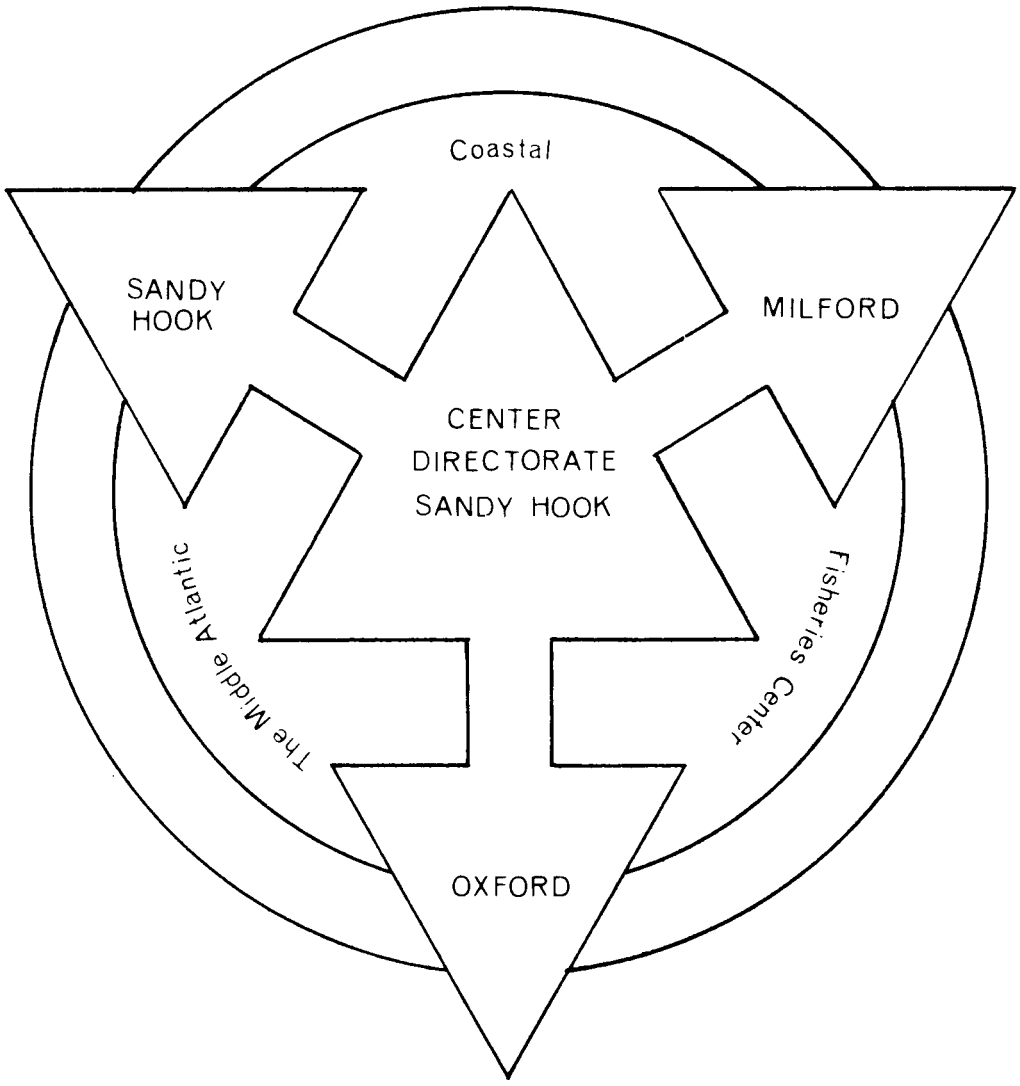
PROGRAMS AND FACILITIES OF THE MIDDLE ATLANTIC COASTAL FISHERIES CENTER

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

MIDDLE ATLANTIC COASTAL FISHERIES CENTER



April 1973

Informal Report No. 12

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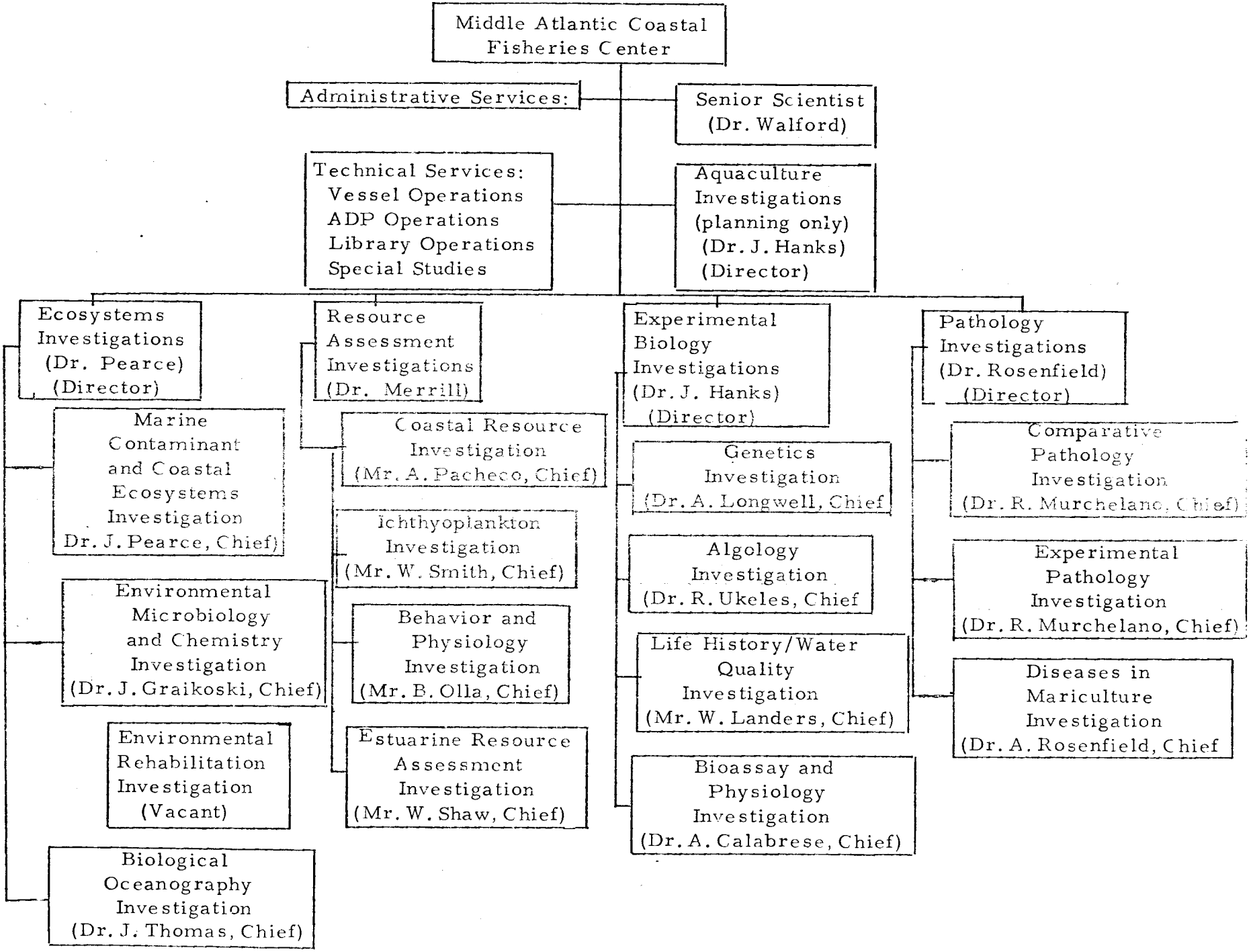
Middle Atlantic Coastal Fisheries Center
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Technical Services:
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ADP Operations
Library Operations
Special Studies
Aquaculture Investigations (planning only) (Dr. J. Hanks) (Director)
Ecosystems Investigations (Dr. Pearce) (Director)
Resource Assessment Investigations (Dr. Merrill)
Experimental Biology Investigations (Dr. J. Hanks) (Director)
Pathology Investigations (Dr. Rosenfield) (Director)
Marine Contaminant and Coastal Ecosystems Investigation Dr. J. Pearce, Chief)
Coastal Resource Investigation (Mr. A. Pacheco, Chief)
Genetics Investigation (Dr. A. Longwell, Chief
Comparative Pathology Investigation (Dr. R. Murchelano, Chief)
Ichthyoplankton Investigation (Mr. W. Smith, Chief)
Algology Investigation (Dr. R. Ukeles, Chief
Experimental Pathology Investigation (Dr. R. Murchelano, Chief)
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Behavior and Physiology Investigation (Mr. B. Olla, Chief)
Life History/Water Quality Investigation (Mr. W. Landers, Chief)
Diseases in Mariculture Investigation (Dr. A. Rosenfield, Chief
Environmental Rehabilitation Investigation (Vacant)
Estuarine Resource Assessment Investigation (Mr. W. Shaw, Chief)
Bioassay and Physiology Investigation (Dr. A. Calabrese, Chief)
Biological Oceanography Investigation (Dr. J. Thomas, Chief)

I. THE MIDDLE ATLANTIC COASTAL FISHERIES CENTER

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

The Middle Atlantic Coastal Fisheries Center is a component of the Northeast Region, National Marine Fisheries Service, National Oceanic and Atmospheric Administration, U. S. Department of Commerce. The 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 Director,NMFS Northeast Region, 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 (bacteria, viruses, fungi and algae) in the 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; subpopulation studies using immunogenetic and biochemical techniques, 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 genetic manipulation of selected mariculture species and with mutagenesis related to environmental factors; as well as with experimental studies of the effects of environmental factors, natural and man-made, on growth, development, behavior, and survival of marine fish and shellfish.

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 within the 12-mile contiguous zone; 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.

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, Va. 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.

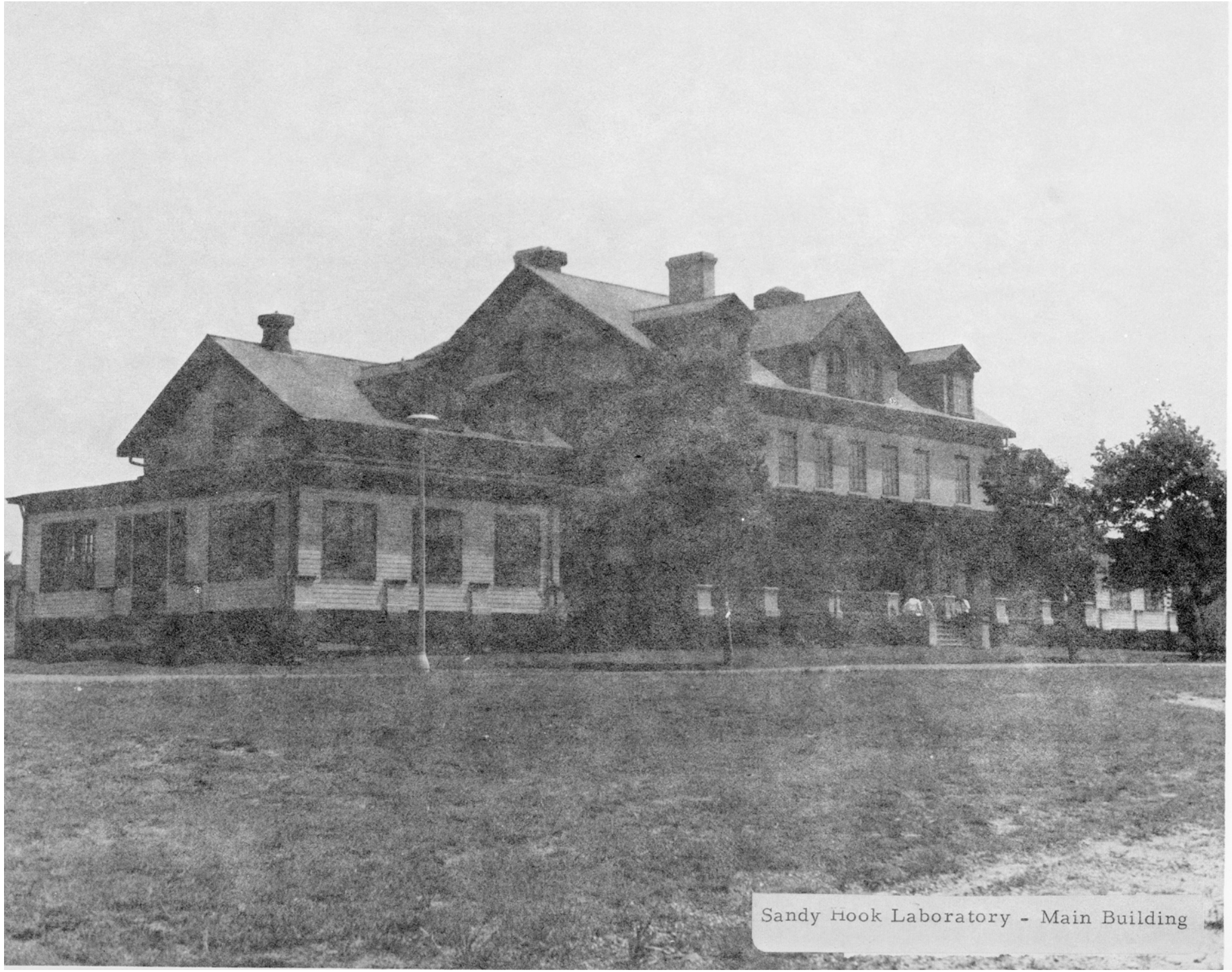
SANDY HOOK LABORATORY

This laboratory is in northern 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.

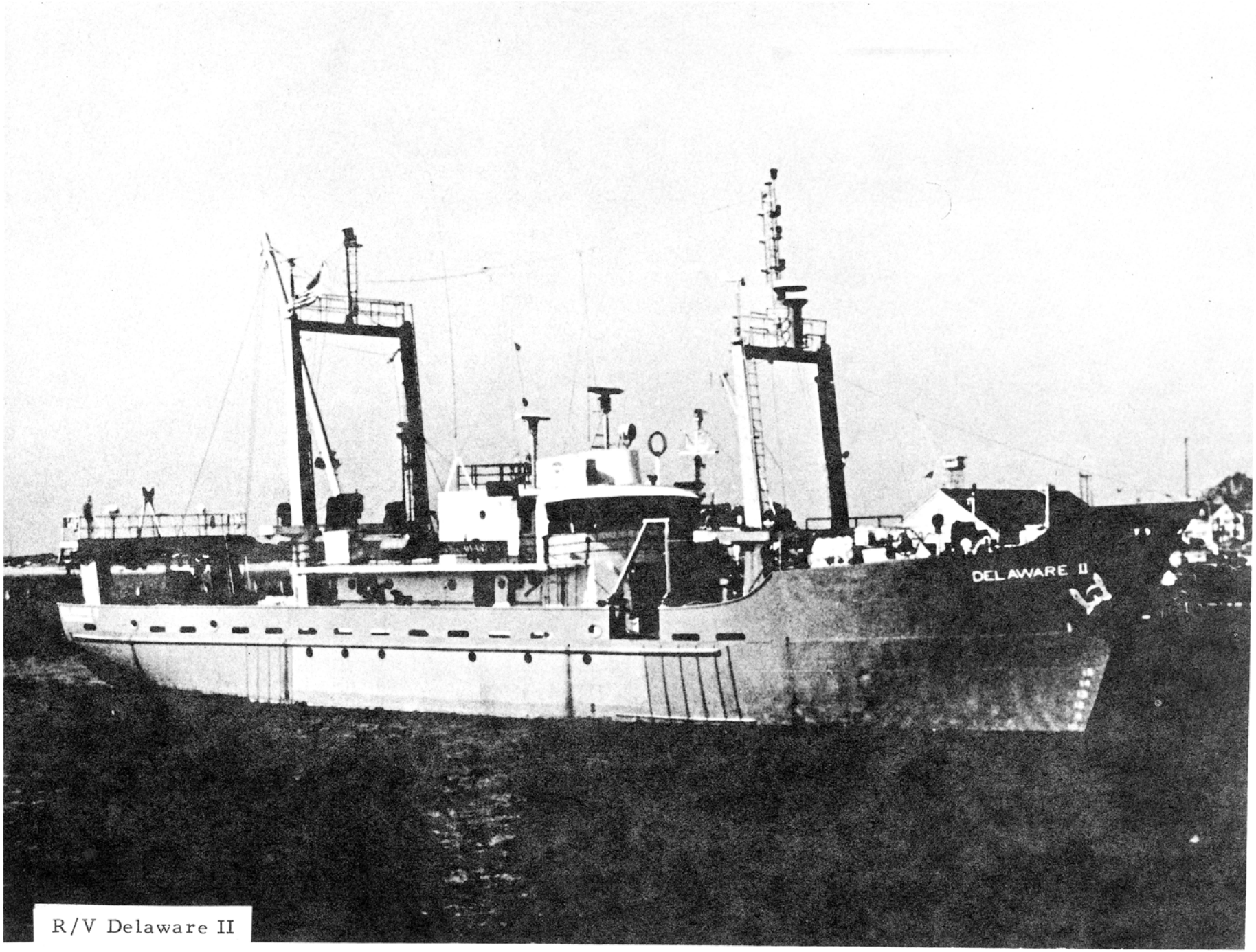
The laboratory facilities include dormitory, shops, offices, library, conference rooms, darkroom, aquaria and laboratory suites for chemistry, microbiology, fish behavior, benthic and plankton studies. There are special laboratories for phytoplankton culture, fish culture, experimental ecology of invertebrates,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

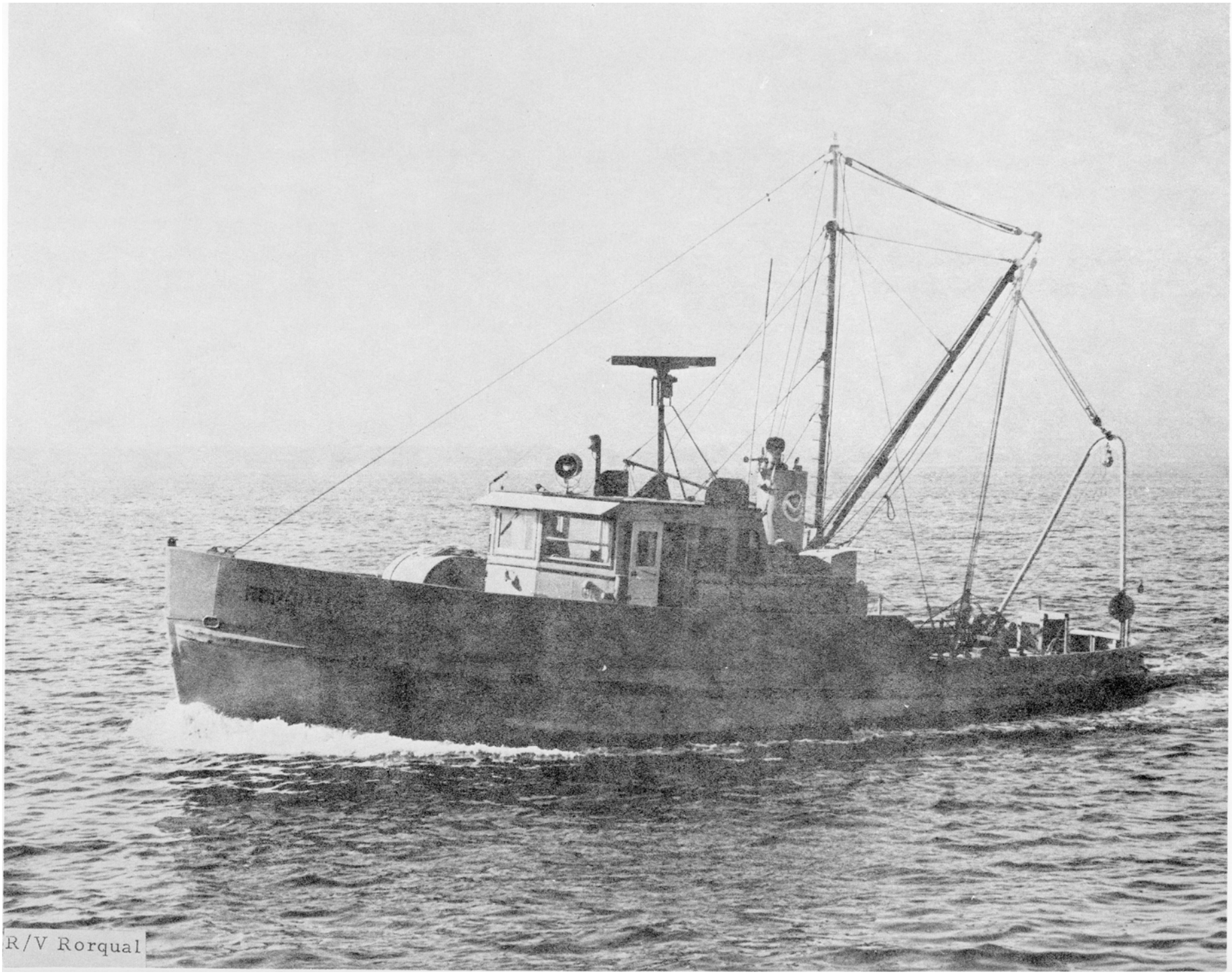
Vessels are berthed at deepwater piers near the laboratory. The docking area includes a large pier for the Delaware II and protected berths for the Rorqual and smaller boats. A pier shed combines diving locker, storage, and shore power supply.



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.

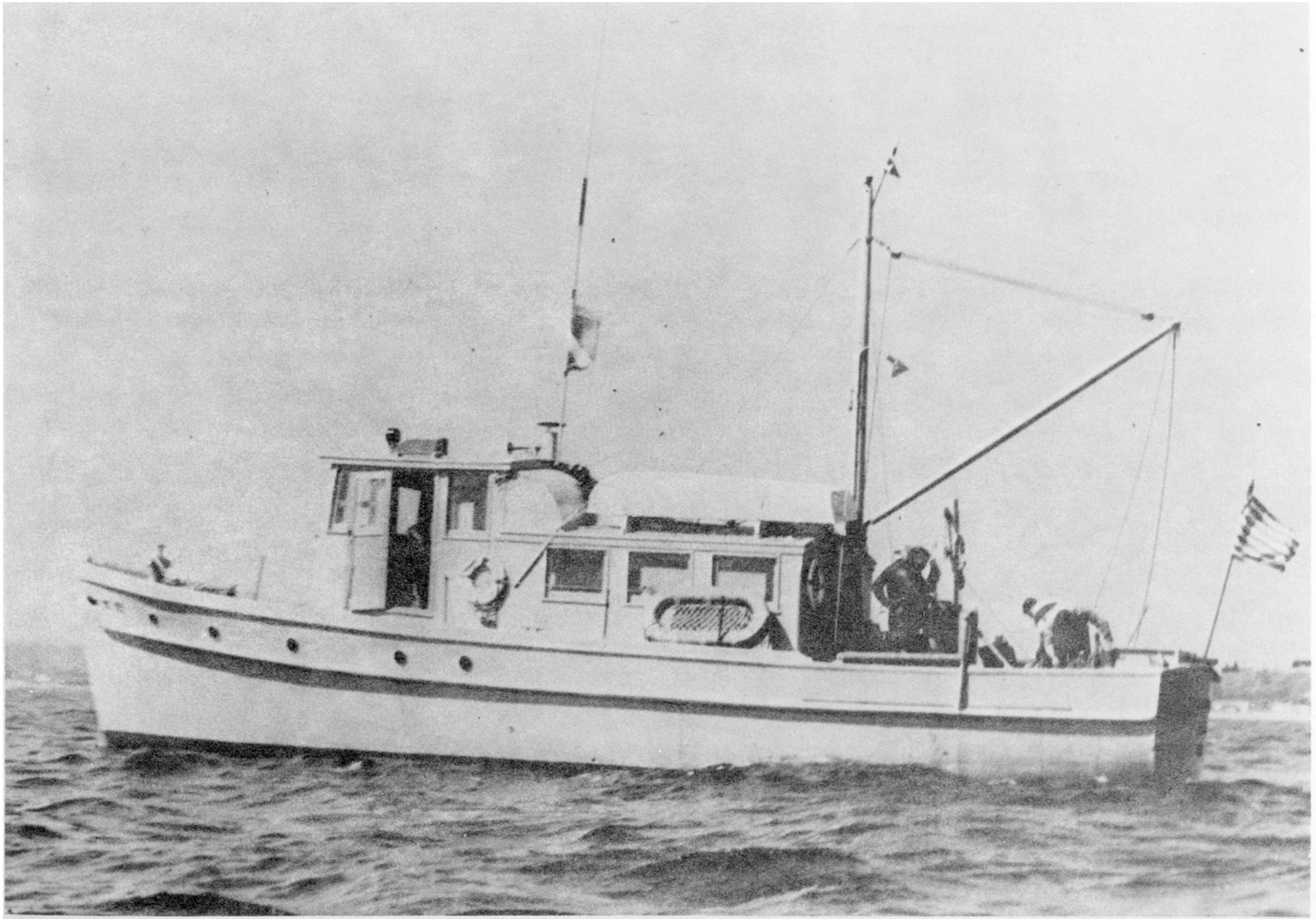
A modern, three-story laboratory building was completed in 1966. It has more than 28,000 square feet of floor space and contains 17 research laboratories, an experimental shellfish hatchery, administrative offices, a combined library-conference room, and a lobby-display area. Each laboratory can be supplied 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



R/V Shang Wheeler

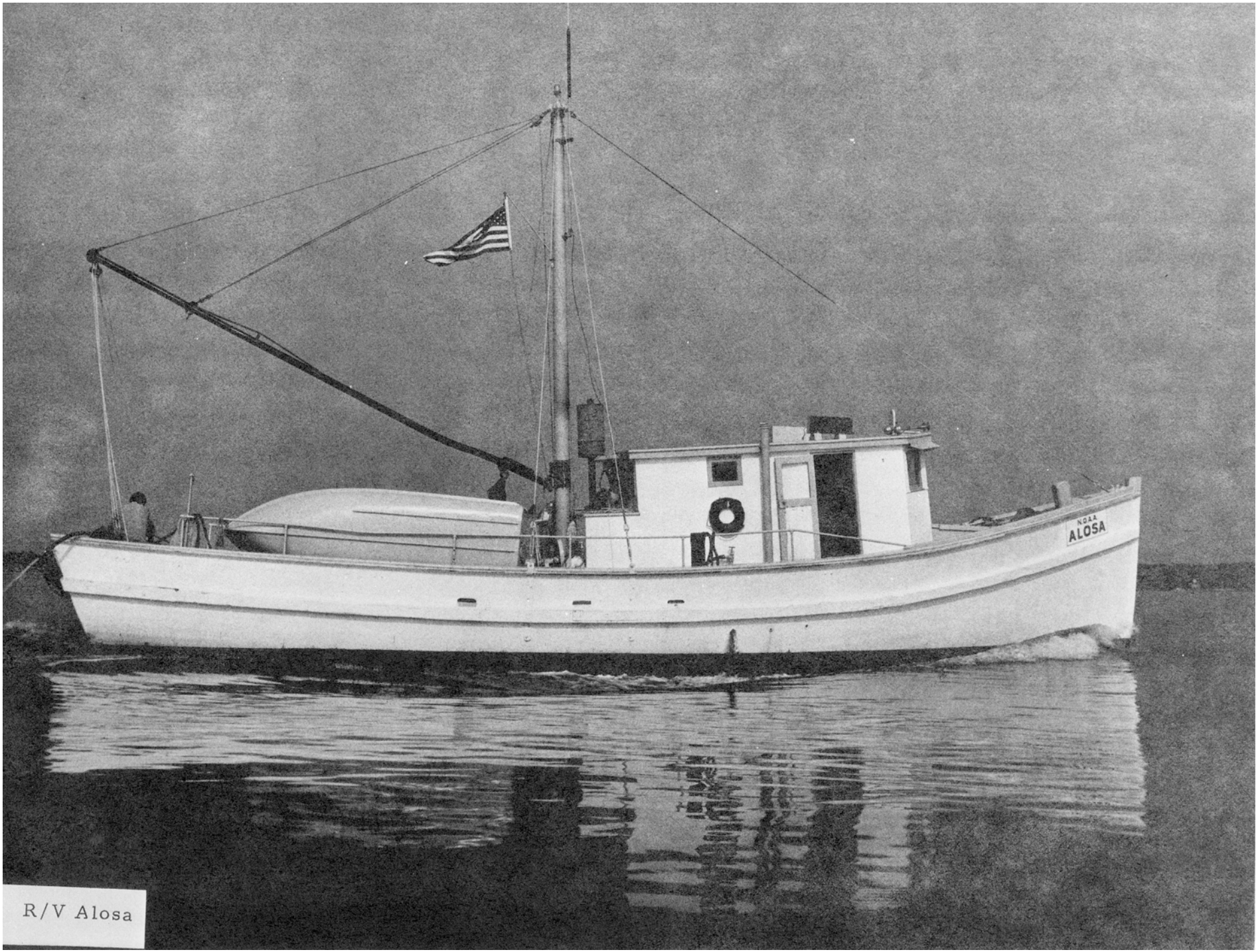
OXFORD LABORATORY

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



R/V Alosa

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 -- Coastal, Estuarine, Ichthyoplankton, and Fish Behavior. All investigations are working closely 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 sister centers to the north and south. To fulfill our commitment, certain objectives must be achieved. The four investigations are outlined briefly on the following pages stating their major objectives and recent findings.

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 four closely integrated investigations. The Biological Oceanography Investigation was designed to provide data on baseline distributions and life histories of benthic, natatory and planktonic invertebrates and their relationships to marine and estuarine finfish. The Marine Contaminants and Coastal Ecosystems Investigation is concerned principally with the effects of pollution and environmental deterioration on the living resources of coastal and estuarine ecosystems.

The Environmental Chemistry and Microbiology Investigation consists of several projects designed to quantitate the distribution and abundance of marine microorganisms of heavy metals and other known toxins and their effects on higher plants and animals.

The fourth investigation in Ecosystems Investigations is the Environmental Rehabilitation Investigation. It has been hypothsized that artificial habitats might be used to rehabilitate polluted or physically impoverished environments. We propose to test this hypothesis in Raritan Bay, a heavily polluted embayment adjunct to the New York Bight and once extremely productive of gamefish and commercial finfish and shellfish.

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. The nucleus of such a research team, expert in hatching, rearing and algology and in the physiology, genetics, pathology and chemistry of living marine organisms became available through the termination of a molluscan aquaculture program at Milford Laboratory. Should the aquaculture program be reactivated, these groups could, with a relatively small increment in personnel, service both programs. 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. Evaluate findings in terms of specific pollutants and of population genetics.

PATHOBIOLOGY INVESTIGATIONS

Disease- and parasite-induced mortalities are among the paramount factors limiting the abundance of marine fish, crustaceans, and mollusks. 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 group is composed of two units: Experimental Pathobiology Investigation and Comparative Pathobiology Investigation. Two additional units, Disease/Mariculture Investigation and Disease/Stress-Induced Investigation, are in the planning stages. By employing both comparative observational and experimental studies and team approaches, disease research on marine organisms will be conducted with the present Pathobiology Investigations staffs at the Oxford facility. Primary emphasis will continue to be placed on studies of problems related to infectious disease.

The Pathobiology Investigations at 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 mollusks, 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.

AQUACULTURE INVESTIGATIONS

Because of the nature of the budgetary process, funding for significant in-house aquaculture research must be delayed until FY 1974. It is important, however, to have a clearly-defined plan of research and action developed during the interim period. It is also very important to note that much of the present research of the Center -- genetics, experimental biology, pathology, physiology, nutrition studies, contaminant exposures -- relates directly to aquaculture. What we have now, then, are the fundamental studies related to aquaculture; what we lack now is emphasis on aquaculture systems -- including systems engineering and development of continuous flow production systems.

Some areas which will be of significance in planning (in addition to aquaculture systems) include genetic selection of molluscan, crustacean and fish species; hybridization; development of technology with species other than oysters and hard clams (bay scallop, calico scallop, smaller clam species) -- species which may be reared in closed systems; endocrinology (particularly as it related to growth and metamorphosis of larvae); algal physiology; and nutrition (of cultured species and of food supply organisms).

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 North Atlantic 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: the estuaries and the nearshore (0-15 fathoms) coastal surveys.

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.

An "Angler's Guide" for the Atlantic Coast is in the final stage of preparation. It will demonstrate graphically the optimum 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 researches 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 add significantly to it, to provide a much clearer understanding of man's impact on the nearshore environment and its resources.