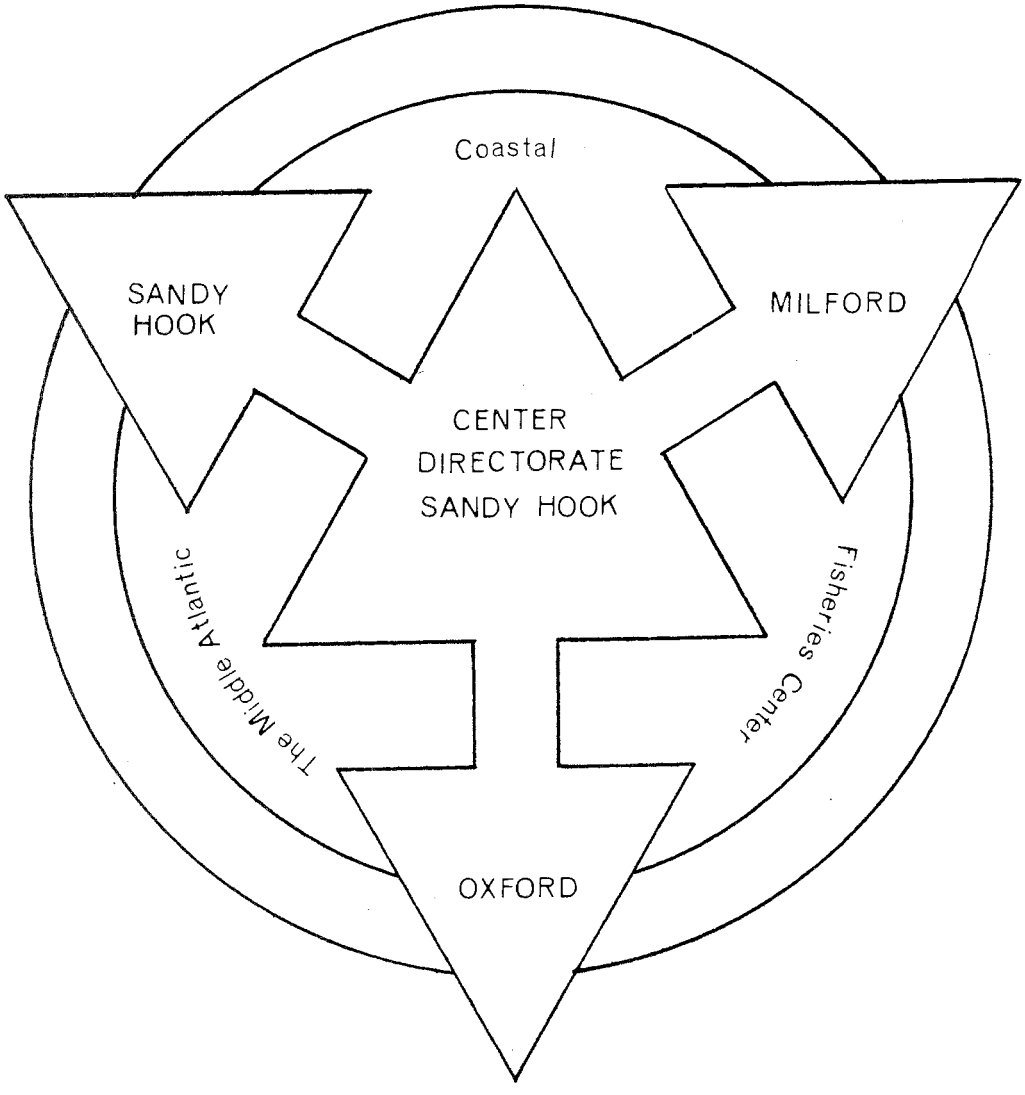
BRIEFING BOOK: PROGRAM REVIEW
SANDY HOOK LABORATORY

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

MIDDLE ATLANTIC COASTAL FISHERIES CENTER



Informal Report No. 11

MIDDLE ATLANTIC COASTAL FISHERIES CENTER

REVIEW OF RESEARCH CONDUCTED AT THE SANDY HOOK FACILITY

October 6, 1972

Briefing Book: MACFC

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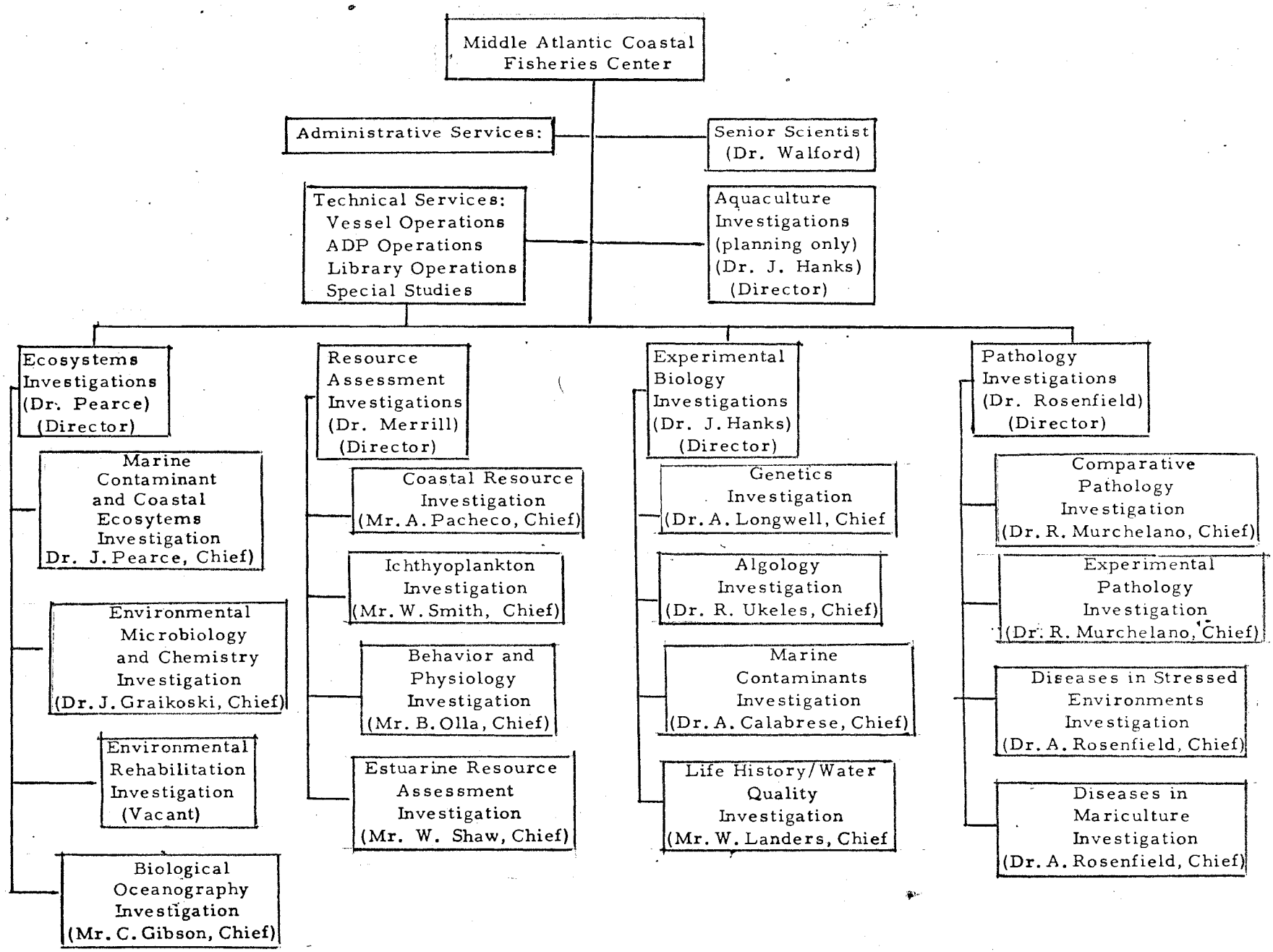
MIDDLE ATLANTIC COASTAL FISHERIES CENTER

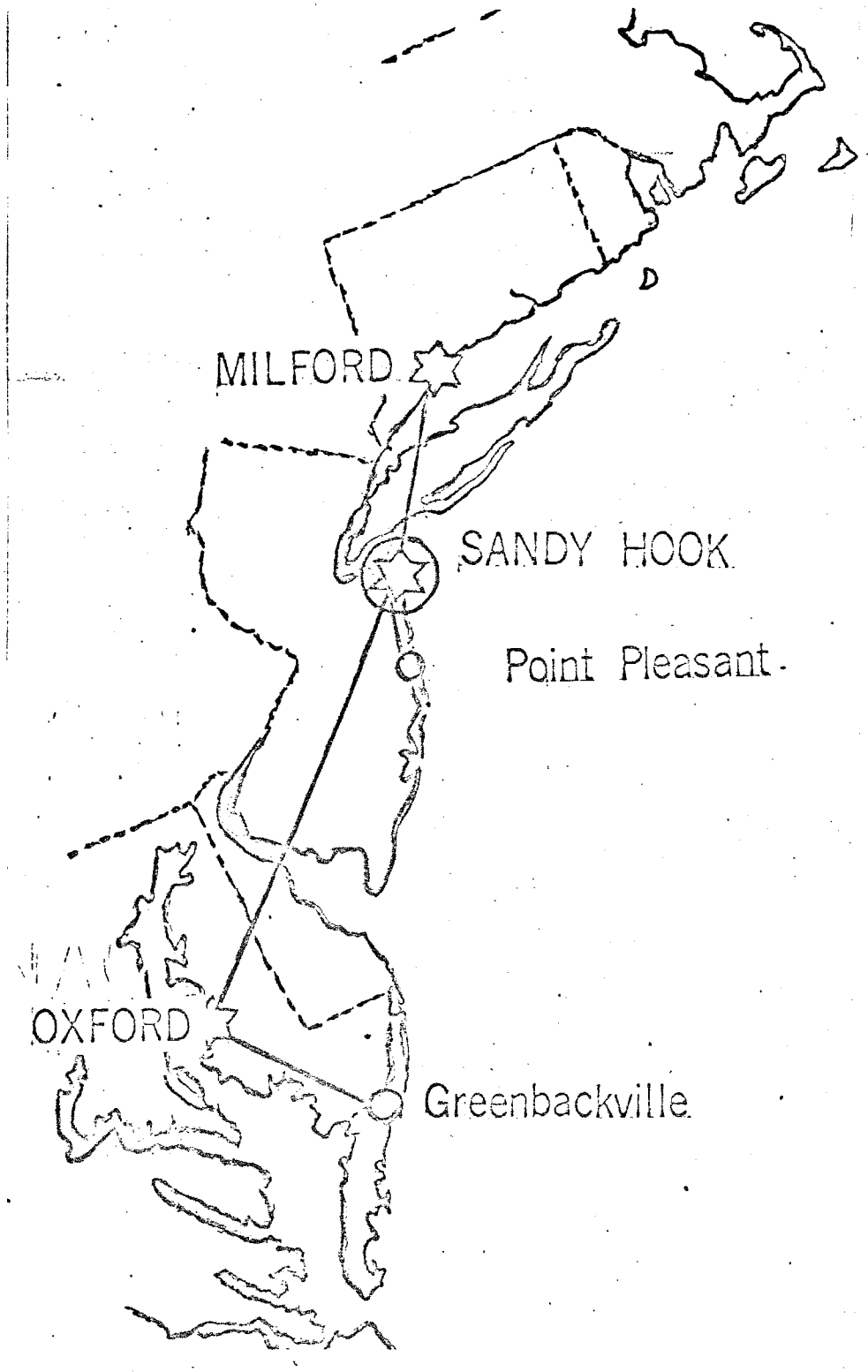
Sandy Hook Facility

Program Review
October, 6, 1972

AGENDA

8:00 a.m.	Convene Center Organization and Missions: Dr. Carl Sindermann
8:30	Resource Assessment Investigations: Dr. Arthur Merrill (Objectives, present and future research, user groups, milestones)
9:15	Ecosystems Investigations: Dr. John Pearce
10:00	Coffee Break
10:15	Tour of facility and discussions with Investigation Chiefs Mr. Bori Olla - Behavior Mr. John Mahoney - Microbiology Dr. Robert Tucker - Physiology Mr. Charles Gibson - Biological Oceanography Mr. Bruce Freeman - Sportfish Atlas
11:15	Relations with other research activities at other center facilities Dr. John Graikoski - Environmental Microbiology and Chemistry at Milford Dr. James Hanks - Experimental Biology at Milford Dr. Aaron Rosenfield - Pathobiology at Oxford
12:00	Adjourn


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


MILFORD
SANDY HOOK
Point Pleasant
OXFORD
Greenbackville

MISSION OF THE
MIDDLE ATLANTIC COASTAL FISHERIES CENTER

The mission of the Middle Atlantic Coastal Fisheries Center is to develop, establish, and to prosecute aggressively an integrated, cooperative multi-disciplinary research program on the biology and ecology of the living marine resources of the North Atlantic, especially in the zoogeographic area known as the Middle Atlantic Bight.

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 coherent 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; the biology, ecology, and behavior of coastal fish species whose distribution or migration extend beyond State boundaries; study and surveillance of living resources of the 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 studies of the impact of disease on marine animals.

Important immediate problems which need to be confronted by the Middle Atlantic Coastal Fisheries Center include: coordination and integration of research efforts of component laboratories oriented towards a few broad programs (e.g., New York Bight Study; effects of pollutants on fish and shellfish; coastal resources assessment); increased visibility for NMFS research in coastal resource problems; development of effective cooperative working relations with other research groups (State, Sea Grant, EPA, universities, Corps of Engineers, other NMFS research centers, etc.); development of effective communication with NMFS water resources staff, State conservation agencies, industry segments and recreational fishermen.

Coastal research areas in which it seems possible to develop high visibility and significant coherent programs include:

1. Full assessment of the effects of pollutants and other man-made changes on marine life. The New York Bight Study would be a focus of field and experimental work.

2. Analysis of trends in coastal fishery resources -- both recreational and commercial -- with an evaluation of the impact of various factors, man-made and other, on abundance.

3. Development of nationally recognized programs in disease and marine genetics (including immunogenetics) -- oriented especially but not exclusively toward mariculture.

Accomplishments (Fiscal '72) of Middle Atlantic Coastal Fisheries Center

1. Significant steps toward development of mission-oriented, truly integrated research programs have been taken. Many small, autonomous, isolated projects at the three component laboratories of the Center now are consolidated into 4 active Investigations units, responsive to our mission and engaging in joint planning and complementary activities.

2. Integration has also been achieved in resource survey studies and in ecosystems studies with other Centers. Thus, all surveys are coordinated with the NEFC (Woods Hole), AEC (Beaufort), and SEC (Miami) Centers. Vessel cruises are, to the extent possible, synoptic; resultant data, on fishes of special interest to one Center, are being forwarded to the Center by the cooperating Centers. For the first time, through such integration, we can expect comprehensive resource assessment surveys of the entire Atlantic coast, encompassing estuarine, coastal and offshore operations and yielding information on egg, larval, juvenile and adult forms of demersal, bathypelagic and pelagic fishes as well as on invertebrates such as lobsters, crabs and mollusks.

3. We have developed lines of communication with and have participated in the planning for the NMFS-wide MARMAP program and the NOAA-wide MESA program. We are becoming increasingly involved in cooperative actions and vessel operations with NOAA's AOML Laboratories at Miami and with NOAA's NOMES, MUS&T and OMAP programs. Several cooperative cruises such as the recent 40-day MARMAP #1-IOC cruise from Block Island to Jacksonville, Fla., have been completed.

4. We have developed and are operating an efficient, decentralized program-oriented administration system for the Center despite wide geographic separation of and diversity of disciplinary interests at the three facilities comprising the Center.

5. We have developed mission-oriented programs for effective, full-time usage of a major new research vessel Delaware II, and have begun implementing these programs.

6. Major facility-rehabilitation projects at the Milford and Sandy Hook Laboratories have been completed or are well underway. Laboratories have modernized and equipped with modern instrumentation and services.

7. All field work has been completed on an intensive (500 stations) assessment of the distribution and abundance of onshore surf clams of the entire New Jersey coast. When coupled with data developed from equally intensive offshore studies completed in 1969 and earlier, these data will afford an estimate of the total biomass of this important resource and will permit consideration and development of plans for its rational management.

8. The extensive field work completed this summer off the entire New Jersey coast and throughout Long Island Sound constitutes major milestones in terms of their scope and intensity. These field studies and the resultant data, when interpreted will, for the first time, afford comprehensive marine environmental quality base lines for a major part of the onshore areas of the New York Bight.

9. A complex and integrated multi-discipline pollution-bioassay program has been developed utilizing physico-ecologists, physiologists, immunologists, enzymologists and chemists at Milford as well as physiologists and pathologists, respectively, at Sandy Hook and Oxford. Each cooperator receives tissues from the egg, larval and adult forms of fish, crustaceans, and mollusks which have been exposed, under controlled, static conditions, to specific pollutants. The purpose is to determine and define the effects of each such pollutant upon these living marine resources. Plans are well advanced to expand this activity to include long-term, sub-acute exposure studies.

10. Comprehensive, simply-worded statements on the organization, philosophy, administration, mission and programs of the Center as well as on the rights, privileges, benefits and duties of employees were made available to each member of the Center staff.

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.

COASTAL RESOURCE INVESTIGATION: Because of increasing commercial, recreational and foreign fishing pressure, improved technology and an expanding market, coupled with apparent reduction of suitable spawning and nursery grounds, many fishery stocks are in danger of being overfished. To establish and maintain proper management policies, a comprehensive and intensive program of biological research is necessary to assess the resources along the entire Atlantic coast. The Coastal Investigation program is designed to provide information for assessing abundance and distribution of fishery stocks principally based on information derived from a regular series of scientific cruises. A core for these studies already exists at Sandy Hook. During the past several years, a series of primarily inshore cruises were made from Long Island to Florida to obtain information on distribution, abundance and migration of bluefish and weakfish. All fish species collected were enumerated, measured and weighed and hydrographic observations taken at each station. Samples from the cruises provide material for such life history topics as age and growth, stock identification, migrations, feeding habits and species composition. These studies will be intensified and expanded to include a greater number of species and will utilize data derived from regularly scheduled synoptic cruises by research vessels operating in coastal (0-15 fathoms) and offshore (15-100 fathoms) waters. Such information with our improved assessment and statistical capabilities will allow better predictive models for managerial purposes.

ESTUARINE RESOURCE INVESTIGATION: The estuaries in the mid-Atlantic region are continually being subjected to greater demands as a result of increasing population pressures with their accompanying industrial and domestic wastes. Yet, it is these areas that are the spawning and nursery grounds for many of our commercial and sport fish and shellfish. Estuaries with their marshes and wetlands are also areas where the primary production occurs which is so essential in the early life stages of our fishery stocks. Intensive assessment of estuarine finfish and shellfish populations is necessary to evaluate the effects of lower water quality ("natural" mortality) on these stocks. For the past 2 years, several important river systems in Chesapeake Bay have been assessed for water quality and the numbers and kinds of finfish and shellfish. It has been found that these rivers are truly important in the early life stages of many fish species which are later harvested in our coastal waters. Such estuarine assessment studies are providing the data necessary to predict future availability of these fishery stocks.

ICHTHYOPLANKTON INVESTIGATION: The occurrence of juvenile fishes in estuaries has led to the belief that a major role of the estuarine zone is its function as a sanctuary or nursery ground for young fishes, many of which are spawned at sea. To test this hypothesis and to gain information on natural mortalities in estuaries, the Ichthyoplankton Investigation unit has been studying the distribution of fish eggs, larvae, and juveniles from the inner reaches of the littoral zone to the edge of the continental shelf from Cape Cod, Massachusetts, to Palm Beach, Florida. Data on the hydrography and juvenile fish collections from these cruises have been published. In addition, fish eggs and larvae have been separated from the samples and, to date, 57 species have been identified, counted, measured, and their geographic distribution plotted. Illustrations and descriptions of Atlantic mackerel, black sea bass, and summer flounder have been made. Studies are also underway on the vertical distribution of eggs and larvae and their diel movements. As an integral part of the Resource Assessment Investigations, the Ichthyoplankton Investigation will provide useful data for estimating the existing abundance and distribution of both pelagic and demersal fish stocks.

BEHAVIOR INVESTIGATION: The primary objective of the Behavior Investigation is to study the behavior of selected marine fish species under controlled laboratory conditions in conjunction with direct visual observations at sea in order to define normal patterns and measure quantitatively how they are affected by selected environmental stimuli. An understanding of the objective will allow a better measurement of marine fish assessment in relation to environmental changes. The Investigation includes: (1) laboratory investigations on the effects of light and temperature on the activity and feeding of important commercial and game fish species, (2) field and laboratory studies to investigate the relationship between feeding habits, inter- and intraspecific interactions and factors involved in habitat selection of various coastal benthic species, and (3) determination, in the laboratory, of normal patterns of social behavior (both inter- and intraspecific) for various midwater and pelagic species, which may act as behavioral indices in assessing the effects of various environmental stresses.

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 base line 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 hypothesized 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.

BIOLOGICAL OCEANOGRAPHY INVESTIGATION: A rational management of marine fishes is dependent upon several factors which include quality of the aqueous environment and organisms which comprise the food chains which the fishes use for sustenance. To measure water quality and develop an understanding of plants and invertebrate animals which form the food chains of marine fishes, it is necessary to make in-depth investigations of estuarine and coastal ecosystems. Despite the fact that the New York Bight and ancillary embayments constitute one of the most intensively used coastal environments in the world, little is known about the present status of living marine resources in these waters. The Biological Oceanography Investigation is designed to provide information concerning the more important forage and commercially valuable invertebrates and their environment within the Bight with the following objectives: 1) establish base lines in regard to the areas and temporal distribution of benthic, natatory and planktonic invertebrates; 2) determine the life histories and ecology of invertebrate species found to be of unusual importance in particular marine and estuarine food chains; 3) establish the relationship between invertebrate species found in gut contents of finfish and invertebrate species diversity and standing crops in areas habituated by the finfish from which the gut contents were removed; 4) obtain sufficient samples to furnish tissues and living animals to the Marine Contaminants Investigation for analyses for heavy metal and microbial contamination as well as experimental manipulation to determine the effects of lethal and sublethal doses of toxins and pathogens; 5) develop hypotheses and predictive models which will be generally applicable to other temperate water ecosystems for use in the management of living resources.

MARINE CONTAMINANTS AND COASTAL ECOSYSTEMS INVESTIGATION: The uses of the New York Bight and ancillary embayments include shipping, pleasure boating, waste disposal, and recreational and commercial fishing. Additional waste disposal activities, nuclear-electric power generation, and offshore mineral recovery are proposed for this coastal area. Are all of these uses compatible in a single, multiple-use scheme? We cannot presently answer this question, particularly as long-term management of the living resources is concerned. To provide the data necessary to answer the foregoing question, we propose a continuing program with the following objectives: 1) establish the patterns of distribution of heavy metals, pesticides, petrochemicals and other toxic materials in sediments; 2) determine patterns of distribution of bottom-dwelling macrofauna and meiofauna as these patterns are related to deteriorated environments; 3) determine the effects of a variety of contaminants on the physiology, behavior and reproduction of selected species of marine organisms; 4) continue our present investigation concerned with the sublethal and lethal effects of thermal additions and oil pollution on marine and estuarine species; and 5) develop generally applicable hypotheses and models which can be used to predict the effects of waste disposal in coastal and estuarine waters.

ENVIRONMENTAL CHEMISTRY AND MICROBIOLOGY INVESTIGATION: Man's activities can change the coastal waters and thereby have a diverse effect on living marine resources. Increased discharges of organic nutrients and chemicals into the aquatic environment as well as elevation of water temperature, can modify the marine biota both quantitatively and qualitatively. Of immediate concern is to determine the degree to which microbial populations and chemical pollutants can cause diseases in living marine resources as will the utilization of the resource by man. Recently, in the United States, elevated levels of mercury and pesticides have been demonstrated to occur in certain fish species with resulting regulatory restrictions on their utilization. Whether additional heretofore unknown and undetected microbial species and chemicals (compounds) exist in the aquatic environments, and whether such adversely affects the physiology of living marine organisms, warrants immediate attention. The objectives of the microbial aspect of this investigation are to determine, both qualitatively and quantitatively, the microbial flora (both aerobic and anaerobic) of marine waters, sediments and organisms. The objective of the chemistry aspect of this investigation is to determine the level of chemical contamination, heavy metals, pesticides, etc., in the same elements of the ecosystems. The prime objectives of these two studies are to determine whether changes in the indigenous microbial flora and increased levels of chemical pollutants adversely affect the food chain organisms, the fishery resources and the utilization of the resource.

ENVIRONMENTAL REHABILITATION INVESTIGATION: Raritan and Sandy Hook Bays represent two heavily polluted marine water bodies in the New York-New Jersey region. Over 2 million gallons of primary-treated sewage is discharged into these waters. In order to "rehabilitate" these embayments for sport and commercial fishermen the following base line study is proposed in which miniature artificial reefs, constructed of tires, will be evaluated as potential tools for increasing finfish productivity. Experimental reef sites are planned for Raritan Bay in the vicinity of Great Kills Harbor. 1) To determine the spatial effect of reef distribution on finfish abundance. Information on fish inhabiting reef sites, especially throughout the months of April-November, is of special interest since it will provide answers to questions concerning seasonal fish mobility and reef interaction during the prime fishing months; 2) to compare secondary productivity, using a bioenergetic approach, in reef and non-reef areas of Raritan Bay. Invertebrates and algae utilized as food for finfish are of particular interest since their seasonal settlement and abundance influence the resident finfish population; 3) to examine the effect of an experimental reef on the behavior of finfish. Diving observations indicate that finfish utilize a reef for "cover" in addition to obtaining food.

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. Base line 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 animals life history) to be caused by any single extrinsic or intrinsic factor acting alone. Rather, it is usually a combination of infectious and/or non-infectious factors acting competitively, sequentially, complementarily, or synergistically <u>on</u> or <u>in</u> these animals to modify their behavior, physiology, growth, development, reproduction or to render them more susceptible to the same or still other infectious and non-infectious 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 <u>infectious disease</u>.

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 relates to growth and metamorphosis of larvae); algal physiology; and nutrition (of cultured species and of food supply organisms).

FUNDING AND STAFF

The Middle Atlantic Coastal Fisheries Center will operate in fiscal year 1973 with a budget of 2.96 million, which includes full funding of 370 thousand dollars for the research trawler Delaware II and outside contract support (from AEC and Corps of Engineers) of approximately 80 thousand dollars. Total staff of the Center includes 131 assigned permanent ceilings (including vessel personnel) and a present complement of 49 temporary and intermittent staff members in various categories. Personal services costs will be approximately 1.91 million. Additional funding from MARMAP and MESA programs is anticipated, but is not included in the above totals.

Distribution of Funds, Fiscal '73[1/] (less Vessel[2/])

Investigations	Personal Services	Expenses	Totals
1. Resource Assessment:	488.4	127.6	616.0
a. Coastal Resources			
b. Estuarine Resources			
c. Ichthyoplankton			
d. Behavior-Physiology			
2. Experimental Biology:	430.4	137.8	568.2
a. Life History/Water Quality			
b. Algology			
c. Genetics			
d. Marine Contaminants			
3. Pathobiology:	246.1	91.9	338.2
a. Comparative Pathology			
b. Experimental Pathology			
c. Diseases/Mariculture[3/]			
d. Diseases/Stress-induced[3/]			
4. Ecosystems Analysis:	586.3	160.7	747.0
a. Biological Oceanography			
b. Marine Contaminants-Ecosystems			
c. Environmental Rehabilitation			
d. Environmental Microbiology and Chemistry			
5. Mariculture[3/]	--	--	--
A. Center	161.6	45.0	206.6

1/ Includes O&M funds for facilities
2/ $370.0K set aside for transfer to NOS
3/ Planning Stages - inactive

MIDDLE ATLANTIC COASTAL FISHERIES CENTER

Dr. Carl Sindermann, Center Director, GS-15
John Helston, Deputy Center Director, GS-15
Kathe Meikers, Secretary, GS-6

Dr. Lionel Walford
Senior Scientist

Technical Services

Vessel Operations
Vacancy, Port Captain, GS-12

Robert Landsvik
Master, Delaware II, WB-00

Andrew Tobiasen, 1st Officer, WB-00
Stephen Leeds, Chief Engineer, WB-00
Richard Halvorson, Fishing Mate, WB-00
Alfred Leeds, Skilled Fisherman, WB-00
Stephen Marry, Skilled Fisherman, WB-00
Joseph Rego, Skilled Fisherman, WB-00
Vacant - Skilled Fisherman, WB-00
William Burt, Cook-Steward, WB-00
James Fitzgerald, 2nd Engineer, WB-00
Leonard Castle, Fisherman, WB-00
Thomas Brophy, Seaman/Messman, WB-00
Stephen Rich, Wiper, WB-00
Douglas Howe, Messman

ADP Operations
Charles Morrison
Phys. Sci. Tech., GS-9
Catherine Noonan
Computer Aid, GS-4
John LeBaron
Computer Aid, GS-4
Sueilan Steimle, GS-2
Clerk/Typist

Library Operations

Special Studies Unit

Administrative Services

Daryl Mayberry
Administrative Officer, GS-11
Betty Morton
Gen. Acct. Clerk, GS-5
Agnes Smith
Supply Clerk, GS-5
Jane Schadt
Personnel Clerk, GS-4
Elizabeth Leimberg
Clerk/typist, GS-3
Vacant - Clerk-typist, GS-3

FACILITY ADMINISTRATION

Officer-in-Charge Oxford (Dr. Rosenfield)

ADMINISTRATION

William O'Connell
Admin. Officer, GS-11
Mary Ann Smith
Clerk-Typist, GS-4
Jo Ann Bridges
Clerk-Typist, GS-3
Dorothy Sawyer
Clerk-typist, GS-3 (temp.)
Vacant (temp.)
Clerk-typist, GS-3

MAINTENANCE

Paul Heister
Bldg. Repairman, WG-10
Solomon James
Maintenance Man, WG-8
Barney Brooks
Laborer, WG-3

LIBRARY

Helen Lang
Library Tech. GS-5

SMALL VESSELS

Paul Heister
Bldg. Repairman, WG-10

Officer-in-Charge Milford (Dr. Hanks)

ADMINISTRATION

James Clarke
Admin. Assistant, GS-7
Estelle Frauenberger
Clerk-typist, GS-5
Nancy Jacob
Clerk-typist, GS-2
Catherine Elliot
Clerk-typist, GS-2
Eileen Stratton
Clerk-typist, GS-2

MAINTENANCE

Kenneth S. Prevost
Maint. Man, Uncl.
Andrew Onofrey
Janitor, Uncl.
Thomas Tsimbidaros
Maint. Man, Uncl. (temp.)

SMALL VESSELS

Joel Singer
Motorboat Capt., Uncl.

Officer-in-Charge Sandy Hook (Dr. Pearce)

ADMINISTRATION

Vacant
Admin. Assistant, GS-7
Gail Siam
Clerk-typist, GS-3
Claire Steimle
Clerk-typist, GS-3
Elaine Waldhauer
Clerk-typist, GS-2

MAINTENANCE

William Allan
Foreman I-Cabinet Maker, WG-11
Edward Lauer
Cabinet Maker, WG-11
Arthur Mellish
Maint. Man, WG-8
Peter Rosenberg
Carpenter, WG-9
Solomon Adams
Laborer, WG-3
Frederick Farwell
Electrical Worker, WG-8

LIBRARY

Mabel Trafford
Editorial Assistant, GS-5
Edith Menning
Library Tech. GS-5

SMALL VESSELS

Irving Wicklund
Captain, WG-8A
Henry Fisler
Boat Operator, WB-5A
Edward King
Deckhand-Cook, WB-8B

Experimental Biology Investigations

Dr. J. Hanks, Director, GS-15
Rita Riccio
Tech. Publ. Ed., GS-9

Algology Investigation
Dr. R. Ukeles, Chief
GS-13

in Bishop, GS-7
Biol. Lab. Tech.
n. Rose, GS-5
Biol. Lab. Tech.
Alexander McColl, GS-4
Biol. Aid
Vacant/Vacant, GS-3/4
Alternates
NE Work/Study

Genetics Investigation
Dr. A. Longwell, Chief
GS-13

Sheila Stiles, GS-9
Fish. Biol.
Rice Collier, GS-7
Fish. Biol.
James Hughes, GS-5
Fish. Biol.
David Nelson, GS-5
Fish. Biol.
Vamuti/Rosenfield, GS-4
Alternates
NE Work/Study

Marine Contaminants Investigation
Dr. A. Calabrese, Chief
GS-12

Edith Gould, GS-12
Res. Chemist
Dr. Frederick Thurberg
GS-11, Res. Physiol.
Margaret Dawson, GS-7
Fish. Biol.
John MacInnes, GS-7
Fish. Biol.
James Miller, GS-7
Fish. Biol.
Newman/Manning, GS-4
Alternates
NE Work/Study

Life History/Water Quality Investigation
Mr. W. Landers, Chief
GS-13

Dr. Walter Blogoslawski
GS-11, Res. Microbiol.
Clyde MacKenzie, Jr.
GS-11, Fish. Biol.
Edwin Rhodes, Jr. GS-9
Fish. Biol.
Carolyn Brown, GS-7
Biologist
Wayne Cable, GS-7
Fish. Biol.
Prezasiko/Drewes, GS-4
Alternates
NE Work/Study

Pathology Investigations

Dr. A. Rosenfield, Director, GS-14
Nadine Wheatley
Clerk-Typist, GS-3

Comparative Pathology Investigation
Dr. R. Murchelano, Chief
GS-13

Austin Farley, GS-12
Fish. Biol.
Dr. Phyllis Johnson, GS-12
Biologist
Martin Newman, GS-11
Fish. Biol.
Jane Wade, GS-7
Biol. Lab. Tech.
Helena Jones, GS-5
Biol. Lab. Tech.
Frederick Kern, GS-5
Biol. Lab. Tech.
Cecelia Sullivan, GS-5
Biol. Lab. Tech.

Experimental Pathology Investigation
Dr. R. Murchelano, Chief
GS-13

Dr. Gilbert Pauley, GS-12
Fish. Biol.
Heathell Tobiash, GS-12
Res. Microbiol.
Vacant, GS-12
Fish Pathologist

Diseases in Mariculture Investigation (Planning)
Dr. A. Rosenfield, Chief
GS-14

Diseases in Stressed Environments Investigation (planning)
Dr. A. Rosenfield, Chief
GS-14

Ecosystems Investigations

Dr. J. Pearce, Director, GS-14
Helen Pawlikowski
Adm. Clerk, GS-6

Biological Oceanography Investigation
Charles Gibson, Chief
GS-11

Wm. Phoel, GS-9
Oceanographer
Robert Reid, GS-7
Fish. Biol.
Newell Eisele, GS-4
Biol. Aid
Leslie Rogers, GS-4
Biol. Aid

Environmental Rehabilitation Investigation (Vacant) (Planning)

Frank Steimle, GS-4
Biol. Aid

Environmental Microbiology and Chemistry Investigation
Dr. J. Grasekski, Chief
GS-13

Richard Greig, GS-12
Chemist
Richard Robohm, GS-12
Microbiologist
John Pahnchak, GS-11
Microbiologist
John Mahoney, GS-11
Fish. Biol.
Sharon Dudley, GS-9
Biologist
Christopher Sheipuk, GS-9
Chemist
Maureen Nitkowski, GS-7
Microbiologist
John O'Reilly, GS-7
Fish. Biol.
Douglas Wenstoff, GS-5
Chemist
John Ziskowski, GS-5
Fish. Biol.
Myra Cohn, GS-4
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Marine Contaminant and Coastal Ecosystems Investigation
Dr. J. Pearce, Chief
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Robert Tucker, GS-11
Fish. Biol.
James Young, GS-9
Fish. Biol.
Christine Evans, GS-7
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Janice Caracciolo, GS-5
Biol. Lab. Tech.
Richard McIlreith, GS-5
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Andrew Dressler, GS-4
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Ann Frame, GS-4
Biol. Aid
Robert Grimoff, GS-4
Biol. Aid
Ruth Waubhaser, GS-4
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Dorothy Jeffress, GS-3
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David Wheeler, GS-2
Biol. Aid

Resource Assessment Investigations

Dr. A. Merrill, Director, GS-15
Jane Swann
Secretary, GS-5

Coastal Resource Investigation
Anthony Pacheco, Chief
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Thomas Azarovitz, GS-9
Fish. Biol.
Bruce Freeman, GS-9
Fish. Biol.
Wallace Morse, GS-7
Fish. Biol.
Malcolm Silverman, GS-7
Fish. Biol.
Myron Silverman, GS-7
Fish. Biol.
Cynthia Joyner, GS-5
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Michele Cox, GS-4
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Sue Mager, GS-4
Cartographer
Clara Mayer, GS-3
Biol. Aid
Val. Anderson, GS-2
Biol. Aid

Behavior and Physiology Investigation
Bori Olla, Chief
GS-13

Allan Martin, GS-9
Fish. Biol.
Carol Samet, GS-9
Fish. Biol.
Anne Studholme, GS-9
Biol. Tech.
Alice Pejsa, GS-7
Fish. Biol.
Kenneth Hirsch, GS-4
Biol. Aid
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Biol. Aid

Estuarine Resource Assessment Investigation
William Shaw, Chief
GS-13

John Ropes, GS-12
Fish. Biol.
Darrel Christensen, GS-11, Fish. Biol.
Robert Lippson, GS-11
Fish. Biol.
Allen Barker, GS-9
Fish. Biol.
George Ward, GS-7
Biol. Lab. Tech.
David McIlvay, GS-6
Biol. Lab. Tech.
Michael Kreutheim, GS-5
Biol. Aid
Anton Farrnan, GS-4
Biol. Aid
David Townsend, GS-4
Biol. Aid

Ichthyoplankton Investigation
Wallace Smith, Chief
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Peter Berrien, GS-11
Fish. Biol.
Michael Fahey, GS-11
Fish. Biol.
Arthur Kendall, GS-11
Fish. Biol.
John Schunke, GS-6
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Cindy Dalinger, GS-4
Biol. Aid
Doris Finan, GS-4
Biol. Aid
Stephen Fletcher, GS-4
Biol. Aid
Susan Roberts, GS-4
Biol. Aid
Patricia Rosenberg, GS-4
Biol. Aid
Alyce Wolfe, GS-4
Biol. Aid

Role of MACFC in Marine Sportfish Research

Traditionally, the Sandy Hook Laboratory, MACFC, 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 non-specific user-oriented resource assessment surveys, eco-systems investigations and pathobiological studies, the interests of the sport fisherman are still permanent 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 alleged to equal the commercial catch. Both user groups are, of course, vitally interested in maintaining the quality of the marine environment and in the detection and alleviation of diseases of living marine organisms.

The listing of fish species in which Sandy Hook and the Center are especially interested reflects this recreational fishing support despite the non-species orientation of our resource surveys. Those species are listed below in our discussion of the Center's ichthyoplankton studies.

Several basic findings derived from our previous sportfish-oriented research dominated our design for the resource assessment surveys. The basic stratified random sampling plan for both the coastal and offshore surveys is that developed by the Woods Hole laboratory. The emphasis on the estuarine and 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) largely pelagic or bathy-pelagic 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 Hatteras relieving the NEFC of this responsibility. 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.

The present Ichthyoplankton Investigation 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 of interest to those of us working with ichthyoplankton were sport fishes, and much of our ongoing research is an extension of our initial surveys involving sport fishes. We are actively writing manuscripts and/or conducting field studies on early life histories of the following sport fishes:

Black sea bass	Atlantic mackerel
Summer flounder	Silver hake
Bluefish	

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

Weakfish	Little tunny	Tautog
Kingfish	King mackerel	Billfishes
Spot	Codfish	Winter flounder
Croakers	Pollack	
Bonito	Ling	

An "Angler's Guide" for the Atlantic Coast, keyed to 40 C&GS charts is in the final process 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 laboratory pioneered in development of the artificial reef concept and developed an effective cooperative citizen-government program whereby sport fishermen anywhere in the United States can effectively and efficiently 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 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 comprehensive 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.