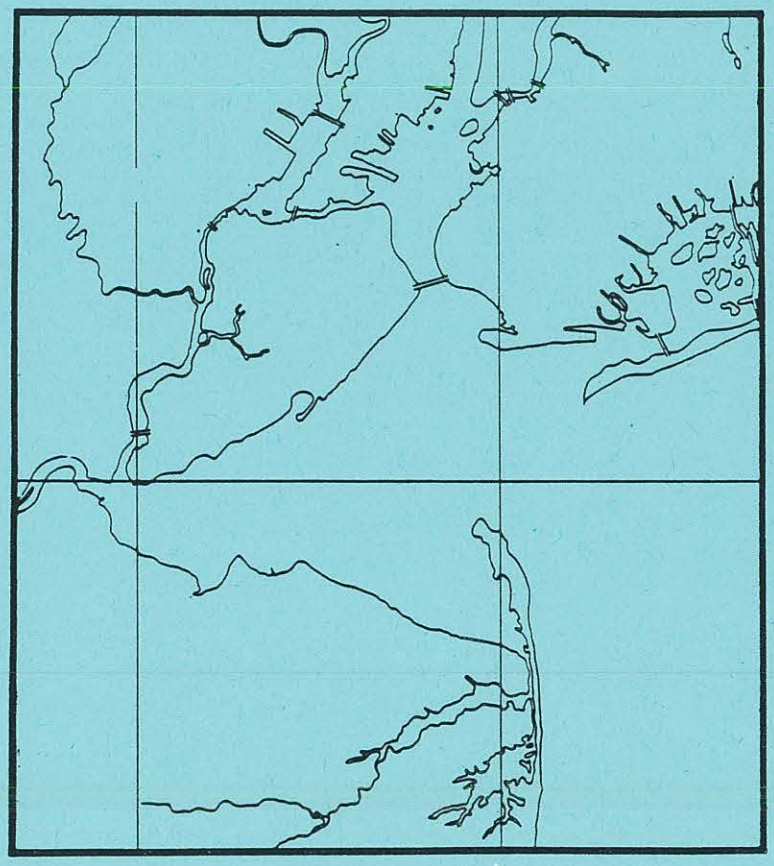
NOAA Involvement in Hudson/Raritan Estuary

April 1988



U.S. DEPARTMENT OF COMMERCE

National Oceanic and Atmospheric Administration

NOAA Estuarine Programs Office

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U.S. DEPARTMENT OF COMMERCE
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HUDSON/RARITAN INVOLVEMENT PAPER

FOREWORD

In the 1984 renewal of the Clean Water Act, Congress initiated a major program designed to improve the quality and management of our estuarine resources. The program is taking place in selected estuaries of national importance. The Hudson/Raritan is one such estuary considered nationally important. It is the primary harbor for commerce in the United States and ranks first in foreign cargo. Coastal development has destroyed wetlands; waste discharges have degraded sediments, closed shellfish beds, and have created real concerns for public health. Because of the environmental concerns in the Hudson/Raritan Estuary, the States of New Jersey and New York have requested from the Environmental Protection Agency (EPA) that the Hudson/Raritan Estuary be designated a "National Estuary" for study to develop and implement environmentally sound management practices. The EPA will be charged with establishing the program, in consultation with the states of New Jersey and New York, the National Oceanic and Atmospheric Administration (NOAA), and other appropriate Federal and state agencies, and interested organizations to develop a management strategy concerning environmental issues that must be addressed for the Hudson/Raritan Estuary.

NOAA has participated in and conducted studies in the Hudson/Raritan Estuary since 1968. NOAA scientists and managers serve on several committees that develop and review programs and plans for the Hudson/Raritan Estuary, and NOAA researchers are presently involved in a number of studies on the Estuary and its resources.

To provide information to assess the Hudson/Raritan as a National Estuary and to assist in developing programs of study, this document was prepared by the NOAA Estuarine Programs Office (EPO). It describes the full range of activities NOAA has conducted in the Hudson/Raritan Estuary from 1985 to 1987. In addition, to facilitate coordination between NOAA and the Hudson/Raritan planning, we have designated individuals both in the region and at headquarters in Washington, D.C. to coordinate NOAA's future activities in the Hudson/Raritan Estuary.

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I. INTRODUCTION

The New York/New Jersey metropolitan area is one of the most highly urbanized and industrialized regions in the United States. Three quarters of the population of New York and half the population of New Jersey live within the boundaries of the Hudson/Raritan drainage basin. The area is continually undergoing development. Proposals for new and converted housing, commercial, and office space are presently being made for the Hudson River shoreline. New York, ranked number one in foreign trade, houses the primary harbor for commerce in the United States. The New Jersey Department of Commerce and Economic Development reports that the export business alone is worth $3 billion per year. The economic importance of this Estuary to not only New York and New Jersey, but also to the Nation as a whole cannot be overestimated. The price paid for this continued industrialization has been severe degradation of the environmental quality of the Hudson/Raritan Estuary. It is important to implement sound management practices and decisions for the survival of this Estuary.

Refineries, smelters, and other industries have contributed toxic contaminants such as polychlorinated biphenyls (PCBs), trace metals, radionuclides, petroleum hydrocarbons (PAHs), and heavy metals to the water column and sediment. Pesticides and fertilizers from farming practices enter the system via the rivers and their tributaries. Fifteen million inhabitants of the metropolitan New York City area contribute to tons of treated and untreated sewage entering the Hudson/Raritan system daily. The dredging industry stirs up and relocates contaminated sediments in its maintenance of shipping channels and harbors. Development has destroyed important wetlands, including habitats and nursery grounds.

Contamination in the Hudson/Raritan Estuary does not end at the mouth of the estuarine system. The plume from the estuary extends well into the New York Bight and has contributed to pollution problems along the New Jersey coast. Excessive nutrients emanating from the Hudson/Raritan have contributed to high primary productivity and anoxia in subsurface waters. Dumping of dredged materials and sewage from the New York area and harbors have degraded benthic environments in the New York Bight Apex.

While development, shipping, dredging, etc. provide jobs to a thriving economy, some of the consequences to the environment have been: reduced species diversity; declines in fisheries catch; contaminant burdens in finfish and shellfish; areas closed to fishing; poor water quality; and loss of nursery grounds and habitats. Documented problems in the Hudson/Raritan Estuary include:

- A once thriving oyster industry has disappeared.
- Clams from the estuary now have to be depurated at other sites prior to human consumption.

- Increased nutrient loading appears to have impacted biological productivity and modified fish distribution.

- Public swimming areas have decreased.

- Declines in blue crab catch have been linked to contamination by the chlorinated pesticides, DDT and DDE.

- The smelt fishery has disappeared because of overfishing and destruction of spawning grounds caused by industrial pollution.

- Unacceptable levels of PCBs and other toxicants have been reported in striped bass and other exploited fishes of the estuary.

These represent only a few of the problems that have occurred in the Hudson/Raritan Estuary. State and local governments, the Federal Government, environmental managers, scientists, and the general public are becoming increasingly aware that sound management practices must be implemented to protect the living marine resources for future generations.

Scientists have made significant progress toward understanding the threats that contaminants pose to humans and environmental health, but much remains to be done. Environmental managers charged with protecting the quality of the Hudson/Raritan Estuary and its resources continue to require information from properly-designed studies and programs.

NOAA already has programs in place in the Hudson/Raritan Estuary to provide information to address some of the major problems facing the region. They are designed to characterize or describe the current "state" of the estuary, to conduct research to fill gaps in understanding, and to provide information to agencies responsible for managing natural resources or water quality. NOAA's estuarine programs in the Hudson/Raritan Estuary are conducted primarily by the National Marine Fisheries Service (NMFS), the Office of Oceanic and Atmospheric Research (OAR), including Sea Grant, the National Ocean Service (NOS), and the National Environmental Satellite, Data, and Information Service (NESDIS). These programs will be described in this paper. NOAA also supports a fisheries laboratory at Sandy Hook, New Jersey adjacent to Raritan Bay. NOAA personnel at the laboratory are actively involved in investigations in the Hudson/Raritan Estuary.

NOAA also conducts generic estuarine studies and programs that can be applied to the Hudson/Raritan Estuary. For a description of the full range of NOAA's estuarine programs, contact the NOAA Estuarine Programs Office for a copy of the companion document, NOAA's Estuarine Capabilities Paper.

II. ESTUARINE CHARACTERIZATION

Estuarine characterization is the essential first step in describing the health of an estuarine ecosystem. To characterize an estuary, existing information on the physical environment and on the resident biota must be identified and analyzed. This step reveals what additional data need to be collected to more effectively balance man's activities in the region.

NOAA sponsors a number of efforts designed to characterize different aspects of the Hudson/Raritan Estuarine system.

A. Data Archives and Data Assessment

The National Estuarine Inventory (NEI)

The NEI is the framework in NOAA's efforts to assess the health of the Nation's estuaries. The Inventory identifies all large- and medium-sized estuaries within the contiguous United States; compiles a data base of their important physical, hydrologic, biological, and economic characteristics; and specifies a commonly-derived spatial unit, the estuarine drainage area, by which data are compiled. One hundred and one estuaries have been identified in the NEI, and these receive approximately 90 percent of the freshwater inflow along each of the three major coastal areas of the contiguous United States. The National Estuarine Inventory Data Atlas illustrates characteristics of estuaries identified in the NEI. Volume 1 of the Atlas describes physical and hydrologic characteristics, and Volume 2 describes land use characteristics. Among the estuaries identified in the NEI are the Hudson River and Raritan Bay. Additional, related projects are being conducted by NOAA within the NEI framework and are described below. Data from the NEI and related projects will be used to make comparisons, rankings, statistical correlations, and other analyses related to resource use, environmental quality, and economic value among estuaries.

National Coastal Pollutant Discharge Inventory (NCPDI)

The NCPDI is a data base and computational framework containing discharge estimates for all point, non-point, and riverine sources of pollutant discharges into the estuarine, coastal, and oceanic waters of the contiguous United States (excluding the Great Lakes). Pollutant discharge estimates cover a variety of contaminants including nutrients, metals, petroleum hydrocarbons, PCBs, chlorinated hydrocarbons, pesticides, fecal coliform bacteria, particulate matter, sludge, oxygen-demanding materials, and wastewater flow. The NCPDI will enable nationwide assessments of the impact of pollutant discharges into these waters under different assumptions about economic conditions, pollution control options, meteorologic and hydrologic conditions, and public policies. The NCPDI contains three components: the Gulf of Mexico; the east coast, including the Hudson/Raritan Estuary; and the west coast. NCPDI data for pollutant categories of interest such as nutrients and pesticides will be compiled for the estuaries of the NEI in 1987.

National Coastal Wetlands Data Base

NOAA is developing a national coastal wetlands data base through use of a systematic grid sampling procedure on wetland maps produced for the National Wetlands Inventory (NWI) of the U.S. Fish and Wildlife Service (FWS). Fifteen habitat types are recorded by 45 acre cells on 1:24,000 scale maps. Acreage estimates and color maps for one or several NWI maps can be produced. Grid sampled data can be intersected with digitized boundaries, such as counties and estuarine drainage areas as defined in the NEI, to produce acreage summaries and maps for specific units of interest. Approximately 3,300 of the 5,000 NWI maps required to complete coverage of the Nation's estuaries are currently available. Grid sampling of coastal wetlands for Maine through Connecticut, San Francisco Bay, Barnegat Bay, Albemarle Sound, and areas of Texas and Florida is completed. These data will be integrated into the NWI and used in conjunction with other information such as pollutant loadings, distribution of estuarine fishes and invertebrates, and the status of classified shellfish water to develop a national estuarine assessment capability. Prior to beginning this inventory, NOAA examined existing state and local wetland inventories and summarized the distribution of four wetland types -- salt marsh, fresh marsh, tidal flat, and swamp -- in coastal counties of 22 states, including New York and New Jersey. This work is described in a January 1986 NOAA report entitled An Inventory of Coastal Wetlands of the United States.

National Shellfish Register of Classified Estuarine Waters

This project compiles nationwide information on the classification of shellfishing areas by state. These areas are classified predominantly on the basis of coliform bacteria levels as approved, prohibited, conditionally approved, restricted, or nonshellfish/nonproductive. NOAA and the Food and Drug Administration jointly prepared the 1985 Shellfish Register, and NOAA has begun to analyze the data presented in the 1985 and previous Shellfish Registers. Classification data from 1971, 1975, 1980, and 1985 have been reorganized into the estuaries that comprise the NEI, including the Hudson/Raritan Estuary. The data also have been corrected for areas that were classified for reasons other than water quality. They are summarized in a December 1986 NOAA report entitled National Estuarine Inventory: Classified Shellfish Growing Waters by Estuary. NOAA, in cooperation with shellfish producing states, is now identifying the pollution sources of areas that are limited to the harvest of shellfish.

Living Marine Resources

NOAA is developing information on the distribution and abundance of living marine resources in the Nation's estuaries. The information will be developed for approximately 150 species and will initially be organized by the three salinity zones depicted for each estuary in Volume 1 of the National Estuarine Inventory Data Atlas plus additional estuaries of biological importance. The project is being conducted in

three phases: 1) the west coast; 2) the Gulf of Mexico; and 3) the east coast, including the Hudson/Raritan Estuary. The overall feasibility of the project is discussed in the NOAA report National Estuarine Inventory, Living Marine Resources Component, West Coast. The data for the Hudson River/Raritan Bay are scheduled to be available late in FY 88.

Shoreline Characterization

This NOAA project will develop information on shoreline characteristics for each of the estuaries of the contiguous United States identified in the NEI as part of an effort to develop a national estuarine assessment capability. The project identifies modified and unmodified shorelines, dredged channels, and dredged material disposal sites from NOAA nautical charts and estimates the relative extent of each in the estuaries identified in the NEI. Out of 751 miles of shoreline identified in the NEI for the Hudson/Raritan Estuary, 170 miles have been modified. These data will eventually be integrated into an estuarine classification scheme to explore relationships between estuarine habitats and their susceptibility to anthropogenic inputs to the estuarine environment.

Water Quality Screening Model

A generalized, water quality screening model "framework" was developed for application to estuarine systems included in the NEI. This model was designed to use available data and can be applied to most systems in a matter of days. The model is based on 8 years of experience with an oil spill simulation model developed by NOAA. It is a steady-state, two-dimensional formulation composed of a hydrodynamic component that estimates circulation based on system geometry, freshwater inflow, and tidal action and a water quality component that estimates pollutant concentrations based on advection and dispersion processes. The model has been applied to Pamlico and Albemarle Sounds, Breton Sound, Louisiana, and Long Island Sound and can be applied to the Hudson/Raritan Estuary.

Marine Environmental Data Archives and Information Referral Service

To assist with the identification and acquisition of data and information to meet user needs in the Northeast, NOAA maintains a staff person in Woods Hole, Massachusetts to work with local and regional users. This representative can provide information about marine science activities, personnel, data sets and sources pertinent to the Northeast, including the Hudson/Raritan Estuary.

NOAA collects and archives extensive data files for pollution, oceanographic, geophysical, climatic, and fisheries data for the coastal areas and nearshore waters of the Northeast region. Many of these data files are available to the public upon request and may be located through NOAA's National Environmental Data Referral Service (NEDRES).

NEDRES is a computer catalog of environmental information that describes and quantifies data sets by type, source, and location, and held at Federal, state, local, academic, and private sector locations. The NEDRES data base contains descriptions of several thousand NOAA and non-NOAA environmental data sets for the Northeast region of the U.S. that includes the Hudson/Raritan Bay area.

A significant amount of historical data acquired by NOAA and their contractors during the New York Bight Marine EcoSystem Analysis (MESA) Program and the Northeast Monitoring Program is maintained at the National Oceanographic Data Center. Data include a variety of physical, chemical, and biological data types. Products from these files include data tape copies, statistical summaries, and selected graphic displays. Numerous publications and reports have resulted from these two programs and are available upon request. A five-year summary report covering progress and a future plan was produced by the Northeast Monitoring Program. The report presented an assessment of environmental conditions for the Northeast shelf and coastal waters from Virginia to Maine including information on the New York Bight Apex. Areas where there was evidence of pollution and related effects were identified for water quality, sediments and bottom organisms, trace contaminants in tissues, and biological effects.

Hudson/Raritan Coastal Information System (CIS)

To provide a regional tool for assessing environmental conditions and related coastal activities in the Hudson River/Raritan Estuary area, NOAA's Ocean Pollution Data and Information Network (OPDIN) jointly funded (with the William H. Donner Foundation) the development of a personal-computer based CIS. The CIS permits managers and decision-makers to review a broad range of historical and current data and information files for the Hudson/Raritan area and generates tailored summaries and graphics using the commercially available Lotus 1-2-3 software. The system was completed in May 1985. Update capabilities are available for each file within the CIS.

B. Stock Assessment and Fisheries Statistics

Effective management of fisheries resources requires an understanding of the factors affecting the size and health of estuarine populations of finfish and shellfish. In the heavily populated Hudson/Raritan area, pollution has significantly impacted the reproductive success and recruitment of finfish and shellfish. An evaluation of the linkage between pollutant effects on individuals and on entire populations is one application of stock assessment research.

Comparison of Fishery Declines in Estuaries of the Northeast

For purposes of comparison, NOAA scientists examined the relationship between the level of pollution and the response of finfish and shellfish

stocks in five Northeastern estuaries. The Hudson/Raritan is one of these estuaries. Using historical data, hypotheses were developed to examine possible relationships between pollution and the health of local fisheries. This study concluded that for some species in some estuaries, after allowing for fishing pressure and climate, annual stock size trends are correlated with measures of human activities such as demographic trends, dredging activities, sewage inputs, and dissolved oxygen levels. An attempt now is being made to develop historical records of specific chemical discharges, and relate them to the fishing- and climate-corrected stock data.

Grants to States for Fisheries Work

NOAA has provided funds to New Jersey and New York under the Grant-In-Aid for Fisheries Program (P.L. 88-309/P.L. 89-304) since 1966. Currently, funds are being used by these states for studies that include investigations of assessments of estuarine shellfish resources and sanitary examination of shellfish lands, assessment of striped bass stocks, and run restoration for anadromous herring. Previous funding has been used for developing and implementing data processing programs for reporting and compiling commercial fisheries statistics.

C. Environmental Description

National Status and Trends Program (NS&T)

The NS&T program was initiated in 1984 to describe the current levels and trends of selected contaminants in fish, shellfish, sediments, and water at coastal sites around the country. It is the only national program to collect consistent information on contaminant levels and fish diseases throughout the Nation's coastal and estuarine environments using standardized quality assurance procedures. Products of the NS&T program will include research reports and a national data base that will aid in the prediction of trends in pollutant levels and their effects on living marine resources. The NS&T program's two major field sampling components, Benthic Surveillance and Mussel Watch, are described below. In order to have an historical baseline against which to measure the findings of these field sampling efforts, a data base is being compiled from historical studies on contaminants in coastal organisms.

Benthic Surveillance

For the Benthic Surveillance project, sediments and bottomfish are sampled at 50 sites around the country. Bottomfish were selected for sampling because of their close association with sediments, which tend to act as traps for contaminants entering coastal waters. Fish collected at selected sites -- including one site in Raritan Bay -- are analyzed for contaminants, including metals and organics, and are histologically examined for tissue abnormalities. Sediments are analyzed for metals, organic contaminants, total organic carbon, and grain size. This project began in 1984 and has continued with annual

sampling. Preliminary results show high levels of trace metals, PAHs, PCBs and DDT in sediments from the Hudson/Raritan Estuary, and that it falls within the top five estuaries in the Northeast for high levels of these contaminants. Highest levels of the sewage indicators Clostridium perfringens and coprostanol (a fecal sterol) for the Northeast region were found in sediments from the Hudson/Raritan Estuary and New York Bight Apex. A report, "National Status and Trends Program Progress Report and Preliminary Assessment of Findings of the Benthic Surveillance Project - 1984" was published in March 1987.

Mussel Watch

For the Mussel Watch component of NS&T, mussels (or other suitable bivalves) and sediments are analyzed for contaminant loads from 150 sites nationwide. Mussels were selected because of their sessile nature, and because they filter food and associated contaminants from the water column. In addition to contaminant loads, the bivalves are examined for visible and histopathological abnormalities. Three mussel watch sites in the Hudson/Raritan estuarine system -- upper Raritan Bay, Hudson River, lower Raritan Bay -- are sampled routinely. Two additional sites along the northern New Jersey coast in the New York Bight Apex are also sampled annually. These sites are influenced by the outflow from the Hudson/Raritan Estuary. Sampling results from 1984 showed the highest levels of pesticides, mercury, and lead in bivalves collected from the Hudson/Raritan Estuary and New York Bight Apex in the entire Northeast region. Cadmium, chromium, and PCBs were also found at elevated levels for bivalves from this area.

Environmental Chemistry Investigation

Because water discharge from the Hudson/Raritan Estuary impacts the New York Bight Apex and the New Jersey coast, NOAA conducts cruises off Long Branch, New Jersey to investigate contributions of the estuarine derived waters to eutrophication processes and hypoxia. NOAA also monitors the abundance, distribution, sources, fates, and biological effects of key contaminants, biostimulants, and phytoplankton. The purpose is to construct comprehensive baselines in order to help ensure sustained optimal yields of the fisheries.

Coastal Dynamics

Along with environmental chemistry investigations, NOAA monitors temporal and spatial changes of selected indicators of ecosystem energy flow, alga bioassays, and phytoplankton community structure from Raritan Bay and the New York Bight Apex. Remote sensing is used in this study to map and monitor coastal wetlands and define water management units and changes over time. The project is giving particular attention to documenting and assessing the extent and severity of eutrophication in coastal waters and the impacts of ocean disposal on the marine ecosystems. NOAA is also monitoring the ecological recovery of the 12-mile dumpsite (sludge dumpsite for New York City) using seabed metabolism as an indicator of the health of the impacted area.

Charting, Tide Gauge, and Hydrographic Work

NOAA has been charting coastal and oceanic waters since 1884, providing an invaluable and essential service to mariners. The Hudson/Raritan Estuary is covered by several Charting and Geodetic Service nautical charts as well as by bathymetric and topographic/bathymetric maps. The location of wrecks and obstructions is updated periodically with wire drag and sidescan sonar surveys. Another product used by Hudson/Raritan mariners is the Coast Pilot (Cape Cod to Sandy Hook), which provides information on ports and harbors and their facilities. Occasionally, special projects are undertaken, including a planned shoreline mapping project for the Hudson/Raritan Estuary, as described above.

To provide information on tidal levels essential to the mariner, a network of three tide gauges is being operated in the Hudson/Raritan Estuary; the gauges are located at Sandy Hook, North Battery, and Bergan Point. Data collected by these tide gauges are used to produce an annual report: Tide Tables, East Coast of North and South America.

III. ESTUARINE RESEARCH

The review and synthesis of data gathered in the characterization phase help to identify areas where additional research is needed to support management decisions. NOAA's research activities in the Hudson/Raritan Estuary emphasize the health of local finfish and shellfish populations and physical processes.

Some of the projects described below are conducted by NOAA scientists, and some are conducted by academic researchers through NOAA's National Sea Grant College Program. The latter are referred to below as NOAA funded scientists.

Federal Survey of PCBs in Atlantic Coast Bluefish

PCBs are a major problem in finfish and appear to be increasing in fish caught along the Atlantic seaboard. In response to this, Congress requested NOAA scientists to conduct a study on the levels of PCBs in bluefish along the east coast of the United States. Young bluefish spawned in spring spend their first summer in estuaries of the New York Bight including the Hudson/Raritan Estuary. The Hudson/Raritan is known to be highly contaminated with PCBs. This research program was therefore conducted to determine the nature and scope of the problem and any associated health risks. The study was coordinated by NOAA in cooperation with the Food and Drug Administration and the Environmental Protection Agency. An Operations Manual was produced in October 1984 to serve as a guide in the conduct of the survey and also as a blueprint for future surveys of contaminants in fish. A data report was provided to Congress and the states in June 1986 and a final interpretive report in December 1986.

Behavior of Marine Fishes and Invertebrates

NOAA scientists are conducting studies to define critical life habits, habitat requirements, and effects of environmental perturbations on coastal and estuarine organisms. The studies include: looking at effects of oiled sediments on burrowing, emergence, and feeding of selected infaunal invertebrates; effects of cadmium-contaminated sediments on behavior and bioaccumulation in polychaetes; seasonal changes in activity, growth, and feeding of adult bluefish; feeding ecology and habitat utilization of juvenile bluefish, habitat requirements of young flounder; and behavioral responses of red hake to hypoxia.

Fish Community Structure in the Hudson River National Estuarine Reserve (NER)

NOAA has designated estuarine and marine sanctuaries around the country to preserve and maintain a natural environment for recreation and research and monitoring studies. There is one such sanctuary on the Hudson River. NOAA is funding a study to gather quantitative data on the occurrence and abundance of fishes found in the Hudson River NES. Data from this project will provide the sanctuary manager with information on the relation of fresh-tidal marshes to the Hudson River fish fauna and thus, direct management and research. Moreover, these baseline data will be made available for comparison with research on other systems and future changes in the estuary.

Viral Content and Filtration Rates in the Hard Clam *Mercenaria mercenaria* at a Commercial Depuration Facility

In lower Raritan Bay where shellfish areas are closed to fishing, this project was established in direct response to an immediate problem identified by the New Jersey Sea Grant Extension Service concerning the ongoing depuration of hard clams. If hard clams taken from marginally polluted waters in New Jersey can be effectively depurated of viruses and coliform bacteria, approximately 26,000 acres of currently condemned waters could be harvested. NOAA-funded scientists will determine whether commercial depuration is able to reduce or eliminate enterovirus contamination of *Mercenaria mercenaria*, and will identify those physical and chemical parameters that can be manipulated to maximize viral depuration efficiency.

Chemico-biological Interactions between Fish and Treated Municipal Wastewater

Treated wastewater from municipal sewage plants (TMW) is a major source of pollution in the Hudson/Raritan system. NOAA-funded scientists are conducting research on what impact TMW has on pelagic and demersal fish (winter flounder and striped bass) in the Hudson estuary. Embryos and juveniles from the New York Harbor and from a reference site will be compared for responses to TMW and its fractions. Sublethal levels of

TMW will be used to test whether resident populations have developed tolerance or stress at these sensitive life stages to the pollutants found in the field studies.

The TMW to be studied is the largest input of its kind from New Jersey into the Hudson estuary, and contains an estimated 25 percent industrial component. TMW supplies 90 percent of point-source input volume and 98 percent of pollutants to the New York Harbor, which is the wintering and/or spawning ground for significant populations of several species of finfish of economic and recreational value. This study will provide an understanding of the impact of treated municipal wastewater on fish and how rapidly fish recover once wastewater input is modified or stopped. Knowledge will be gained concerning which TMW components are actually absorbed and have biological effects. Although the study has obvious relevance for the Hudson/Raritan Estuary, the results will be important to understanding the impact of TMW throughout the United States.

Impact of Reducing Phosphorous Loads from Domestic Wastewaters on New Jersey Coastal Algal-Related Water Quality

Recreation and tourism are leading industries in the New Jersey and New York areas. The nearshore coastal waters of New Jersey are experiencing excessive blooms of algae which interfere with the recreational use of these waters and, in some years, lead to the massive die-offs of shellfish. An evaluation has not been made of the potential benefits to water quality that could be achieved by limiting the phosphorous discharged to the waters from domestic wastewaters. This will be a pilot project conducted by NOAA-funded scientists to begin to make these evaluations and to consider the economic aspects of phosphorous control and the benefits that would result from such control. The study will provide information on the following: 1) Determine potential benefits of removal of 90 percent of the phosphorous in domestic wastewater effluents in New York and New Jersey on excessive fertilization in the Hudson/Raritan Estuary and the New Jersey nearshore waters of the New York Bight; 2) Assess the current nitrogen and phosphorous sources for these waters; 3) Quantify the nutrient load -- algal biomass response relationships for these waters and evaluate the impact of altering phosphorus loads on algal biomass related water quality using load-response models; 4) Evaluate use of remote sensing for assessing planktonic algal chlorophyll in nearshore waters; and 5) Evaluate the socioeconomic impact of excessive algal biomass on recreational uses and commercial fisheries in these waters.

Past and Present Distributions of Soft Clams, *Mya arenaria* and Eelgrass, *Zostera marina*, in Raritan Bay

A study was conducted by NOAA scientists to compare the distributions of soft clams, *Mya arenaria*, and eelgrass, *Zostera marina*, prior to the mid-1930s and the present. The results showed that soft clams were abundant on intertidal flats along the New Jersey shore of Raritan Bay

and in Great Kills Harbor, New York. They are now scarce except in areas where the sand is mixed with gravel or roots. Eelgrass was also found to be abundant in the shallow areas from the same region, but now occurs only in a small cove in Sandy Hook Bay. This is a significant study showing a decline in a commercial fishery and an alteration in habitat.

Benthic Macrofauna of Raritan and Lower New York Bays

NOAA scientists conducted an assessment of the benthic macrofauna of the Raritan Estuary and lower New York Bays previously reported to have been severely impacted by pollution. New and previously unused data from a 1973-74 survey were used. Preliminary assessments of community structure indicate diversity and biomass levels similar to other estuaries of the Middle Atlantic Region. This suggests that perhaps the benthic environment may not be as degraded as previously reported. The scientists report, however, that long-term population dynamics data are needed to properly assess the environmental status and trends.

Effects of Elevated Sulfide on Densities of Benthic Invertebrates

In the marine environment, sediments with anoxic subsurface layers contain hydrogen sulfide. This can be produced under naturally occurring anaerobic conditions by bacteria or from sewage sludge being deposited on surface sediments. Distinct invertebrate communities are found to be associated with sulfidic surface sediments and are different from those in oxygenated environments.

In a laboratory study conducted by NOAA scientists to determine settlement densities of selected invertebrates on sulfide-treated sand and untreated sand were compared. Larvae from different species showed preferences for treated or untreated sand. The results of the study showed that the response to sulfide by the settling larvae initiated the formation of distinct, yet not exclusive, invertebrate communities.

Seafood Science

In addition to work on the biology and ecology of living marine resources, NOAA is funding studies that consider these resources as seafood. One such study conducted by NOAA funded scientists is examining the effects of various methods of trimming and cooking striped bass on flavor and reduction of PCB residues. Another project, also being investigated by NOAA-funded scientists, is studying by-product recovery and improved technologies for seafood handlers and processors. An accomplishment of this investigation was the isolation of two proteinases from surf clam bellies. The enzymes were shown to be useful in cheese production and in tenderizing red meat.

IV. COASTAL ZONE ESTUARINE MANAGEMENT

NOAA's programs and activities encourage wise management of the Nation's estuarine resources. NOAA administers programs and grants that help

manage the Nation's marine fisheries, protect valuable marine and estuarine habitats, and balance coastal development and conservation activities. NOAA also provides expertise to Federal and state agencies that have management or decision-making responsibilities for coastal resources.

Marine Advisory Service on Fisheries and Marine Interests

Sea Grant operates a Marine Advisory service for commercial, charter boat, and recreational fishermen and other marine interests that is directed toward education, improvement of harvesting methods, increased efficiency, and savings in operating expenses. In addition, commercial fishermen are advised on seafood marketing techniques and development of under-utilized species. Other programs relate to developing coastal resources and businesses in an economically and ecologically acceptable manner.

Contaminants Management

Dredged Material Investigations

Guidelines are needed to help state and Federal managers to evaluate and formulate spoil disposal plans and compare the relative merits of alternatives for development of dredge spoil mounds. Barrow pits in the lower New York harbor are being investigated as a place to dispose of contaminated dredged material. In several studies, NOAA-funded scientists are investigating the potential for capping these contaminated dredged materials with clean aggregates such as sand. Analyses indicate that a sand cap over fine-grained dredged material should be mechanically stable. Such results can be developed into methods for assessing the short- and long-term mass stability of mounds subjected to spoil accumulation and storm wave loading. These results will be integrated into recommendations, guidelines, and methods that can be applied to making rational decisions with regard to dredging operations and disposal.

Risk, Information, and the Development of Marine Resources

NOAA funded scientists are assessing the risks associated with disposal of sewage sludge at sea. A model is being developed to identify the costs of development to individuals and the likelihood of environmental damage caused by ocean dumping of sewage sludge. The work will focus on the trade-offs between land-based and distant offshore disposal. This is particularly important to the Hudson/Raritan Estuary where a major pollutant to the estuary is the input of sludge. The cost-effectiveness of a number of approaches to improving water quality in the inner New York Bight will aid coastal managers in resource decision-making.

V. PUBLIC/PRIVATE PARTNERSHIP IN ESTUARINE RESEARCH

NOAA actively works with state governments and private institutions to support estuarine research. Three such projects are listed below.

Multiple Low-Cost Projects

This project establishes a research program of multiple low-cost projects for a variety of research institutions to participate in. The development of this program depends on establishing a public/private partnership between the New York Department of Environmental Conservation and the Hudson River Foundation to support the program and develop jointly a research agenda which combines the interests of these and other institutions, foundations, and agencies.

Tibor T. Polgar Fellowship Program

NOAA provides funds through the Hudson River Foundation to the State of New York for graduate and undergraduate students to do research on marshes, shallows, and shorelines of the Hudson River for management purposes. These funds are in honor of Tibor T. Polgar. Through this program, NOAA and the Foundation will develop important information on estuaries and train students in riverine/estuarine studies.

Special Student Research Projects

NOAA, through Sea Grant, in the State of New Jersey provides aid to students to conduct research in marine affairs, including estuarine research. One such study, on trace metal transport, pollution, and estuarine flocculation in the Raritan River, won the Sea Grant scientific award for outstanding research in 1984.

VI. CONCLUSION

The Hudson/Raritan Estuary and New York Bight Apex is of national importance serving as the Nation's number one port for commerce. These waters also serve the area as a repository for industrial wastes, sewage, and dredged material disposal with degradation effects on all aspects of the estuary, particularly declines in living marine resources and recreational activities. Because of this NOAA maintains an active role in characterization and research to provide environmental managers with information for wise decision-making regarding estuarine activities. Also NOAA will review its ongoing programs, identify those important in addressing issues raised regarding estuaries, and recommend programs to better understand and manage the resources of the estuary.

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