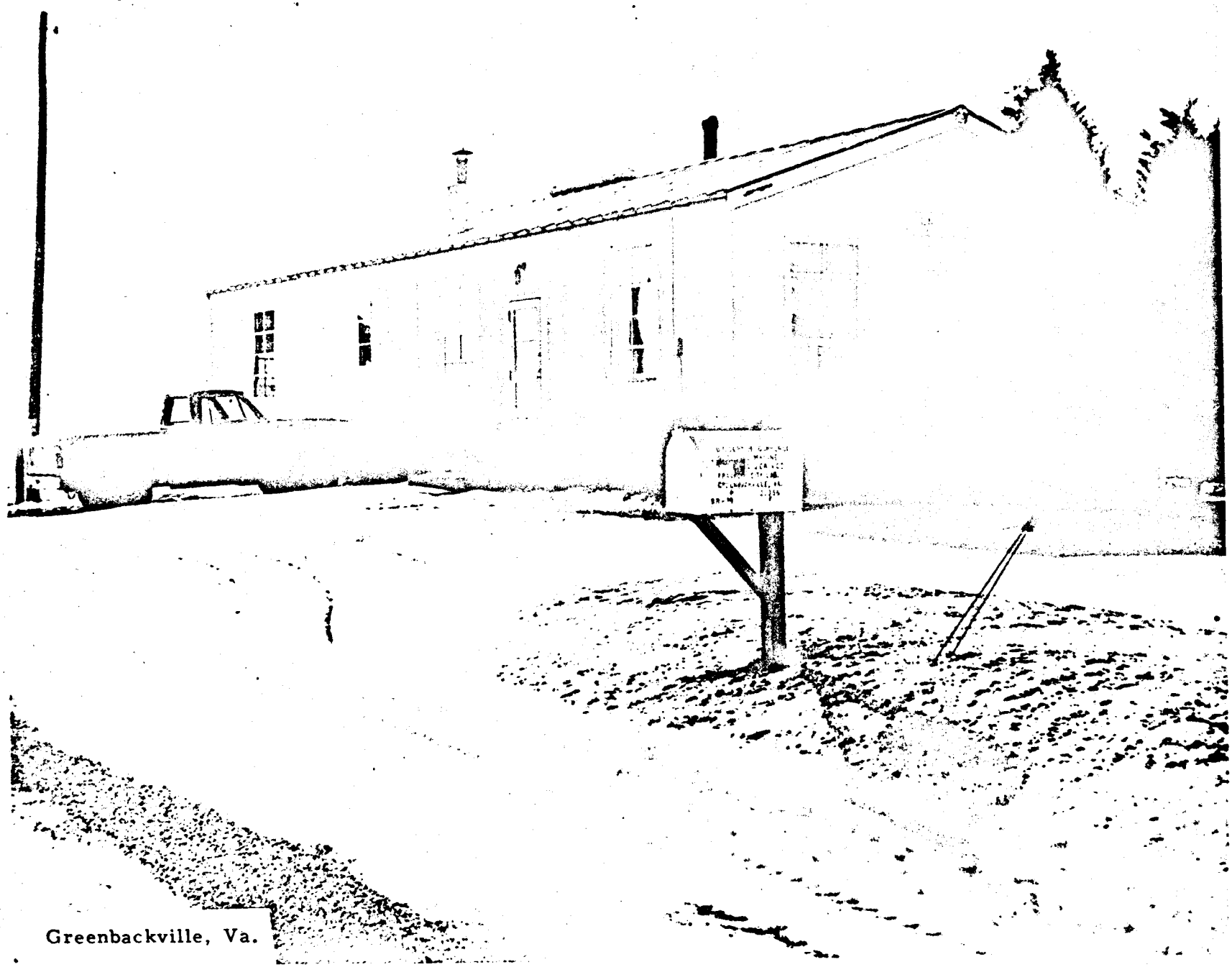
Present investigations are concerned directly with pathology and resource assessment (with emphasis on invertebrates). Strong emphasis has been given to research on problems of shellfish mortalities, including identification and life histories of pathogens, control of predators, and the effects of environmental changes. Close liaison is maintained with State research and management agencies, and the shellfish industries. Research programs have concentrated on the oyster, Crassostrea virginica, and the surf clam, Spisula solidissima.



Cxford Laboratory

GREENBACKVILLE SUBSTATION

Located on Chincoteague Bay, an important shellfish producing area on the seaside coast of the Delmarva Peninsula, the Greenbackville substation contains 3000 square feet of floor space with chemical and biological laboratories, offices, and sea water aquarium room. A large rack suspension system in front of the substation provides facilities for experimental work with shellfish in the high salinity bay environment. The field station has been the base for some of the oyster mortality studies, and for field and experimental work on surf clams.



Greenbackville, Va.

III. A MORE DETAILED DESCRIPTION OF THE RESEARCH OF THE MIDDLE ATLANTIC COASTAL FISHERIES CENTER

RESOURCE ASSESSMENT INVESTIGATIONS

The National Marine Fisheries Service (NMFS) has long been engaged in offshore assessment of fish stocks along the Atlantic coast, especially on the highly productive Georges Bank and Gulf of Maine grounds. More recently, studies have been extended into the mid-Atlantic and Chesapeake Bay regions. In the past, this amount of effort was deemed sufficient to assess the North Atlantic commercial stocks. However, the increase in fishing pressure by foreign fleets, with the concurrent decrease in stocks on the traditional North Atlantic grounds, has caused an increase in fishing intensity in the Middle Atlantic areas. Along with dwindling stocks, there is an apparent degradation of critical estuarine and coastal spawning and nursery grounds. In addition, our technological gains in the field of freezing, holding, processing, and transportation of fishery products have expanded the markets to new inland areas where seafood products had not previously been utilized. Moreover, recreational fishing pressure on these stocks has increased steadily. These factors listed above have put a serious strain on fishery resources along the Atlantic coast of the United States and many are in jeopardy of being depleted by overfishing. It, therefore, becomes essential that the fishery stocks along the Atlantic coast and adjacent estuaries be assessed as completely as possible in order that wise management policies be established to save them from further depletion.

To properly assess the resources along the entire Atlantic coast, a comprehensive and intensive national program of integrated research has been developed which, in the Middle Atlantic Coastal Fisheries Center, involves four investigations. All investigations are working together as one coordinated group called Resource Assessment Investigations, in order that the status of our current and the future commercial and recreational stocks can be predicted. The Center's coastal resource program couples with and complements those being conducted by NMFS Centers to the north and south.

ORGANIZATION: Coastal Survey Investigation, Middle Atlantic Coastal Fisheries Center, NMFS, NOAA, Highlands, N.J.

ACTIVITY AREA: Middle Atlantic Bight / Resource Assessment / Finfish and Shellfish

OBJECTIVE: To efficiently and effectively utilize the fisher resources of the Middle Atlantic by establishing an adequate data base for management decisions. Resource assessment data, supplemented by existin sources, including fishery statistics, will provide accurate information permitting the development of predictive models for middle Atlantic coastal fisheries resources.

SUMMARY: Fishery stocks in the Middle Atlantic are subjected to a combined influence of increasing fishi pressures and environmental extremes. Fishing pressures have changed drastically in recent years with the influence of foreign fleets offshore and with the recent and rapid development of inshore recreational fishing. Stresses of normal environmental extremes of temperature and salinity have been compounded by a reduction in quality and area of estuarine nursery zones. In recent years the above factors have decreased the yield or catch rate of a number of our utilized fishery resources and in unrealized ways affected unexploited stocks Many of these fishes migrate not only within the middle Atlantic area but range along the shelf waters of the entire Atlantic coast. These facts demonstrate why a strict regional approach is not practical; and show the need for a cooperative coastwise program utilizing joint data banks for storage of information.

Using standard trawl gear, we will continue our sampling pattern in order to estimate and monitor numbers and distribution of all benthic fish and selected shellfish species with principal emphasis in the Middle Atlantic Bight. Since the life pattern of many inshore finfish incur migrations of not only on a coastal scale but to the offshore waters, we will continue to coordinate and refine sampling systems cooperatively carried on by

Federal and State fishery laboratories both north and south of the region (from Nantucket to Cape Canaveral). Assessment of groundfish will be based on fall and spring surveys, coastwise in concept, particularly to monitor juvenile and adult components. Input statements on age, fecundity, growth, and stock identification will derive from other task units working on these species groups of special interest (sciaenids, flounders, etc.). As a data base of information builds up, we will begin biometrical analyses to estimate the potential yield and harvestable fractions of particular stocks.

Primary recipients of these data will be Federal groups and in-house personnel developing ICNAF and bilateral policies. State agencies and industry representatives (commercial and recreational) will be given requested information to assist in management decisions.

RESOURCES: FY 74 91.2 K
FY 75 98.0 K

SENIOR STAFF: Thomas Azarovitz

ORGANIZATION: Resource Assessment, Biological Investigation, Middle Atlantic Coastal Fisheries Center, NMFS, NOAA, Highlands, N.J.

ACTIVITY AREA: Life History Agents of Marine Finfishes - East Coast from Florida to Massachusetts

OBJECTIVE: Fish populations of the Middle Atlantic Bight have been subjected to encroachment of foreign fleets, increased U.S. commercial and sport fisheries, and reduction in quality and area of suitable spawning and nursery grounds. These forces have combined with natural fluctuations, in varying proportions, to jeopardize our coastal fishery resources to the extent that some are on the verge of depletion. Unfortunately, our basic biological knowledge of the life histories of coastal fishes is inadequate for recommending immediate and sound national and international management policies. We are not in a position to determine recruitment, levels of exploitation, or the impact of long-term natural fluctuations and man-made changes in the environment upon our fishery resources. The scientific base needed to properly manage our coastal fisheries will incorporate the understanding of basic biological components that make up the life history patterns of coastal species. It is essential that the assessment of fishery stocks along the Atlantic coast be augmented in order that proper management policies can be established to insure the maximum sustainable yield of important marine resources.

SUMMARY: Programs are now underway to:

1) collect biological materials pertinent to selected Atlantic coast sport and commercial species such as drums, flounders, porgies, sea basses, during groundfish cruises, and routine port sampling;

2) analyze biological materials to determine one or more of the following: age composition and growth rate, sexual development, spawning season, fecundity, and food and feeding habits;

3) conduct stock and racial identification studies of selected species by means of discriminant function analysis of morphometric and meristic variates;

4) record all data collected on the appropriate automatic data processing forms, transfer to punch cards, and incorporate into sorting, listing, and statistical systems;

5) retrieve and analyze data for use in technical reports, scientific publications, and special problem areas;

6) retrieve data requested by various user groups such as population and environmental analysts, NMFS research, industry, sportsmen, management and regulatory agencies.

RESOURCES: FY 74 164.3 K
FY 75 159.1 K

SENIOR STAFF: Stuart Wilk

ORGANIZATION: Resource Assessment, Life Studies Prerecruits Investigation, Middle Atlantic Coastal Fisheries Center, NMFS, NOAA, Highlands, N.J.

ACTIVITY AREA: Ichthyoplankton / Distribution and Relative Abundance / Diurnal Movements / Transport / Survival / Fisheries Management

OBJECTIVE: To provide a data base for forecasting and predicting seasonal occurrence, relative abundance, and distribution of eggs and larvae of coastal fishes.

SUMMARY: The increased fishing pressures, both foreign and domestic, and the apparent diminution of suitable spawning and nursery grounds have combined to jeopardize our coastal fisyery resources to the extent that some are on the brink of being depleted. To acquire the scientific and technical base to construct sound management policies, we must obtain information about living marine resources that will permit meaningful predictions of distribution, abundance, condition, and availability of these resources.

Emphasizing those species that are found near-shore, field work during the next 3 to 5 years will center around: a) continued investigations of the diurnal activities of young planktonic fishes to acquire an understanding of their associations with such environmental parameters as photoperiod, depth, temperature, salinity, and seasonal thermocline, and to estimate their dispersion rates on the basis of known coastal circulation; b) surveys of selected coastal areas, designed to monitor fluctuations in abundance of larval fishes, to determine their distribution in coastal waters, to attempt to correlate fluctuations in abundance and distribution with hydrographic features, and to learn more about environmental needs of specific fishes.

Six cruises are planned to study diurnal activities of young fishes. Collections from these cruises will contain young of the most important commercial and recreational fishes that spawn in the bight. Of the 10 most important coastal species in terms of total combined sport and commercial catch between New York and Cape Hatteras, only Atlantic mackerel and possibly bluefish are not dependent on the shallow coastal areas. The other species depend on the subtidal zone for spawning and/or nursery areas, and even young bluefish and mackerel utilize this area for foraging to some extent.

We will conduct coastal surveys to monitor fluctuations in abundance and distribution of young fishes in conjunction with ongoing finfish assessment surveys. Plankton collections will be taken at preselected stations in the Middle Atlantic Bight, chosen on the basis of previous cruises designed to study the seasonal distributions of fish eggs and larvae. We will record concomitant measurements of the marine environment on the above cruises and subsequently incorporate pertinent physical data from other sources to establish norms and ranges of variability. These data will be integrated with all available biological data to evaluate the role of the environment in terms of its effect on larval transport, geographic distribution, year-class success and, ultimately, to establish the actual role of the coastal zone in the early life history of economically important fishes.

We will operate with standard gear (as adapted for MARMAP Survey I operations) over enough years so that normal fluctuations and cycles in abundance and distribution of the species and also fluctuations in the natural environment of these species can be ascertained. This information is essential to determine the causes of population fluctuations or declines.

RESOURCES:

FY 74	155.2 K
FY 75	326.8 K

SENIOR STAFF: Wallace Smith

ORGANIZATION: Fishery Analysis Investigation, Middle Atlantic Coastal Fisheries Center, NMFS, NOAA, Highlands, N.J.

ACTIVITY AREA: Sportfish, Population Dynamics, Middle Atlantic Bight

OBJECTIVE: To systematically collect sportfish catch data from selected areas, deriving information on catch composition, success of fishing of various elements of the fishery to determine participation and competition within zhe recreational fraction and comparisons to the commercial fishery to determine total harvest.

SUMMARY: Successful management of commercial and sporfish resources requires the systematic collection and analysis of commercial and sportfish catch data. This need is being satisfied by the use port samplers assigned to cover strategic fishing port areas along the Atlantic Bight. The sampling time is stratified by type of fishing, area of fishing and time of fishing. Appropriately expanded, these data will provide realistic estimates of catch rates of species seasonally, and variations in catch composition. Direct biological samples of the catch include size, weight and age analysis of important species. These data from the recreational segments will be contrasted to ground fish survey catch and commercial catch to determine removals and competition between the various harvesting elements. The effort is of a prototype nature anticipating a State-Federal continuing study. The techniques, recording formats and data processing programs will be applied to the cooperative study to ensure continuity and comparability of results. The ultimate goal, vitally needed is a continuous record of the total harvest for the region and for subareas within the area. The task will provide statistically reliable indices to establish a baseline level from which subsequent variations can be related. On these variations management recommendations will result in conservation strategies.

RESOURCES:

FY 74	68.3 K
FY 75	80.5 K

SENIOR STAFF: Anthony Pacheco

ECOSYSTEMS INVESTIGATIONS

To an ever greater extent the yield of marine fisheries is dependent upon water quality in coastal marine environments. Anadromous species of fish and shellfish have traditionally been the first species affected by deteriorated coastal and estuarine waters. There seems little doubt, however, that the deterioration of coastal environments is having or will have an effect on coastal and offshore marine species which reproduce in or migrate through coastal and estuarine ecosystems.

The effects of deteriorated environments do not always impinge directly upon commercial and game finfish or shellfish; rather, polluted waters or physically disrupted environments may result in an elimination of or diminution in the standing crops of invertebrates important as forage species in marine food chains or disrupt the flora and fauna which play an important role in stabilizing marine sediments. Finally, invertebrate species, which are often attached forms unable to avoid polluted waters, are excellent indicator organisms which can be used to assess change in environmental quality.

The Ecosystems Investigations program was developed to provide data for a comprehensive overview of the coastal and estuarine environments of the Middle Atlantic Bight. This program includes a number of closely integrated investigations designed to provide data on baseline distributions and life histories of benthic, natatory and planktonic invertebrates and their relationships to marine and estuarine finfish; to determine the effects of pollution and environmental deterioration on the living resources of coastal and estuarine ecosystems; and to quantitate the distribution and abundance of marine microorganisms and of heavy metals, and to determine their effects on higher plants and animals.

ORGANIZATION: Sandy Hook Laboratory, Middle Atlantic Coastal Fisheries Center, NMFS, NOAA, Highlands, N.J.

ACTIVITY AREA: Benthic baseline impact surveys and dynamics (benthic macrofauna, sediment types and contaminant burdens) in New York Bight Apex and outer Continental Shelf.

OBJECTIVE: To describe present benthic community structure in area of interest and to understand relationships between productivity of water column, benthic assemblages and demersal finfish and shellfish; to determine relationships between sediments and existing contaminant loads on macro - and meiofauna and monitor effects of new impacts and pollution abatement.

SUMMARY: Due to their sensitivity and convenience of study, benthic macrofauna are perhaps the group most suitable for use as biological indicators of environmental contamination. They are also important or dominant constituents in marine finfish food webs. Knowledge of their distribution, abundance, natural and man-induced fluctuations are of value in determining man's effects on the environment and thus are an indispensible aid in managing marine resources.

This investigation routinely uses Smith-McIntyre samplers and other devices to collect sediments, meio - and macrofauna from grids or transects of stations in the above investigation areas. Macrofauna are sieved to the 1 mm level and are identified to species whenever possible. As many as 20 replicate samples are collected per station. Statistical analyses of within-station faunal variability are used to determine the number of grabs which must be sorted to detect given differences in faunal parameters such as number of individuals, number of species, species diversity and equitability.

Effects of sediment type and constituents on macrofauna are examined using regression analysis. Clustering techniques are used to determine affinities between species and between stations. Long-term monitoring of stations selected from the cluster groups will enable detection of changes resulting from present and future impacts.

The resulting information is used to understand the relationship between contamination and stress and productivity of living marine resources, particularly cycling between the water column, benthic populations and finfish.

RESOURCES: FY 74 70.5 K
FY 75 104.8 K

SENIOR STAFF: Dr. Kneeland McNulty

ORGANIZATION: Sandy Hook Laboratory, Middle Atlantic Coastal Fisheries Center, NMFS, NOAA, Highlands, N.J.

ACTIVITY AREA: Seabed Oxygen Consumption in the New York Bight/ Phytoplankton and Primary Productivity in the Lower Hudson Estuary.

OBJECTIVE: To determine and describe extant baseline conditions. To provide environmental managers with required information for proper management of the system.

SUMMARY: Seabed oxygen consumption measurements are indicative of the quantity of organic carbon (including organic carbon in sewage sludge and other waste and non-waste materials) oxidized per unit area per unit time. The measurement is also an indicator of seabed environmental conditions. Measurements have been made in March, August, December and February 1974-75. During the winter the highest rates of oxidation are associated with the waste disposal areas in the Apex. During the summer, however, the area associated with sewage sludge disposal exhibits depressed rates of oxidation (comparable to winter values) while peripheral areas are elevated. The summer measurements indicate that the area is being overstressed by present waste disposal practices. The proposed alternate waste disposal sites and continental shelf area within the New York Bight will be examined both for baselines and to assist in environmental management. The Apex area will continue to be investigated to determine regulative mechanisms and recovery rates.

In our investigations of phytoplankton and primary productivity in the Lower Hudson Estuary (Raritan, Lower, and Sandy Hook Bays) we are not only establishing baselines but are attempting to compare the distribution and abundance both seasonally and spatially of phytoplankton biomass and production with certain environmental variables to understand the regulation, significance, and contribution of phytoplankton to the New York Bight waters.

Measurements of phytoplankton biomass and production, nutrients, and other environmental variables were made each month beginning November 1973.

We found a shift in size of the phytoplankton from netplankton (> 20 μ), dominating during the fall, winter and spring bloom (March) periods, to nannoplankton (< 20 μ), dominating during the summer.

We found that the Sandy Hook, Lower, and Raritan Bays have much higher biomass and rates of primary productivity than either the rivers coming into the system or the Inner Bight to which the system overflows. We also found above average and often exceedingly high rates of release of dissolved organic carbon from phytoplankton within the system. The size shifts have particular significance to phytoplankton feeding organisms and their ability to handle particular food sources. The peculiar geographical distribution of phytoplankton production and biomass in these estuarine waters has particular significance in understanding the Inner Bight for management and regulation. The high rates of release of dissolved organic carbon from the phytoplankton have yet to be interpreted, but may have far ranging significance to the ecosystem and the living marine resources within it.

We have recently discovered evidence indicating that in the metropolitan area organic carbon imports to the system as pariculate and dissolved detritus may be greater than those from primary productivity. We intend to investigate this possibility because it would mean that the detrital food chain or web would be of greater importance at lower trophic levels than the grazing food web. Such a reality would have significance in terms of understanding the system for management, including its living marine resources.

RESOURCES: FY 74 164.5 K
FY 75 326.1 K

SENIOR STAFF: James P. Thomas

ORGANIZATION: Sandy Hook Laboratory, Middle Atlantic Coastal Fisheries Center, NMFS, NOAA, Highlands, N. J.

ACTIVITY AREA: Benthic baseline impact surveys (sediment types and constituents, benthic macrofauna) in Raritan Bay, Long Island Sound, New Jersey Coast and contiguous Outer Continental Shelf.

OBJECTIVE: To describe present benthic conditions throughout the above areas, determine effects of sediment type and existing contaminant loads on macrofauna, and monitor effects of new impacts.

SUMMARY: Due to their sensitivity and convenience of study, benthic macrofauna are perhaps the group most suitable for use as biological indicators of environmental contamination. They are also often important constituents in marine food webs. Knowledge of their distribution, abundance, natural and man-induced fluctuations are of value in determining man's effects on the environment and thus are an aid in managing marine resources.

This investigation routinely uses Smith-McIntyre samplers to collect sediments and macrofauna from grids or transects of stations in the above survey areas. Macrofauna are sieved to the 1 mm level and are identified to species whenever possible. As many as ten replicate samples are collected per station. Statistical analyses of within-station faunal variability are used to determine the number of grabs which must be sorted to detect given differences in faunal parameters such as number of individuals, number of species, species diversity and equitability.

Effects of sediment type and constituents on macrofauna are examined using regression analysis. Clustering techniques are used to determine affinities between species and between stations. Long-term monitoring of stations selected from the cluster groups will enable detection of changes resulting from present and future impacts.

RESOURCES:

FY 74	135.0 K
FY 75	492.9 K

SENIOR STAFF: Robert N. Reid

ORGANIZATION : Sandy Hook Laboratory, Middle Atlantic Coastal Fisheries Center, NMFS, NOAA, Highlands, New Jersey.

ACTIVITY AREA: Pollutant heavy metals; metal-organic interactions; effects of metals and metal-organic combinations on living marine resources and on physiological and biochemical subsystems thereof.

SUMMARY : Many of the marine and estuarine environments of the Middle Atlantic coastal area are considerably contaminated with organics and heavy metals resulting from sewage sludge, dredge spoil and chemical dumping which has occurred for more than fifty years (MACFC, Sandy Hook Lab report to Army Corps of Engineers, 1972). Although some quantitative information is available concerning the amounts of metals in marine environments, especially in sediments, far too little is known about binding or chelation to organics, adsorption on particulate material or even inorganic combinations and states of the metals. Knowledge of the forms and combinations of contaminant metals is crucial in understanding their effects upon marine animals.

We are investigating several aspects of this problem, including metal determination in the water column by the sensitive method of anodic stripping polarography, by use of ultraviolet irradiation (220 nm) to destroy organic moieties, by use of ion exchange, filtration, equilibrium dialysis and chromatographic methods to study binding.

The second thrust of our investigation involves analysis of effects of metals, and of their organically bound forms, on living organisms and on biochemical systems within marine animals. Such studies include assays of effects of contaminants on the enzymes, ATPase and glutamic dehydrogenase, and on such physiological mechanisms as osmoregulation, respiration, and metabolism in crabs, lobster, and shrimp.

By combining our chemical studies of metal-organic interactions with investigations of effects on organisms we hope to gain a better understanding of the real role of these contaminants in the marine ecosystem.

RESOURCES : FY 74 89.5 K
FY 75 111.1 K

SENIOR STAFF : Robert K. Tucker

ORGANIZATION: Milford Laboratory, Middle Atlantic Coastal Fisheries Center, NMFS, NOAA, Milford, Conn.

ACTIVITY AREA: Environmental Chemistry and Microbiology, Mid-Atlantic Coastal and Offshore Area

OBJECTIVE: To identify and quantify major microbial communities and heavy metal pollutants in marine animals and their environs.

SUMMARY: Contamination and organic loading of the fisheries environment by ocean dumping (dredge and sewage), discharges and runoffs from contiguous land masses results in increase in chemical pollutants, bacterial numbers and types. These pollutants can affect the viability of the fisheries as well as place limitations on their utilization. Thus the identification and quantitation of these pollutants are important for the proper management and expansion (aquaculture) of the fisheries, particularly the inshore areas.

In this investigation the areas of the Mid-Atlantic Coastal Offshore regions are being examined for several select heavy metals and bacterial types in the fisheries, food chain organisms and bottom sediments. Although the activity is primarily concerned with the inshore environs, offshore areas are not excluded.

Precedent for the chemical studies of this investigation was established by the mercury problem in the fisheries which surfaced several years ago. Many fish species and marine animals have been examined for the presence of this element. In addition, a survey of over 2,000 individual animals of 40 species of finfish from North Atlantic waters have been examined for mercury. Except for the levels in spiny dogfish, levels of mercury in these fish species were shown to be less than the action level proposed by the F.D.A. The mercury survey has been extended to include the capability of analysis for other elemental chemical species (Cd, Ag, Pb, Sn, Cu, Ni, Sb, Zn, Cr, Fe) as well as in other marine food chain organisms and bottom sediments from select fisheric environments. Areas of the Mid-Atlantic region most thoroughly studied to date, are the New York Bight and Long Island Sound. Sediments from some 160 stations in Long Island have been examined for 11 heavy metals, fecal coliforms and other select pathogenic and toxicogenic bacteria. Studies in

the New York Bight are related to the ocean dumping of sewage and associated problems (migration, alternate sites). New York Bight studies are in cooperation with the MESA project. In addition to obtaining baseline data, uptake and clearance studies of select metals in several animal species are being performed in the laboratory. These are in cooperation with other investigations studying additional aspects of metal toxicities in marine animals.

The microbiological activity of the task is related to outlining areas of fecal contamination of the inshore fisheries environment and looking for the presence of select groups of bacteria. As indicators of fecal pollution, thus the possible presence of pathogenic bacteria, fecal coliforms distribution in the top layer of sediments has been determined in Long Island Sound and New York Bight area.

In addition to fecal coliforms, studies included are total bacterial numbers, both aerobic and anaerobic, presence of certain biochemical types and those organisms which belong to the genus Clostridium and Vibrio. The former genus include perfringens, another indicator of fecal contamination, as well as other toxin producing types - i.e. botulinum. The Vibrio group of organisms are of importance since species belonging to this genus have been implicated in fish diseases, (fin rot) (anguillarum) and diseases in man (parahaemolyticus). Fin rot disease has been shown to occur in the New York Bight fisheries. Results obtained to date show various degrees of fecal pollution in inshore areas as well as variability of numbers of those select groups of bacterial being examined.

RESOURCES: FY 74 194.0 K
FY 75 156.7 K

SENIOR STAFF: John T. Graiksoki, Ph.D.

ORGANIZATION: Sandy Hook Laboratory, Middle Atlantic Coastal Fisheries Center, NMFS, NOAA, Highlands, N. J.

ACTIVITY AREA: Behavior of marine fishes in the field and laboratory; Measures of environmental stress; Light and temperature.

OBJECTIVE: To observe and measure patterns of behavior as related to the normal habits of various marine fish species and to utilize these norms to measure and predict the effects of selected environmental stresses.

SUMMARY: The major aim of the program has been to study the behavior and life habits of various species of marine fish in both the field and laboratory. The results of these studies have been used to define normal environmental requirements and the effects of pollution stress on established norms of behavior.

Field studies have concentrated on observing and defining feeding habits, daily movements, relation to shelter and social interactions of benthic and demersal species including winter flounder, Pseudopleuronectes americanus, tautog, Tautoga onitis, and cunner, Tautogalabrus adspersus (see below for relevant references). Laboratory studies have centered on measuring rhythms of activity, feeding, schooling and territoriality under both normal and stress in various species including bluefish, Pomatomus saltatrix, Atlantic mackerel, Scomber scombrus, mullet, Mugil cephalus, tautog and cunner. The information gathered from the field studies on the life habits of various species has formed the basis for subsequent laboratory studies, while the laboratory studies concentrate on measuring stress by observing departures from established behavior norms. For example, the results of the field study on the life habits of tautog were largely responsible for our hypothesis regarding this species' response capability, which was subseqently tested and confirmed by experiments performed under controlled laboratory conditions. Much in the same manner results of field studies on cunner will provide the basis for laboratory research on response capability of this species, enabling us to make comparisons between two members of the same family. Comparisons among species studied have shown that the capability of each to survive stress is greatly dependent on the behavioral scope of responsiveness for that species.

Ref: See below for relevant articles and publications.

RESOURCES:	**FY 74**	**117.5 K**
	FY 75	**117.7 K**

SENIOR STAFF: **Bori L. Olla**

EXPERIMENTAL BIOLOGY INVESTIGATIONS

There exists, at all levels of both the public and the private sectors, considerable alarm that the living marine resources of the estuarine, coastal and offshore waters of the Middle Atlantic Bight are being adversely affected by extensive offshore dumping of untreated wastes and by run-offs of highly polluted waters. The mode and intensity of such adverse physiological effects is largely unknown. Baseline findings of marine environmental quality cannot be interpreted without such knowledge nor can rational water quality standards be established or enforced when such knowledge is lacking. Quantitative, controlled exposure experiments, both static and chronic, on living organisms, and involving all stages in their life histories, followed by a battery of analytical tests are necessary to permit evaluation, standards-development, successful enforcement, and resource conservation. Present programs are designed to (1) determine lethal effects of a large variety of known pollutants on the larval, juvenile and adult stages of molluscs, crustaceans, and finfish as well as on marine phytoplankton and benthic fauna inasmuch as these form the base of the food chain for all living marine organisms; (2) determine the long-term sub-acute effects of exposure to a large variety of known pollutants on the larval, juvenile and adult stages of molluscs, crustaceans and shellfish; (3) define the physiological and biochemical pathways affected and relate them to the metabolic disorders, tissue abnormalities, etc., which result in death or permanent damage to the living marine organisms; (4) determine effects of marine pollutants on the chromosomes, and genetic development of the American oyster, C. virginica, initially, and on other fish and shellfish; and (5) evaluate findings in terms of specific pollutants and of population genetics. Effective March 1, 1975, funds were reprogrammed within the Center to begin aquaculture studies in genetics, nutrition, and disease, reinstating aquaculture as a major research area of the Center after a hiatus of five years.

Emphasis in the reestablished aquaculture investigations will be placed on molluscan genetics, nutrition, and disease control. Initially, genetics will concentrate on selective breeding of oysters; nutrition will concentrate on definition of algal nutrients for oysters, and disease work will concentrate on hatchery diseases of molluscan larvae. Longer term research, with expected additional funding, will encompass broader objectives, but will continue to emphasize molluscan aquaculture research and development.

ORGANIZATION: Milford Laboratory, Middle Atlantic Coastal Fisheries Center, NMFS, NOAA, Milford, Conn.

ACTIVITY AREA: Bivalve aquaculture - basic methodology

OBJECTIVE: To develop economically and biologically sound methods for rearing various species of bivalves of present or potential economic value in controlled environments.

SUMMARY: This is a new program initiated April 1, 1975. Its major objective is to develop the basic methodology for rearing bivalves of commercial value not now being reared as aquaculture species; in effect, the program seeks to anticipate the future interest of the shellfish industry in new bivalve aquaculture candidates. Two species have been chosen for study initially; they are the bay scallop, Argopecten irradians, and the surf clam, Spisula solidissima. Some work has already been started to develop methods for stimulating gametogenesis and spawning out of season so that subsequent studies of embryological development, larval survival and growth and metamorphosis need not be confined to the natural reproductive season, which is summer for both species. Modest success in promoting early gametogenesis in the bay scallop has been achieved and studies of the environmental factors influencing larval development have been initiated. As a result of previous studies on surf clam culture, in connection with a program now defunct, considerably more is known of the requirements for successful rearing of this species than for the bay scallop. Many groups of larvae have been reared to metamorphosis and beyond. Future work in this area will emphasize refinement of the culture methods to improve the dependability of the techniques and the consistency of the results.

Much work is planned which will lead to the development of methods for rearing the juvenile stages of the two bivalve species to market; the so-called "grow-out" period. The literature on bivalve culture shows clearly that rapid growth of the animals during this period is the sign of a healthy environment. The goal of the program at this stage, consequently, is to determine the optimum value of each environmental factor for maximum survival and growth of the animals being reared. Many of the studies will be carried out in a tank-farm facility where the environment is under partial control of the culturist. Later studies of growth just prior to marketing will be done with animals transplanted to the field, the only environment where the large amounts of water, space and food necessary for rapid growth of commercial numbers of near-adult size are available.

Ref: See below for relevant publications.

RESOURCES:

FY 74	148.6 K
FY 75	106.1 K

LEAD STAFF: Warren S. Landers

ORGANIZATION: Milford Laboratory, Middle Atlantic Coastal Fisheries Center, NMFS, NOAA, Milford, Conn.

ACTIVITY AREA: Aquacultural Genetics; breeding-oriented studies on commercial oysters and related species.

OBJECTIVE: To obtain the kinds of genetic information about oyster breeding (selection and inbreeding) that commercial growers and breeders need for their own breeding and planting programs; also, to work on the development of some difficult-to-come-by hybrids, and on reliable easy methods to obtain these. A limited amount of experimental mutation breeding will be conducted with commercial needs in mind.

SUMMARY: Prior work of this Investigation established a basic cyto-genetic understanding of the oyster and a small amount of such work continues. Inbreeding studies demonstrated the existence in the commercial American oyster, Crassostrea virginica, of some gamete incompatibility barrier, and significant inbreeding depression. Methods were worked out for mass selection and heritability studies but these were suspended when work of the laboratory was reprogrammed away from aquaculture. The mutation breeding approach was explored for the oyster, and data at the same time obtained on radiation sensitivity of this shellfish.

Ref. See below for relevant publications.

RESOURCES: FY 75 23.1 K

SENIOR STAFF: Arlene C. Longwell

ORGANIZATION: Milford Laboratory, Middle Atlantic Coastal Fisheries Center, NMFS, NOAA, Milford, Conn.

ACTIVITY AREA: Mutagenic Effects of Pollutants

OBJECTIVE: To determine whether and at what levels several important marine pollutants are mutagenic for important commercial fish species and key food-chain species. How genetic damage reduces recruitment into the fisheries is the focal point of the research.

SUMMARY: Experimental and field-sampled materials alike are being utilized. Three related approaches are being taken: a genetic test with larval culture, the dominant lethal gene test; a cyto-genetic test of spawned, fertilized eggs; a combined cytological-cyto-genetic study of gametogenesis. Acute short-term and chronic longer-term contaminant exposures are being given, and history of exposure in nature is considered as well. The mutagenicity of some heavy metal contaminants has been established for the commercial American oyster, Crassostrea virginica.

Ref: See below for relevant publications.

RESOURCES:

FY 74	61.9 K
FY 75	40.6 K

SENIOR STAFF: Arlene C. Longwell

PUBLICATIONS

MacLean, S. A., A. Crosby Longwell and W. J. Blogoslawski, 1973.
Effects of ozone-treated seawater on the spawned, fertilized, meiotic, and cleaving eggs of the commercial American oyster. Mutation Research, 21: 283-285.

Stiles, S. S., and A. Crosby Longwell, 1973.
Fertilization, meiosis and cleavage in eggs from large mass spawnings of Crassostrea virginica Gmelin, the commercial American oyster. Caryologia, 26(2): 253-262.

Longwell, A. Crosby, 1974.
Evaluation of the mutagenicity of marine contaminants for marine species as affecting in-shore and off-shore fisheries. Informal Report, pp. 1-54.

ORGANIZATION: Milford Laboratory, Middle Atlantic Coastal Fisheries Center, NMFS, NOAA, Milford, Conn.

ACTIVITY AREA: Laboratory culture of microscopic marine algae; Effects of pollutants on growth of marine microscopic algae; Role of microscopic algae in the nutritional support of molluscs in aquaculture systems.

OBJECTIVE: To conduct research on the chemical and physical factors affecting the productivity of phytoplankters in laboratory culture, as well as the natural environment, particularly polluted areas; to determine the role of the phytoplankters in fulfilling the dietary requirements of molluscan species reared in aquaculture.

SUMMARY: An extensive collection of unicellular marine and estuarine microscopic algal strains is being maintained in the laboratory. These cultures serve as sources of standardized material for use in research of this Investigation and are also available to other investigators as a courtesy nationally and internationally. Cultures are maintained on several media formulations and efforts are made to bring and keep all strains in the axenic condition. A simple inexpensive method for the cultivation of large volumes of algae in pure culture was designed and is now in continuous operation to provide food organisms for molluscan research and aquaculture projects at the Milford laboratory. This system has served as the prototype for development of commercial and university aquaculture systems. Experimental studies have recently concentrated on studies of bacterial-algal interaction; the role of organic compounds and the elements, selenium and lithium, potential polluters, on algal growth. New methods are being tried in efforts to design appropriate systems for critical studies on the nutrition of oyster veliger larvae.

Ref: See below for relevant publications.

RESOURCES:

FY 74	57.8 K
FY 75	59.7 K

SENIOR STAFF: Ravenna Ukeles

ORGANIZATION: Milford Laboratory, Middle Atlantic Coastal Fisheries Center, NMFS, NOAA, Milford, Conn.

ACTIVITY AREA: Assessment of physiological changes in various species of marine molluscs, crustaceans, and fish exposed to heavy metals in the laboratory.

OBJECTIVE: To examine in the laboratory, using bioassay, physiological, and biochemical techniques, a selected group of Middle Atlantic Bight coastal animals, to determine the effect of contaminants on their normal life functions. These laboratory experiments, when correlated with contaminant levels in the environment, may indicate that some marine animals are extremely sensitive to minute amounts of pollutants, and that subtle sublethal physiological changes do occur.

SUMMARY: This Investigation has been concerned with the effect of heavy metals on various marine molluscs, crustaceans, and finfish, including various life stages of certain species. Embryos and larvae of hard clams, Mercenaria mercenaria, and oysters, Crassostrea virginica, are being exposed to metal ions through in vivo experiments to determine concentrations that affect normal development of embryos and survival and growth of larvae. Similar studies are under way with larvae of the lobster, Homarus americanus.

A chronic exposure laboratory has been fabricated at this facility to enable us to expose marine animals to sublethal levels of pollutants for varying lengths of time. Various animals, including the lobster, winter flounder (Pseudopleuronectes americanus), striped bass (Morone saxatilis), cunner (Tautogolabrus adspersus), American oyster, hard clam, and surf clam (Spisula solidissima), are currently under study. Both short-term (4 days) and long-term (1-3 months) studies are being conducted to determine physiological and biochemical changes. These studies include respiratory and osmoregulatory changes in larval through adult stages where feasible. Also under examination are changes in key enzyme systems and blood chemistry. Currently under study are magnesium-linked oxidoreductases, enzymes of glycogen and of amino-acid metabolism, and some metallo-enzymes, all of which have shown, in some degree, property changes ascribable to the animals' exposure to cadmium, mercury, or silver.

Ref: See below for relevant publications.

RESOURCES:

FY 74	150.7 K
FY 75	165.9 K

SENIOR STAFF: Anthony Calabrese

PATHOBIOLOGY INVESTIGATIONS

Disease- and parasite-induced mortalities are among the paramount factors limiting the abundance of marine fish, crustaceans, and molluscs. Mass mortality of aquatic animals grown under intensive controlled culture conditions is often a consequence of disease. Host susceptibility to disease is directly influenced by environmental stress and there are no ways of knowing what stresses are significant in limiting populations without studying their effects upon the animals themselves. Adequate knowledge of disease prevalence, whether nutritionally, genetically or environmentally induced, is fundamental to the success of resource assessment, prediction and management and, where necessary, for preventative legislation.

One must recognize that it is the exception rather than the rule for abnormalities (pathoses) or mortalities (during any stage of the animal's life history) to be caused by any single extrinsic or intrinsic factor acting alone. Rather, it is usually a combination of infectious and/or noninfectious factors acting competitively, sequentially, complementarily, or synergistically on or in these animals to modify their behavior, physiology, growth, development, reproduction or to render them more susceptible to the same or still other infectious and noninfectious agents or predators.

The Pathobiology Investigations at the Oxford Laboratory have long recognized the need to study the causes of mortalities of all marine animals, and have been pioneers in disease studies. Originally with molluscs, recently with crustaceans, and presently with fish, the Investigations will continually expand their research efforts to effect a multispecies approach to the study of disease. A multispecies study of disease has been substantially more productive than limiting the research effort to only a single species, since from the aspect of comparative and experimental pathology, invaluable basic information has been acquired on both disease processes and defense mechanisms.

DISEASES OF ENVIRONMENTAL STRESS INVESTIGATIONS

R. A. MURCHELANO, CHIEF

ORGANIZATION: Oxford, Milford, and Sandy Hook Laboratories, Middle Atlantic Coastal Fisheries Center, National Marine Fisheries Service, National Oceanic and Atmospheric Administration, Oxford, Maryland, Milford, Connecticut, and Highlands, New Jersey.

ACTIVITY AREA: Field and laboratory studies of the diseases of estuarine and marine fishes and crustaceans inhabiting stressed environments.

OBJECTIVE: The major objective of the task is to study disease -- infectious, noninfectious, and environmentally induced -- in marine fishes and crustaceans. Although diagnostic histopathology is employed initially to determine etiology, other biomedical disciplines (bacteriology, cytopathology, immunology, parasitology) are utilized whenever appropriate. Knowledge acquired is of substantial importance in 1) assessing the effects of environmental alterations on economically important aquatic resources (including the role of disease in the limitation of stock size) and 2) countering the impact of disease as a limiting factor in the aquaculture of marine species.

SUMMARY: Field studies have focused on the prevalence of disease in fishes and crustaceans from the New York Bight, an area which has been altered substantially as a consequence of the disposal of sewage sludge, harbor dredge spoils and acid industrial wastes. Laboratory bacteriologic, histologic, and immunologic studies in progress are attempting to determine the etiology of fin rot disease of fishes and gill fouling or "black gill" disease of crustaceans. Both of these diseases are prevalent in the New York Bight and may cause significant mortality. Light and transmission and scanning electron microscopy are being utilized to assess histopathology and cytopathology. A Registry of Marine Pathology (ROMP) has been established to catalog the diseases of marine fishes, crustaceans, and mollusks.

Fin Rot Disease in the New York Bight: Determine the prevalence of fin rot disease in winter and summer flounder from the New York Bight. Determine the etiology of fin rot disease employing bacteriologic, histopathologic, and immunologic studies. Attempt to induce fin rot disease in apparently disease-free winter flounder by the placement of entrapped fish in the New York Bight.

Microfauna of New York Bight Fish and Benthos: Isolate, culture, and identify protozoa in water column and sediments of the New York Bight and in or on tissues of benthic crustacean Determine the etiology of "black gill" disease of crabs and lobsters from the Bight apex. Prepare species lists of amoeboid and ciliate protozoa inhabiting the sewage sludge, dredge spoil, and acid waste areas of the New York Bight.

Ultrastructural Studies of Normal and Physiologically Stressed Fish, Crustaceans, and Mollusks: Establish a functional and accessible electron microscope facility. Utilize transmission and scanning electron microscopy to elucidate the pathogenesis of fin rot disease in winter and summer flounder from the New York Bight. Conduct cytologic studies on the phagocytic cells of fishes that have been exposed to heavy metals.

Immunity in Marine Fish: Determine whether environmental pollutants reduce immunity to bacterial diseases. Determine bacterial agglutinin levels in winter flounder with fin rot disease from the New York Bight. Examine the effects of cadmium stress -- short term, high dose and long term, low dose -- on antibody production and phagocytosis in two economically important marine fishes.

Registry of Marine Pathology: Establish a Registry of Marine Pathology at the Oxford Laboratory. To solicit, catalog, and maintain accessions representative of pathology in marine and estuarine fishes, crustaceans, and mollusks. Accessions will include reprints, fixed tissues, and prepared slides.

RESOURCES:

FY 80.0 K
FY 119.7 K

SENIOR STAFF:

MURCHELANO, ROBERT ADRIAN, b. Providence, R.I, Feb. 7, 34; m. 58; c. 2. BIOLOGICAL OCEANOGRAPHY. B.A, Brown Univ, 55; M.S, Univ. of R.I, 57; Ph.D, (biol. oceanogr.) Univ. of R.I, 67. Fish. Biol. (Res.), B.C.F, U.S.D.I, 67-70; SUP. FISH. BIOL. (RES.), N.M.F.S, U.S.D.C, 70- U.S.A, 57-60. Wildlife Dis. Assoc, Am. Fish. Soc, Biological Oceanography; Pathobiology; Diseases of Fishes. Address: Oxford Laboratory, Middle Atlantic Coastal Fisheries Center, Oxford, Maryland 21654.

Publications

Cleverdon, R. C., Leifson, E. and R. Murchelano. 1961. Morphological and physiological types of Gram negative stenohaline marine bacteria. In Proceedings of the First National Coastal and Shallow Water Research Conference, ed. by D.S. Gorsline, pp. 127-130.

Leifson, E., Cosenza, B. J., Murchelano, R. and R. C. Cleverdon. 1964. Motile marine bacteria. I. Techniques, ecology, and general characteristics. J. Bacteriol. 87: 652-666.

COMPARATIVE PATHOBIOLOGY INVESTIGATIONS
R. A. MURCHELANO, CHIEF

ORGANIZATION: Oxford and Milford Laboratories, Middle Atlantic Coastal Fisheries Center, National Marine Fisheries Service, Oxford, Maryland, and Milford, Connecticut.

ACTIVITY AREA: Investigation of the role of infectious and noninfectious disease in massive natural mortalities of wild populations of marine animals and marine animals maintained under conditions of cultivation, including aquaculture operations. Studies of mortalities and abnormalities in marine poikilotherms as indicators of environmental degradation.

OBJECTIVES: To understand the biology and mechanics of disease dissemination and transmission; to further understand those disease processes and defense mechanisms operative in marine poikilotherms (vertebrate and invertebrate) for fishery management purposes and to prevent or control disease spread and disease caused abnormalities and mortalities: to assess the effects of marine animal health resulting from environmental modification or from exposure to man's effluvia.

SUMMARY: Studies are aimed toward understanding disease induced abnormalities and mortalities of marine mollusks, crustaceans, and fish. Approaches used are primarily observational using light and electron transmission microscopy. Experimental approaches include acute and chronic exposures of marine species to certain micropathogens, heavy metals, inorganic and organic compounds. Activities involve: descriptions of pathologic responses in host tissues and cells; disease diagnoses; disease epizootiology and etiology; and the isolation and characterization of infectious disease agents.

There are four major areas of research whose current functions may be summarized as follows:

Molluscan Pathology: 1) Histologic studies of representative mollusks for prevalence of micropathogens and pathologic manifestations, including neoplasia and baseline histology; 2) comparative ultrastructure of molluscan neoplasms; 3) identification and characterization of oyster viruses; 4) chemical induction of neoplasia; 5) diagnostic services for other agencies.

Crustacean Pathology: 1) The production of a practical atlas of normal crab histology geared for use by pathologists is a major activity; 2) histologic investigations of abnormal conditions such as those found in crabs or other crustaceans stressed by exposure to heavy metals and other pollutants and by parasitic infections.

Fish Pathology: 1) Baseline histology and histopathology of fish exposed to heavy metals; 2) study abnormalities and mortalities in fish and determine cause of fish disease whether infectious, noninfectious, or environmentally induced; 3) histopathology of the "puffy snout" condition in captive skipjack tuna.

Disease of Larval Mollusks: 1) Utilizing conventional and newly developed microbiologic techniques, isolate and identify micropathogens in bivalve mollusk cultures; 2) develop chemical and physical methods (including ozonization) for the elimination of microbial pathogens, toxins, and metabolites; 3) provide consultative disease control services to industry and sea grant institutions engaged in molluscan aquaculture.

RESOURCES: FY 161.7 K
FY 144.1 K

SENIOR STAFF: JOHNSON, DR. PHYLLIS T(RUTH), b. Salem, Ore, Aug. 8, 26. INVERTEBRATE PATHOBIOLOGY. Ph.D. (parasitol), California, Berkeley, 54. Parasitologist, med. entom, bur. vector control, State Dept. Health, Calif, 48-50; entomologist, dept. entom, Walter Reed Army Inst. Res, Walter Reed Army Med. Center, 50-55; entom. res. br, U.S. Dept. Agr, 55-58; med entomologist, Gorgas Mem. Lab, 59-63; Asst-Assoc. Res. Pathobiologist, California, Irvine, 64-70; Res. Associate, Calif. Inst. Technol, 70-71; Consult, Smithsonian Inst, 71-72; BIOLOGIST, NATL. MARINE FISH. SERV, OXFORD, MD, 72-. Res. assoc, U.S. Dept. Agr, 58-63; Consult, U.S. Naval Med. Res. Unit 3, Cairo, Egypt, 57- Editorial Bd, J. Invertebr. Pathol, 70-74; Comm. Animal Models & Genetic Stocks, ILAR, Natl. Res. Council 73- AAAS; Soc. Invertebr. Pathol; Soc. Parasitol; Soc. Trop. Med. & Hyg.; Entom. Soc. Wash. Crustacean pathobiology; immune processes in invertebrates; relationships of diseases and their arthropod vectors, especially protozoan and rickettsial diseases; Leishmaniasis; taxonomy of Siphonaptera and Anoplura. Address: Oxford, Laboratory, Middle Atlantic Coastal Fisheries Center, Oxford, Maryland 21654.

Publications

Johnson, P. T., and E. B. Thurman. 1950. The occurrence of Aedes (Ochlerotatus) pullatus (Coquillett), in California. Pan-Pacific Entomol. 26: 107-110.

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Traub, R., and P. T. Johnson. 1952. Fleas collected during a plague survey in Venezuela. Bol. Ofic. Sanit. Panamer. 32: 111-135.

IV. ROLE OF THE MIDDLE ATLANTIC COASTAL FISHERIES CENTER IN MARINE SPORTFISH RESEARCH

Salt-water recreational fishing has grown into a major industry in the last 20 years. In 1970, 4 million people traveled to the shore some from hundreds of miles inland, to fish in the sea all along the Atlantic coast. Salt-water fishermen generated total dollar expenditures of 1.2 billion dollars in pursuit of their sport, thus contributing heavily to the support of boat builders, repair yards, marinas, operators of charter and party boats, bait and tackle shops, and all the miscellaneous business associated with recreation in and by the sea. It is no wonder that the prosperity of many coastal towns depends largely on salt-water angling.

People of all ages and all economic levels enjoy fishing at the shore or in the sea, from youngsters with cane poles to big game fishermen with costly yachts. It is a sport for whole families to share, or for seekers of solitude. The annual take of game species on the Atlantic coast runs into millions of fish.

Salt-water fishing is one of few remaining large industries of the United States that depends on wild animals -- creatures that respond to rules of nature and not to rules of man. Most of the Atlantic sport species are migratory, moving hundreds of miles each year in response to seasonal changes in water temperature and food supply. Because fish are migratory wild creatures and therefore the common property of all our people, caring for them is a public responsibility vested in State and Federal governments.

Traditionally, the Sandy Hook Laboratory of the Middle Atlantic Coastal Fisheries Center, has been the leader on the Atlantic Coast of Federal research on marine game fish. Today, while the marine game fish activities have been consolidated into general resource assessment surveys, ecosystems investigations and pathobiological studies, the interests of the sport fisherman are still paramount in our planning and prosecution of research and services. This orientation is justified in that the total recreational fish catch in some areas of the New York Bight is equal to or greater than the commercial catch. Both user groups are, of course, vitally interested in maintaining the quality of the marine environment.

The listing of fish species in which the Center is especially interested reflects this recreational fishing support despite the broad orientation of our resource surveys. These species are:

Black sea bass	Atlantic mackerel
Summer flounder	Silver hake
Bluefish	Little tunny
Weakfish	King mackerel
Kingfish	Codfish
Spot	Pollock
Croakers	Ling
Bonito	Tautog
Billfishes	Winter flounder

Several basic findings derived from earlier sportfish-oriented research at Sandy Hook formed the basis for design of the resource assessment surveys. The basic sampling plan for both the coastal and offshore surveys is compatible with that in use by the Northeast Fisheries Center at Woods Hole, Mass. The emphasis of the coastal surveys derives however from findings that fishes in the Middle Atlantic Bight are (1) transient, migratory fishes, (2) largely estuarine dependent in their juvenile stages, and (3) often pelagic or bathypelagic in nature. Thus our overall plan calls for (1) State-Federal estuarine resource surveys, (2) intensive coastal resource surveys (estimated to be twice as intensive as the offshore surveys and (3) offshore surveys from Block Island to Cape Hatteras. Thus our surveys will emphasize intensive and periodic sampling in areas of special interest to sportsmen as well as commercial fishermen.

For the fishes listed above, we are studying: where and when they spawn; patterns of horizontal and vertical distribution for eggs, larvae and juvenile stages; movements of larvae and their relation to such environmental factors as depth, temperature, salinity, and currents.

The present larval fish studies at Sandy Hook began in 1965 when the laboratory was part of the Interior Department's Bureau of Sport Fisheries and Wildlife. As a consequence most of the "key" species studied were sport fishes, and much of our ongoing larval fish research is an extension of initial surveys involving sport fishes.

The first of two volumes of an "Anglers' Guide" for the Atlantic Coast has been published, and the second volume is in the final stage of preparation. The "Guide" demonstrates graphically the optimum fishing locations for some 150 fish species, all of which have a greater or lesser degree of sportfish significance. Composed of 40 annotated charts, 80 tables and a wealth of explanatory textual material, this Guide will be a unique and valuable achievement and a real contribution to recreational fishing.

The Sandy Hook Laboratory of the Center pioneered in development of the artificial reef concept and developed an effective cooperative citizen-government program whereby sport fishermen can obtain permission for and construct such reefs. A wealth of how-to information was developed and disseminated. The development aspect is now headquartered at Beaufort Laboratory - while Sandy Hook has undertaken the task of research aimed at rehabilitation of the profoundly deteriorated marine environment of the New York Bight through use of artificial reefs as stabilizers of disrupted ocean sediments and as a source of the primary productivity which forms the base of the food chain of and thus attracts finfishes. Small experimental reefs have been emplaced in Raritan Bay, N.J. to test the feasibility of their use for such rehabilitation purposes.

All recreational fishermen, for both aesthetic and abundances-of-fish reasons, support efforts to improve or maintain marine environmental quality. The Center's Ecosystems Investigations activities will yield at least equal, if not more benefit to recreational than to commercial fishermen inasmuch as recreational fishing vessels use the polluted nearshore waters more than do the latter. Similarly, it is the recreational fisherman who finds his prize catch degraded in value by the ugly effects of fin rot disease, etc. This summary therefore demonstrates an active and comprehensive program of interest to recreational fishermen.

V. ROLE OF THE MIDDLE ATLANTIC COASTAL FISHERIES CENTER IN THE NOAA NEW YORK BIGHT STUDY

It is now almost universally recognized that the nearshore waters of the oceans cannot be considered simultaneously as a stable source of living resources and as a waste disposal area. The ecosystems of the sea are resilient up to a point, but man's rapid encroachment into and degradation of inshore waters lead to genuine fear for the continued productivity of such waters.

Environmental degradation resulting from man's activities has readily observable effects on the inshore marine ecosystems, and on the living resources which are integral parts of that ecosystem. Such effects are usually negative, resulting in reduction in quantity and quality of products derived from the degraded environment. While we may feel, intuitively, that harmful changes result from environmental contamination, it is necessary to develop a body of demonstrated facts to support or refute any suppositions we may make. Vital to this development is establishment of a baseline of present information about distribution and abundance of living resources; determination of rates of change, as derived from historical data, present surveys and future monitoring; and experimental verification of effects of environmental factors such as pollutants on living organisms.

Of particular importance are assessments and analyses of changes and rates of changes, in environmental factors such as abundance of food chain organisms, and in abundance and distribution of fish and shellfish -- as influenced by changing environmental conditions. Some of the necessary background data are available from earlier research; other data will be acquired during the course of the New York Bight project. Experimental studies are essential in providing a link between observed population changes and the causes of such changes.

In the New York Bight, there have been few investigations of productivity and ecosystems structure. Although some recent preliminary effort has been directed toward the measurement of energy conversion rates for selected marine gamefish, a much more ambitious program will eventually be required to understand primary productivity and the various efficiencies and interactions at trophic levels within the biotic components of the ecosystem. Some definition of energy pathways and efficiency of conversion rates will be developed by component researchers of the entire New York Bight program.

NOAA, as the federal agency concerned with the quality, quantity, and effective management of living marine resources, must address itself specifically to those environmental factors such as pollution which affect the resources negatively. On the other hand, there may be positive effects of man's activities on ocean resources (such as increased growth rates or increased productivity) which must also be examined. The intimate relation of ocean ecosystems with production of food makes it imperative that a broad approach to marine environmental problems be maintained.

The New York Bight, an area of the world's oceans severely degraded by human activities, is an excellent location for intensive examination of the impact of environmental changes on living marine resources, since we may learn the most from waters that we have insulted the most. The biological program for the New York Bight therefore contains the following principal elements:

(1) Establishment of biological baselines by an intensive examination of distribution and abundance of resource and food-chain organisms; and determination of rates of change in populations by compilation and analysis of existing historical data, as well as data obtained by ongoing and planned surveys;

(2) Description of the present levels of principal pollutants in water, sediments, and living organisms; and

(3) Determination by controlled laboratory experiments of the effects of pollutants in various concentrations on living resources, at many stages in their life histories and during various exposure times.

When biological information is combined with that developed by other NOAA components -- physical and chemical oceanography, sediment analyses, etc. -- it should be possible to (1) provide greater understanding of the impact of existing man-induced changes on living marine resources, (2) describe the effects of particular contaminants singly or in combination on living organisms including specific aspects of disease; and (3) develop an initial predictive model for use in the Bight and elsewhere of the impact of pollutants on marine ecosystems.

Information will be of significant value to many user groups, including ocean industries of all kinds, sewage treatment districts and engineers, municipal and regional land and water use planners, Environmental Protection Agency (EPA), Food and Drug Administration (FDA), Corps of Engineers, River Basins Commissions, state fisheries and environmental management departments, citizen conservation groups, fishermen and fishery industries, and groups concerned with developing models of ocean systems. Information will be summarized, analyzed, and presented in as many forms as possible, to best meet the needs of diverse user groups.

The National Marine Fisheries Service, through its Middle Atlantic Coastal Fisheries Center (NMFS/MACFC) has substantial ongoing research in the New York Bight. Other federal agencies (EPA, FDA, Corps of Engineers, etc.) conducted specialized research. Through the NOAA/New York Bight program it should be possible to expand the work significantly -- both the in-house and that supported by contracts. The project should provide the proper vehicle to bring broad capabilities -- governmental as well as academic -- to focus on the problem of the impact of man-induced environmental changes on marine ecosystems and on living marine resources.

It should be clearly understood that a substantial body of largely uncorrelated information about the New York Bight already exists, and that there are ongoing programs of research -- governmental and academic. NMFS/MACFC has been and is one of the principal participants in pollution-oriented research in this area. From work carried out to date has emerged much significant

information, such as the well-documented deleterious effect of ocean dumping on the benthos of the continental shelf in the vicinity of the dump sites (see the following summary report), and the significant decline in landings of many species of fish in the general New York Bight area. During the course of the New York Bight project it should be possible to correlate all existing data and to aid significantly to it, to provide a much clearer understanding of man's impact on the nearshore environment and its resources.