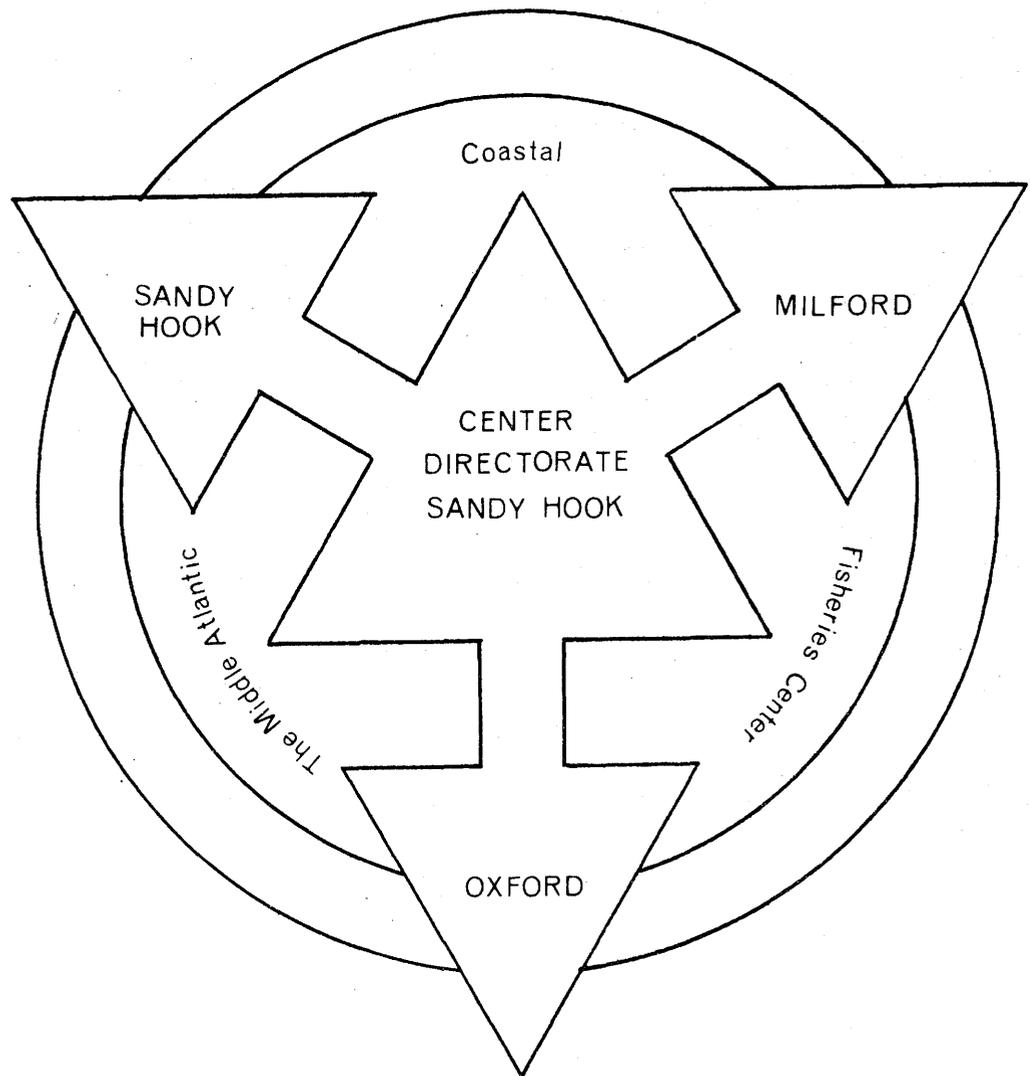


RESEARCH INVESTIGATIONS OF THE
MIDDLE ATLANTIC COASTAL FISHERIES CENTER



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

MIDDLE ATLANTIC COASTAL FISHERIES CENTER



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THE MIDDLE ATLANTIC COASTAL
FISHERIES CENTER AND ITS RESEARCH
INVESTIGATIONS

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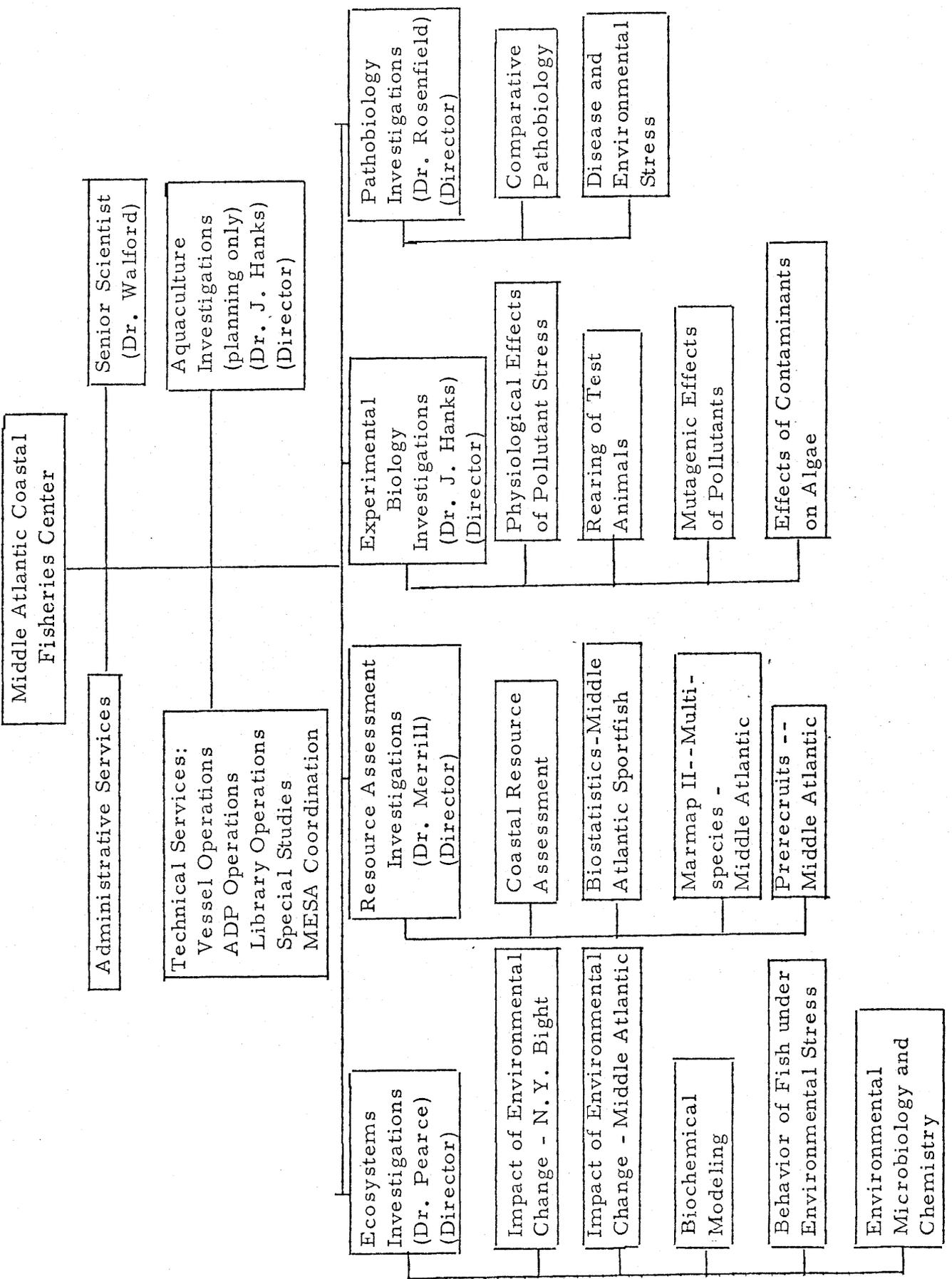
ORGANIZATION The Middle Atlantic Coastal Fisheries Center is one of a series of research centers established in 1971 by the National Marine Fisheries Service, National Oceanic and Atmospheric Administration, U. S. Department of Commerce. Each of these centers represents a consolidation and grouping of several laboratories, often in different geographical locations.

The Middle Atlantic Coastal Fisheries Center is a 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, Washington, and to the Regional 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.

To carry out the Center's research missions, four major groups of investigations have been created:

- (1) Resource Assessment Investigations (Dr. A. S. Merrill, Director) located at Sandy Hook and Oxford.
- (2) Ecosystems Investigations (Dr. J. B. Pearce, Director) located at Sandy Hook and Milford.
- (3) Experimental Biology Investigations (Dr. J. E. Hanks, Director) located at Milford.
- (4) Pathobiology Investigations (Dr. A. Rosenfield, Director) located at Oxford, Sandy Hook and Milford.

A brief summary of each Investigation Group follows this section.



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 resources in 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 decline in abundance and shifts in centers of abundance; and studies of the impact of disease on marine animals.

Coastal research areas in which significant coherent programs are being developed include:

1. Full assessment of the effects of pollutants and other man-made changes on marine life. The New York Bight Study is 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 -- oriented especially toward mariculture and pollution effects.

ACCOMPLISHMENTS Accomplishments of these investigations in the two years (1972 and 1973) since the Center was formed include the following:

1. Significant steps toward development of mission-oriented, truly integrated research programs have been taken. Previously autonomous 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. Several cooperative cruises have been completed.

4. We have developed and are operating an efficient, decentralized program-oriented administrative 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 research vessel, Delaware II, and have implemented these programs.

6. Major facility rehabilitation projects at the Milford and Sandy Hook Laboratories have been completed or are well underway. Laboratories have been 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. Extensive field work completed off the entire New Jersey coast and throughout Long Island Sound constitute 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 baselines for a major part of the onshore areas of the New York Bight.

9. A complex and integrated multi-discipline pollution-effects program has been developed utilizing 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.

10. We have defined, with 95% probability, the epicenter of the fin rot epizootic is located in New York Bight Apex - Raritan Bay complex. Studies on etiology of disease are continuing.

11. We have demonstrated and submitted for publication the Angler's Guide (Vol. 1), covering sportfish potential, public services, fishing grounds, with four-color marine charts, of coastal waters from Maine to including Virginia. Publication is expected in June, 1974.

13. We have completed a chronic exposure facility at Milford, so that a variety of marine organisms can be exposed to sublethal levels of various pollutants for studies of physiological stress, including metabolic dysfunction, biochemical changes, mutagenic effects, induction of histopathological anomalies and chemical uptake. This facility required the development of a 14,000-gallon-per-day ozonized water treatment system for production of clean seawater, nine diluter systems for metering precise amounts of pollutants into test tanks, and a waste treatment system for removing or reducing toxic material from test water before discharging.

14. The first draft of a "Handbook on Diseases in Mariculture" has been completed and distributed to industry and other interested groups. It is designed for use by laymen in the recognition and control of disease outbreaks in large hatchery and fish-holding systems. This illustrated handbook contains sections on diseases of finfish, crustaceans and mollusks; each disease is accorded a synoptic resume which includes gross pathology, etiology, methods of diagnosis and control and on the effect on the host.

15. The Oxford Laboratory of this Center, in cooperation with the Regional Office staff planned and conducted a successful under-utilized seafood symposium which emphasized the marketing opportunities therein. Between 100-130 persons from 10 States and the District of Columbia attended. As an example -- one industry member, during the one-day session, wrote orders for 1.5 million dollars worth of his products.

16. We have demonstrated, through four major seasonal cruises from Montauk Point, L. I. to Cape May, N. J., with a 99% probability that the epicenter of fin rot disease of demersal fish is located in the environmentally stressed apex of the New York Bight, and that oceanic areas to the south and to the east of this apex are relatively free of the disease.

17. We have found that "gill-blackening disease" commonly observed in crabs frequenting the New York apex is, in reality, a very complex, diversified community of protozoans living in the highly-organic New York Bight sediments accumulating on the gills. The crabs are obviously stressed in terms of their respiration but, fortunately, they appear able to shed the sediments and parasites during the molting process.

18. We have demonstrated through electron microphotographs that "ovacystis disease", a disease of ovarian tissues in the American oyster, is of viral origin. The virus particles and the course of the disease were described in several publications.

19. We have prepared a comprehensive slide library of the normal histology of blue crab for use in comparative pathology studies on diseased animals. This first exhaustive investigation of crustacean histology and histochemistry is available for study by all interested groups.

20. We have begun a program of monthly estuarine resource assessment cruises from the western end of Raritan Bay to the edge of the continental shelf. The four objectives of this program are: (1) prepare base for coordinated, contractual State-Federal estuarine assessment program (MARMAP) in Delaware Bay, Chesapeake Bay, Cape Hatteras and Cape Fear (budget item for fiscal 1976), (2) achieve comprehensive coordinated State-Federal oceanic, coastal and estuarine assessment program extending from Nova Scotia to Cape Fear. (Has international implications for management of fish stocks), (3) develop detailed information on behavior, migrations and estuarine dependency of Middle Atlantic fish stocks (has implications for environmental impact analysis), and (4) relate finfish abundance, distribution, and pathology, to observed oceanic environmental characteristics (has implications for NOAA-MESA/New York Bight Ecosystems Study and alternate deep-water ocean dump sites).

21. We have earlier demonstrated that commercially-attractive surf clam concentrations extend below northern New Jersey all the way to southern Virginia and have documented their concentrations and biomass from the waters off Montauk, Long Island to Chincoteague, Virginia. This information assisted industry in moving to southern concentrations of surf clams whereby annual surf clam production was increased by about 66%.

22. We have demonstrated the availability of and documented the abundance and distribution of a second major ocean shellfish resource (A. islandica) seaward of the surf clam resource. This resource appears to be as large and as widely distributed as the surf clam resource.

23. We have completed, and shortly after June 30, 1974, will submit to the NMFS Editor, Angler's Guide (Volume II), covering sport fish potential, public services, fishing grounds, etc., in four-color marine charts of coastal waters from North Carolina to Key West and the Dry Tortugas. Publication of this second and final volume is expected in June, 1975. Volume I will be published and available in June, 1974.

24. We have prepared and submitted several comprehensive analyses of the possible environmental and resource effects of off-shore floating nuclear power plants for use by the President's Council on Environmental Quality in its official report on this subject. Our presentations covered the oceanic waters contiguous to the coasts of New Jersey and Virginia.

25. We have conclusively demonstrated, both in the field and in the laboratory, that gaseous ozone effectively oxidizes and inactivates the paralytic toxins secreted by the several forms of algae and dinoflagellates associated with so-called "red tides."

RESOURCE ASSESSMENT INVESTIGATIONS

Research effort is oriented toward assessing fishable resources within the framework of a comprehensive and integrated program. The tasks involve operations planned to provide information on fish biomass, composition, and distribution into a common data bank for the entire U. S. Atlantic coast, with particular emphasis on the Middle Atlantic Bight.

ICHTHYOPLANKTON INVESTIGATION: The task mission is to understand the early life history and population dynamics of coastal fishes before they enter the recreational and commercial fisheries. Emphasis is on nearshore species, many of which are being heavily exploited. The task 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, Mass. to Palm Beach, Fla. Fish eggs and larvae are separated from the samples and species identified, counted, measured, and their geographic distribution plotted. 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 fundamental data for estimating the existing abundance and distribution of both pelagic and demersal fish stocks in relation to existing hydrographic parameters.

COASTAL RESOURCE INVESTIGATION: The focus of effort is to develop and maintain a baseline of reliable indices on the status of selected species and the impact of fishing, both recreational and commercial. Such information is required for developing population models to predict changes resulting from natural and man-imposed effects.

The MARMAP II: Multispecies, Middle Atlantic Bight task group is designed to provide information for assessing abundance and distribution of juvenile and adult fishery stocks principally based on information derived from a regular series of scientific cruises. All fish species collected are 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. Earlier studies have now been intensified and expanded to include a greater number of species

and utilize data derived from regularly scheduled synoptic cruises by research vessels operating in coastal (0-15 fathoms) and offshore (15-100 fathoms) waters. Shellfish assessment obtains data on recruitment, growth, and mortality to determine harvestable fractions. The clam and scallop resources between Cape Cod and Cape Hatteras are the targets of prime interest. Annual cruises are planned and coordinated to the fullest extent with interested State agencies. The information is compared with previous shellfish surveys, and the resultant analyses made available to appropriate management units.

The Fishery Analysis: Middle Atlantic Sportfish task is concerned with developing source information to insure a unified data base for measuring the proportion of recreational harvest to total harvest, to satisfy our need to supply best estimates of the present and future status of the stocks for action by international, national, and State conservation groups. The preparation of an atlas of information in the form of an anglers guide is nearly complete. Design and implementation of uniform field data collection and analysis from selected sites are now the major areas of emphasis since a reliable estimate of removals is vital to a successful understanding and management of living marine resources.

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. In many instances the effects of deteriorated environments do not impinge directly upon finfish or shellfish which are important in the commercial and game fisheries; 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. Deteriorated environments may also disrupt the flora and fauna which play an important role in stabilizing marine sediments. Finally, invertebrate species, which are often attached or relatively immotile forms which cannot avoid polluted waters, are often excellent indicator organisms which can be used to detect or assess change in environmental quality.

The Ecosystems Investigations are primarily concerned with benthic food chain studies, physiological responses to toxins and organic wastes, distribution of benthic populations, 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.

Personnel assigned to Ecosystems Investigations have been for the past three years conducting intensive investigations of coastal waters and estuaries in Long Island Sound, Raritan Bay and the New York Bight. These scientists are investigating the perturbations which have resulted in the deterioration of these waterways. These studies are not solely concerned with documenting the decline of these aquatic environments and their contained fisheries but are also emphasizing the possibilities for controlling pollution and rehabilitating the shell-fisheries in these areas. It is obvious, however, that problems must be identified before action can be taken. Very recent analyses of data indicate that Raritan Bay has deteriorated significantly within the past 15 years.

EXPERIMENTAL BIOLOGY INVESTIGATIONS

The transfer of the Bureau of Commercial Fisheries/Department of the Interior to the Department of Commerce as National Marine Fisheries Service/National Oceanic and Atmospheric Administration in 1970 assured the continued operation of the research laboratory at Milford, Connecticut. With the subsequent reorganization of the National Marine Fisheries Service into Centers in 1971 this facility became a part of the Middle Atlantic Coastal Fisheries Center, along with laboratories at Sandy Hook, New Jersey, and Oxford, Maryland, with its headquarters at Sandy Hook. A NMFS policy decision at that time directed the reprogramming of the research from molluscan aquaculture to marine contaminant studies relating to an overall Center effort to determine the effects of environmental pollutants on those marine resources in the waters of the Mid-Atlantic. Such action was considered to be the best use of Milford's physical plant, designed in large for experimental research, the staff expertise remaining after 8 months of reduction-in-force and the prime mission established for the Middle Atlantic Coastal Fisheries Center - to better understand how the pollution of our inshore waters is related to abundance fluctuations of commercial and recreational fish, shellfish and crustaceans.

Initial emphasis has been placed on determining the acute and sublethal effects of several heavy metals, as mercury, silver, and zinc, known to occur as industrial pollutants in estuarine waters on several species of commercial mollusks, crustaceans and recreational finfish. This required renovation of the physical plant to allow construction of an environmental exposure laboratory with extensive diluter systems for the continuous delivery of metal ions to aquaria and tanks. Similarly, studies were initiated to determine 1) what mutagenic effect heavy metals might have on the chromosome system of the American oyster and other inshore marine organisms, 2) the effects of metal ions on marine phytoplankton on the base of the food-chain ecosystem, and 3) what physiological and biochemical systems were actually affected by exposure to heavy metals - all as a means of better understanding the gross impact of pollutants on our natural marine resources.

To undertake this work it is necessary to develop standard biological rearing systems for a variety of commercial and recreational fish, shellfish and crustaceans in order that a broad spectrum of organisms will be available for the exposure studies. This currently involves work on sea scallops, surf clams, ocean quahogs and lobsters, and, later, will include squid, crabs and some finfish common to our Mid-Atlantic waters.

The overall program, titled Experimental Biology Investigations, is now well underway with a scientific and support staff of approximately 35 people. Information on the results of several studies is available in the form of reports and publications. Details of these Investigations are attached as Part II for those desiring more information.

PATHOBIOLOGY INVESTIGATIONS

The Pathobiology Investigations at the Oxford Laboratory has long recognized the need to study the causes of mortalities of all marine animals, and has been a pioneer in disease studies. Originally with mollusks, then with crustaceans, and presently with fish, the Laboratory has expanded its research effort 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 information has been acquired on both disease processes and defense mechanisms for fishery management purposes.

Primary emphasis continues to be placed on studies of problems related to infectious disease. However, the Pathobiology Investigations' staff has long and broad experience and the expertise in recognizing pathological conditions in cells, tissues, and organs of marine animals. Therefore, we shall continue to examine, diagnose and describe pathological (abnormal) manifestations that may be attributable to noninfectious agents or combinations of infective and noninfective factors in nature or under culture conditions.

The Pathobiology Investigations consists of two major areas of research: Comparative Pathobiology and Diseases in Stressed Environments. Research projects and their objectives are as follows:

Molluscan Pathology: (1) To conduct histological studies on representative mollusks for parasite prevalence, pathological manifestations, including neoplasia, and baseline histology; (2) to conduct ultrastructural studies on molluscan neoplasms and characterize the oyster "ovacystis" virus; (3) to provide diagnostic services for other agencies on request.

Crustacean Pathology: (1) To produce a practical atlas of normal crab histology, geared for use by pathologists, (2) To study histology of abnormal conditions, such as those found in crabs stressed by exposure to heavy metals and other pollutants, and by parasitic infections.

Fish Pathology: (1) To determine baseline histology and histopathology in fish; (2) To determine causes of disease in fish whether infectious, noninfectious, or environmentally induced.

Fin Rot Disease in the New York Bight: (1) To determine the prevalence of fin rot disease in the New York Bight; (2) To determine the bacterial flora of lesions from diseased fish and to assess the levels of serum agglutinins to the bacteria isolated; (3) To determine disease pathogenesis from histological observations.

Microfauna of New York Bight Fish & Benthos: (1) To isolate, culture, and identify protozoa in water column and sediment of New York Bight, and in or on tissues of benthic animals; (2) To compare results from sewage, dredge, acid waste, and control areas in the New York Bight and Sandy Hook Bay to estimate influence of stressed environments on species composition.