



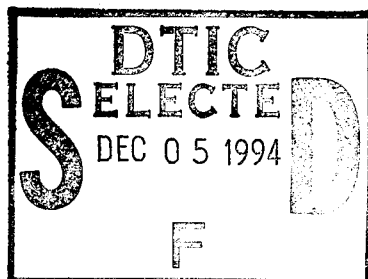
US Army Corps
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Waterways Experiment
Station

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October 1994

New York Bight Study

An Annotated Bibliography of the New York Bight: Emphasis on Biological Studies

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New York Bight Study

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by U.S. Army Corps of Engineers
Waterways Experiment Station
3909 Halls Ferry Road
Vicksburg, MS 39180-6199

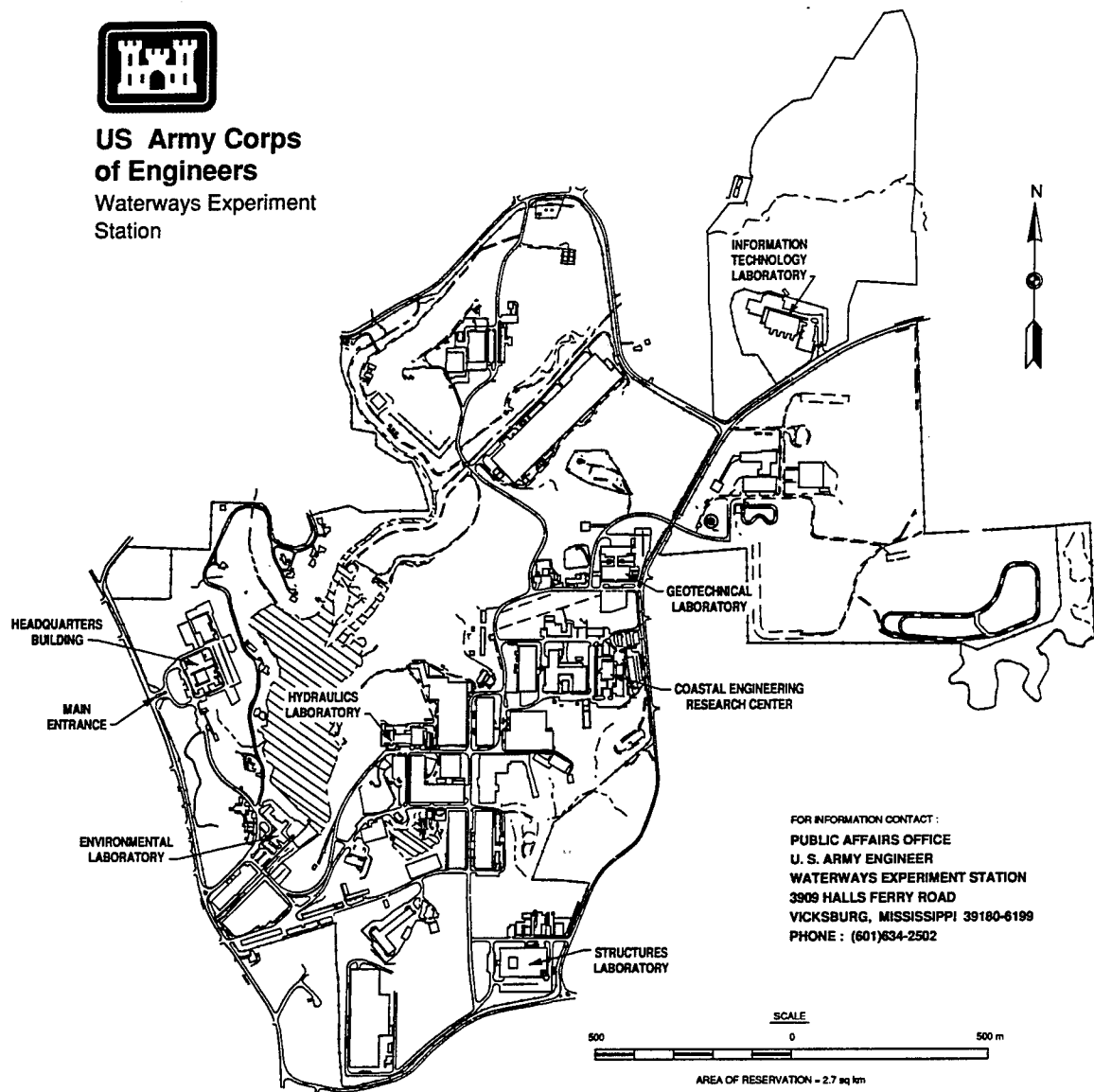
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Preface

The New York Bight Biological Review Program (BBRP) was one portion of a larger effort to determine the feasibility of various modeling and monitoring strategies for measuring effects from pollution in the NY Bight. The specific goal of the BBRP was to identify the information gaps that need to be filled in order to efficiently examine impacts to marine biological resources from large-scale projects within the Bight. The early stages of the BBRP involved searching various databases for published studies about the Bight. Results of these searches were compiled in an annotated bibliography to facilitate preparation of the final BBRP report and various working documents during the 2-year effort of the BBRP. The BBRP focused on potential biological impacts, so the bibliography primarily has a biological focus. There are 579 entries; most related to the hypoxia event observed during 1976 or the Marine Ecosystems and Analysis Program (MESA) conducted by the NY Sea Grant Program and the National Oceanic and Atmospheric Administration (NOAA) (Figure 1). A cross-referenced keyword index is provided at the end to facilitate use. Copies in electronic format are available upon request.

The U.S. Army Engineer Waterways Experiment Station (WES) gratefully acknowledges the direction and assistance of Mr. Robert Will, Mr. John Tavoraro, Ms. Patricia Barnwell-Pechko, Mr. Bryce Wisemiller, Mr. Leonard Houston, and Mr. Brian May (CENAN). Several people helped compile the bibliography, most notably Ms. Virginia Ledbetter, Ms. Darla Muirhead, Ms. Melissa Ashley, and the staff of the WES research library. Their work was directed by Dr. Pace Wilber.

General supervision was provided by Dr. John Keeley, Director of the WES Environmental Laboratory (EL). Direct supervision was provided by Mr. H. Lee Butler, Chief, Research Division, Coastal Engineering Research Center, WES, who also served as the overall project manager. Additional supervision was provided by Dr. C.J. Kirby, Chief, Ecological Research Division, EL, and Mr. E. J. Pullen, Chief, Coastal Ecology Branch (EL).

At the time of publication of this report, Dr. Robert W. Whalin was Director of WES. COL Bruce K. Howard, EN, was Commander.

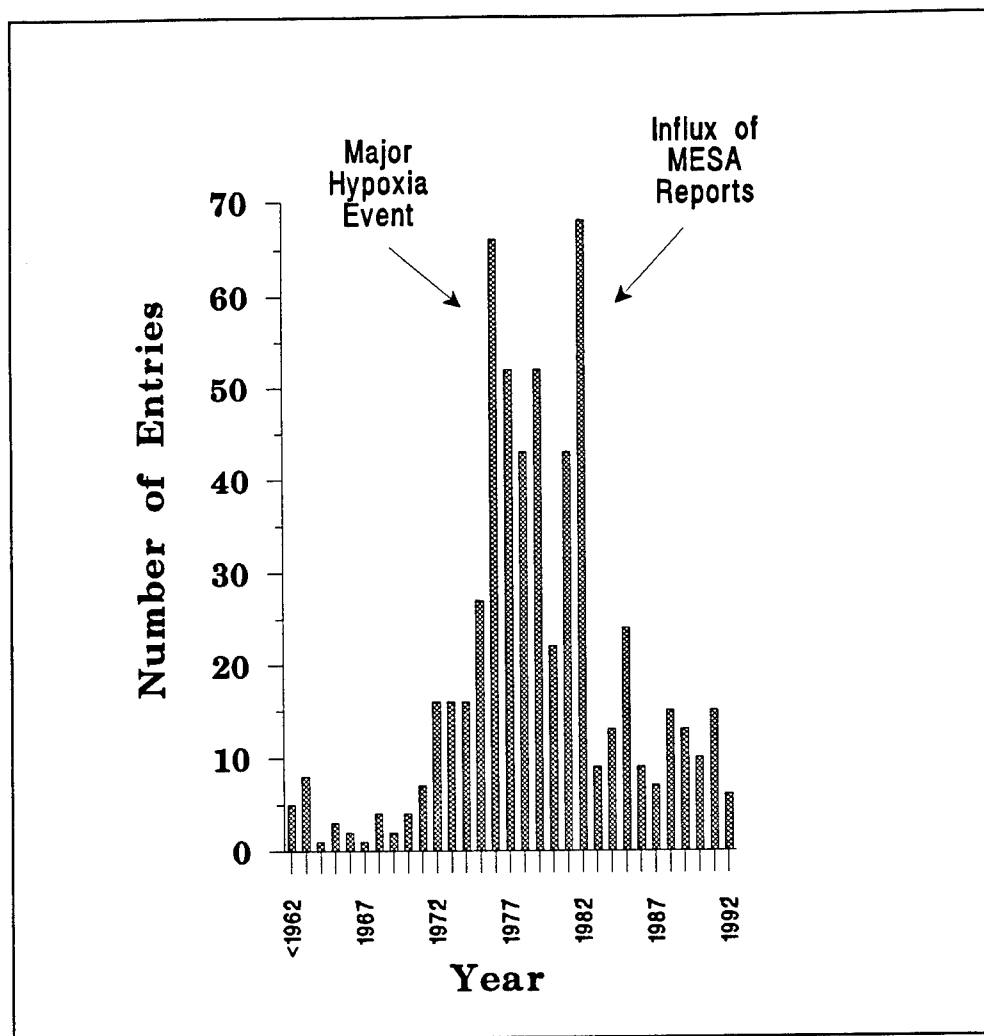


Figure 1. Entries in the bibliography by year

ACHREM, T.J. 1973. OCEAN WASTE DISPOSAL IN THE NEW YORK BIGHT. REPORT NO.: IEC-4460CI559; DLMA-82-71-24-2, 129 pp. The report is an extract from a comprehensive study on ocean waste disposal in selected geographic areas. Its purpose was to provide information to assist in the development of criteria for the control of ocean waste disposal. An intensive field survey was conducted in the New York City metropolitan region during the spring of 1973. The purpose was to establish personal contact with agencies and persons cognizant of ocean disposal practices in the New York Bight. This report presents the findings of that survey. It includes specific sections on ocean dump site characteristics, their geographic location, type and volume of material dumped, method of disposal, description of disposal sites, current monitoring procedures, local regulating agencies, estuarine economics, an extensive chronology of related major events, and alternatives and recommendations for ocean disposal in the New York Bight.

Keywords: Management, Ocean disposal

ALEVRAS, R.A.; EDWARDS, S.J. 1985. USE OF REEF-LIKE STRUCTURES TO MITIGATE HABITAT LOSS IN AN ESTUARINE ENVIRONMENT. BULL MAR SCI 37(1):396. The proposed Westway Project will fill approximately 200 acres and alter an additional 69 acres of aquatic habitat while replacing abandoned shipping facilities. The project will include a 2.5-mile rock rip-rap wall extending to a depth of 40 ft in the Hudson River on the west shore of Manhattan Island. As part of the application for a dredge-and-fill permit, a plan has been developed to incorporate reef concepts into the project to maximize aquatic habitat values and to mitigate in part for the loss of overwintering habitat for striped bass. The rock wall which retains the fill has been reshaped to increase the amount of surface area at depths preferred by striped bass for overwintering. The size of the quarry rock on the outer surface of the wall has been increased over the original design to increase the size of interstitial spaces. Underwater jetties will extend into the river to create low velocity areas near the bottom and a variety of structural fish attractors will be placed along the wall. Fishing piers will be integrated into the planned structural elements. The plan for these mitigation activities is evolving through combined physical, biological, and engineering studies. One element of these investigations was a study of fish association adjacent to and within pier structures. Trawling was conducted through the interpier basins while gill nets and trap nets were deployed adjacent to and within the pier structures. During the period January-March fish were found near the bottom and in higher densities in the deeper quiescent areas, primarily the deeper interpier basins. Higher densities of striped bass were found adjacent to the piers located in shallow water during high tides than at low tides. The program of studies includes prototype testing of a variety of concepts during the first stage of construction in an overall 10-year construction period. The findings of the studies of habitat utilization will be incorporated into the design of the prototype mitigation area.

Keywords: Artificial reefs, Estuaries, Fish-Morone

ALEXANDER, J.E.; ALEXANDER, E.C. 1977. CHEMICAL PROPERTIES. MESA NEW YORK BIGHT ATLAS MONOGRAPH 2, 47 pp. Knowledge of the chemical properties of New York Bight is limited due to lack of research. Temperature-salinity relationships indicate a two-layered system in summer and a vertically homogeneous system in winter. The pH of Bight waters generally ranges between 7.6 and 8.4. Average calcium, magnesium, potassium, strontium/chlorinity ratios are usually lower than those found in the open North Atlantic. Trace metal data indicate that more study is needed, especially for cadmium, copper, lead, and zinc. Dissolved oxygen concentrations of surface waters are commonly at or near saturation. Subsurface dissolved oxygen concentrations vary diurnally and seasonally; low subsurface values are attributed to chemical and biological oxygen demand. Concentrations of micro-nutrients, nitrogen, phosphorus, and silica reflect responses to phytoplankton growth, pollution, and regional variation. No significant radioactivity was found.

Keywords: Monitoring-MESA, Plankton, Reviews-Chemical

ALI, S.A.; GRANT, M.G.; KISHPAUGH, J.R.L. 1975. CLUSTER ANALYSIS OF MARINE SEDIMENTS AND WASTE DEPOSITS IN NEW YORK BIGHT. ENVIR GEOL 1(3):143-148. Cluster analysis of some chemical characteristics of marine sediments and associated waste deposits in the New York Bight reveals the existence of four cluster facies. Cluster facies I is the sediment containing dredged wastes from New York Harbor. Cluster facies II is the widespread sand and gravel deposit of the continental shelf. Cluster facies III is the finer-grained material in the Hudson Channel and the material accumulated in the sewage sludge disposal area. Cluster facies IV is not easily defined; it may correspond to some relic sedimentary feature in the area.

Keywords: Hudson Shelf Valley, Miscellaneous-Geological

ALI, S.J.JR; BRADFORD, M.J.; PEACE, G.E. 1977. MERCURY IN NORTH ATLANTIC LOBSTER OF THE NEW YORK BIGHT USA. PROC PA ACAD SCI 51(1):26-28.

Keywords: Benthos-*Homarus*, Pollutants-Bioaccumulation, Pollutants-Metals

ANDERSON, J.W. 1982. THE TRANSPORT OF PETROLEUM HYDROCARBONS FROM SEDIMENTS TO BENTHOS AND THE POTENTIAL EFFECTS. IN: ECOLOGICAL STRESS AND THE NEW YORK BIGHT: SCIENCE AND MANAGEMENT. PROCEEDINGS OF A SYMPOSIUM ON THE ECOLOGICAL EFFECTS OF ENVIRONMENTAL STRESS, NEW YORK, NY, JUNE 10-15, 1979, G.F. MAYER, (ED.), ESTUARINE RESEARCH FEDERATION, COLUMBIA, SC, pp. 165-180. Polynuclear aromatic hydrocarbons (PAH) enter the New York Bight region from multiple sources. Sewage sludge and bottom sediments collected from the Bight contain significant amounts (50-500 ppb) of various PAH components, while sediments

from the area slated for dredging may contain very high levels (1-120 ppm). Whereas the surface microlayer in the Bight was relatively free of petroleum hydrocarbons, plankton contained 30-200 ppb of 2- and 3-ring aromatics. Fish and lobster flesh and mackerel liver contained relatively low levels of PAH. The detoxification organs of flounder and lobster contained the highest amounts of PAH, and lobster digestive glands possessed contaminants in the full range of those detected (2- to 5- ring aromatics). Blue mussels exhibited contamination intermediate to the flesh and livers of fish and lobster. Possible routes of entry into marine species by PAH components are discussed. The implications of these data regarding tainting of food species and impacts on benthic biota from PAH and other pollutants are considered.

Keywords: Pollutants-Bioaccumulation, Pollutants-Organic, Pollutants-Sediment

ANONYMOUS. 1981. ANNUAL NEMP REPORT ON THE HEALTH OF THE NORTHEAST COASTAL WATERS OF THE UNITED STATES, 1980. NOAA TECH MEMO. PUBL: NOAA/NMFS, WOODS HOLE, MA, 1981, 127 pp. During the past year, the Northeast Monitoring Program (NEMP) has conducted assessment and monitoring activities to document the status of health of the living resources and their habitats on the continental shelf off the northeast coast. One of the principal findings of the program was that many of the fishery resources of the western North Atlantic are contaminated with petroleum hydrocarbons and PCBs. Species occurring over a wide range, from the coastal waters of the New York Bight Apex to the outer continental shelf-slope break, showed unexpected high levels of these contaminants. It is also indicated that the seaward extent of pollution may be greater than earlier expected. Evidence points to severe coastal eutrophication in waters of the Middle Atlantic Bight. Outflow plumes from major estuaries such as Chesapeake Bay, Delaware Bay, and the Raritan/Hudson River complex carry particulates and adsorbed contaminants out to the continental shelf. Preliminary results suggest that greater emphasis should be placed on investigation of seaward flowing estuarine plumes and their effects on living resources.

Keywords: Estuaries, Monitoring-NEMP, Pollutants-Organic

ANONYMOUS. 1971. ARTIFICIAL REEFS ATTRACT FISH. COMMER FISH REV 33(9):6-7. Brief general review and description of tire-unit design is presented.

Keywords: Artificial reefs

ANONYMOUS. 1973. MAINTENANCE OF BUTTERMILK CHANNEL, NEW YORK. U.S. ARMY ENGINEER DISTRICT, NEW YORK. REPORT NO.: ERL73-1872, 43 pp. The proposal concerns maintenance dredging of Buttermilk Channel to authorized Federal Project dimensions. Disposal of the excavated material would be in the approved dumping ground in the New York

Bight. Impacts include excavation and disposal of 500,000 cubic yards of bottom materials in order to maintain the economy of commodity transportation and safety in navigation. Adverse environmental effects include construction disturbance due to disruption of the channel bottom on associated life and generation of turbidity and disposal of excavated material at the already degraded, approved dumping area in the New York Bight.

Keywords: Ocean disposal-Dredged material

ANONYMOUS. 1973. OCEAN WASTE DISPOSAL IN SELECTED GEOGRAPHIC AREAS. REPORT NO.: IEC4460CI54I, 349 pp. The report presents the results of an intensive fact finding survey of ocean waste disposal practices in six geographic areas. The areas were the New York Bight; Charleston, South Carolina; segments of the Gulf of Mexico Coast; Southern California; San Francisco; and Pudget Sound. Ocean Disposal sites within these areas were selected to provide a representative cross section of ocean waste disposal practices in the United States. Concurrent with a field survey and personal interview program, detailed data and information research was performed. The sum of the information obtained by this coordinated program was used to establish a data base which will be used to recommend guidelines for the control of ocean waste disposal.

Keywords: Management, Ocean disposal

ANONYMOUS. 1974. BIBLIOGRAPHY OF THE NEW YORK BIGHT. PART 1 - LIST OF CITATIONS. REPORT NO.: NOAA-74041009-1, 194 pp. The New York Bight extends from Montauk Point, Long Island, to Cape May, New Jersey, and from the coastline to the edge of the Continental Shelf. This bibliography includes literature on maritime law, administration, air pollution, meteorology, solid waste management, and navigation. It also includes literature of Long Island Sound and the hydrology and regional geology of the New York-New Jersey coastal zone. The bibliography consists of two parts; a list of citation of published information and a set of indexes (separately bound). Specific subjects covered are: aquatic biology; oceanography; meteorology and climatology; geology; law; administration; sociology; air, water, solid waste and thermal pollution; industries; energy; mineral extraction; transportation; fisheries and recreation.

Keywords: Bibliographies

ANONYMOUS. 1974. BIBLIOGRAPHY OF THE NEW YORK BIGHT. PART 2- INDEXES. REPORT NO.: NOAA-74041009-2, 495 pp. The New York Bight extends from Montauk Point, Long Island to Cape May, New Jersey, and from the coastline to the edge of the Continental Shelf. This bibliography includes literature on maritime law, administration, air pollution, meteorology, solid waste management, and navigation. It also includes literature of Long Island

Sound and the hydrology and regional geology of the New York-New Jersey coastal zone. The bibliography consists of two parts: a set of indexes and a list of citations of published information (separately bound). Specific subjects covered are: aquatic biology; oceanography; meteorology and climatology; geology; law; administration; sociology; air, water, solid waste and thermal pollution; industries; energy; mineral extraction; transportation; fisheries and recreation.

Keywords: Bibliographies

ANONYMOUS. 1975. ANNUAL SUMMARY OF RESEARCH RESULTS FOR FISCAL YEAR 1974, MESA NEW YORK BIGHT PROJECT, APPENDIX A. NOAA TM ERL MESA-2-APP-A; NOAA-7511702, 22 pp. The report is the first annual summary of research results of the National Oceanic and Atmospheric Administration's (NOAA) Marine EcoSystems Analysis (MESA) Program New York Bight Project. It summarizes the scientific, technical and engineering accomplishments of the project during fiscal year 1974 (FY74), and the last quarter of FY73. Research results are presented in a classical discipline orientation; physical, chemical, biological and geological research efforts are discussed in some detail, including significant data and results.

Keywords: Monitoring-MESA

ANONYMOUS. 1975. OCEANOGRAPHIC STUDIES TO ASSESS THE ENVIRONMENTAL IMPLICATIONS OF OFFSHORE SITING OF ELECTRIC GENERATING FACILITIES-NEW YORK FIELD STUDIES - 1973-1974. REPORT NO.: NYSERDA-75/15, 466 pp. Physical, chemical and biological data were collected concurrently over an 800-square-mile area of the New York Bight, south of Long Island, during the period November 1973 to October 1974. The objectives of the study were to determine significant differences within the study area that might affect the suitability of siting an offshore power plant and to characterize the physical, chemical, and biological conditions and processes in the study area.

Keywords: Miscellaneous

ANONYMOUS. 1976. DUMPING SEWAGE SLUDGE IN THE OCEAN. ENVIRON SCI TECHNOL 10(6):530-531. A short time after sewage sludge is dumped at the designated New York Bight site, there is very little evidence that the sludge was ever dumped there. To be sure, organic material-rich muds are detected, but they may be composed partly of dredged material (DM), or even material of natural origin, as well as sewage sludge. Most of this material is found to the north and west of the sewage sludge dump site, in a topographic depression at the head of the Hudson Shelf Valley. Sewage sludge at the New York Bight Apex site consists of about 5% solids and 95% water. Its density is less than that of water. The material does not sink as a unit; rather, it fractionates and is distributed throughout the water column, rapidly losing its density. For this

reason alone, the dark blob will be found only in scare stories. Another reason is the dumped sewage sludge is carried off by currents and eddied about.

Keywords: Christiaensen Basin, Ocean disposal-12 mile

ANONYMOUS. 1976. EVALUATION OF PROPOSED SEWAGE SLUDGE DUMPSITE AREAS IN THE NEW YORK BIGHT. NOAA TM ERL MESA-11; NOAA-76031225, 219 pp. The sections summarize significant features of the New York Bight's midshelf environment and alternative sewage sludge dumpsite areas 1-A and 2-A, draws applicable conclusions about the effect of dumping sewage sludge at any interim dumpsite in this environment, and presents specific recommendations relative to dumping operations and monitoring activities.

Keywords: Management, Ocean disposal-Sewage sludge

ANONYMOUS. 1977. BASELINE REPORT OF ENVIRONMENTAL CONDITIONS IN DEEPWATER DUMPSITE 106. VOLUME I: PHYSICAL CHARACTERISTICS. NOAA DUMPSITE EVALUATION REPORT 77-1 JUN 1977, 231 pp. The results of field studies conducted by NOAA in and about the Deepwater Dumpsite 106 (DWD-106), approximately 106 nautical miles from Ambrose Lightship and 90 nautical miles due east of Cape Henlopen, Delaware, are given in this baseline report for the purpose of characterizing the site's environment and biota. The Baseline Report is divided into three sections: Physical Characteristics (volume 1), Biological Characteristics (volume 2), and Contaminant Inputs and Chemical Characteristics (volume 3). An Appendix, containing results too detailed for the main body of the report is included in volume 3. Characterization results are chiefly from three baseline cruises, but also from data obtained during two summer 1976 experimental cruises, as well as from National Marine Fisheries Service sources. This volume contains the following studies: Deepwater Dumpsite 106; bathymetry and bottom morphology; six dives to the lower continental slope and upper continental rise southwest of Hudson Canyon; geological aspects; general physical oceanography of Deepwater Dumpsite 106; physical oceanography of Deepwater Dumpsite 106; update July 1975 physical oceanography of Deepwater Dumpsite 106; February-March 1976 climatic study of New York Bight.

Keywords: Miscellaneous-Physical, Ocean disposal-106 mile

ANONYMOUS. 1977. BASELINE REPORT OF ENVIRONMENTAL CONDITIONS IN DEEPWATER DUMPSITE 106. VOLUME II. BIOLOGICAL CHARACTERISTICS. REPORT NO.: NOAA-DUMPSITE EVALUATION-77-1-VOL-2; NOAA-77092202, 270 pp. Biological data obtained on the baseline cruises provided limited quantitative coverage of the region. However, when considered along with other available data, this sufficed to provide a qualitative biological overview of the region. A complete picture is not yet available and distinguishing dumping effects from natural variations will

continue to be a problem. This volume contains the following studies: Phytoplankton in the vicinity of DWD-106; DWD-106- Zooplankton studies; Gelatinous zooplankton at Deepwater Dumpsite 106; Apex predators in DWD-106; Distribution and abundance of mesopelagic fishes on cruises 2 and 3 at DWD-106; Observations from DSRV ALVIN on populations of benthic fishes and selected larger invertebrates in and near DWD-106; Epibenthic invertebrates; Epifaunal megabenthos in DWD-106; Final report on benthic infauna of DWD-106 and adjacent areas; and Neuston fish at DWD-106.

Keywords: Benthos, Fish, Ocean disposal-106 mile, Plankton

ANONYMOUS. 1977. BASELINE REPORT OF ENVIRONMENTAL CONDITIONS IN DEEPWATER DUMPSITE 106. VOLUME III. CONTAMINANT INPUTS AND CHEMICAL CHARACTERISTICS-APPENDIX. REPORT NO.: NOAA-DUMPSITE EVALUATION -77-VOL-3; NOAA-77092203, 300 pp. Because of the importance of possible heavy metal contamination, considerable emphasis was placed on measuring concentrations of a variety of metals in the water column and in key organisms. Although it does not seem that the addition of contaminants at DWD-106 is having an observable effect on the water column, the possibility of concentration in the food chain must be considered, particularly for heavy metals such as mercury. This volume contains the following studies: a summary of the input of industrial waste chemicals at DWD-106 during 1974 and 1975, and results of studies on the distribution of some transition and heavy metals at DWD-106. Ten appendices containing detailed data are also included.

Keywords: Ocean disposal-106 mile, Pollutants-Bioaccumulation, Pollutants-Metals

ANONYMOUS. 1977. NEW YORK BIGHT PROJECT ANNUAL REPORT FOR FY 1976-76T. NOA, TECH MEMO ERL MESA 105 pp. Research efforts sponsored by the Marine Ecosystems Analysis (MESA) New York Bight Project and reviews of significant technical, operational, and administrative achievements during the period are summarized. The report provides information to the U.S. Congress and to the Office of Management and Budget on the use of funds allocated for research into ocean dumping and marine ecosystems analysis. The report is used as a management tool by the MESA Program Office, by administrators of the Environmental Research Laboratories, and by the NOAA Facilities. Research results provide data on inventory studies and dynamic studies, with geological, physical and chemical oceanography, and health-related investigations discussed for both. Effects studied include data on effects of chemical pollutants on phytoplankton populations, mutagenesis, fish and shellfish diseases, and antibiotic resistance in benthic bacteria. Synthesis studies are presented. Project responses to short-lived events are discussed including information on the floatable event, the anoxic event, Hurricane Belle, and chemical waste spills. Information transfer, advisory services and cooperative activities, and synopsis and projectives are covered.

Keywords: Anoxia, Disease, Management, Monitoring-MESA, Pollutants

ANONYMOUS. 1977. REPORT TO THE CONGRESS ON OCEAN POLLUTION, OVERFISHING, AND OFFSHORE DEVELOPMENT- JULY 1975 THROUGH SEPTEMBER 1976. (ANNUAL REPT. NO. 4). NOAA REPORT NO.: NOAA-77123004, 59 pp. The programs summarized in this report are representative of those conducted by the National Oceanic and Atmospheric Administration in cooperation with other agencies and organizations in response to the provisions of the Marine Protection, Research and Sanctuaries Act of 1972, Title II, Section 202. This report focuses on six major areas of research: studies of the New York Bight, investigations of the relationships of heavy metals and selected marine organisms, experiments on the effects of petroleum on marine animals, research on the status and effects of over-fishing, work on the environmental questions raised by deep-ocean mining, and assessment of the environments of potential offshore oil lease areas.

Keywords: Fisheries, Mining, Pollutants-Bioaccumulation, Pollutants-Metals, Pollutants-Organic

ANONYMOUS. 1978. MESA NEW YORK BIGHT PROJECT ANNUAL REPORT FOR FISCAL YEAR 1977. NOAA REPORT NO.: NOAA-79022704, 143 pp. The annual report for fiscal year 1977 presents an overview of MESA New York Bight Project activities between October 1, 1976, and September 30, 1977. The research results of the project focused on specific environmental issues, which are highlighted under the following topics: Contaminants of the New York Bight; New York Bight anoxia of 1976; Sewage sludge dumping, and dredge spoil dumping. A bibliography is contained in one of the appendices which lists the publications resulting from work supported by the New York Bight Project and publications of the project itself.

Keywords: Anoxia, Bibliographies, Monitoring-MESA, Ocean disposal, Pollutants

ANONYMOUS. 1978. SLUDGE MANAGEMENT ALTERNATIVES: WHAT WILL WE DO AFTER THE 1981 OCEAN DISPOSAL BAN. NEW YORK SCIENTISTS' COMMITTEE FOR PUBLIC INFORMATION. REPORT NO.: NSF/RA-780924, 147 pp. Proceedings of a workshop held in New York City on January 25, 1978. Workshop topics addressed: (1) the general condition of the New York Bight Project and current sludge disposal practices; (2) the legal framework for sludge management; (3) processing and disposal alternatives; (4) an overview of EPA policy and programs for municipal sludge management; (5) environmental and health concerns; (6) legal, institutional, and economic concerns; (7) citizen evaluation; and (8) conference evaluation. The appendix includes charts of ocean dumping locations; effects of increased land costs of sludge composting; transport and dispersion of sewage sludge in ocean water; factors effecting cadmium accumulation by plants; recommended maximum cumulative

sludge metal applications for privately owned cropland; the fate of cadmium, mercury, lead, and other heavy metals; and projections for population, waste water flow design, and raw and treated sludge production in the years 1980 and 2000.

Keywords: Management, Ocean disposal-Sewage sludge, Pollutants-Metals, Workshops

ANONYMOUS. 1980. AN ARTIFICIAL REEF CONSISTING OF WASTES FROM COAL-FIRED POWER PLANTS (NEAR FIRE ISLAND, NY). MIN CONGR J (WASHINGTON, D.C.) 11(12):5.

Keywords: Artificial reefs

ANONYMOUS. 1980. EXTENSION TO THE BASELINE STUDY OF CONTAMINANT LEVELS IN LIVING RESOURCES OF THE NORTH ATLANTIC. INT COUNC EXPLOR SEA. PALAEGADE 2-4, DK-1261 COPENHAGEN K, DEN. INT COUNC EXPLOR SEA COOP RES REP 0 (95):1-57. Data on finfish and shellfish were analyzed as part of a program designed to assess the levels of metals in living marine resources. In most cases, the species did not contain levels of heavy metals which presented a public health problem (based on current standards or recommendations). Certain species collected from specific geographical areas showed elevated values for copper. More recent studies indicated that when large numbers of samples of surf clams (*Spisula solidissima*) were collected over a wide range of latitudes, from the relatively unpolluted waters off Delmarva (Delaware, Maryland, Virginia) Peninsula to the heavily polluted New York Bight, there was a 2- to 3-fold increase in some metals. While these levels did not pose an immediate health problem, they indicate that monitoring of the species should continue in order to determine if there are temporal and spatial trends toward increased body burdens of contaminants.

Keywords: Benthos-*Spisula*, Monitoring, Pollutants-Bioaccumulation, Pollutants-Metals, Seafood,

ANONYMOUS. 1981. ANNUAL NEMP (NORTHEAST MONITORING PROGRAM) REPORT ON THE HEALTH OF THE NORTHEAST COASTAL WATERS OF THE UNITED STATES, 1980. NOAA/NMFS. NOAA TM NMFS F/NEC-10; NOAA-81092506, 122 pp. During the past year the Northeast Monitoring Program (NEMP) has conducted assessment and monitoring activities to document the health status of the living resources and their habitats on the continental shelf off the northeast coast. One of the principal findings of the program was that many of the fishery resources of the western North Atlantic are contaminated with petroleum hydrocarbons and PCBs. It is also indicated that the seaward extent of pollution may be greater than earlier expected. Evidence points to severe coastal eutrophication in waters of the Middle Atlantic Bight. Outflow plumes from major estuaries such as Chesapeake Bay, Delaware Bay and the

Raritan/Hudson River complex carry particulates and absorbed contaminants out to the continental shelf. Such materials eventually settle to the seabed and may be one of the principal influences on benthic communities and demersal finfish population.

Keywords: Estuaries, Eutrophication, Fisheries, Monitoring-NEMP, Pollutants-Organic

ANONYMOUS. 1982. MARINE FISHERIES REVIEW. VOLUME 44, NUMBER 6-7, JUNE-JULY 1982. NOAA/NMFS REPORT NO.: NOAA-82101302, 77 pp. The report reviews nine papers which describe artificial reefs built in different sections of the United States. Some of the subject areas covered are design, construction materials, food, and affects of reefs on fish population.

Keywords: Artificial reefs, Fish

ANONYMOUS. 1982. OFFICE OF MARINE POLLUTION ASSESSMENT NORTHEAST OFFICE SUMMARY REPORT FOR FISCAL YEARS 1979 AND 1980. NOAA REPORT NO.: NOAA-82090205, 43 pp. This summary report for FY 1979 and FY 1980 presents important accomplishments of the MESA New York Bight Project (NYBP) during those years and the Hudson-Raritan Estuary Project (HREP) during FY 1980. The NYBP is a comprehensive, multidisciplinary, regional study addressing the problems of a large body of water. There are two goals of the NYBP: (1) to determine the types, transport rates, fates, and impacts of pollutants and other human-related activities on this ecosystem and (2) to describe the major existing ecological systems, processes, natural stresses, and responses operating the Bight, as well as their relationships and rates of change.

Keywords: Monitoring-MESA, Pollutants

ANONYMOUS. 1983. REPORT TO THE CONGRESS ON OCEAN POLLUTION, MONITORING AND RESEARCH, OCTOBER 1981 THROUGH SEPTEMBER 1982. NOAA REPORT NO.: NOAA-83101203, 80 pp. This report describes the ocean pollution investigations that the National Oceanic and Atmospheric Administration (NOAA) carried out during fiscal year 1982. It covers four major categories of research activity: (1) ocean waste disposal; (2) coastal land use, hazardous waste disposal and ecosystem modification; (3) ocean resource use and accidental discharges; and (4) environmental assessment and marine management.

Keywords: Management, Monitoring, Ocean disposal

ANONYMOUS. 1988. MARINE FISHERIES REVIEW. VOL. 50, NO. 2, 81 pp. This study discusses a wide variety of topics; such as, hook timers to measure

the capture time of individual fish; Marine recreational boat fishery of the New York Bight Apex in 1971; the commercial bait shrimp fishery in Galveston Bay, Texas, 1959-87; the southeast Area Monitoring and Assessment Program (SEAMAP): a state-federal-university program for collection, management, and dissemination of fishery-independent data and information in the southeastern United States; the traditional central California Setnet Fishery.

Keywords: Apex, Fish, Fisheries

ANONYMOUS. 1988. PLAN FOR STUDY: RESPONSE OF THE HABITAT AND BIOTA OF THE INNER NEW YORK BIGHT TO ABATEMENT OF SEWAGE SLUDGE DUMPING. NOAA/NMFS. NOAA TM NMFS/NEC-55, 41 pp. The purpose of the study was to document changes in living marine resources and their habitats during and following the period in which sewage sludge dumping is phased out at the 12-mile site. Choice of monitoring variables was based on two considerations: (1) relevance to fisheries of the inner Bight, both directly, in terms of abundance, distribution and contamination of resource species and indirectly, as indicated by quality of their habitats, and (2) predictive value in testing changes with abatement. Biological, chemical, and physical oceanographic approaches have been integrated to provide comprehensive and statistically valid work plans.

Keywords: Fisheries, Monitoring, Ocean disposal-12 mile, Ocean disposal-Sewage sludge

APEL, J.R. 1974. OCEAN INTERNAL WAVES OFF THE NORTH AMERICAN AND AFRICAN COAST FROM ERTS-1. SCIENTIFIC AND TECHNICAL AEROSPACE REPORTS 12(20):2422.

Keywords: Circulation-Internal waves

APEL, J.R.; GASPAROVIC, R.F.; THOMPSON, D.R. 1986. HYDRODYNAMICS OF INTERNAL SOLITONS AND A COMPARISON OF SIR-A AND SIR-B DATA (SHUTTLE IMAGING RADAR) WITH OCEAN MEASUREMENTS. JOHNS HOPKINS UNIV., LAUREL, MD. APPLIED PHYSICS LAB. Large internal solitary waves have been observed by Shuttle SIR-A and SIR-B at locations in the Andaman Sea and the New York Bight. Satellite imagery and oceanographic measurements are used in conjunction with hydrodynamic interaction and electromagnetic scattering models to estimate the expected Synthetic Aperture Radar (SAR) image intensity modulations associated with the internal waves. There is reasonable agreement between the predicted and observed internal wave signatures.

Keywords: Circulation-Internal waves

ARMSTRONG, R.S. 1979. BOTTOM OXYGEN AND STRATIFICATION IN 1976 AND PREVIOUS YEARS. IN: OXYGEN DEPLETION AND ASSOCIATED BENTHIC MORTALITIES IN NEW YORK BIGHT, 1976, NOAA PROFESSIONAL PAPER 11, R.L. SWANSON AND C.J. SINDERMAN, (EDS.), pp. 137-148. Based on historical oceanographic data, the DO content of bottom waters over the New Jersey-Cape May and Long Island continental shelves typically declines during spring and summer, reaching minimum values in August. The seasonal decline in DO closely parallels the development of density stratification, and the rate at which DO declines seems to correspond with the strength of stratification. Stratification tends to isolate bottom waters from vertical replenishment until September, at which time cooling of the surface and mixing begins to destroy the vertical structure. This results in increased replenishment of bottom DO. Continued cooling and overturning through autumn and winter typically cause a steady increase in oxygen values to the annual maximum in March. The influence of stratification on rates of oxygen decline may be greater off New Jersey than in adjacent regions because of bathymetric differences. However, this assessment does not take into account any effects on DO concentrations that might result from unusual advective and biological processes. Comparison with the normal cycle of bottom DO indicates that concentrations were already below normal by April in 1976 throughout the New York Bight.

The early onset of stratification in 1976 would have contributed to the occurrence of abnormally low bottom DO in the New York Bight in three different ways. First, if DO concentrations increased as per the normal trend into January 1976, then with a 2-month earlier than normal onset of stratification, maximum concentration for the year would have been in January at about 6.5 ml/l, which is 0.5 ml/l less than the usual March maximum of 7.0 ml/l. Given normal conditions through the rest of the year, the DO values in 1976 could have been somewhat below normal each month until autumn. Second, the season of strengthening stratification and declining DO normally lasts about 5 months (April-August). In 1976, this season was apparently lengthened as much as 2 months, because of the early onset of stratification. Third, from March through May 1976, and probably beginning as early as February, stratification was stronger than normal and about typical for June through August. As a result, the decline in DO would have been greater than normal during as many as 4 months in 1976 and at typical rates during the summer. Thus the cycle of bottom DO concentration would have proceeded at values below normal for as long as February through August.

Keywords: Anoxia

ATWOOD, D.; BROWN, D.W.; CABELLI, V.; FARRINGTON, J.; GARSIDE, C.; HAN, G.; HANSEN, D.V.; HARVEY, G.; KAMLET, K.S.; O'CONNOR, J.; SWANSON, L.; SWIFT, D.; THOMAS, J.; WALSH, J.; WHITLEDGE, T. 1979. THE NEW YORK BIGHT. PRESENTED AT: WORKSHOP ON ASSIMILATIVE CAPACITY OF U.S. COASTAL WATERS FOR POLLUTANTS, CRYSTAL MOUNTAIN, WA 29 JULY 1979. NOAA ERL WORK. PAP. FED. PLAN OCEAN POLLUT. RES. DEV. MONIT. IN:

PROCEEDINGS OF A WORKSHOP ON ASSIMILATIVE CAPACITY OF U.S. COASTAL WATERS FOR POLLUTANTS, CRYSTAL MOUNTAIN, WASHINGTON, JULY 29-AUGUST 4, 1979. E.D. GOLDBERG, (ED.). PUBL: NOAA ENVIRONMENTAL RESEARCH LABS. NOAA/ERL REPORT, pp. 148-178. A few representative, fairly well understood contaminants were selected for consideration. The impacts chosen for use in the analyses are those that constitute radical changes in the ecosystem or threats to human health. Microbial contamination is probably the most straightforward issue addressed. The panel selected the polychlorinated biphenyls (PCBs) as representative of this class of contaminants and as a group for which some biogeochemical data are available. Threat to human health from finfish consumption was chosen as the critical impact function. Cadmium was chosen as representative of contaminant trace metals, and again threat to human health (through the consumption of edible fish and shellfish) was selected as the impact function. Contamination by excess nitrogen was chosen because it is a particularly bioactive substance, intimately linked to biological productivity and to the ecosystem generally, and because it is a subject of present concern in the New York Bight in connection with sewage system engineering practices. As a result of excess plankton production and ensuing eutrophication, anoxia was identified as the critical impact function. This selection of contaminants and impacts exemplifies the diversity of time and space scales that must enter into consideration of regional assimilative capacity.

Keywords: Workshops

ATWOOD, D.K.; WHITLEDGE, T.E.; SHARP, J.H.; CANTILLA, A.Y.; BERBERIAN, G.A.; PARKER, J.M.; HANSON, P.G.; THOMAS, J.P.; O'REILLY, J.E. 1979. CHEMICAL FACTORS. IN: OXYGEN DEPLETION AND ASSOCIATED BENTHIC MORTALITIES IN NEW YORK BIGHT, 1976, NOAA PROFESSIONAL PAPER 11, R.L. SWANSON AND C.J. SINDERMAN, (EDS.), pp. 79-123. Dissolved oxygen in bottom waters of the New York Bight shelf (especially in the Apex and off the New Jersey coast) was severely depleted in 1976 compared to other years. Although DO depletion is an annual occurrence during the warm season (that is, when the density stratification is strong), it occurred earlier in 1976 and was more severe. In certain areas, DO values were zero or near zero. Other than this severe oxygen depletion, no clear chemical differences were detected in the water column between 1976 and other years. Apparently, there was no exceptional nutrient input to stimulate productivity. In fact, there is some evidence that fewer nutrients may have been available at the shelf break in 1976. If this is true, it might have affected the types of organisms found in shelf waters; that is, it could have favored production of organisms such as *Ceratium tripos*. Also, there is no chemical evidence of exceptional inputs of organic carbon either as POC or DOC although there is strong biological evidence for a very dense plankton bloom (*Ceratium tripos*), which certainly contributed to the organic loading. The high DOC levels present in the Bight had the capacity to cause the depletion observed.

Clearly something was different in 1976, and perhaps this "something" was a natural occurrence. Since an adequate existing data base covers only a short time span (post-1970) and lacks many essential variables, we cannot ascertain what this was. It is significant that extraordinary DOC values exist in the Bight, especially in the Apex. Our limited data do not allow a comparison of 1976 DOC levels with those of previous years, nor do they allow much insight into the chemical or physical nature or variations in space and time of the organic matter that is lumped into the category of DOC. More information on organic matter perhaps could provide insights into future events of a similar nature. The observed chemical responses of Bight seawater to the oxygen depletion were as expected, based on our knowledge of other low oxygen or anoxic areas in the ocean. When oxygen was depleted, nitrate was reduced to nitrite, and then ammonium sulfate was reduced to sulfide, and the solubility of certain metals changed as the reducing environment developed and caused changes in their oxidation states.

Keywords: Anoxia, Miscellaneous-Chemical

AUSTIN, H.M. 1976. DISTRIBUTION AND ABUNDANCE OF ICHTHYO PLANKTON IN THE NEW YORK BIGHT, USA. FALL, 1971. N.Y. FISH GAME J 23(1):58-72. Sampling for phytoplankton, water chemistry, and physical parameters was conducted at a series of stations in the New York Bight in September and November of 1971. The relationships of the finfish eggs and larvae collected to the associated oceanographic conditions are discussed in terms of the sources of the parent stocks and the time and place of spawning. The bulk of the spawning that occurs in coastal New York waters is by migratory stocks, the principal species in the New York Bight being the menhaden, anchovy, weakfish, mackerel, and searobin.

Keywords: Fish, Miscellaneous-Chemical, Miscellaneous-Physical, Plankton

AZAROVITZ, T.R.; BYRNE, C.J.; SILVERMAN, M.J.; FREEMAN, B.L.; SMITH, W.G.; TURNER, S.C.; HALGREN, B.A.; FESTA, P.J. 1979. EFFECTS ON FINFISH AND LOBSTER. IN: OXYGEN DEPLETION AND ASSOCIATED BENTHIC MORTALITIES IN NEW YORK BIGHT, 1976, NOAA PROFESSIONAL PAPER 11, R.L. SWANSON AND C.J. SINDERMANN, (EDS.), pp. 295-314. The fishkill phrase often used to describe the anoxic water mass off the New Jersey coast in 1976 is misleading because finfish populations did not have massive mortalities. Intensive trawling surveys throughout the summer and autumn did not produce significant numbers of dead fish. Therefore, based on observations, it was concluded that a significant and sustained kill of adult fish did not take place, although scattered finfish mortalities continued throughout the summer. What the data do show is that instead of dying, finfish in most cases were able to avoid the low dissolved oxygen area. American lobster probably react to depressed oxygen levels in the same manner as finfish do. Evidence is mixed on whether lobsters avoided or succumbed to anoxia.

Keywords: Benthos-*Homarus*, Fish, Fish kills

AZAROVITZ, T.; SILVERMAN, M.; ANDERSON, V.; THOMS, A.; AUSSICKER, C. 1976. DEMERSAL FINFISH CATCHES IN THE NEW YORK BIGHT BY STATIONS AND SPECIES. R/V ATLANTIC TWIN OCTOBER 31-DECEMBER 5, 1972. NOAA DR ERL MESA-11, 102 pp. In the fall of 1972 the Sandy Hook Laboratory began a finfish assessment survey of the Middle Atlantic Shelf. This extended earlier, less systematic fish surveys of the Middle and South Atlantic coast conducted since 1966. Survey cruises begun in 1972 were designed to complement ongoing offshore surveys being conducted by the Northeast Fisheries Center. This cooperative effort provided for the first time continuous synoptic coverage from less than 5 to 200 fathoms. The data report series present ADP summaries of finfish and associated data collected in the New York Bight on cruises conducted by the Middle Atlantic Center. This report summarizes the catch in the New York Bight of the inshore segment of the fall 1972 survey. The chartered research vessel Atlantic Twin sailed from Sandy Hook, New Jersey on October 31 and completed coastal survey operations on December 5, 1972.

Keywords: Fish, Monitoring-MESA

AZAROVITZ, T.; SILVERMAN, M.; ANDERSON, V.; THOMS, A.; AUSSICKER, C. 1976. DEMERSAL FINFISH CATCHES IN THE NEW YORK BIGHT BY STATIONS AND SPECIES. R/V ATLANTIC TWIN MAY 8-JUNE 4, 1973. NOAA DATA REP MESA-12, 148 pp. The data report series presents ADP summaries of finfish and associated data collected in the New York Bight on cruises conducted by the Middle Atlantic Center. This report summarizes the catch in the New York Bight of the inshore segment of the spring 1973 survey. The chartered research vessel Atlantic Twin sailed from Sandy Hook, New Jersey on May 8 and completed coastal survey operations on June 4, 1973.

Keywords: Fish, Monitoring-MESA

AZAROVITZ, T.; SILVERMAN, M.; ANDERSON, V.; THOMS, A.; AUSSICKER, C. 1976. DEMERSAL FINFISH CATCHES IN THE NEW YORK BIGHT BY STATIONS AND SPECIES. R/V ATLANTIC TWIN OCTOBER 1-NOVEMBER 7, 1973. NOAA DATA REP MESA-13, 116 pp. The data report series presents ADP summaries of finfish and associated data collected in the New York Bight on cruises conducted by the Middle Atlantic Center. This report summarizes the catch in the New York Bight of the inshore segment of the fall 1973 survey. The chartered research vessel Atlantic Twin sailed from Sandy Hook, New Jersey on October 1 and completed coastal survey operations on November 7, 1973.

Keywords: Fish, Monitoring-MESA

AZAROVITZ, T.; SILVERMAN, M.; ANDERSON, V.; THOMS, A.; AUSSICKER, C. 1976. DEMERSAL FINFISH CATCHES IN THE NEW YORK BIGHT BY STATIONS AND SPECIES. R/V DELAWARE II AND ATLANTIC TWIN, APRIL 1-MAY 2, 1974. NOAA DATA REP MESA-14, 106 pp. The data report series presents ADP summaries of finfish and associated data collected in the New York Bight. This report summarizes the catch of the inshore segment of the spring 1974 survey by the chartered research vessel Atlantic Twin which sailed from Sandy Hook, New Jersey on April 1, 1974 and returned April 22, 1974, and by the R/V Delaware II which sailed from Sandy Hook, New Jersey on April 24 and completed coastal survey operations on May 2, 1974.

Keywords: Fish, Monitoring-MESA

AZAROVITZ, T.; SILVERMAN, M.; ANDERSON, V.; THOMS, A.; AUSSICKER, C. 1976. DEMERSAL FINFISH CATCHES IN THE NEW YORK BIGHT BY STATIONS AND SPECIES. R/V ALBATROSS IV AND DELAWARE II, SEPTEMBER 23-OCTOBER 4, 1974. NOAA DATA REP MESA-15, 115 pp. The data report series presents ADP summaries of finfish and associated data collected in the New York Bight on cruises conducted by the Middle Atlantic Center. This report summarizes the catch of the inshore and offshore segments of the autumn 1974 survey. Albatross IV sailed from Woods Hole, Mass., on September 23, and returned October 4, 1974, and Delaware II sailed from Sandy Hook, New Jersey on September 28 and completed coastal survey operations on October 4, 1974.

Keywords: Fish, Monitoring-MESA

AZAROVITZ, T.; SILVERMAN, M.; ANDERSON, V.; THOMS, A.; AUSSICKER, C. 1976. DEMERSAL FINFISH CATCHES IN THE NEW YORK BIGHT BY STATIONS AND SPECIES. R/V ALBATROSS IV AND ATLANTIC TWIN, MARCH 4-24, 1975. NOAA DATA REP MESA-16, 142 pp. The data report series presents ADP summaries of finfish and associated data collected in the New York Bight on cruises conducted by the Middle Atlantic Center. This report summarizes the catch in the New York Bight of the inshore and offshore segments of the spring 1975 survey. Albatross IV sailed from Woods Hole, Mass., on March 4, 1975, and returned March 21, 1975. The chartered vessel Atlantic Twin sailed from Sandy Hook, New Jersey on March 18 and completed coastal survey operations on March 24, 1975.

Keywords: Fish, Monitoring-MESA

BABINCHAK, J.A.; GRAIKOSKI, J.T.; DUDLEY, S.; NITKOWSKI, M.F. 1977. DISTRIBUTION OF FECAL COLIFORMS IN BOTTOM SEDIMENTS FROM THE NEW YORK BIGHT. MAR POLLUT BULL 8(7):150-153. The

distribution of faecal densities found in New York Bight sediments indicated that sewage sludge material has contaminated areas extending 11 km north and 37 km south from the disposal site. A high degree of confidence for enumerating faecal coliforms in marine sediments was demonstrated by standard water methodology since 82.3% of the faecal group isolated were *Escherichia coli*. This study also indicated that marine sediments could be stored 4 days at 4 °C without appreciable changes in the faecal count, and that, in situ, faecal coliforms would persist longer when sediment temperatures were low.

Keywords: Bacteria, Ocean disposal-Sewage sludge

BEARDSLEY, R.C.; HART, J. 1978. A SIMPLE THEORETICAL MODEL FOR THE FLOW OF AN ESTUARY ONTO A CONTINENTAL SHELF. J GEOPHY RES 83(C2):873-883. A model was developed to describe the steady flow of an estuary onto an adjacent continental shelf. A two-layer density stratification is assumed for the shelf water, and the fluid motion is driven by the positive (upper layer) and negative (lower layer) mass fluxes associated with a pair of point sources located at the mouth of the estuary. The dynamics are linear and include the effects of Coriolis acceleration, turbulent friction, and bottom topography. Analytic solutions for the one-layer single-source problem are found for two special depth profiles. The far-field flow is asymmetrically concentrated toward the right-hand coast in the northern hemisphere, a consequence of the basic balance between topographic vortex stretching and bottom friction. This mechanism also applies when a constant alongshore current is present. In the two-layer case the flow in the upper layer generally is concentrated toward the left-hand coast, since the upper fluid feels the interface and not the bottom topography and the interfacial drag exerted by the lower fluid toward the right-hand coast. A brief comparison is made between model predictions and observations for the Hudson and Chesapeake Bay estuaries.

Keywords: Circulation, Estuaries, Modeling-Hydrodynamic

BENNETT, J.R.; MAGNELL, B.A. 1979. A DYNAMICAL ANALYSIS OF CURRENTS NEAR THE NEW JERSEY COAST. J GEOPHY RES 84(C3):1165-1175. A numerical model is used to analyze currents measured on the continental shelf near the shore of New Jersey. The model neglects longshore variations of current and all variations of density, but includes inertial accelerations and a nonlinear eddy viscosity. Local wind stress, sea level changes, and a constant longshore pressure gradient are the forcing terms. The model successfully reproduces most of the current variance; however, the predicted currents do not exhibit the dominant 4-hr response time of the observed currents indicating that the transient behavior of the currents is strongly influenced by distant boundaries. The model sometimes misses energetic current events. These differences are ascribed to three-dimensional setup effects elsewhere in the New York Bight.

Keywords: Circulation, Modeling-Hydrodynamic

BERGMANN, J. 1979. THE NEW YORK BIGHT, 1977. UNDERWATER NAT 11(3):14-18. This article compares climatological and biological data obtained from January to September 1977 with similar data compiled in 1976 when a summer fish kill resulted in mortalities in economically important marine resources, due to dissolved oxygen levels of less than 2 ppm below the thermocline.

Keywords: Anoxia, Fish, Fish kills

BETZER, P.R. 1978. A STUDY OF THE SOURCES, TRANSPORT, AND REACTIONS OF SUSPENDED PARTICLES IN WATERS OF THE NEW YORK BIGHT. NOAA-78041802; NOAA TM ERL MESA-23, 41 pp. Eighty-six samples of suspended matter collected on five cruises to the New York Bight have been subjected to chemical analyses. The results demonstrate that some of the major inputs of particulate matter to this system can be chemically typed and then traced. Seasonal changes in the distribution and composition of suspended materials are related to (1) river discharge, (2) diatom productivity, (3) sediment-water interactions, and (4) the dumping of anthropogenic materials.

Keywords: Monitoring-MESA, Ocean disposal, Particulates, Plankton, Pollutants-Loadings

BISCAYE, P.E. 1978. TRANSPORT AND TRANSFER RATES IN THE WATERS OF THE CONTINENTAL SHELF. COLUMBIA UNIV., PALISADES, NY LAMONT-DOHERTY GEOLOGICAL OBSERVATORY LDGO PALISADES, NY, 115 pp. Using natural radioactive tracers the removal rates of reactive metals from the surface waters of the New York Bight were estimated and these ranged over an order of magnitude from most rapid nearshore to least rapid over the upper continental slope. Once removed nearshore, however, these tracers, and the pollutants for which they proxy, did not remain permanently in the sediments but appeared to be remobilized (probably by oxidation) during the winter and reintroduced into the water column. Hydrographic data on the structure of the water column resulted in a description of the system that is crucial to understanding geochemical and biological processes which affect pollutants. Hypotheses concerning the renewal of shelf water by direct exchange between shelf and upper slope water are discussed.

Keywords: Circulation, Pollutants-Water quality, Sediment

BISCAYE, P.E.; OLSEN, C.R. 1976. SUSPENDED PARTICULATE CONCENTRATIONS AND COMPOSITIONS IN THE NEW YORK BIGHT. IN: MIDDLE ATLANTIC CONTINENTAL SHELF AND THE NEW YORK BIGHT. PROCEEDINGS OF THE SYMPOSIUM AMERICAN MUSEUM OF NATURAL HISTORY, NEW YORK CITY, NOVEMBER 3-5, 1975, M.G.

GROSS, (ED.), SPECIAL SYMPOSIA 2:124-137. Suspended particulate concentrations in the New York Bight from 1973-1975 decreased seaward across the shelf, decreasing more rapidly in surface than in bottom waters. Resuspension of fine-grained sediments causes local high concentrations of suspended particles in near-bottom waters. Horizontal displacement of these high concentration plumes from their sources suggests short residence times for suspended particles. Vertical mixing of resuspended particles is limited by the thermocline. Along the upper continental slope over a depth range of about 1,000 m, there is a minimum in near-bottom suspended particulate concentrations suggesting horizontal mixing with waters from the open ocean. Anomalous concentrations of trace metals of anthropogenic origin associated with organic particles, Fe-Ti (oxide) coatings and discrete Ti (oxide) particles are potential tracers of particle dispersion paths and transport processes. Different type of organic particles exhibit different interparticle and trace element associations and appear to have different geographic distributions. Some of this variability may be seasonal. Surface water suspended matter has a higher proportion of biogenic (inorganic skeletal as well as organic) particles than near-bottom suspended matter which is dominantly nonbiogenic (principally aluminosilicate). Skeletal debris is primarily siliceous in shelf waters, becoming more carbonate-rich seaward of the shelf break. Aluminosilicate suspended particles in shelf waters are predominantly K-rich whereas Mg-Ca-K-Fe-rich aluminosilicates dominate beyond the shelf break.

Keywords: Miscellaneous-Geological, Particulates, Sediment transport

BISHOP, J.M. 1975. AN ANALYTICAL SEA CURRENT MODEL FOR COASTAL REGIONS WITH APPLICATIONS TO THE NEW YORK BIGHT. USCG, OCEANOGRAPHIC UNIT SEARCH AND RESCUE DIV., NAVY YARD ANNEX, WASH., DC 20590. U.S. COAST GUARD. OCEANOGRAPHIC UNIT. TECH. REPORT 75-2,(N.D.), 31 pp. Seasonal coastal currents on a continental shelf are modeled for use in search and rescue planning. The model considers a balance of Coriolis, pressure gradient, and frictional forces. Input parameters are the climatological wind and density fields. Comparison of results to currents depicted on climatological atlases for the New York Bight indicates the validity of the approach. In this light, one might extend this approach to other geographical regions where analogous oceanographic conditions prevail.

Keywords: Circulation, Modeling-Hydrodynamic

BOESCH, D.F. 1982. ECOSYSTEM CONSEQUENCES OF ALTERATIONS OF BENTHIC COMMUNITY STRUCTURE AND FUNCTION IN THE NEW YORK BIGHT REGION. IN: ECOLOGICAL STRESS AND THE NEW YORK BIGHT: SCIENCE AND MANAGEMENT. PROCEEDINGS OF A SYMPOSIUM ON THE ECOLOGICAL EFFECTS OF ENVIRONMENTAL STRESS, NEW YORK, NY, JUNE 10-15, 1979, G.F. MAYER, (ED.), ESTUARINE RESEARCH FEDERATION, COLUMBIA, SC, pp. 543-568. Structure and function are divorced in most studies of the ecology of benthos.

Furthermore, the interaction of the benthos with the remainder of the ecosystem is seldom considered. Data on the structure and function of benthos in the New York Bight region are drawn together, and inferences are made about the role of benthos in these ecosystems and the consequences of human alterations of benthic communities. Alterations to the macrobenthic communities in the Hudson-Raritan Estuary, the Christiaensen Basin, and the upper Hudson Shelf Valley have resulted in reductions in populations of species that are predominant food items for demersal fishes and invertebrates. The Christiaensen Basin supports a dense and productive benthic community, but little of this productivity appears to be transferred to high trophic levels. Energy flow through the seabed has been increased due to waste additions, but this may result in localized depletion of oxygen in bottom waters during the summer when water masses are stratified. Nutrients regenerated from the seabed do not appear to be influential in supporting the high primary productivity in the Bight Apex, and the seabed may actually be an important nutrient sink. Benthic biological processes affecting toxicants concentrated in sediments may determine their availability to benthic and demersal organisms but are probably not responsible for significant reintroduction of these toxicants into the water column, except as they affect resuspension of bottom sediments.

Keywords: Anoxia, Benthos, Christiaensen Basin, Pollutants, Workshops

BOKUNIEWICZ, H.J. 1979. STABILITY AND FATE OF DREDGED SEDIMENT. CDS REPORT 219, 23 pp. Hopper dredges often remove fine-grained sediment from navigation channels and release this material at disposal sites into water about 20 m deep. Such operations involving dredges with a capacity of 703 m³ were studied at two locations in the Great Lakes. The bulk density of the material in the hoppers was 1.3 Mgm/m³. The dredged material behaved as a fluid and, when the hopper doors were opened, it was driven out by the excess pressure head at speeds up to 4 m/sec. Almost all of the sediment released is deposited from a thin, radially spreading, bottom surge in a ring between 50 and 160 m from the point of impact with the lake floor. The layer formed by a single discharge has a thickness of about 3 mm. The minimum radius of a deposit that is formed by sedimentation from turbidity currents is determined by the range of the surge (<300 m), and the deposit cannot have side slopes greater than 0.05. These conditions control the capacity of a designated disposal area. The surface layer of the deposit is in contact with the overlying water and may be dispersed. The thickness of this layer depends upon the depth of resuspension or bioturbation. In coastal waters of the northeastern U.S., resuspension of the top few millimeters of sediment is typical, and bioturbation may mix sediment to a depth of about 0.1 m. Under these conditions, dredged sediment in a deposit containing less than 10⁴ m³ will be almost entirely exposed to the water column; if no net erosion occurs, containment is favored in deposits containing more than 10⁶ m³. Conditions in mined submarine pits in New York Harbor favor the containment of dredged sediment. The side slopes and roughness of the pit floors will restrict the spread of the bottom surge. The pits act as traps for fine-grained sediments and the naturally high sedimentation rates would make net erosion of the dredged sediment deposit unlikely.

Keywords: Ocean disposal-Dredged material

BOKUNIEWICZ, H.; GOLDSMITH, V.; CLARKE, K.; HANSEN, W. 1991. THE NEW YORK BIGHT GEOGRAPHIC INFORMATION SYSTEM: DEVELOPMENT, RESULTS, AND FUTURE EFFORTS. REMOTE SENSING AND SPATIAL ANALYSIS LAB REPORT NO. 91/1, MARINE SCIENCE RESEARCH CENTER REPORT NO. 91.

Keywords: Remote sensing

BOKUNIEWICZ, H.H.; FRAY, C.T. 1979. THE VOLUME OF SAND AND GRAVEL RESOURCES IN THE LOWER BAY OF NEW YORK HARBOR. REPORT NO.: SR-32; REF-79-16; NOAA-81043001, 41 pp. The shallow (less than 100 ft) stratigraphy of the Lower Bay floor was investigated in order to estimate the volume of sand and gravel deposits under the Lower Bay. Four types of information were studied: (1) core and boring logs, (2) seismic reflection profiles, (3) the surficial sediment distribution on the floor of the Lower Bay, and (4) the stratigraphy in Long Island, Staten Island, northern New Jersey, and the New York Bight. In general, marine sands overlie glacial outwash sands which, in turn, overlie unconsolidated Cretaceous sediments. Along the margins of the Bay, sands are known to rest on fine-grained deposits at depth; the composition of layers underlying the surficial sand deposits in the central and eastern Bay is unknown.

Keywords: Miscellaneous-Geological

BOTTON, M.L. 1979. EFFECTS OF SEWAGE SLUDGE ON THE BENTHIC INVERTEBRATE COMMUNITY OF THE INSHORE NEW YORK BIGHT. ESTUAR COAST MAR SCI 8(2):169-180. Benthic invertebrate community structure including species diversity, biomass and trophic structure was examined at a sewage sludge disposal site and nearby "control" site in the inner New York Bight off New York City. Although both sites are characterized by soft bottoms with high organic carbon, and support similar deposit feeding assemblages, species diversity is lower at the sludge site, reflecting decreased species richness and evenness. Likewise, total biomass as well as the proportional distribution of biomass among trophic groups, differed between sites. A previously suggested indicator species, *Capitella capitata*, is present in greater numbers at the control station than the sludge station. It is therefore unsuitable as an indicator species of pollution tolerance in the portion of the New York Bight examined in this study. A small polychaete belonging to the family Ampharetidae, *Amage auricula*, is by far the most abundant animal at the sludge disposal site, but its potential use as an indicator species is complicated by the fact that it exhibits a great tendency for aggregation. Ampeliscid amphipods appear sensitive to the presence of sludge and may be useful as indicators of contamination. Most of the common animals at both stations were aggregated, and it is recommended

that future sampling in the area should be by the use of a large number of small grabs such as the Shipek, rather than a smaller number of large grabs, as this will increase the probability that patchy fauna are encountered.

Keywords: Benthos, Ocean disposal-Sewage sludge, Pollutants-Organic

BOWMAN, M.J. 1978. SPREADING AND MIXING OF THE HUDSON RIVER EFFLUENT INTO THE NEW YORK BIGHT. PRESENTED AT: 9. INTERNATIONAL LIEGE COLLOQUIUM ON OCEAN HYDRODYNAMICS LIEGE (BELGIUM) 1977. MAR. SCI. RES. CENT., STATE UNIV. NEW YORK, STONY BROOK, NY (NO. 23). IN: HYDRODYNAMICS OF ESTUARIES AND FJORDS. J.C.J. NIHOUL, (ED.) ELSEVIER AMSTERDAM. pp. 373-386. Results are presented from three Hudson River plume sampling cruises made in the New York Bight in August 1976. The data show that the set and shape of the spreading effluent vary widely over time periods of about 6 days and are clearly influenced by local wind stress. Application of Takano's model of a steady state plume spreading into a stagnant ocean suggests a horizontal eddy viscosity of about $10^8 \text{ cm}^2 \text{ sec}^{-1}$ and a strong anticyclonic deflection of the plume. This value is considered to be an overestimate, because interfacial shear stress is neglected in the model. More careful measurements and calculations are needed to separate the effects of horizontal and vertical viscosities, Coriolis force, advection by a prevailing coastal current, and local wind stress on plume dynamics.

Keywords: Estuaries, Modeling-Hydrodynamic

BOWMAN, M.J.; WUNDERLICH, L.D. 1976. DISTRIBUTION OF HYDROGRAPHIC PROPERTIES IN THE NEW YORK BIGHT APEX. IN: MIDDLE ATLANTIC CONTINENTAL SHELF AND THE NEW YORK BIGHT. PROCEEDINGS OF THE SYMPOSIUM AMERICAN MUSEUM OF NATURAL HISTORY, NEW YORK CITY, NOVEMBER 3-5, 1975, M.G. GROSS, (ED.), SPECIAL SYMPOSIA 2:58-68. Seasonal hydrographic cycles are interpreted through a series of isometric block diagrams and planimetric projections illustrating the distributions of temperature, salinity, and density in the Bight Apex. Seasonal cycles are typical of those found in coastal seas near river mouths in drowned river valleys in temperate latitudes. The prevailing southwest coastal drift, the right-angle bend of the coastline, seasonal and short term wind patterns, and the presence of the Hudson Shelf Valley all influence the nearshore circulation.

Keywords: Circulation

BOWMAN, M.J.; WUNDERLICH, L.D. 1977. HYDROGRAPHIC PROPERTIES. MESA NEW YORK BIGHT ATLAS MONOGRAPH 1, 78 pp. Cycles of temperature, salinity, and density characteristic of the Middle Atlantic Bight, which includes New York Bight, are determined by seasonal patterns of

isolation, river runoff, evaporation minus precipitation, winds, ocean currents and shelf/slope exchange processes. Shelf temperatures have a large annual nearshore range around 25 °C; the water column is unstratified in winter but is dominated by a strong thermocline in summer. A cool pool of bottom shelf water on the middle and outer continental shelf remains during the summer as a remnant of the previous winter and persists throughout the entire Middle Atlantic Bight. The salinity of shelf water varies from year to year; these variations are often larger than the seasonal cycle. The principle salinity gradients are vertical and cross-shelf; salinities are lowest near shore. Salinities increase with depth on the shelf, but the vertical gradient reverses over the continental slope. Salinities are highest in winter and lowest in late summer. Total freshwater volume on the shelf equals an average of 18 months' discharge of river water. The density field in winter is principally determined at all depths by salinity; patterns of surface density throughout the year are similar to those of surface salinity. The summer thermocline converts the winter's unstratified density field into one with strong vertical stratification. The principal winter hydrographic feature of the outer shelf is a strong temperature/salinity front separating shelf water from slope water. During summer the thermocline eliminates any surface manifestation of the temperature front, but the salinity front persists throughout the year. A temperature/salinity inversion underlying the fronts is formed of shallow slope water and inclines shoreward, intersecting the shelf break at about 150 m. Shelf/slope exchange processes and slope frontogenesis are dominated by small-scale dynamics, vary greatly with time and space, and are difficult to measure. Gulf Stream meanders and eddies occasionally pass through the outer Bight, creating major disruptions in the hydrographic properties of the slope waters.

Keywords: Circulation, Monitoring-MESA, Reviews-Physical

BOXER, B. 1984. BO HAI, MEDITERRANEAN, NEW YORK BIGHT: SCIENCE AND POLICY PERSPECTIVES. VIEWPOINT 15(9):320-325.

Keywords: Management

BRADFORD, R.G.; STEPHENSON, R.L. 1992. EGG WEIGHT, FECUNDITY, AND GONAD WEIGHT VARIABILITY AMONG NORTHWEST ATLANTIC HERING (*CLUPEA HARENGUS*) POPULATIONS. CAN J FISH AQUAT SCI 49(10):2045-2054.

Keywords: Fish-*Clupea*

BRAIL, R.K.; HUGHES, J.W. 1977. TRANSPORTATION. MESA NEW YORK BIGHT ATLAS MONOGRAPH 24, 37 pp. Transportation facilities in the New York Bight region include extensive highways, subways, railroads, airports, tunnels, and bridges. In 1970, 14.9 million people lived in the Bight region; there were 6.8 million jobs. The dominant mode of transportation is the automobile. Fully 70% of all weekdays trips in 1970 were made by car; 13%

were made by rapid transit (predominantly the subway) and 21% by bus. Though New York City contained most of the region's employment (60%) and population (53%) in 1970, decentralizing influences are at work. As the suburban and outer fringe countries grow, their almost total dependence on the automobile will mean increased congestion and pollution unless mass transit utilization is encouraged.

Keywords: Monitoring-MESA

BRANNON, J.M.; HOEPEL, R.E.; GUNNISON, D. 1987. CAPPING CONTAMINATED DREDGED MATERIAL. MAR POLLUT BUL 18(4):175-179. The ability of various uncontaminated cap materials of varying thicknesses to isolate contaminated dredged material from the water column was assessed in large (250 l.) reactor units using chemical and microbial tracers. Heavy metals, PCBs, PAHs, and bacterial spores contained in the underlying contaminated dredged material were monitored in the overlying water column, in clams (*Rangia cuneata*) suspended in the water, and in burrowing polychaetes (*Nereis virens*). Tissue analysis of *Rangia* indicated that none of the 5-cm cap thicknesses tested was totally effective in preventing contaminant transfer to biota. However, cap materials consisting predominantly of clay and silt appeared more effective than sand in preventing contaminant transfer to biota. *Rangia* did not show elevated tissue concentrations of chemicals when contaminated sediment was covered with a 50-cm cap. However, chemical and microbial results indicated the *Nereis* breached both the 5 cm and 50 cm thicknesses of all cap materials tested.

Keywords: Capping

BRANNON, J.M.; HOEPEL, R.E.; STURGIS, T.C.; SMITH, I.; GUNNISON, D. 1985. EFFECTIVENESS OF CAPPING IN ISOLATING CONTAMINATED DREDGED MATERIAL FROM BIOTA AND THE OVERLYING WATER. TECH. REPORT D-85-10, US ARMY ENGINEER WATERWAYS EXPERIMENT STATION, VICKSBURG, MS. The effectiveness of capping in chemically and biologically isolating contaminated dredged material was investigated using large- (250 l) and small- (22.6 l) scale laboratory reactor units. The ability of various cap materials to isolate contaminated dredged material was assessed in the large reactor units by following the movement of chemical contaminants and microbial spores contained in the capped dredged material into the overlying water column and by monitoring the biological uptake of chemical contaminants by clams and polychaetes. The depth of cap material needed to chemically isolate contaminated dredged material was assessed in the small-scale reactor units. Changes in overlying water concentrations of DO, ammonium nitrogen ($\text{NH}_4^+\text{-N}$), manganese, and orthophosphate were monitored following isolation of the water column from air by placing a 4-cm layer of mineral oil on the surface. The constituents analyzed were selected due to their mobility under anaerobic conditions, ease of measurement, and generally high concentrations in contaminated dredged material compared to clean cap materials

Three capping materials, sand, clay (New Haven Harbor sediment), and silt (Vicksburg silt), were evaluated for their efficiency in preventing transfer of contaminants from a contaminated sediment into the overlying water column and biota. In the presence of bioturbating polychaetes (*Nereis virens*) at densities of 100 large animals per square meter, a 50-cm cap of any of the three materials tested in the large chamber experiments was effective in preventing the transfer of chemical constituents and microbial spores to the overlying water and nonburrowing biota. Chemical analysis of polychaetes penetrated both the 5-cm cap and 50-cm caps of all materials tested.

A 5-cm cap in the presence of polychaetes was not completely effective in preventing the transfer of contaminants and microbial spores in the dredged material into the overlying water and biota. However, a 5-cm New Haven Harbor sediment or Vicksburg silt cap was relatively more effective than a 5-cm sand cap in preventing the movement of PCB or PAH compounds through the cap and into biota (clams). These bioaccumulation results were in relatively close agreement with results obtained in smaller reactor units for DO depletion and NH_4^+ -N release. The efficiency of cap materials in preventing DO depletion and NH_4^+ -N releases attributable to the capped dredged material was in the order: New Haven sediment > Vicksburg silt > sand. Cap materials with higher proportions of clay and silt should, therefore, be relatively more effective than cap materials consisting predominantly of sand in preventing contaminant movement into the overlying water and biota. However, a thick cap (50 cm or more) of any of the materials tested effectively isolated the overlying water and nonburrowing biota from the contaminated sediment.

Keywords: Capping

BRANNON, J.M.; HOEPEL, R.E.; STURGIS, T.C.; SMITH, I.; GUNNISON, D. 1986. EFFECTIVENESS OF CAPPING IN ISOLATING DUTCH KILLS SEDIMENT FROM BIOTA AND THE OVERLYING WATER. MISC. PAPER D-86-2, US ARMY ENGINEER WATERWAYS EXPERIMENT STATION, VICKSBURG, MS.

Keywords: Capping

BRANNON, J.M.; POINDEXTER-ROLLINGS, M.E. 1990. CONSOLIDATION AND CONTAMINANT MIGRATION IN A CAPPED DREDGED MATERIAL DEPOSIT. THE SCIENCE OF TOTAL ENVIRONMENT 91:115-126. The effectiveness of capping contaminated dredged material was investigated in a subaqueous depression in the Duwamish Waterway in Seattle, WA. Field studies were conducted to evaluate the consolidation of the capped material as well as the movement of contaminants from the dredged material into the uncontaminated cap material. Results showed that most of the dredged material consolidation at this site occurred during the first 2 weeks following capping. Monitoring of containment concentrations in the

capped deposit for 18 months showed no movement of contaminants from the dredged material into the capping material.

Keywords: Capping

BREWER, J. 1965. MARINE LIFE ON THE ARTIFICIAL REEF OFF FIRE ISLAND, N.Y. UNDERWATER NAT 3(3):11-14. Survey of marine life found at three-year-old boulder and rubble reef.

Keywords: Artificial reefs

BRIGGS, P.T. 1975. AN EVALUATION OF ARTIFICIAL REEFS IN NEW YORK'S MARINE WATERS. NY FISH GAME J 22(1):51-56. Kismet Reef in Great South Bay and Fire Island in the Atlantic Ocean were studied to determine their success in attracting finfish. Kismet Reef attracted large numbers of fish with catches dominated by tautog. Fire Island Reef also attracted many fish, although no species dominated the catch. Both reefs were considered successful. Kismet Reef was often overcrowded in the fall, and expansion to its fully authorized area seems desirable. Future artificial reef building in New York waters might best be directed toward the south shore bays and similar sheltered waters, although present oceanic reefs should not be abandoned.

Keywords: Artificial reefs

BRIGGS, P.T. 1978. BLACK SEA BASS IN NEW YORK WATERS. NY FISH GAME J 25(1):45-58. Black sea bass were found to be slow growing, reach an average length of only 378 millimeters at annulus IX. The ratio of males to females did not differ significantly from 1:1. Larger fish were mostly males. Migration southward from New York waters appears to begin in October. Local fish winter at least as far south as off the Delaware coast. Northward migration back to New York waters apparently begins in late April and early May. To assure that black sea bass reach sexual maturity and spawn at least once, it would be necessary to raise the minimum size for fish that may be bought or sold to at least 9.5 inches and apply it to sport-caught fish as well as those traded in commerce.

Keywords: Fish-*Centropristis striata*, Fisheries

BRIGGS, P.T.; ZAWACKI, C.S. 1974. AMERICAN LOBSTERS AT ARTIFICIAL REEFS IN NEW YORK, U.S.A. NY FISH GAME J 21(1):73-77. The American lobster (*Homarus americanus*) was studied at two artificial reefs, one in South Bay and the other in the Atlantic Ocean. Different catch rates, sizes and sex ratios were observed at these reefs. The differences in population parameters appeared to be primarily a result of onshore migration of adult lobsters from offshore stocks to oceanic reefs.

Keywords: Artificial reefs, Benthos-*Homarus*

BRIGGS, P.T. 1977. STATUS OF TAUTOG POPULATIONS AT ARTIFICIAL REEFS IN NEW YORK WATERS AND EFFECT OF FISHING. NY FISH GAME J 24(2):154-167. Population estimates indicate that as many as 18,898 tautog (*Tautoga onitis*) were attracted to the Kismet artificial reef in Great South Bay, Long Island, New York. At Kismet fish averaged only 216 mm long, while at the Fire Island artificial reef in the Atlantic Ocean they averaged 280 mm. Tag returns indicate that a migration of tautog from Kismet reef began in October each year and that these fish overwintered in the inshore waters of the northwestern corner of the New York Bight. Data for mortality, growth rate, and age at sexual maturity indicate that the population studied is not achieving its potential productivity. Assuming this population to be representative of that in New York waters, in order that females spawn at least once it would be necessary to raise the minimum size of tautog that may be taken to 9 inches (228 mm) and apply this size limit to both the sport and commercial fisheries.

Keywords: Artificial reefs, Fisheries, Fish-*Tautoga*

BUCHANAN, C.C. 1972. A COMPARISON OF SPORT FISHING STATISTICS FROM MAN-MADE AND NATURAL HABITATS IN THE NEW YORK BIGHT. REPORT NO.: NOAA-83052504, 12 pp. The author reports a study to compare sport fishing statistics for anglers using artificial reefs, wrecks, and natural habitats in the northwest section of the New York Bight. The data indicate that anglers' catch rates over man-made and natural habitats varied among the different fishing techniques and angler groups. In general, man-made habitats improved an angler's catch rates while bottom-fishing, but did not alter his surface-fishing catch rate. It is suggested that artificial reefs have proven to be an effective tool for increasing the amount of good bottom-fishing grounds in the New York Bight.

Keywords: Artificial reefs, Fisheries

BUCHANAN, C.C. 1973. OCCURRENCE OF MATURE REDFISH *SEBASTES MARINUS* IN SPORT FISHERY OF THE NEW YORK BIGHT. U S NATL MAR FISH SERV FISH BULL 71(2):597-598. The 1971 sport fishery survey of the New York Bight waters reported catching redbfish *Sebastes marinus* along the edges of the Hudson Canyon. Specimens obtained and examined later were found to be sexually mature fish. This is the first record of redbfish being caught in the marine sport fishery off New York and is a substantial extension of the southern and western breeding range for *Sebastes* in the North Atlantic.

Keywords: Fisheries, Fish-*Sebastes*, Hudson Shelf Valley

BULLOCH, D.K. 1965. THE DEVELOPMENT OF THE WRECK, PINTA AS A MARINE HABITAT. UNDERWATER NAT 3(1):17-19, 31-32. This paper discusses colonization of a sunken motorship off New Jersey.

Keywords: Artificial reefs

BUMPUS, D.F.; 1969. REVERSALS IN THE SURFACE DRIFT IN THE MIDDLE ATLANTIC BIGHT AREA. DEEP-SEA RES SUPPL 16:17-23. Reversals in the surface drift off the Middle Atlantic States in mid-summer have been observed more frequently during the 1960s than previously. These are associated with the low runoffs of the Delaware and Hudson River watersheds during this period especially during the drought of 1963-1966. It is predicted that surface current reversals may be expected at any time, April-September, when the wind is from the southern sector and the runoff during March, April and/or May has been much below normal.

Keywords: Circulation

BUZAS, M.A.; CARPENTER, J.H.; KETCHUM, B.H.; MCHUGH, J.H.; NORTON, V.J. 1972. SMITHSONIAN ADVISORY COMMITTEE REPORT ON STUDIES OF THE EFFECTS OF WASTE DISPOSAL IN THE NEW YORK BIGHT. SMITHSONIAN INSTITUTION, WASHINGTON, D.C., OCEANOGRAPHY AND LIMNOLOGY PROGRAM, 68 pp. The report reviews six documents on ocean waste disposal off of New York Harbor, in terms of scientific content and meaning, and the effects of waste disposal on the New York Bight. It also suggests changes in present disposal operations and recommends further research. The six reports reviewed were: Preliminary Analyses of Urban Wastes, NY Metropolitan Region; Analysis of Dredged Wastes, Fly Ash, and Waste Chemicals-NY Metropolitan Region (AD 723 791); Ocean Waste Dumping Operations Monitoring; and The Effects of Waste Disposal in the New York Bight.

Keywords: Ocean disposal

CALABRESE, A.; GOULD, E.; THURBERG, F.P. 1982. EFFECTS OF TOXIC METALS IN MARINE ANIMALS OF THE NEW YORK BIGHT: SOME LABORATORY OBSERVATIONS. IN: ECOLOGICAL STRESS AND THE NEW YORK BIGHT: SCIENCE AND MANAGEMENT. PROCEEDINGS OF A SYMPOSIUM ON THE ECOLOGICAL EFFECTS OF ENVIRONMENTAL STRESS, NEW YORK, NY, JUNE 10-15, 1979, G.F. MAYER, (ED.), ESTUARINE RESEARCH FEDERATION, COLUMBIA, SC, pp. 281-298. This report summarizes the results of eight years of experimental exposure studies on the effects of heavy metals in marine animals. The studies were conducted at the National Marine Fisheries Service Laboratory at Milford, Connecticut and focused on organisms from the New York Bight. Of the metals tested, mercury and silver were most toxic to early-life stages (bivalve embryos

and larvae, juvenile crustaceans), as determined by bioassay methods. Cadmium and mercury were the most toxic to adult teleosts and crustaceans, as determined by physiological and biochemical measurements. Tissue uptake was far greater for mercury than for cadmium. Lead was more toxic than cadmium for early-life forms but less toxic than either mercury or silver. Chronic exposure to 6 ppb cadmium or to 6 ppb mercury induced metabolic disturbances in the lobster (*Homarus americanus*), with somewhat more significant effects seen in cadmium-exposed animals, despite greater accumulation of mercury in body tissues. Analogous results were seen during chronic exposures of winter flounder (*Pseudopleuronectes americanus*) to 10 ppb of either cadmium or mercury; similar exposures of flounder to five times as much lead produced less metabolic disturbance. Low salinity enhanced or altered some effects and, in combination with suboptimal temperatures, increased metal toxicity to early-life forms. Chronic exposure of adult animals to sublethal concentrations of toxic metals drains energy reserves and may reduce capacity to adapt and survive natural environmental stresses.

Keywords: Pollutants-Metals, Pollutants-Toxicity

CALLAWAY, R. 1974. COMPUTATION OF TIDES, CURRENTS, AND DISPERSAL OF POLLUTANTS IN THE NEW YORK BIGHT FROM BLOCK ISLAND TO ATLANTIC CITY WITH LARGE GRID SIZE, SINGLE AND TWO-LAYER HYDRODYNAMICAL-NUMERICAL MODELS. PART 4. GOVERNMENT REPORTS ANNOUNCEMENTS 74(14):57.

Keywords: Modeling-Hydrodynamic, Pollutants

CALLAWAY, R.J.; TEETER, A.M.; BROWNE, D.W.; DITSWORTH, G.R. 1976. PRELIMINARY ANALYSIS OF THE DISPERSION OF SEWAGE SLUDGE DISCHARGED FROM VESSELS TO NEW YORK BIGHT WATERS. IN: MIDDLE ATLANTIC CONTINENTAL SHELF AND THE NEW YORK BIGHT. PROCEEDINGS OF THE SYMPOSIUM AMERICAN MUSEUM OF NATURAL HISTORY, NEW YORK CITY, NOVEMBER 3-5, 1975, M.G. GROSS, (ED.), SPECIAL SYMPOSIA 2:199-211. New York City sewage treatment plant wastes discharged to the New York Bight Apex average 2.6% solids with an average solids density of 1.5 g/cm³. Bulk waste density is about 1.009 g/cm³, whereas the density of surface seawater in the sludge dumping area ranges from 1.019-1.025. Solids concentration of the wastes in the sludge vessels ranged from 5 to 50 g/liter. Correlation of extinction coefficient from a 10-cm light-path beam-transmissometer with total suspended matter (TSM) allowed continuous profiling of TSM. STD and beam transmittance profiles were made either by towing the instrument through a sludge patch or by making vertical profiles. Dilution from a near-instantaneous release was on the order of 1,000 within 10 min of release. Dilution in the wake of a release ranged from 500-100.

The time for TSM to reach background or equilibrium values (0.5-2 mg liter⁻¹) depends on initial concentration. Equilibrium time was approached exponentially

for well mixed conditions in about 5.5 hr. Pycnocline formation in the upper 8 m caused a similar approach to equilibrium time; below that depth TSM increased slightly with time. Settling velocities for the larger flocculated sludge particles averaged about 0.5-1 cm/sec. Values of 0.01-0.3 cm/sec were obtained from plots of the center of mass of the waste field. The remainder of the dispersing sludge field had velocities of 10^{-3} cm/sec and less.

TSM from New York Harbor can reach the permit area, but oceanographic conditions in the Apex usually prevent this. Relocating the permit area to other deeper areas would cause the affected bottom area to increase in proportion to the increased depth, but concentrations of settled-out material would be inversely proportional, if the oceanographic environment was similar.

Keywords: Ocean disposal-12 mile, Pollutants-Water quality

CAMPBELL, R.A.; HAEDRICH, R.L.; MUNROE, T.A. 1980. PARASITISM AND ECOLOGICAL RELATIONSHIPS AMONG DEEP SEA BENTHIC FISHES. MAR BIOL 57(4):301-314. The metazoan parasite fauna of 52 species of deep-living benthic fishes from depths of 53 to 5,000 m off the New York Bight (39-49° N; 70-72° W) was studied. A total of 17,144 parasites were recovered from 1712 fishes. The infestation rate was 80%, with an average of 12.5 worms per host. Percentage occurrence by group among all fishes was Monogenea 12.9%, Digenea 48%, Cestoda 22.1%, Nematoda 54.5%, Acanthocephala 3.8%, and Copepoda 4.5%. Differing composition of the parasite fauna in different fish species reflects differences in diet. Specialized feeders are distinct; generalized feeders, which predominate, show overlaps in parasite fauna. In individual species, changes in diet with growth are reflected in changes in the parasite fauna. Infestation rate is directly related to abundance of the free-living fauna; fish from within the submarine canyon are more heavily infested than those living outside the canyon. Although it contains fewer families and genera than shallow faunas, the deep-sea parasite fauna is not extremely unusual in terms of its abundance, diversity, or host specificity. At the greatest depths, parasite abundance and diversity dramatically decline.

Keywords: Benthos, Fish, Parasites

CARACCILOLO, J.; PEARCE, J.; HALSEY, M.; ROGERS, L. 1978. DISTRIBUTION AND ABUNDANCE OF BENTHIC ORGANISMS IN THE NEW YORK BIGHT, FIRST AND SECOND MONITORING CRUISES, NOVEMBER 1975 AND MARCH 1976. NOAA DR ERL MESA-40; NOAA-78121205, 53 pp. Analyses of benthic communities have been used since 1968 to indicate impacts from contaminants on the ecosystem of the New York Bight Apex. This data report is product of the fourth phase, monitoring of selected stations in the Apex, and was prepared to provide machine listed data and certain statistical calculation, diversity, and equitability concerned with the distribution and abundance of benthic organisms collected at 18 monitoring stations located in the standard New York Bight MESA sampling grid. Data from these stations will

yield information on changes in the Bight over time by providing more replicate samples which may be compared with earlier samples collected at the same stations. Moreover, these stations also form the basis for sampling strata 4 of the NMFS Ocean Pulse environmental assessment program.

Keywords: Apex, Benthos, Monitoring-MESA

CARACCILOLO, J.V.; STEIMLE, JR, F.W. 1983. ATLAS OF THE DISTRIBUTION AND ABUNDANCE OF DOMINANT BENTHIC INVERTEBRATES IN THE NEW YORK BIGHT APEX WITH REVIEWS OF THEIR LIFE HISTORIES. NOAA TECHREP NMFS-SSRF-766; NOAA-83052314, 68 pp. Distribution, abundance, and life history summaries are given for 58 important species of benthic invertebrates collected in the New York Bight Apex during five sampling cruises in 1973 and 1974. These species showed affinities to major community types that have been previously identified in the Middle Atlantic Bight, and some showed varying degrees of tolerance of areas in the Apex where the dumping of New York Harbor dredge spoils and New York metropolitan area sewage sludge occurs. *Capitella capitata*, a species often associated with pollution stress, dominated the sewage sludge dump site.

Keywords: Apex, Benthos, Ocean disposal-Sewage sludge

CARACCILOLO-WARD, J.; STEIMLE, F.W., JR. 1984. A REVIEW OF THE BENTHIC FAUNA AT THE PROPOSED 60-MILE NORTHERN ALTERNATE SITE FOR WASTE DISPOSAL AND RISKS IF USED. NOAA/NMFS/NEFC, SANDY HOOK LABORATORY REPORT SHL 84-03, 22 pp.

Keywords: Benthos, Ocean disposal

CARLETON, H.R.; DUEDALL, I.W.; WOODHEAD, P.M.J.; PARKER, J.H. 1982. COAL COMBUSTION WASTES AS MATERIAL FOR ARTIFICIAL REEF CONSTRUCTION. OCEANS 82 CONFERENCE RECORD: INDUSTRY, GOVERNMENT, EDUCATION - PARTNERS IN PROGRESS - WASHINGTON, D.C., pp. 1010-1015. An artificial reef program has been established to study the environmental acceptability of using scrubber sludge and fly ash for offshore fishing reef construction. Biological colonization has been successful. A diverse community of invertebrates and fishes inhabit the reef.

Keywords: Artificial reefs

CARLS, E.G. 1978. RECREATION. MESA NEW YORK BIGHT ATLAS MONOGRAPH 19, 32 pp. Marine recreation in the New York Bight region is a varied and extensive field for study. Although its shoreline resources are limited, the Bight region is increasingly in demand as a coastal recreation area. Federal,

state, and local authorities currently provide significant park and open space opportunities for recreation and related services. Private and commercial enterprises provide important services and facilities as well (e.g., marinas and charter boat rentals) and may become increasingly important in meeting future demand. Recreational activities include swimming, fishing, and boating. Extensive information is available on coastal recreation in the Bight region but not in a form for integration of sources or overall regional synthesis. Future study should center on problems associated with shoreline access, environmental quality, planning and management procedures, and economic analysis. The future of coastal recreation in the New York Bight is tenuous. Accurate prediction of recreation potential is made impossible by a set of ongoing and interacting changes (e.g., population size and distribution, water quality, and demand for shoreline uses). The future of recreation is tied very closely to and will depend on the dynamics of the region's broader social, economic, and environmental conditions.

Keywords: Monitoring-MESA

CARMODY, D.; PEARCE, J.; YASSO, W. 1973. TRACE METALS IN SEDIMENTS OF THE NEW YORK BIGHT. MAR POLLU BULL 4(9):132-135. Concentrations of chromium, copper, lead, nickel, and zinc in superficial sediments in New York Bight are ten to a hundred times greater near waste disposal areas than in uncontaminated sediments. Some wastes are transported by currents northeast towards Long Island and southeast along the Hudson Shelf Valley.

Keywords: Pollutants-Metals

CARRIKER, M.R.; ANDERSON, J.W.; DAVIS, W.P.; FRANZ, D.R.; MAYER, G.F.; PEARCE, J.B.; SAWYER, T.K.; TIETJEN, J.H.; TIMONEY, J.F.; YOUNG, D.R. 1982. EFFECTS OF POLLUTANTS ON BENTHOS. IN: ECOLOGICAL STRESS AND THE NEW YORK BIGHT: SCIENCE AND MANAGEMENT. PROCEEDINGS OF A SYMPOSIUM ON THE ECOLOGICAL EFFECTS OF ENVIRONMENTAL STRESS, NEW YORK, NY, JUNE 10-15, 1979, G.F. MAYER, (ED.), ESTUARINE RESEARCH FEDERATION, COLUMBIA, SC, pp. 3-21. Intensive quantitative ecological studies of the benthos of the New York Bight were not begun until the early 1960's, by which time significant alteration of benthic communities had already occurred. This paper summarizes investigations on the effects of organic loading, petroleum hydrocarbons, synthetic organics (e.g., pesticides and industrial compounds), and toxic metals on the structure and function of benthic communities of the New York Bight.

Keywords: Benthos, Pollutants-Bioaccumulation, Pollutants-Toxicity

CASEY, J.G.; PRATT, H.L., JR. 1985. DISTRIBUTION OF THE WHITE SHARK, *CARCHARODON CARCHARIAS*, IN THE WESTERN NORTH

ATLANTIC. BIOLOGY OF THE WHITE SHARK (*CARCHARODON CARCHARIAS*), FULLERTON, CA 7 MAY 1983. MEM. SOUTH. CALIF. ACAD. SCI., VOL. 9. BIOLOGY OF THE WHITE SHARK. J.A. SEIGEL AND C.C SWIFT, (EDS.), pp. 2-14. Based on 380 recorded sightings, the white shark (*Carcharodon carcharias*) is principally distributed in neritic waters of the western North Atlantic from the Gulf of Mexico to Newfoundland. The species is rare throughout most of the western North Atlantic. The authors have recorded relative abundances in the New York Bight as high as 1:210 of all sharks landed. An examination of stomachs from 54 young white sharks showed a diet comprised primarily of demersal fishes. Larger white sharks feed on marine mammals in this area. Sizes of examined specimens ranged from 122 cm (12 kg) to 497 cm (1247 kg). Lengths in the sightings file ranged from 105 cm to 945 cm. A length-weight curve based on 200 sharks is provided.

Keywords: Fish-*Carcharodon*

CHANG, S.; LONGWELL, A.C. 1984. EXAMINING STATISTICAL ASSOCIATIONS OF MALFORMATION, CYTO-PATHOLOGY AND CYTOGENETIC ABNORMALITY OF ATLANTIC MACKEREL EMBRYOS WITH INDICATOR LEVELS OF ENVIRONMENTAL CONTAMINANTS IN THE NEW YORK BIGHT. 1984 COUNCIL MEETING OF THE INTERNATIONAL COUNCIL FOR THE EXPLORATION OF THE SEA (COPENHAGEN DENMARK) 8 OCTOBER 1984. INTERNATIONAL COUNCIL FOR THE EXPLORATION OF THE SEA, COPENHAGEN (DENMARK). PUBL: ICES, COPENHAGEN (DENMARK). ICES-CM-1984/E:11, 15 pp.

Keywords: Disease, Fish-*Scomber*, Pollutants-Toxicity

CHANG, S.; STEIMLE, F.W.; REID, R.N.; FROMM, S.A.; ZDANOWICZ, V.S.; PIKANOWSKI, R.A. 1992. ASSOCIATION OF BENTHIC MACROFAUNA WITH HABITAT TYPES AND QUALITY IN THE NEW YORK BIGHT. MAR ECOL PROG SER 89:237-251. Previous qualitative and limited quantitative analyses of benthic data from the New York Bight have suggested associations among macrofauna and sediment characteristics, including levels of chemical contamination. Benthic data from 3 summers (1980 to 1982) of sampling were used to examine these relationships more thoroughly. Factor and canonical analyses confirmed that a limited group of macrofaunal taxa (*Ceriantheopsis americanus*, *Nephtys incisa*, *Capitella* spp., *Nucula proxima* and *Ampelisca agassizi*), historically considered indicators of habitat quality, were indeed valid indicators. Ordination analyses provided greater detail about the association of, and between, sediment variables and the 80 most frequently occurring species. The results allowed a characterization of the New York Bight benthic habitat, encompassing the range from an undisturbed habitat to the lowest quality habitat. One species group was consistently associated with minimally contaminated sediments and appears to represent a basic natural benthic macrofaunal assemblage for the Bight. This group included taxa such as the sand

dollar *Echinarachnius parma* and several species of amphipods (e.g., *Byblis serrata*, *Corophium crassicornis* and *Ampelisca agassizi*) as well as some polychaetes (e.g., *Goniadella gracillis* and *Exogone hebes*). Species that were the most common in the contaminated areas of the Bight were mainly polychaetes (e.g., *Tharyx acutus*, *Nephtys incisa*, *Pherusa affinis* and *Capitella* spp.) as well as the Nemertinea (*Cerebratulus lacteus*), an anemone (*Ceriantheopsis americanus*), a phoronid (*Phoronis architecta*) and the nut clam (*Nucula proxima*).

Keywords: Benthos, Reviews-Biological

CHARLES, J.; MURAMOTO, J.A. 1991. ASSESSMENT OF CONTAMINANTS IN SEDIMENT AND BIOTA AT THE MUD DUMP SITE, NEW YORK BIGHT OCTOBER 1990. SAIC REPORT NO. SAIC-91/7608 & 256, 138 pp. Results of body burden analyses at the Mud Dump Site compared well with reported literature values for comparable field studies involving polychaetes. Metals, pesticides, and PCBs were either low in the tissue or below detection limits and do not appear to pose a significant problem within the Mud Dump from the standpoint of bioaccumulation in polychaete worms.

Metal concentrations were higher in the sediments from the Mud Dump site than concentrations at the reference site or farther outside the Mud Dump site. The highest sediment concentrations of most metals (Ag, As, Be, Cd, Cr, Cu, Fe, Hg, Ni, Pb, and Zn) were found at stations OFF15, OFF19, and/or both. Elevated concentrations of metals were also found at the stations which were sampled along the eastern and southern sides of the Mud Dump. The lowest concentrations of most metals were found in the areas south and north of the Mud Dump and in the northern part of the designated Mud Dump. Metal concentrations correlated positively to silt content. High concentrations of silt were observed at the same stations along the eastern and southern sides of the Mud Dump where high metal concentrations were measured. Sandy sediments had low concentrations of metals. Silt concentration appears to be a reasonably good predictor of the metal concentration in a sediment, so that if the silt content of a sediment were known, the approximate metal concentration may be estimated. Metal enrichment factors for sediments at individual stations, calculated relative to natural quartzose sand and glauconitic sand underlying the Mud Dump, corroborated this pattern: the highest enrichment factors were found at stations along the eastern and southern sides of the Mud Dump and particularly at stations OFF15 and OFF19. All metals were strongly associated with each other. The metals Ag, Cd, Cr, Cu, Hg, Ni, Pb, and Zn showed a particularly strong association and Be, Ni, and Fe a somewhat weaker correlation.

Keywords: Ocean disposal-Dredged material, Pollutants-Bioaccumulation, Pollutants-Sediments

CHARNELL, R.L.; APEL, J.R.; MANNING, W.; QUALSET, R.H. 1974. UTILITY OF ERTS-1 FOR COASTAL OCEAN OBSERVATION: THE NEW

YORK BIGHT EXAMPLE. MAR TECH SOC J 8(3):42-47. An Earth Resources Technology Satellite (ERTS-1) image taken over New York Bight on August 16, 1972 was enhanced with the view to evaluating the sensor package for oceanic observation. Although ocean information is substantially less dynamic than land-related information, several important ocean features were detected. This examination leads to the conclusion that satellites such as ERTS can be used to study movement and structure of particulate plumes from river outflow, to monitor deposition and dispersion of waste dumps, to observe some water mass boundaries, and to detect the presence and measure the characteristics of internal gravity waves.

Keywords: Remote sensing

CHARNELL, R.L.; DARNELL, M.E.; BERBERIAN, G.A.; KOLITZ, B.L.; HAZELWORTH, J.B. 1976. NEW YORK BIGHT PROJECT, WATER COLUMN CHARACTERIZATION CRUISES 1 AND 2 OF THE NOAA SHIP RESEARCHER 4-15 MARCH--5-14 MAY 1974. NOAA DR ERL MESA-18; NOAA-77072516, 226 pp. During the spring of 1974, two oceanographic cruises were made by the NOAA Ship Researcher in the New York Bight. The cruises were used for deployment and recovery of three bottom-mounted pressure gauges and to collect physical and chemical oceanographic data from the water column. Thirty-one oceanographic stations were occupied on a segment of the continental shelf bounded on the east by Block Island, on the south by Cape May, and extending outward to the edge of the continental shelf. This report presents the corrected water column data from these two cruises and describes the measurement methods and corrections applied to the data.

Keywords: Miscellaneous-Physical, Monitoring-MESA

CHARNELL, R.L.; MAUL, G.A. 1973. LETTERS TO NATURE. NATURE 242:451-452. On August 16, 1972, the multispectral scanner (MSS) aboard the first Earth Resources Technology Satellite (ERTS) obtained images of New York Bight which contained information of oceanographic significance. The MSS measures reflectance of solar energy in four channels with band pass filters that cover visible and near infrared bands from 0.5 to 1.1 μm . The band most sensitive to ocean features shows turbid surface water near the coast. A plume of light-colored water extends from the New York Harbor complex south along the New Jersey coast. The plume, approximately 18 miles long and 7 miles wide, represents the offshore Hudson River effluent. Inhomogeneities in the plume indicate the turbulent mixing processes by which plume water is absorbed into ambient Bight water. A line resulted from the disposal of waste acid. Less distinct portions of the line may be the residue of an earlier dump, at least 12 hr. before; dispersion has evidently been slow. The diffuse circular path north of the waste acid dump is close to the sewer sludge dump site. Surface vestige of a sewer sludge dump is much less noticeable than waste acid. It seems likely that satellites with sensors optimized to view the ocean in visible and infrared

wavelengths, supplying synoptic data over large areas, will materially aid management of the coastal zone on a broad scale.

Keywords: Circulation, Hudson River plume, Ocean disposal, Remote sensing

CHIARELLA, L.A.; CONOVER, D.O. 1990. SPAWNING SEASON AND FIRST-YEAR GROWTH OF ADULT BLUEFISH FROM THE NEW YORK BIGHT. TRANS AM FISH SOC 119(3):455-462. Bluefish *Pomatomus saltatrix* in the western North Atlantic spawn in the South Atlantic Bight in spring and the Mid-Atlantic Bight in summer. Back-calculations were performed to length at age 1 from scales of fish captured during June-September 1986 and 1987 from Long Island, New York, to determine if spring- and summer-spawned fish could be identified among summer-spawning adults captured in New York Bight. Analysis of gonads confirmed that the summer spawning season off New York is a temporally distinct event occurring from late June to late August, with peak activity in July. All fish used for back-calculations were in spawning condition, and most had lengths at age 1 characteristic of a spring birth date (mean length, 26.5 cm). This observation does not support the hypothesis that spring and summer spawners are two different stocks of fish. Contemporary stocks of adult bluefish along the mid-Atlantic coast may consist largely of spring-spawned fish.

Keywords: Fish-*Pomatomus*

CLANCY, M. 1974. COMPUTATION OF TIDES, CURRENTS AND DISPERSAL OF POLLUTANTS IN LOWER BAY AND APPROACHES TO NEW YORK WITH FINE MEDIUM GRID SIZE HYDRODYNAMICAL-NUMERICAL MODELS. PART 3. GOVERNMENT REPORTS ANNOUNCEMENTS 74(14):57.

Keywords: Modeling-Hydrodynamic, Pollutants

CLARK, J. 1968. SEASONAL MOVEMENTS OF STRIPED BASS CONTINGENTS OF LONG ISLAND SOUND AND THE NEW YORK BIGHT. AM FISH SOC TRANS 97(4):320-343. Recaptures of striped bass, *Morone saxatilis*, tagged along the northeast Atlantic coast of the United States from 1959 to 1963 gave evidence of varied patterns of seasonal movement of the species. From analysis of distribution patterns of 498 recaptured fish, it is shown that distinguishable contingents of striped bass seasonally inhabit Long Island Sound and coastal waters of the New York Bight. Three groups that appeared to be of Hudson River origin were the Hudson Estuary, Hudson-Atlantic, and Hudson-West Sound Contingents. The origin of a fourth group, the Long Island Sound Contingent, was not evident. Other contingents, of southern or undetermined origin, also appeared in the area from spring to fall. The Hudson River is shown to be a major spawning river and source of recruitment of striped bass populations of Long Island Sound and the New York Bight.

Keywords: Fish-Morone

CLARK, J.F.; SIMPSON, H.J.; BOPP, R.F.; DECK, B. 1992. GEOCHEMISTRY AND LOADING HISTORY OF PHOSPHATE AND SILICATE IN THE HUDSON ESTUARY. ESTUAR COAST SHELF SCI 34:213-133. The loading history and geochemistry of soluble reactive phosphorus (SRP) and dissolved silica (DSi) are evaluated in the Hudson estuary using 16 years of axial transect data. SRP behaves atypically in the estuary. Profiles show conservative mixing between a large mid-salinity source and the freshwater and seaward end members. Order of magnitude calculations indicate that waste water treatment facilities (WWTFs) are the dominant mid-salinity SRP source. DSi profiles display behavior more typical of other estuaries in the northeastern United States, showing conservative mixing during periods of high flow and a mid-salinity source during periods of low flow. A single-layered multi-box model is used to evaluate the loading history of SRP and DSi. Shortly after the New York State phosphate detergent ban of 1972, the SRP load dropped to two thirds of that typical of the early 1970's. Loading of SRP remained at this level until the mid-1980's when construction began at the largest point source. During the construction phase (1984-1986), SRP loading returned to the early 1970's level. Upon completion, the total load declined once again and by the end of the 1980's it reached a level approximately one-third of that existing prior to the detergent ban. Model calculations of observed DSi profiles do not show a similar time-trend. They suggest that during summer months dissolution of diatom tests is a major source of DSi; however, WWTF DSi loads also appear to be a significant source to the Hudson estuary.

Keywords: Estuaries, Pollutants-Loadings, Pollutants-Organic

CLARKE, T.L.; SWIFT, D.J.P.; YOUNG, R.A. 1983. A STOCHASTIC MODELING APPROACH TO THE FINE SEDIMENT BUDGET OF THE NEW YORK BIGHT. J GEOPHYS RES 88(C14):9653-9660. A stochastic model of fine sediment transport on the continental shelf is modified to incorporate the effects of storm flows. The model, based on surface gravity wave resuspension, now includes transport by both tides and episodic storm flows. Effects of gravity wave/storm flow correlation as deduced from near bottom current meter measurements are also included. Sediment dispersion is significantly faster when the effects of storm flows are included. The effects of the gravity wave/storm flow correlation and the regional net flow pattern are small. The model is solved numerically for equilibrium dispersal patterns for sediment entering at estuary inlets bordering the New York Bight region. Additional dispersal patterns are found for upcoast and downcoast sources as well as the dredge spoil dump site.

Keywords: Circulation, Sediment transport

COCH, C.A.; STERN, E.A. 1988. INNOVATIVE USES OF DREDGED MATERIAL: CAPPING AS A MANAGEMENT TECHNIQUE FOR OCEAN DISPOSAL OF DREDGED MATERIAL. IN: BENEFICIAL USES OF DREDGED MATERIAL. PROCEEDINGS OF THE NORTH ATLANTIC REGIONAL CONFERENCE, BALTIMORE, MARYLAND, MAY 12-14, 1987, M.C. LANDIN, (ED.), pp. 158-176. The New York Corps of Engineers District (NYD) has developed viable management strategies for dredge material disposal requiring mitigation such as capping. These strategies result from continued monitoring and surveys of the Mud Dump Site and from previous dredging studies. These studies indicated that disposal and capping of contaminated dredged material with clean material by point dumping at a taut-moored buoy is an effective technique for ocean disposal of contaminated dredged material in an environmentally sound manner. Heavy metals, organics, and other contaminants are rapidly rendered harmless and are unavailable for potential bioaccumulation. Capping has been used as an effective management tool in NYD since 1980. Comparison of three surveys over an 8-year time period indicated that material was accurately placed at the buoy and that it had remained constant.

The Memorandum of Understanding between NYD and Region II, EPA, focuses on management and monitoring of the Mud Dump Site. It includes capping and disposal of maintenance and new work material by point dumping, cooperation on testing and permit processing, reporting of disposal volumes, alternatives to ocean disposal, and initiation of feasibility studies for designation of a new disposal site 20 miles offshore. Based on the 1986 survey results, EPA and NYD have agreed to a management plan for disposal and capping of material from Kill Van Kull/Newark Bay Deepening Project (KVK/NB). Two buoys will be used alternatively during the next 2 years so that maintenance material successively caps the KVK/NB material. PL 99-662, Section 211, requires that a new ocean disposal site 20 miles offshore be designated within 3 years and that the Mud Dump Site be used only for rock, sand, and "acceptable" material. NYD and EPA are seeking clarification on the definition of "acceptable" material and a time extension to allow data collection. Only material not requiring mitigation such as capping will be placed at the Mud Dump Site once the new site has been designated. Capping has proven to be a beneficial use of dredged material and an effective management tool for disposal of material from New York/New Jersey Harbor and will continue to be used by NYD on an operational basis in the foreseeable future.

Keywords: Management, Ocean disposal-Dredged material

COCHRAN, J.K.; ALLER, R.C. 1979. PARTICLE REWORKING IN SEDIMENTS FROM THE NEW YORK BIGHT APEX: EVIDENCE FROM $^{234}\text{Th}/^{238}\text{U}$ DISEQUILIBRIUM. ESTUAR COAST MAR SCI 9(6):739-747. Two diver-collected cores of mud-rich sediment from the New York Bight apex have been analyzed for ^{238}U and ^{232}Th decay series nuclides with emphasis on $^{234}\text{Th}/^{238}\text{U}$ disequilibrium. Excess ^{234}Th is present in both cores and shows exponential decrease in the top 4 cm. Biogenic reworking by a deposit-feeding community characterized by a *Nucula proxima-Nephtys incisa* assemblage

apparently controls the form of the ^{234}Th profiles. Mixing coefficients of $0.3\text{-}0.6 \times 10^6 \text{ cm}^2 \text{ s}^{-1}$ are calculated. No decrease of ^{210}Pb with depth (0-11 cm) is found, nor is there any vertical structure in profiles of ^{228}Th . Episodic deposition, followed by periods of stability, causes the observed homogeneity of the longer lived nuclides as well as laminated horizons in the sediment. $^{234}\text{U}/^{238}\text{U}$ isotope ratios reflect addition of either sea water or sewage source uranium to the collection area.

Keywords: Apex, Benthos, Sediments, Sediment transport

COCHRAN, J.R.; TALWANI, M. 1976. GRAVITY, MAGNETICS, AND SEISMICITY. MESA NEW YORK BIGHT ATLAS MONOGRAPH 9, 21 pp. Free-air gravity and total-intensity magnetic anomalies in the New York Bight region, presented as profiles along ships' tracks, are dominated by prominent positive and negative bands. Those on the outer edge of the continental shelf and on the continental slope are associated with the transition from the North American continent to the Atlantic Ocean. Those on the inner shelf are associated with structures inherited from the region's geology prior to the formation of the present Atlantic Ocean. The Avalonian trends in the eastern part of the survey area extend to the shelf edge where they are truncated. The Appalachian trends in the western section are not truncated south of Long Island but swing west and continue under the coastal plain sediments in New Jersey. Although the Bight region is not particularly active seismically, numerous small to moderate earthquakes have occurred. The earthquake activity is scattered, without any distinct trends, though epicenters have tended to cluster in a few areas; such as, Westchester, New York City. The cause of the seismic activity is not well understood.

Keywords: Monitoring-MESA

COLTON, J.B. JR.; SMITH, W.G.; KENDALL, A.W.; BERRIEN, P.L.; FAHAY, M.P. 1979. PRINCIPAL SPAWNING AREA AND TIMES OF MARINE FISHES, CAPE SABLE TO CAPE HATTERAS. FISH BULL 76(4):911-915. The purpose of this compendium is to summarize spawning areas and seasons of the more abundant marine fishes of the continental shelf between Cape Sable, Nova Scotia, and Cape Hatteras, NC, as an aid to the identification of fish eggs and larvae and planning and scheduling ichthyoplankton surveys. The species composition and abundance of fishes vary markedly between two regions, with boreal, nonmigratory species dominating the Gulf of Maine and warm water, migratory species prevailing in the Middle Atlantic Bight. The bulk or total spawning of many species is restricted to areas east (e.g., haddock, pollock, redfish) or west (e.g., bluefish, menhaden, anchovies) of Nantucket Shoals, although there are exceptions to this general rule (notably, yellowtail flounder and silver hake).

Keywords: Fish, Reviews-Biological

CONRAD, J.M. 1985. RESIDUALS MANAGEMENT: DISPOSAL OF SEWAGE SLUDGE IN THE NEW YORK BIGHT. MAR RESOUR ECON 1(4):321-345. This paper discusses a problem facing New York and several other coastal cities: how and where they should dispose of the sludge produced in the treatment of municipal and industrial wastewater. A dynamic model of sludge accumulation is constructed that identifies conditions under which it is optimal to "cease and switch" or dispose simultaneously at both nearshore and offshore sites. Environmental conditions in the New York Bight are discussed along with incidents occurring during the summer of 1976 that galvanized public concern over the amount and types of contaminants entering the bight. While sludge accumulations were not a major factor in either incident, the cost of sludge-related degradation, particularly if inner bight fisheries were well managed, is probably sufficient to warrant disposing of sludge at the more distant 106-mile site. It is important to institute ecological and economic monitoring of both the offshore and nearshore sites if the role of ocean disposal in residuals management is to be better defined.

Keywords: Ocean disposal-Sewage sludge

CONWAY, H.L.; WHITLEDGE, T.E. 1979. DISTRIBUTION, FLUXES AND BIOLOGICAL UTILIZATION OF INORGANIC NITROGEN DURING A SPRING BLOOM IN THE NEW YORK BIGHT. J MAR RES 37(4):657-668. The utilization of ammonium and nitrate by natural phytoplankton communities was measured during a *Ceratium tripos*-dominated spring bloom in the New York Bight. During 6-8 hr uptake experiments, the inshore phytoplankton communities that were typically located at depths >25 m were characterized by NH_4 and NO_3 uptake rates that were less light-dependent than those of the more uniformly distributed communities at the shelf break. Measurements of NH_4 utilization, as a percentage of NH_4 plus NO_3 utilization, yielded values of 59% inshore and 70% at the shelf break. High biomass of zooplankton at the shelf break suggested they could account for 62% of the regenerated production (i.e., based on benthos), and bacterioplankton could account for 38 to 53% of the phytoplankton requirements. In the cross-shelf distribution, the ambient concentrations of NH_4 and NO_3 in the surface water were 0.4 and 0.1 mol./l, respectively; however, at depths between 25 and 50 m, concentrations of 2 and 4 mol/l were observed.

Keywords: Plankton-*Ceratium*

CSANADY, G.T. 1980. LONG-TERM MIXING PROCESSES IN SLOPEWATER. 2ND INT. OCEAN DUMPING SYMP. WOODS HOLE, MA, APR. 15-18. The fate of industrial waste barged to DWD-106 in New York Bight, can only be followed in diffusion experiments for a maximum period of about three days, after which the waste becomes too dilute and its advection by currents too erratic for successful detection. However, a natural tracer is available to demonstrate the freshwater originating from land runoff. The principal sink for freshwater runoff is the excess evaporation over precipitation of the Sargasso Sea.

Salinity cross sections of the slopewater between the continental shelf and the Gulf Stream show that the main seaward transport of freshwater takes place in the surface layer, while the compensating landward transport of salt is accomplished by a saline intrusion centered at 150-300 m. A mixing process dominated by the transfer of large parcels of fluid is unlike gradient diffusion. The parameterization of such a mixing process in terms of an eddy diffusion coefficient is unprofitable. However, a bulk-mass-transfer coefficient of the dimension of velocity is physically realistic and presumably transferable to the waste diffusion problem. On this basis a box model calculation for waste accumulation in the slopewater mass becomes possible.

Keywords: Circulation, Ocean disposal-106 mile

DAVIES, D.S. 1982. MARICULTURE DEVELOPMENT ON LONG ISLAND-LAND AND WATER USE CONSIDERATIONS. FISHERIES 7(2):11-13. Until state and local governments provide the stimulus, mariculture activities in this area will not develop. Recommendations, such as leasing bay bottom land and financial incentives, are provided.

Keywords: Management, Reviews-Biological

DEAN, D.; HASKIN, H.H. 1964. BENTHIC REPOPULATION OF THE RARITAN RIVER ESTUARY FOLLOWING POLLUTION ABATEMENT. LIMNOL OCEANOGR 9:551-563. A total of 69 samples of benthic animals was taken in the lower 20 km of the Raritan River estuary from 1957 to 1960. During 1957, under heavily polluted conditions, no freshwater species were discovered. Of the 17 marine species found, the barnacle *Balanus improvisus* extended 8.5 km above the river mouth; the remaining species were confined to the seaward 4.6 km of the river.

In January 1958, a trunk sewer system began operation in the lower Raritan Valley, and pollution was abated in the river. Rapid repopulation of the estuary occurred. The sequence and numbers of freshwater and marine species invading the estuary and colonizing the bottom sediments were followed in the samples of 1958, 1959, and 1960. The most obvious change in 1958 was the distribution and density of *Balanus improvisus*. These barnacles coated all firm substrata in the previously uninhabited section, extending upriver to the limit of salt penetration. The 12 stations sampled in both 1958 and 1959 yielded 6 freshwater and 21 marine species in 1958 and 8 freshwater and 28 marine species in 1959. In 1960, freshwater species continued to increase, but there was a slight decrease in the number of marine species. Dominant components of the freshwater fauna were the oligochaetes *Limnodrilus* spp., the leech *Erpobdella punctata*, and the bivalve *Sphaerium* sp. A density of 7,102 organisms/m² was found at one of the freshwater stations in 1960. Marine species that invaded the river following pollution abatement are placed in five groups--three of pioneers, one of secondary invaders, and one of progressive penetrators--on the basis of their year of arrival, penetration, and length of stay. By the end of the study, biotic recovery had so

progressed that a plot of the quantitative distribution of species illustrated the classic V-shaped curve for estuaries. A similarly shaped curve was obtained for the distribution of population densities.

Keywords: Benthos, Estuaries, Pollutants-Toxicity

DECAMP, M.A. 1963. EXPLORING A NORTHERN "REEF." UNDERWATER NAT 1:16-17. Marine life around a wreck off the New Jersey Coast was briefly contrasted with wrecks and coral reefs in the tropics, including fish browsing. Northern wrecks are suggested to be fish attractors (gathering places) rather than a site for food for the fish.

Keywords: Artificial reefs

DEUBLER, E.E., JR.; WHITE, J.J., JR. 1962. INFLUENCE OF SALINITY ON GROWTH OF POSTLARVAE OF THE SUMMER FLOUNDER, *PARALICHTHYS DENTATUS*. COPEIA 2:468-469. This paper presents results from a brief study of the influence of salinity on growth of postlarvae of the summer flounder, *Paralichthys dentatus* (Linnaeus) under laboratory conditions. The postlarvae were collected from surface waters of Bogue Sound at Morehead City, NC in February 1961, following the method of Deubler and were identified by the pigmentary pattern unique to the postlarvae of this species. Following the technique of Deubler four subsamples of 20 individuals each were drawn from the original sample of postlarvae, assuming that each subsample represented accurately the original sample as to size of individuals (12-15 mm S. L.; mean, preserved weight, 29 mg). A subsample was assigned at random to each of four plexiglass aquaria (10-gal capacity) containing five gallons of water, in which the salinity varied by 10 ppt and ranged from 10 ppt to 40ppt. A duplicate experimental series, housed in a constant-temperature room, was maintained for 33 days at a water temperature of 14 °C. The animals were kept in complete darkness for 16 continuous hours during each 24-hr period. Food consisted exclusively of brine shrimp (*Artemia*), and feeding was not restricted since the quantity introduced was in excess of feeding requirements. The experiment was terminated by killing and fixing the animals in 5% formalin and storing them in 40% isopropyl alcohol.

The data show that animals in the duplicate series exhibited an increase in weight with increasing salinities in that range (10 ppt-30 ppt) encountered by postlarvae under natural conditions but showed a marked reduction in weight in 40 ppt, a salinity which, to our knowledge, is never encountered by postlarvae in their natural environment. These observations suggest that salinity *per se* merits consideration as a controlling factor in the growth of postlarvae of *Paralichthys dentatus*. They indicate further that growth is optimum at salinities found commonly in the lower reaches of estuaries.

Keywords: Fish-*Paralichthys*

DEVANAS, M.A.; LITCHFIELD, C.D.; MCCLEAN, C.; GIANNI, J. 1980. COINCIDENCE OF CADMIUM AND ANTIBIOTIC RESISTANCE IN NEW YORK BIGHT APEX BENTHIC MICROORGANISMS. MAR POLLUT BUL 11:264-269. Microorganisms resistant to 1-500 ppm cadmium were isolated over an 11 month period from sediments at the sewage sludge, dredge spoils, and industrial acid waste disposal sites, as well as at an estuarine outflow to the New York Bight Apex. Tests for antibiotic resistance in these isolates revealed that 94% of the isolates were resistant to one or more antibiotics and that 91% of the original isolates could be characterized by multiple drug resistance. Different selective pressures may account for the various genera and antimicrobial resistance patterns observed. The possibility of extrachromosomal linkage of cadmium and streptomycin resistance is discussed.

Keywords: Bacteria, Pollutants-Sediment, Pollutants-Toxicity

DEWLING, R.T.; ANDERSON, P.W. 1976. NEW YORK BIGHT I: OCEAN DUMPING POLICIES. OCEANUS 19(4):2-10. Nationally, EPA became active in ocean dumping activities with the passage of the Marine Protection, Research, and Sanctuaries Act. This legislation assigned specific functions to EPA, as well as the Coast Guard, the Army Corps of Engineers, and the Department of Commerce, namely NOAA. In general, EPA administers and enforces the overall program; administration involves the issuance of dumping permits to municipal and industrial applicants, the evaluation of alternative means of handling wastes, and the selection and management of dump sites. Promulgation of EPA's interim regulations in April-May 1973 for the transportation and dumping of material into ocean waters was the basis for Region II, the New York-New Jersey area, to develop its permit program. Dumpers were identified according to the quantity and types of waste being handled. Site visits were then made to determine each dumper's immediate need for continuing this practice and the availability of environmentally acceptable alternatives. Based on these visits, forty-seven industries were immediately required to phase out ocean dumping. Industries were issued permits that required all liquid wastes, except acid wastes (which are dumped 15 miles offshore), to be dumped at the chemical wastes site 106 miles offshore. Region II only issued permits to municipalities or industries in the New York-New Jersey area that were ocean dumping before 1973.

In June 1974, in conjunction with New Jersey and New York, a program was initiated for the development of land-based alternatives to ocean dumping of municipal sludges in the New York-New Jersey metropolitan area. All municipal ocean dumping permittees in the metropolitan area are required either to participate in the sludge disposal management plan developed by the program or to devise their own alternative disposal method.

Keywords: Management, Ocean disposal

DEYOUNG, B.R. 1985. A PROMISING MATERIAL TO IMPROVE FAD DURABILITY AND COST. BULL MAR SCI 37(1):397. This research project involves laboratory investigations and field testing to discern the feasibility of using rubber belting as a substitute for chain in small moorings. The impetus of this research is the skyrocketing cost of purchasing and maintaining moorings utilizing galvanized chain. With 0.5-in. chain typically costing over 2\$/ft (U.S.\$ 1983), many are frustrated by corrosion limiting its life span to 3 years or less. An alternative material, conveyor belting, holds promise for ameliorating this dilemma. Strips of conveyor belting have been successfully used in the construction of floating tire breakwaters. Often 75% cheaper than chain, this material is inert in saltwater and often exceeds strength characteristics of the chain. In several cases it was found that both the belting and a method of fastening it using industrial glue exceeded 5,000 pounds before failing. This value compares favorably with steel chain, the conventional material, now used in moorings. Further research is needed to confirm the benefits of using this material, specifically in the construction and mooring of FADs and refining ways in which it is deployed to enhance artificial reef technology.

Keywords: Artificial reefs

DEYOUNG, B.R. 1984. PROMISING MATERIAL FOR MARINE STRUCTURES. COASTLINES 15(1):1. Strips of rubber conveyer-belt material were successfully used to hold floating tire breakwaters at one fourth the cost and were expected to exceed the durability of chain. Over 300 navigation aid moorings have been replaced with the conveyor belt strips in New York.

Keywords: Miscellaneous

DIAZ, H.F. 1979. ATMOSPHERIC CONDITIONS AND COMPARISON WITH PAST RECORDS. IN: OXYGEN DEPLETION AND ASSOCIATED BENTHIC MORTALITIES IN NEW YORK BIGHT, 1976, NOAA PROFESSIONAL PAPER 11, R.L. SWANSON AND C.J. SINDERMAN, (EDS.), pp. 51-77. Some of the relevant atmospheric forcing fields affecting the surface environments in New York Bight were examined for February through August 1976, the period before and during the oxygen-depletion event. The same kinds of physical conditions in the historical record were compared to identify possible similarities.

Three salient points relating to atmospheric conditions emerged. First, sea-surface temperatures throughout the Bight were relatively high early in the year when compared with the record for the past 100 years, but there were other similar occurrences in the record. Also, February and March air temperatures over the northeast were near their warmest levels in the past century. The unusually warm temperatures may have aided in the early development and subsequent strengthening of stratification of Bight waters. Second, the monthly surface wind patterns showed persistent south to southwesterly flow during the entire period, blowing with above-normal constancy during May and June. Steady wind

conditions could have had a pronounced effect on Bight circulation and exchange processes. The general atmospheric circulation patterns over eastern North America departed considerably from the norm from February through June. This resulted in a minimum of storm activity over the Bight and presumably less mixing of the water column, compared with the record for the past 25 years. And third, vertical motion calculations using both open-ocean and coastal upwelling estimates indicate that upwelling/onwelling may have been prevalent during most of the analysis period.

Keywords: Anoxia, Miscellaneous-Physical

DRAKE, D.E. 1974. SUSPENDED PARTICULATE MATTER IN THE NEW YORK BIGHT APEX: SEPTEMBER-NOVEMBER 1973. NOAA TR ERL-318 MESA-1, 59 pp. The distribution of suspended particulate matter in the New York Bight Apex was studied during the fall of 1973. Five surveys from September through November revealed consistent suspended matter distributions that reflect the Bight Apex water circulation. Two major currents dominate during the fall season of limited river flow and gradually weakening water column stratifications: (1) relatively fresh surface water, containing between 1 and 4 mg/l of suspended particles, flows from Hudson estuary and down the New Jersey coast within 50 to 10 km from shore; and (2) northward flow along the Hudson shelf channel occurred during all surveys. Total suspended matter distributions and dispersion patterns of iron particulates dumped at the acid-waste dumpsite support the existence of a clockwise gyre in the central portion of the area during the fall season; the shelf-channel current forms the western limb of this gyre. Contaminated sediments are widely dispersed in the shelf channel with good evidence that material dumped at the valley head is transported both up and down the channel in substantial quantities.

Keywords: Apex, Circulation, Monitoring-MESA, Sediment transport, Pollutants-Sediment

DRAKE, D.E. 1977. SUSPENDED PARTICULATE MATTER IN THE NEW YORK BIGHT APEX, USA, FALL 1973. J SEDIMENT PETROL 47(1):209-228. Four surveys of suspended particulate matter in the New York Bight Apex from September through November 1973 revealed consistent distributions that reflect the water circulation. Two major currents were dominant during the fall season of limited river flow and gradually weakening stratification of the water column: low-salinity (29-31 ppt) surface water, containing between 1-4 mg/l of suspended particles, flows from Hudson estuary southward along the New Jersey coast within 5-10 km from shore; and northward flow along the Hudson shelf channel occurred during all surveys. Low concentrations of total suspended matter and ash fractions dominated by diatoms indicate a central shelf origin for the shelf-channel current. The distribution of total suspended matter and the dispersion patterns of iron particles released at the acid-waste dumpsite support the existence of a clockwise gyre in the central part of the area during autumn; the shelf-channel current forms the western limb of this gyre. Dredge spoil and

sewage sludge dumped near the head of the shelf channel settle into this depression to form mud lenses rich in organic matter. Some of this material is entrained into a turbid bottom layer by the northward current and transported from the depression to the northeast over Cholera Bank. The bank crest does not accumulate fine sediment owing to relatively vigorous wave surge. As the turbid current turns south along the east side of Cholera Bank, fine-grained, mineral and organic material begins to settle, forming two disconnected lenses of mud on either side of the sand bank. Contaminated sediments are widely dispersed throughout the water column in the Bight Apex. Major dispersion appears to be centered on the Hudson shelf channel, and there is good evidence that material dumped near the channel head is transported up and down the channel in substantial quantities.

Keywords: Apex, Circulation, Hudson Shelf Valley, Sediment transport

DUCE, R.A.; WALLACE, G.T.; RAY, B.J. 1976. ATMOSPHERIC TRACE METALS OVER THE NEW YORK BIGHT. NOAA TECH. REPORT ERL 361-MESA 4.

Keywords: Miscellaneous-Chemical

DUEDALL, I.W.; BOWMAN, M.J.; O'CONNORS, H.B., JR. 1975. SEWAGE SLUDGE AND AMMONIUM CONCENTRATIONS IN THE NEW YORK BIGHT APEX. ESTUAR COAS MAR SCI 3:457-463. Water column ammonium concentrations were determined at several stations at or near the sewage sludge dump site in the New York Bight Apex on July 30 and 31, 1973, and also at several stations located on a perimeter surrounding the dump area. Parachute drogues were used to track the movement of water over a 31-hr period. Within the dump site, ammonium concentrations were patchy and usually increased from surface to bottom with concentrations in the ranges of less than 1 μ M and 1-9 μ M, respectively. However, at one station that had recently received sludge input, the surface ammonium concentration was over 500 μ M and the bottom concentration was about 200 μ M. All except two background stations showed no significant vertical variation in ammonium. The observations suggest that sludge dumping increases ammonium content of the water column, but that high levels probably do not persist for long periods.

Keywords: Ocean disposal-12 mile, Pollutants-Water quality

DUEDALL, I.W.; DAYAL, R.; PARKER, J.H.; KRANER, H.W.; JONES, K.W.; SHROY, R.E. 1978. DISTRIBUTION, COMPOSITION, AND MORPHOLOGY OF SUSPENDED SOLIDS IN THE NEW YORK BIGHT APEX. SUNY, MARINE SCIENCES RESEARCH CENTER, STONY BROOK, NY, pp. 533-564. Tidal and spatial changes in the morphology and concentrations of suspended solids; particulate carbon and nitrogen; the particulate metals Fe, Mn, Cu, and Zn; and chlorophyll *a* were determined over a tidal cycle at seven stations during June 3, 1975, on a transect between Sandy Hook, NJ, and

Rockaway Point, NY (the entrance to the New York Harbor). Most of the particulate matter in the suspended solids consisted of diatom frustules which were present in relatively large abundances near Sandy Hook. Near Rockaway Point, both diatoms and dinoflagellates were found in the suspended matter. Other particulates included organic aggregates, mineral grains and some opaque particles which were assumed to be anthropogenic in origin. The organic aggregates appeared as a large amorphous matrix containing a wide size range of mineral grains including some spherical and irregular opaque particles. Some of the opaque particles were reddish-brown in color and were therefore probably iron hydrus oxides. There was a strong correlation among the concentrations of Fe, Mn, Cu, and Zn, suggesting that these metals were associated with each other. Fine mineral grains were found attached to the surfaces and edges of phytoplankton cells.

Keywords: Apex, Particulates, Pollutants-Loading

DUEDALL, I.W.; O'CONNERS, H.B. 1976. FINAL REPORT - PART 1: THE ABUNDANCES, DISTRIBUTION, AND FLUX OF NUTRIENTS AND CHLOROPHYLL *a* IN THE NEW YORK BIGHT APEX. PART 2: SANDY HOOK/ROCKAWAY POINT TRANSECT STUDY - DATA REPORT OF CRUISES FROM NOVEMBER 1973 TO JUNE 1974. NOAA DATA REP ERL MESA-20, 459 pp. Tidal, spatial, and seasonal changes in salinity, temperature, and the concentrations of ammonium, nitrite, nitrate, phosphate, silicic acid, chlorophyll *a*, and suspended matter in the waters between Sandy Hook, New Jersey, and Rockaway Point, New York were measured during five cruises which took place between November 1973 and June 1974. Over this period concentrations of nutrients and chlorophyll *a* were much greater than those found in adjacent coastal waters. The main source of the ammonium, nitrite, and phosphate is sewage effluent which is discharged into the waters surrounding the New York metropolitan region. Nitrate comes mainly from the Hudson River, and silicic acid is discharged in large amounts from river and sewage sources. The largest tidal variation in salinity and nutrient and chlorophyll *a* concentrations occurs near Sandy Hook, where the Hudson River discharge has the greatest influence. Part II presents data on the measurements of the variables of salinity, temperature, dissolved oxygen, turbidity, weight of suspended solids, chlorophyll *a* fluorescence, and extracted chlorophyll *a*, plus nutrients in tabulated form along with surface current, weather, and sea conditions.

Keywords: Apex, Ocean disposal-Sewage sludge, Plankton, Pollutants-Loadings

DUEDALL, I.W.; O'CONNORS, H.B.; IRWIN, B. 1975. FATE OF WASTEWATER SLUDGE IN THE NEW YORK BIGHT APEX. J WATER POLLUT CONTROL FED 47(11):2702-2706. It is suggested that most of the particulate organic matter in wastewater sludge that settles to the bottom near the dump site is being decomposed rapidly. This is one explanation of why anomalously high TOC concentrations are not found in the sediments at or near the dump site. Cutin, a major sludge component, may be metabolized by

decomposers. Other organic components, such as cellulose, may also be decomposed by microorganisms. The C:N ratios of sediments within the dump area are low, indicating that nitrogen is not limiting. These observations are suggestive of processes that lead to the rapid breakdown of sludge in the New York Bight Apex.

Keywords: Ocean Disposal-12 mile, Pollutants-Sediments

DUEDALL, I.W.; O'CONNERS, H.B.; OAKLEY, S.A.; STANFORD, H.M. 1977. SHORT-TERM WATER COLUMN PERTURBATIONS CAUSED BY WASTE WATER SLUDGE DUMPING IN THE NEW YORK BIGHT APEX. J WATER POLLUT CONTROL FED 49(10):2074-2080. Water column properties in the New York Bight Apex were monitored before and after a controlled spot dump of wastewater sludge. Ammonium, phosphate, and suspended solids in the discharged wastewater sludge dispersion plume caused the greatest water column perturbations. Temperature, salinity, pH, and the concentrations of dissolved oxygen and chlorophyll *a* in the water column were not significantly affected by the wastewater sludge dumping, thus suggesting, for the hydrographic and discharge conditions of the experiment, a relatively rapid descent rate for the particular wastewater sludge. By 110 minutes after dumping, the water column above the thermocline (approximately 17 m) had nearly returned to its background condition with respect to the variables measured. Below the thermocline, concentrations of ammonium, phosphate, and suspended solids remained high for a period greater than 2.5 hr.

Keywords: Apex, Monitoring, Ocean disposal-Sewage sludge

DUEDALL, I.W.; O'CONNORS, H.B.; PARKER, J.H.; WILSON, R.E.; ROBBINS, A.S. 1977. THE ABUNDANCES DISTRIBUTION AND FLUX OF NUTRIENTS AND CHLOROPHYLL *A* IN THE NEW YORK BIGHT APEX USA. ESTUAR COAST MAR SCI 5(1):81-105. Tidal, spatial and seasonal changes in salinity, temperature and the concentrations of ammonium, nitrite, nitrate, phosphate, silicic acid, chlorophyll *a*, and suspended matter in the waters between Sandy Hook, New Jersey and Rockaway Point, New York were measured during five cruises which took place between November 1973 and June 1974. Over this period concentrations of nutrients and chlorophyll *a* were much greater than those found in the adjacent coastal waters. The main source of the ammonium, nitrite, and phosphate is sewage effluent which is discharged into the waters surrounding the New York metropolitan region; nitrate comes mainly from the Hudson River and silicic acid is discharged in large amounts from river and sewage sources. The largest tidal variation in salinity and nutrient and chlorophyll *a* concentrations occurred near Sandy Hook where the Hudson River discharge has the greatest influence. Near Rockaway Point, nutrient and chlorophyll *a* concentrations were generally lower and salinities higher than those observed near Sandy Hook because of the inflow of Bight water by non-tidal currents. During the spring freshet, nutrient concentrations, especially ammonium, are low along the transect due to dilution by the spring freshet and utilization by the abundant

phytoplankton. Flux calculations for the June observations indicate that most of the nutrients and chlorophyll *a* are being transported from the lower Hudson Estuary into the New York Bight Apex.

Keywords: Apex, Ocean disposal-Sewage sludge, Plankton, Pollutants-Loadings

DUEDALL, I.W.; O'CONNORS, H.B.; WILSON, R.E.; PARKER, J.H. 1979. THE LOWER BAY COMPLEX OF THE NEW YORK HARBOR USA N.Y. MESA NEW YORK BIGHT ATLAS MONOGRAPHS 29, 47 pp. The lower Bay complex is the seaward part of New York Harbor and includes Raritan, Sandy Hook, and Lower Bays. It connects with Upper Bay through a narrow constriction between Staten Island and Brooklyn. The bay complex is relatively shallow (5-20 m or 16-66 ft) but has an irregular topography due mainly to the numerous ship channels in Lower and Raritan Bays. The weather in the bay complex is typical of a mid-latitude coastal region, with the adjacent Atlantic Ocean acting as a buffer. The bay complex is a dynamic and complex estuarine system and receives a large, seasonally variable inflow of fresh water originating mainly from the Hudson River with lesser amounts from the Raritan and Passaic rivers. Sewage effluent is also a significant source of fresh water. The non-tidal inflow of salt water through the Sandy Hook-Rockaway Point transect is confined to Ambrose and Sandy Hook channels and through the entire water column near Rockaway Point. Because of the variable inflow of fresh water, the distribution of water properties (salinity, nutrients, and chlorophyll *a*) varies seasonally. Tides and tidal currents in the bay complex are semidiurnal; their patterns are complicated because of the shape of the bay, the variation in freshwater discharge, Coriolis acceleration, and the intricate connection of waterways. Tidal variations in water properties are large and can be perturbed significantly by storms. Sewage effluent from the New York metropolitan area is the principal source for the high concentrations of nutrients observed in the bay complex. A large fraction of these nutrients are consumed in biological processes occurring within the bay complex. There is a net transport of nutrients and chlorophyll *a* to the Apex of New York Bight. The nutrients from the bay complex transported seaward may be an important factor leading to the decline of oxygen in bottom waters of the Bight during summer periods.

Keywords: Circulation, Estuaries, Monitoring-MESA, Pollutants-Loadings

DUEDALL, I.W.; WOODHEAD, P.M.; PARKER, J.H.; CARLETON, H.R. 1982. COAL-FIRED POWER PLANT WASTES FOR OCEAN REEF CONSTRUCTION. IN: 6TH INTL SYM DOE/NATL ASH ASSN ASH UTILIZATION, RENO, NV, MARCH 7-10, 1:102. This paper describes 15,000 block demonstration reefs built in the Atlantic to be monitored for the next three years.

Keywords: Artificial reefs

EDENBORN, H.M.; LITCHFIELD, C.D. 1985. GLYCOLATE METABOLISM BY PSEUDOMONAS SP., STRAIN S227, ISOLATED FROM A COASTAL MARINE SEDIMENT. MAR BIOL 88(2):199-205. Glycolate excreted by phytoplankton is a potentially important nutrient for bacteria in coastal and estuarine environments. The metabolism of glycolate by *Pseudomonas* sp., strain S227, originally isolated from the New York Bight Apex, has been studied. The specific growth rate for this strain on glycolate is 0.156 doubling/h. The apparent V_{max} and K_m for glycolate uptake are 83.6 nmol min⁻¹ mg cell protein⁻¹ and 7.4×10^{-8} M, respectively. The preferential respiration of the carboxyl carbon (C-1) and the incorporation of the hydroxymethyl carbon (C-2) suggest that the glycerate pathway is used for growth on glycolate. Alternatively, another pathway can be utilized which results in the complete catabolism of glycolate. Glycolate and lactate metabolism are also closely linked either by a common metabolic pathway or a common transport system other than the monocarboxylate transport system. The magnesium ion concentration is also important in glycolate metabolism.

Keywords: Apex, Bacteria

EPPLEY, R.W. 1972. TEMPERATURE AND PHYTOPLANKTON GROWTH IN THE SEA. FISH BULL 70(4):1063-1085. The variation in growth rate with temperature of unicellular algae suggests that an equation can be written to describe the maximum expected growth rate for temperatures less than 40 °C. Measured rates of phytoplankton growth in the sea and in lakes are reviewed and compared with maximum expected rates. The assimilation number (i.e., rate of photosynthetic carbon assimilation per weight of chlorophyll *a*) for phytoplankton photosynthesis is related to the growth rate and the carbon/chlorophyll *a* ratio in the phytoplankton. Since maximum expected growth rate can be estimated from temperature, the maximum expected assimilation number can also be estimated if the carbon/chlorophyll *a* ratio in the phytoplankton crop is known. Many investigations of phytoplankton photosynthesis in the ocean have included measures of the assimilation number, while fewer data are available on growth rate. Assimilation numbers for Antarctic seas are low as would be expected from the low ambient temperatures. Tropical seas and temperate waters in summer often show low assimilation numbers as a result of low ambient nutrient concentrations. However, coastal estuaries with rapid nutrient regeneration processes show seasonal variations in the assimilation number with temperatures which agree well with expectation. The variation in maximum expected growth rate with temperature seems a logical starting point for modeling phytoplankton growth and photosynthesis in the sea.

Keywords: Plankton

ESSER, S.C. 1982. LONG-TERM CHANGES IN SOME FINFISHES OF THE HUDSON-RARITAN ESTUARY. IN: ECOLOGICAL STRESS AND THE NEW YORK BIGHT: SCIENCE AND MANAGEMENT. PROCEEDINGS OF A SYMPOSIUM ON THE ECOLOGICAL EFFECTS OF

ENVIRONMENTAL STRESS, NEW YORK, NY, JUNE 10-15, 1979, G.F.MAYER, (ED.), ESTUARINE RESEARCH FEDERATION, COLUMBIA, SC, pp. 299-314. Long-term changes in abundance as expressed in catch statistics have occurred for most finfish species of the Hudson-Raritan estuary. The commercial catch of the American shad within the Hudson-Raritan estuary has experienced significant fluctuations and decline since the end of the nineteenth century. Possible causes, including physical changes, pollution, and overfishing are reviewed. An extensive sturgeon fishery flourished in the Hudson River during the 1800's but declined in the early 1900's. A similar decline occurred in the smelt fishery, which prospered in the Raritan River in the early 1800's. Only the striped bass population appears to have increased slightly in recent years. Other species, including bluefish, scup, and flounders, are caught both in the estuary and in the ocean, but the combined statistics make it impossible to determine the harvest alone. Most of these species use the estuary as a spawning or nursery area. Their populations are influenced by water quality of the Hudson and its tributaries.

Keywords: Fisheries

FALKOWSKI, P.G.; HOPKINS, T.S.; WALSH, J.J. 1980. AN ANALYSIS OF FACTORS AFFECTING OXYGEN DEPLETION IN THE NEW YORK BIGHT. J MAR RES 38:479-506. Low oxygen water, of varying spatial extent, has been observed during the summer over past years in the New York Bight. In the summer of 1976 a \$60 million loss of shellfish resulted from anoxia along the New Jersey coast. The development of anoxia has been attributed to increased anthropogenic carbon loading from urban areas adjacent to the Bight, an unusual climatological regime that restricted renewal of oxygen to the bottom waters, and an unusual abundance and subsequent respiratory demand of the dinoflagellate, *Ceratium tripos*, beneath the pycnocline. In an attempt to distinguish between man-induced and natural generic causes of oxygen depletion within the New York Bight, we have analyzed historical data extending back to 1910. As a result, we have identified a casual chain of events which led to the observed 1976 anoxia: namely, a warm winter with large runoff, a low frequency of spring storm events, a deep summer thermocline, persistent southerly winds with few reversals, a large autochthonous carbon load (e.g., *Ceratium tripos*), and low grazing pressure by zooplankton. Our calculations suggest that anoxia could have occurred off the New Jersey coast in the summer of 1976 without any carbon loading from New York City, and that anoxia in this open shelf system can result from natural physical forcing and biological response.

Keywords: Anoxia, Plankton-*Ceratium*, Reviews-Biological

FARRINGTON, J.W. 1977. THE BIOGEOCHEMISTRY OF OIL IN THE OCEAN. OCEANUS 20(4):5-14. Crude oil contains tens of thousands of chemicals. Most are hydrocarbons, molecules composed of carbon and hydrogen atoms arranged in a variety of chemical structures. The molecular weight range of these hydrocarbons varies from methane, which is composed of one carbon atom and four hydrogen atoms, to hydrocarbons composed of more than 60 carbon

atoms and 120 hydrogen atoms. In addition to the hydrocarbons, crude oils are composed of small but significant quantities of chemicals that contain nitrogen, sulfur, oxygen, and/or trace metals.

Since 1972, surface sediments have been collected from a number of locations in the western North Atlantic. These samples have been analyzed for concentration and composition of alkanes and cycloalkanes, some of the principal hydrocarbons of petroleum. The results from the analyses show that there is no more than 1 to 10 micrograms (μg) of petroleum hydrocarbons per gram of dry weight for continental margin sediments. At this time it is impossible to tell where these petroleum compounds came from. Analyses of the wide molecular weight range and extreme complexity of the hydrocarbons' composition show that petroleum pollution is causing the elevated concentrations of hydrocarbons. The concentration of hydrocarbons in the New York Bight dump site is high enough to make it practical to extract about 2 to 5 kg of surface sediments and obtain a sufficient amount of hydrocarbons to measure the C-14 radioactivity of the carbon portion of the hydrocarbon molecule.

Keywords: Ocean disposal-Dredged material, Pollutants-Organic

FARRINGTON, J.W.; TEAL, J.M.; TRIPP, B.W.; LIVRAMENTO, J.B.; MCELROY, A. 1983. BIOGEOCHEMISTRY OF PETROLEUM COMPONENTS AT THE SEDIMENT-WATER INTERFACE. FINAL REPORT IN RESUME FORM 1 APRIL 1977-31 DECEMBER 1981. WOODS HOLE OCEANOGRAPHIC INSTITUTION. REPORT NO.: DOE/EV/04256-04, 48 pp. The biogeochemistry of hydrocarbons in benthic ecosystems has been investigated by experimentation and field observations. A recirculating benthic chamber with field deployment and on-land experimental capabilities has been designed, constructed, tested, and used in experimentation. A C-14 benzantracene experiment was conducted in two benthic chambers. More than 97% of the C-14 activity introduced to the water column and remaining in the chamber after 42 days of the experiment was associated with benthic ecosystem. HPLC separation showed that more than 90% of the C-14 activity in sediment extracts was present as metabolites or reaction products of benzantracene. These data add to the growing evidence that metabolites and reaction products of higher-molecular-weight polycyclic aromatic hydrocarbons (PAH), some of which are mutagenic or carcinogenic, can persist for periods of weeks or months in benthic ecosystems. A comparison of PAH data from the New York Bight ecosystem, PAH data from northeast US coast surface sediments, and bivalves shows a predominance of pyrogenic source PAH from fossil-fuel combustion in surface sediments but a predominance of petroleum source PAH in biota ecosystems near urban areas. We hypothesize that this dichotomy results from the greater bioavailability of PAH1 from petroleum inputs because of differences in physical-chemical forms of PAH from the two input sources.

Keywords: Pollutants-Organic

FIGLEY, W.; PYLE, B.; HALGREN, B. 1979. SOCIOECONOMIC IMPACTS. IN: OXYGEN DEPLETION AND ASSOCIATED BENTHIC MORTALITIES IN NEW YORK BIGHT, 1976, NOAA PROFESSIONAL PAPER 11, R.L SWANSON AND C.J. SINDERMANN, (EDS.), pp. 315-322. The estimated, actual, and potential economic losses to New Jersey's commercial and recreational marine fisheries as a result of oxygen depletion during summer 1976 are summarized. The surf clam was by far the hardest hit commercial resource, followed by the ocean quahog, finfish, lobster, and sea scallop. Resource losses cannot be directly converted into losses for the fishing industry. Despite not being able to determine industry losses directly, the tremendous losses experienced by several of New Jersey's fishery resources have caused significant financial losses to many fishermen and businesses. In fisheries that had significant mortalities, especially surf clam, the decline in harvest and economic losses is expected to continue in future years until recruitment begins to replenish stocks. In addition, the impact of the disruption of the food chain by the elimination of much of the benthic community may have far-reaching consequences that will hamper commercial fishermen in future years. Losses to the recreational fisheries during 1976 were \$3.7 million. The party, charter, and dive boat fleets absorbed most of the financial losses. Losses by the reduced number of private-boat ocean fishing trips were minimal and were distributed over a large number of recipients tackle shops, marinas, restaurants, motels, and gas stations.

Keywords: Anoxia, Benthos-*Spisula*, Fisheries, Fish kills

FILADELFO, R.J. 1985. SUBTIDAL SEA LEVEL AND CURRENT VARIABILITY IN THE HUDSON RARITAN ESTUARY. DISS ABST INT PT B - SCI & ENG 46(5):202. The response of subtidal sea level and currents within the Hudson Raritan Estuary to coastal sea level, local wind, and riverine forcing is examined. The system forms a complex branched estuarine network more representative of a system of coupled basins than a classical estuary. Frequency domain regression is applied to sea level and current velocity time series from the 1980-81 NOS Circulatory Survey within the estuary. Response functions are interpreted in light of simple dynamical models. Results suggest very strong coupling between the estuary and the New York Bight. The response of barotropic flow through the East River to coastal sea level and local wind forcing is complex coastal sea level dominates at periods longer than approximately seven days and local wind set up dominates at shorter periods. A simple model is outlined to study subtidal response in shallow coupled basins subject to local wind and boundary sea level forcing.

Keywords: Circulation, Modeling-Hydrodynamic

FLEMMING, A.; HULSEMAN, K. 1977. GEOGRAPHICAL RANGE AND TAXONOMIC DIVERGENCE IN NORTH ATLANTIC *CALANUS* (*C. HELGOLANDICUS*, *C. FINMARCHICUS* AND *C. GLACIALIS*). MAR BIOL 40:233-248. The known distribution of *Calanus helgolandicus* in the North Atlantic Drift is difficult to explain in the absence of a reproductively active

population inhabiting continental waters off eastern North America. New evidence indicates that this population, overlooked in the past, does in fact exist. The species has been found in a study of zooplankton samples from a number of MARMAP (Marine Resource Monitoring, Assessment, and Prediction Program) cruises surveying ichthyoplankton between Cape Hatteras and the New York Bight. Sexual activity in these stocks of *C. helgolandicus* was indicated by the ripeness of ovaries, the frequency of males, the presence of sperm in the females' seminal receptacles and the appearance of a female bearing a *Calanus* spermatophore. The new records provide a likely origin for the presence of the species in the vicinity of the Labrador Grand Banks as well as farther east in the North Atlantic Drift. *C. finmarchicus*, similarly sexually active, was found to be sympatric with *C. helgolandicus* in the MARMAP collections which were taken from a region contiguous with the southernmost known distribution of *C. glacialis*. The distribution of integumental organs (i.e., pore signature patterns) was examined in the three species to determine whether they would be taxonomically useful. Strikingly different patterns were found on the female urosome. Pore signature differences between the polar species *C. glacialis* and the temperate *C. helgolandicus* proved to be as pronounced as those between the boreal *C. finmarchicus* and its two neighboring species. The successively overlapping ranges and the distinctive differences in pore signature patterns suggest that divergence from the generic pattern of integumental organ distribution has been a product of selection against hybridizing among the three species. If this is in fact the case, the reproductive range of *C. helgolandicus* has overlapped with those of *C. finmarchicus* and *C. glacialis* for appreciable periods in the history of the three species.

Keywords: Monitoring, Plankton

FRAME, A.B. 1980. TWO NEW SPECIES OF SAND BURROWING AMPHIPOD CRUSTACEANS FROM LONG ISLAND SOUND AND THE NEW YORK BIGHT (AMPHIPODA: HAUSTORIIDAE). ESTUARIES 3(2):75-83. *Acanthohaustorius bousfieldi* n. sp. and *A. similis* n. sp. (Amphipoda: Haustoriidae) are described from the offshore bottom sands of the New York Bight and Long Island Sound regions.

Keywords: Benthos

FRANZ, D. 1975. DISTRIBUTION AND ABUNDANCE OF INSHORE POPULATIONS OF THE SURF CLAM *SPISULA SOLIDISSIMA*. IN: MIDDLE ATLANTIC CONTINENTAL SHELF AND THE NEW YORK BIGHT. PROCEEDINGS OF THE SYMPOSIUM AMERICAN MUSEUM OF NATURAL HISTORY, NEW YORK CITY, NOVEMBER 3-5, 1975, M.G. GROSS, (ED.), SPECIAL SYMPOSIA 2:404-413. The distribution and abundance of juvenile and adult surf clams were determined inshore of the 3-mile contour in July 1974 at 141 sites off Long Island, NY. Transects were located every 2 miles from Montauk to Rockaway Point, and samples were taken at 0.5, 1.5, and 2.5 miles offshore. Selected stations were revisited in July 1975.

East of Shinnecock Inlet adult clams occurred at densities between 0.5 and 3.0 bushels per dredge haul. West of Shinnecock adults declined gradually, reaching a minimum west of Jones Inlet to East Rockaway Inlet. Abundances increased precipitously off Rockaway Beach. Highest densities of juveniles occurred at 0.5 miles and decreased rapidly farther offshore. Juveniles were more abundant at the west end of Long Island, particularly inshore at 0.5 mi. Higher densities of juveniles here may result from accumulation of larvae produced farther east and transported westward via longshore currents. The convergence of tidal and longshore currents may effectively "trap" larvae off western Long Island. Clam stocks off eastern Long Island probably are older than 9 years and are mostly composed of 1-3 age classes. Clam stocks off the Rockaways appear younger. The commercial fishery is apparently dependent on massive settlements of larvae occurring irregularly and infrequently.

Keywords: Benthos-*Spissula*

FRANZ, D.R. 1982. AN HISTORICAL PERSPECTIVE ON MOLLUSCS IN LOWER NEW YORK HARBOR, WITH EMPHASIS ON OYSTERS. IN: ECOLOGICAL STRESS AND THE NEW YORK BIGHT: SCIENCE AND MANAGEMENT. PROCEEDINGS OF A SYMPOSIUM ON THE ECOLOGICAL EFFECTS OF ENVIRONMENTAL STRESS, NEW YORK, NY, JUNE 10-15, 1979, G.F. MAYER, (ED.), ESTUARINE RESEARCH FEDERATION, COLUMBIA, SC, pp. 181-197. Information on benthic organisms and communities in the lower Hudson estuary prior to the 1950's is scarce. Records from the late 1800's indicate that species richness in the shallow bay habitats along Staten Island was comparable to that presently characteristic of Great South Bay and northeastern Long Island Sound. By the 1920's many species had disappeared from Staten Island, and the number of species remaining approached that which presently exists. These data indicate that major environmental deterioration occurred during the years 1890-1920. Supporting evidence is provided by historical accounts of New York's oyster industry. Before 1900 oysters were found throughout much of the lower estuary and north to Ossining, New York, including Newark Bay, Arthur Kill, Kill Van Kull, Jamaica Bay, Raritan Bay, and the New Jersey shore of the Hudson. By the turn of the century, the shellfish industry was limited to waters south of the Narrows; by 1920 it largely had disappeared from harbor waters. Destruction of shellfish beds was caused by a combination of factors including sewage pollution, harbor dredging, and industrial pollution. Although it is difficult to determine the relative importance of individual factors, sewage-related pollution appears to have played a major role in bringing about the general degradation of the estuarine environment. This is suggested by records of DO levels in the harbor that were collected beginning in 1909. These data clearly indicate that by the 1920's, DO levels over much of the harbor had declined to critical levels (0-20% saturation in summer). While the lower Hudson estuary is seriously impacted, communities of benthic organisms exist throughout. The degree of environmental deterioration and the recovery of the estuary probably can be measured best by comparing these benthic communities with those of nearby, less polluted estuarine systems.

Keywords: Benthos, Estuaries, Fisheries

FREELAND, G.L.; MERRILL, G.F. 1977. THE 1973 BATHYMETRIC SURVEY IN THE NEW YORK BIGHT APEX: MAPS AND GEOLOGICAL IMPLICATIONS. ECOSYSTEMS ANALYSIS PROGRAM, BOULDER, CO. NOAA TM ERL MESA-19, 22 pp. A hydrographic survey of the New York Bight Apex was undertaken by the New York District of the Corps of Engineers under contract to NOAA as part of the MESA Program. A bathymetric map was prepared and a comparison was made between the 1973 data and hydrographic data from the most recent previous survey of the area, H-6190, done in 1936 by the U.S. Coast and Geodetic Survey. A resulting contoured net bathymetric change map shows that the most significant change has occurred in the dredge-spoil dumpsite, where there has been up to 10 m of shoaling. Calculations of volumes of eroded and deposited sediment indicate that the area has generally eroded and that, except at the dredge-spoil dumpsite and the now abandoned dumpsites near Ambrose and Sandy Hook Channels, dumping is not causing significant changes in water depths.

Keywords: Apex, Miscellaneous-Geological, Monitoring-MESA

FREELAND, G.L.; SWIFT, D.J.P. 1978. SURFICIAL SEDIMENTS. MESA NEW YORK BIGHT ATLAS MONOGRAPH 10, 93 pp. The surficial sediment of New York Bight is a sheet of sand 0-10 m thick, resting on early Holocene lagoonal and estuarine clays. The basal 20 cm of the sand sheet consists of coarse sand, gravel, and shell hash, which is exposed where the sand sheet is very thin. Occasionally the underlying clay layer is exposed in troughs between ridges. Over the shelf edge, Pleistocene muds are overlain by Holocene muds generally less than 2 m thick. The shelf surface is divided into compartments by transverse shelf valleys that were the sea-level rise. Between the shelf valleys, broad plateau-like surfaces were partly molded into areas of sand-ridge topography where the ridges are up to 10 m (33 ft) high and from 2-4 km apart. Southwest-trending storm currents evidently continue to scour troughs and aggrade ridge crests and flanks, transporting the fine sand particles and any accumulated mud across the shelf surface toward the southwest. Fine sediments enter the water column by discharge from river mouths and tidal inlets, by erosion of the sea floor and by man's dumping. They are largely entrained in nearshore waters, especially the bottom nepheloid layer, and are deposited on the bottom during periods of low current velocities. Fines may then be resuspended during storms if bottom currents reach appropriate velocities. When the shoreline lay beyond the shelf edge about 15,000 years ago, there was rapid deposition of fines on the continental slope, but as the nearshore turbid zone migrated landward, slope deposition rates fell abruptly. Shelf mud deposits in the northeastern part of the Bight appear to be the result of intense glacial outwash and deposition in an embayment when the shoreline was in a mud-shelf position. Surficial sediment studies indicate there was little additional sediment transported from the land to the shelf since lowered sea level. However, there appears to be a vigorous southwestward flux of bottom materials in response

to storm flows, and bottom features are being slowly altered in response to sediment transport during storms. The Bight Apex studies reveal that while considerable sediment was dumped, there was negligible bottom sediment deposition except at the dredge spoil dumpsite.

Keywords: Monitoring-MESA, Reviews-Geological

FREELAND, G.L.; SWIFT, D.J.P.; STUBBLEFIELD, W.L.; COK, A.E. 1976. SURFICIAL SEDIMENTS OF THE NOAA-MESA STUDY AREAS IN THE NEW YORK BIGHT. IN: MIDDLE ATLANTIC CONTINENTAL SHELF AND THE NEW YORK BIGHT. PROCEEDINGS OF THE SYMPOSIUM AMERICAN MUSEUM OF NATURAL HISTORY, NEW YORK CITY, NOVEMBER 3-5, 1975, M.G. GROSS, (ED.), SPECIAL SYMPOSIA 2:90-101. In the New York Bight Apex, extensive sedimentological studies and a 1973 bathymetric survey reveal that the only significant change in bottom topography since 1936 occurred at the dredge spoil dumpsite where the dumping of $98 \times 10^6 \text{ m}^3$ of dredged material has caused up to 10 m of shoaling. The center of the Christiaensen Basin, a natural collecting area for fine-grained sediment, is no doubt contaminated with sludge but shows no apparent sediment buildup during the intervening 37 years. The Apex outside of the Christiaensen Basin is floored primarily by sand ranging from silty fine to coarse, with small areas of sandy gravel, artifact (anthropogenic) gravel, and mud. Nearshore mud patches appear to be covered at times with sand and occasionally scoured out. Sidescan sonar records show linear bedforms, indicative of sand movement, over most of the Apex area.

Two midshelf areas have been proposed as interim alternative dumping areas. The northern area is in a tributary valley of the ancestral Long Island river system. Fine sands cover the northeast part and medium sands predominate to the west and south. Bottom photographs show a smooth, slightly undulatory, mounded or rippled sea floor. In the southern alternative dumping area coarse sand and gravel deposits lie on the crest and east flank of the Hudson divide, while medium and fine sand occurs in the ridge and swale topography to the west. These distributions suggest fine sediment is winnowed from the crest and east flank of the divide and deposited to the west. Veatch and Smith Trough contains a veneer of shelly, pebble sand with large, angular clay pebbles and occasional oyster shells derived from exposed early Holocene lagoonal clay. These studies suggest that if sewage were dumped, widespread dispersion, mostly to the southwest, could be expected, with winter resuspension and transport of fine material on the bottom. Possible permanent buildup on the bottom could be expected if dredged material were dumped.

Keywords: Christiaensin Basin, Miscellaneous-Geological, Ocean disposal-Dredged material

FRIEDMAN, P. 1980. ARTIFICIAL OCEAN REEFS FROM COAL WASTES: LEGAL PERSPECTIVES. IN: NEW YORK SEA GRANT LAW

AND POLICY J, M. KAPLAND, (ED.), 3:77-106. Discussion of legal aspects of reef construction from coal wastes or related materials.

Keywords: Artificial reefs

FRY, V.A.; BUTMAN, B. 1991. ESTIMATES OF THE SEAFLOOR AREA IMPACTED BY SEWAGE SLUDGE DUMPED AT THE 106-MILE SITE IN THE MID-ATLANTIC BIGHT. MAR ENV RES 31:145-160. Approximately 8×10^6 wet tons of sewage sludge is dumped annually at the DWD-106 Municipal Sewage Sludge Disposal Site, 185 km off the New Jersey coast. A simple particle-tracking model is used to estimate the areas of sludge deposition using current meter observations made as part of the Mid-Atlantic Slope and Rise (MASAR) study and Lavelle *et al.*'s settling velocity distribution for sewage sludge. Model results indicate that sewage particles settle primarily to the southwest of the dump site due to the mean southwesterly flow throughout the water column. Only the coarser fraction (particles with settling velocities greater than 0.04 cm/sec), about 23% of the sludge discharged, is predicted to settle on the seafloor within 350 km of the site. The model predicts a maximum flux in the southwestern quarter of the site of $60 \text{ mg m}^{-2} \text{ day}^{-1}$ at distances of approximately 50 and 350 km to the southwest, respectively. Little material is predicted to reach the shelf and the finer particles are assumed to be widely dispersed in the water column. These estimated fluxes compare with a natural particle flux of 100-150 $\text{mg m}^{-2} \text{ day}^{-1}$ as measured by sediment traps to the north of the DWD-106. Field studies to assess the effects of sludge dumping on benthic organisms should initially focus on the region 0-50 km southwestward of the site.

Keywords: Ocean disposal-106 mile

GADD, P.E.; LAVALLE, J.W.; SWIFT, D.J.P. 1978. ESTIMATES OF SAND TRANSPORT ON THE NEW YORK SHELF USING NEAR-BOTTOM CURRENT METER OBSERVATIONS. J SED PETROL 48(1):239-252. Calculations of cohesionless bottom-sediment movement within the New York Bight were made by applying transport formulae to near-bottom current meter and surficial sand size observations. Current data were drawn from the records of 18 long-term Savonius rotor current meter deployments at various locations within the Bight during the fall of 1973 and spring of 1974. The assumptions underlying the calculations are that wave activity was minimal at recording sites, that a drag coefficient of 3×10^{-3} reflecting small scale roughness and large boundary layer Reynolds number is suitable to convert measured currents to friction velocities, and that laboratory threshold velocities apply in the marine environment. Oceanic bottom sediment movement reaches maximum intensity during fall and winter due to the added energy input from strong meteorological events. Calculated transport quantities on the inner shelf decrease as depth and distance from shore increase. During the fall of 1973, the deep waters near the head of the Hudson Shelf Valley exhibited current flows directed to the north at 40 cm/sec. These up-channel flow events are in response to strong, sustained westerly winds. The maximum sediment transport rate caused by these current velocities is two orders of

magnitude greater than that occurring at much shallower depths along the New Jersey coast during the same measurement period. The spring 1974 current velocity field yields transport rates of lesser magnitudes relative to the previous fall, with a net down-channel sediment flux at the head of the Hudson Shelf Valley.

Keywords: Circulation, Hudson Shelf Valley, Sediment transport

GARLO, E.V. 1982. INCREASE IN A SURF CLAM POPULATION AFTER HYPOXIC WATER CONDITIONS OFF LITTLE EGG INLET, NEW JERSEY. J SHELLFISH RES 2(1):59-64. From July through September 1976, intermittent hypoxic water conditions occurred off Little Egg Inlet, NJ. The following year, the estimated number of surf clams in the 100-km² area had increased seven fold, due to the increased number of 1+ year-old clams. The high survival of the 1976 cohort indicated that the population had the ability to make a rapid recovery after intermittent hypoxia. Apparently, a reduction of the number of predatory echinoderms and crustaceans during the period when the 1976 cohort set contributed to its success.

Keywords: Anoxia, Benthos-*Spisula*

GARLO, E.V.; MILSTEIN, C.B.; JAHN, A.E. 1979. IMPACT OF HYPOXIC CONDITIONS IN THE VICINITY OF LITTLE-EGG INLET, NEW JERSEY IN SUMMER 1976. ESTUAR COAST MAR SCI 8(5):421-432. A major kill of marine animals in the New York Bight from July through September 1976 was caused by hypoxic conditions. Its inshore effects were studied in the vicinity of Little Egg Inlet, New Jersey. The macrobenthic community was most severely affected. Echinoderms suffered the greatest mortalities, followed by crustaceans and bivalves. Of the *Spisula solidissima* population, 7% was killed. Polychaetes apparently had very low mortalities. Most motile invertebrates and, to a greater extent, fish were able to avoid the hypoxia.

Keywords: Anoxia, Benthos, Benthos-*Spisula*

GARLSON, C.; MALONE, T.C. 1978. MONTHLY OXYGEN AND CARBON BUDGETS OF THE NEW YORK BIGHT APEX. ESTUAR COAST MAR SCI 6(1):93-104. A relationship between surface oxygen flux and particulate organic carbon as a means of estimating mean benthic respiration is proposed and examined using data from the Apex of the New York Bight for 1973-1974. A mean water column mass balance for oxygen involving mean surface oxygen flux, mean benthic and water column respiration, and photosynthetic oxygen production is used to give a first approximation and the carbon and oxygen budgets of the Apex annually. The carbon budget is compared with known organic carbon inputs to the Apex and found to be balanced. The major source of particulate organic carbon is demonstrated to be in situ primary production, with no other single source of POC providing more than 10% of the annual total. High production of

POC by primary production is always accompanied by high evasive surface oxygen flux and generally by higher levels of water column respiration. Benthic respiration is controlled primarily by temperature, but at times by rapid supply of new substrate. It is postulated that one such source of supply is resuspended estuarine sediment as a result of high runoff. The possibility of anoxic conditions in the Apex is examined, and it is concluded that major organic loading events, as a result of high river runoff, could only occur if mechanisms other than those responsible for the property distribution reflected in the data used in this paper were operative.

Keywords: Anoxia, Apex, Benthos, Pollutants-Organic

GARSIDE, C.; MALONE, T.C.; ROELS, O.A.; SHARFSTEIN, B.A. 1976. AN EVALUATION OF SEWAGE-DERIVED NUTRIENTS AND THEIR INFLUENCE ON THE HUDSON ESTUARY AND NEW YORK BIGHT. ESTUAR COAS MAR SCI 4(3):281-289. Sewage wastes discharged into estuaries contain oxidizable organic matter and inorganic nutrients from which further organic matter may be formed. This paper presents an evaluation of the total discharge of nutrients into the Lower Hudson Estuary and estimates the quantities taken up by photosynthetic organisms under summer and winter conditions. Primary production is shown not to be nutrient-limited at any time in the Lower Estuary and in a seasonally variable area of the Apex of the New York Bight. Primary production contributes a significant part of the oxidizable organic matter to the Lower Estuary. The general approach requires few input data and can be of value in assessing the impact of sewage wastes on receiving waters.

Keywords: Estuaries, Plankton, Pollutants-Loadings

GARSIDE, C.; MALONE, T.C.; ROELS, O.A.; SHARFSTEIN, B.A. 1976. AN EVALUATION OF SEWAGE-DERIVED NUTRIENTS AND THEIR INFLUENCE ON THE HUDSON ESTUARY AND NEW YORK BIGHT. ESTUAR COAS MAR SCI 4(3):281-289. Sewage wastes discharged into estuaries contain oxidizable organic matter and inorganic nutrients from which further organic matter may be formed. This paper presents an evaluation of the total discharge of nutrients into the Lower Hudson Estuary and estimates the quantities taken up by photosynthetic organisms under summer and winter conditions. Primary production is shown not to be nutrient-limited at any time in the Lower Estuary and in a seasonally variable area of the Apex of the New York Bight. Primary production contributes a significant part of the oxidizable organic matter to the Lower Estuary. The general approach requires few input data and can be of value in assessing the impact of sewage wastes on receiving waters.

Keywords: Estuaries, Plankton, Pollutants-Loadings

GASPAROVIC, R.F.; APEL, J.R.; KASISCHKE, E.S. 1988. AN OVERVIEW OF THE SAR INTERNAL WAVE SIGNATURE EXPERIMENT. J

GEOPHYS RES C OCEANS 93(C10):12304-12316. The SAR Internal Wave Signature Experiment (SARSEX) was conducted in the New York Bight in late summer 1984 to investigate SAR imaging of oceanic internal waves. The experiment was designed to acquire adequate *in situ* data to test hydrodynamic theories for the interaction of surface waves and currents, as well as theories for radar imaging of internal wave surface manifestations. This paper provides an overview of the experiment and highlights from results obtained to date. Excellent agreement has been found between measured and calculated surface wave modulations at wavelengths from 20 to 100 cm. Internal wave signatures in SAR images at X and L band were found to have comparable magnitudes.

Keywords: Circulation-Internal waves

GIBSON, C.I.; CIACCIO, L.L.; KETCHUM, B.; MICHAEL, A.D. 1979. PETROLEUM HYDROCARBONS SUBPANEL REPORT. IN: CHEMICAL POLLUTANTS OF THE NEW YORK BIGHT: PRIORITIES FOR RESEARCH. J.S. O'CONNOR AND H.M. STANFORD, (EDS.), pp. 20-32. The potential impact of oil pollution in the New York Bight can be grouped into three kinds of effects: (1) a decrease in marine resource abundance by acute or chronic toxicity, physical disruption of habitat, or tainting of food organisms, (2) increased human health hazards through eating contaminated seafood, and (3) a decrease of aesthetic values due to oil slicks and fouled beaches. In this report, the first two effects are considered; aesthetic impact is not discussed. The total existing and potential quantities of PHC available to the New York Bight ecosystem provide justification for the development of an understanding of the fate and effects of PHCs in the Bight. The current state of knowledge does not provide sufficient data to determine the extent to which existing levels of hydrocarbons in the Bight impact the ecosystem. In addition, there are few data on the long-term fate and effects of sediment-bound PHCs. The potential exists for human health to be affected by ingestion of food organisms containing polynuclear aromatics, but evidence was not found that the presence in the sea of carcinogens found in oil, or the presence in seafood of carcinogens from oil, causes cancer in humans.

Keywords: Disease, Pollutants-Organic, Pathology, Seafood

GIFT, J.L.; FAVA, J.A.; MACIOROWSKI, A.F.; MCCULLOCH, W.L. 1989. EVALUATION OF SEWAGE SLUDGE BIOACCUMULATION AND TOXICITY TESTS. OCEANIC PROCESSES IN MARINE POLLUTION, VOL. 3, MARINE WASTE MANAGEMENT: SCIENCE AND POLICY. M.A. CHAMP AND P.K. PARK, (EDS.), pp. 213-220.

Keywords: Ocean disposal-Sewage sludge, Pollutants-Bioaccumulation

GOLDBERG, E.D. 1979. PROCEEDINGS OF A WORKSHOP ON ASSIMILATIVE CAPACITY OF U.S. COASTAL WATERS FOR POLLUTANTS, HELD AT CRYSTAL MOUNTAIN, WASHINGTON, ON

JULY 29- AUGUST 4, 1979. NOAA REPORT-80050709, 291 pp. This report of the workshop held at Crystal Mountain, Washington, in July 1979 has been designated Working Paper No. 1 for preparation of the second Federal Plan for Ocean Pollution Research Development and Monitoring for 1981-1985, which is due early in 1981. The theme of the Crystal Mountain workshop implies that coastal waters can assimilate certain amounts of various pollutants without being undesirably degraded. The task of the workshop was to determine amounts and kinds of pollutants that could be assimilated by these nearby waters without unacceptable effects.

Keywords: Management, Pollutants, Workshop

GOPALAN, U.K.; YOUNG, J.S. 1975. INCIDENCE OF SHELL DISEASE IN SHRIMP IN THE NEW YORK BIGHT. MAR POLLUT BUL 6:149-153.

Incidence of shell disease in shrimp is as high as 30% in certain localities in the New York Bight. Gross examination and histopathological preparations revealed cracking and pitting of the exoskeleton, common characteristics of crustacean shell disease, followed by necrosis of underlying tissue. Aquarium studies, which included tests of the effects of an antibiotic, indicated a possible infectious etiology. The disease may be related to pollution of the habitat by organic wastes including cellulose.

Keywords: Apex, Benthos, Disease, Ocean disposal-106 mile

GORDON, A.L.; AMOS, A.F.; GERARD, R.D. 1976. NEW YORK BIGHT WATER STRATIFICATION--OCTOBER 1974. IN: MIDDLE ATLANTIC CONTINENTAL SHELF AND THE NEW YORK BIGHT. PROCEEDINGS OF THE SYMPOSIUM AMERICAN MUSEUM OF NATURAL HISTORY, NEW YORK CITY, NOVEMBER 3-5, 1975, M.G. GROSS, (ED.), SPECIAL SYMPOSIA 2:45-57. Thermohaline stratification of New York Bight continental shelf water during October 1974 is basically of the summer regime. Salinity increases markedly with increased distance from the coast, yet a basic vertical structure is maintained: an upper isohaline layer; a salinity maximum at the top of the thermocline; a salinity minimum at the base of the thermocline; a deep isohaline layer associated with the cold near-bottom winter residual stratum; and (over the outer shelf) a bottom intrusion of relatively saline and warm slope water. Inversions in temperature and salinity are common within the thermocline. The pycnocline is continuous over the shelf and slope, though some weakening and deepening occurs over the shelf break. Over the shelf it is mainly supported by the thermocline and over the slope by the whalelike. The pycnocline may not be an effective barrier to isopycnal interchange of surface and deep layers in view of the relative slope of isopycnals to pycnocline.

In October 1974 oxygen distribution of the continental shelf was primarily two-layered, with a sharp division at the pycnocline. The lower cold layer has an oxygen concentration of near 60% of full saturation, with values near 3.6 ml/l. This is low; if the deeper layer is principally a residue of the winter homogeneous

condition with initial saturated oxygen values, it would represent oxygen consumption at a rate of 2.6 ml/l during the six summer months after accounting for the low oxygen influx of slope water.

Keywords: Anoxia, Circulation, Miscellaneous-Chemical

GORDON, R.B.; BOHLEN, W.F.; BOKUNIEWICZ, H.J.; DE PICCIOTTO, M.; JOHNSON, J.; KAMLET, K.S.; MCKINNEY, T.F.; SCHUBEL, J.R.; SUSZKOWSKI, D.J.; WRIGHT, T.D. 1982. MANAGEMENT OF DREDGED MATERIAL. IN: ECOLOGICAL STRESS AND THE NEW YORK BIGHT: SCIENCE AND MANAGEMENT. PROCEEDINGS OF A SYMPOSIUM ON THE ECOLOGICAL EFFECTS OF ENVIRONMENTAL STRESS, NEW YORK, NY, JUNE 10-15, 1979, G.F. MAYER, (ED.), ESTUARINE RESEARCH FEDERATION, COLUMBIA, SC, pp. 113-133. New York harbor is in a naturally shallow estuary. Without dredging, maximum water depth in the harbor would be approximately 6 m, too shallow for most vessels engaged in international trade. Sediment reaches the harbor from both the sea and the rivers. Over a period of many years, appropriate engineering works could reduce the amount of sediment that accumulates in the harbor. However, periodic maintenance dredging will be required as long as New York harbor remains a major seaport. Much of the muddy sediment that is deposited in the harbor is contaminated with a range of undesirable and toxic substances; more contamination is added while the sediment remains in the harbor. The most serious problem associated with maintenance dredging is disposal of contaminated sediments. For many years, the accepted practice has been to discharge such material at an open-water site, the Mud Dump, off the entrance to New York Harbor. As dredging continues, the size of the Mud Dump will increase. Concern about the ecological consequences of continued use of the Mud Dump has lead to exploration of alternative disposal methods. Most are more expensive; some, such as containerized ocean disposal, are enormously more expensive. No one scheme will solve the problem of disposal of contaminated dredged material. Nevertheless, this paper outlines the main elements of a regional plan that will provide for continued economic operation of the port while minimizing environmental damage.

Keywords: Management, Ocean disposal-Dredged material

GOTWOLS, B.L.; STERNER, R.E.,II. 1988. MEASUREMENTS OF SURFACE WAVE MODULATIONS FROM INTERNAL WAVES DURING THE SAR INTERNAL WAVE SIGNATURE EXPERIMENT. J GEOPHYS RES C OCEANS 93(C10):12330-338. Video images of surface waves were recorded from a research vessel to characterize the internal wave-induced surface roughness modulations during the SAR Internal Wave Dynamics Experiment (SARSEX). These images have yielded two-dimensional slope spectra during the vessel's traversal of two internal wave packets. By sampling the spectra along the internal wave propagation direction, spectral modulation time series were generated for surface waves of 20- to 100-cm wavelength which clearly show

roughness modulations correlated with the internal wave activity. Surface waves of 60-cm wavelength or longer were found to experience the largest modulations. The maximum roughness increases and decreases occur near regions where the internal wave surface current gradients are largest, with increased roughness occurring forward of the peak internal wave displacement.

Keywords: Circulation-Internal waves

GREENLEE, S.M.; DEVLIN, W.J.; MILLER, K.G.; MOUNTAIN, G.S.; FLEMINGS, P.B. 1992. INTEGRATED SEQUENCE STRATIGRAPHY OF NEOGENE DEPOSITS, NEW JERSEY CONTINENTAL SHELF AND SLOPE: COMPARISON WITH THE EXXON MODEL. GEOLOGICAL SOCIETY OF AMERICAN BULLETIN 104(11):1403-1411. The observed geometry and lithofacies distribution of the Neogene depositional sequences are compared to the "standard" Exxon sequence stratigraphic model. Depositional sequences recognized in this study are characterized by similar overall stacking patterns within component systems tracts; however, the New Jersey sequences are different in several ways, explained in terms of the limited Neogene accommodation on the New Jersey shelf.

Keywords: Miscellaneous-Geological

GREIG, R.A.; ADAMS, A.; WENXLOFF, D.R. 1977. TRACE METAL CONTENT OF PLANKTON AND ZOOPLANKTON COLLECTED FROM THE NEW YORK BIGHT AND LONG ISLAND SOUND. BULL ENVIRONM CONTAM TOXICOL 18(1):3-8. To determine the mechanisms of cycling of trace metals in the marine environment, the reservoirs for these metals must be identified and the quantity of metal occurring in these reservoirs determined. Nearly all the metal content of aquatic ecosystems residing in the biota is small. Phytoplankton and zooplankton constitute the most important living elemental reservoirs in terms of turnover and total physical transport and redistribution processes.

In the present study various plankton were obtained from Long Island Sound and the New York Bight. The purpose of the study was to obtain baseline data on trace metal levels in zooplankton from these areas and possibly to determine any differences in metal levels related to geographical location of sampling. Plankton were collected with a No. 8 (203 microns) Nitex mesh net, 1/2 m diam, that was towed at the surface of the water for half an hour. Samples were kept frozen in plastic jars until processed at the laboratory. The samples were thawed, large debris were removed, and sub-samples were poured into glass beakers and dried at 105-110 °C for 18 hr. In the case of rock crabs, red hake, and shrimps found in the samples, individual organisms were removed with a tweezer and washed with distilled water prior to drying. The dried material was ground into a powder with a Teflon mortar and pestle.

Keywords: Plankton, Pollutants-Bioaccumulation

GREIG, R.A.; MCGRATH, R.A. 1977. TRACE METALS IN SEDIMENTS OF RARITAN BAY. MAR POLLUT BULL 8(8):188-192. Marine sediments are the ultimate recipient of nearly all trace metals introduced by man into aquatic ecosystems. This study examined the amounts and distribution of six trace metals (Cd, Cr, Cu, Ni, Pb, Zn) in sediments of Raritan Bay, a polluted estuary. The highest levels of these metals (mg/kg) found in Raritan Bay were: Cd-15, Cr-260, Cu-1230, Ni-50, Pb-985, Zn-815. Three metals regimes within Raritan Bay are readily apparent. An area of high values extends across the Bay from the mouth of the Raritan River and Arthur Kill into Sandy Hook Bay. This is bounded on the south and northeast by areas of somewhat lower concentrations. An area of relatively low concentrations, near background values, occupies the region at the mouth of the Bay between Sandy Hook's peninsula and Coney Island, NY. Metals values from Raritan Bay are compared with other areas and with a few exceptions, the Raritan Bay maximum levels were similar in magnitude to those of areas in Corpus Christi Harbor, TX, Severn Estuary (U.K.), Deep Sean and Florida Lakes, River Blyth (U.K.), dump sites off New York City, various basins off South California, and in Long Island.

Keywords: Estuaries, Ocean disposal, Pollutants-Sediments

GREIG, R.A.; SAWYER, T.K.; LEWIS, E.J.; GALASSO, M.E. 1982. A STUDY OF METAL CONCENTRATIONS IN RELATION TO GILL COLOR AND PATHOLOGY IN THE ROCK CRAB. ARCH ENVIRON CONTAM TOXICOL 11(5):539-545. Gills of adult rock crabs (*Cancer irroratus* Say) collected near a sewage disposal site in the New York Bight Apex were analyzed for copper, lead, cadmium, and silver. One gill from each animal was processed for histologic study to document pathological conditions within the tissue and the presence or absence of fouling organisms on gill surfaces. Comparisons are made between metal concentrations in rock crab gills and published data on crustaceans from other locations.

Keywords: Apex, Benthos-Cancer, Disease, Pollutants-Metals

GREIG, R.A.; WENZLOFF, D.R. 1977. TRACE METALS IN FINFISH FROM THE NEW YORK BIGHT AND LONG ISLAND SOUND. MAR POLLUT BULL 8(9):198-200. Concentrations of silver, cadmium, chromium, copper, mercury, manganese, nickel, lead and zinc were measured in five species of finfish collected from the New York Bight and two from Long Island Sound. With few exceptions the trace metal contents were similar for the various species examined and also for a single species when comparing catch locations. Metal levels also were similar to concentrations reported by 2 other investigators who studied fish from the North Atlantic. In the present study, the trace metal content of the teleosts red hake (*Urophycis chuss*), spiny dogfish (*Mustelus canis*), white hake (*Urophycis tenuis*), winter flounder (*Pseudopleuronectes americanus*), and yellowtail flounder (*Limanda ferruginea*) were determined.

Keywords: Fish-*Urophycis*, Fish-*Mustelus*, Fish-*Pseudopleuronectes*, Fish-*Limanda*, Pollutants-Metals, Pollutants-Toxicity

GREIG, R.A.; WENZLOFF, D.R.; ADAMS, A.; NELSON, B.; SHELPUR, C. 1977. TRACE METALS IN ORGANISMS FROM OCEAN DISPOSAL SITES OF THE MIDDLE EASTERN UNITED STATES. ARCH ENVIRON CONTAM TOXICOL 6(4):395-409. Concentrations of Ag, As, Cd, Cr, Hg, Mn, Pb, and Zn were determined for selected marine fish and shellfish collected at or near three ocean disposal sites, a control site and three inshore areas of the middle eastern United States. The disposal sites were off New Haven, Connecticut, New York City, and Delaware Bay. The control site was at Chincoteague Inlet, Virginia, and other areas were in Long Island Sound (near the New Haven disposal site), Barnegat Bay, New Jersey, and a second area off New York City near the Bight Apex disposal site. With the following exceptions, the amounts of trace metals in biological samples did not vary substantially among the geographic areas. Silver in rock crab flesh averaged 0.79 ppm for the New York Bight disposal site compared with 0.24 to 0.38 ppm for 4 other areas. Cadmium, Mn, and Zn concentrations were greatest in rock crab flesh collected from Long Island Sound area 2 (not a known disposal site) compared to three other areas mean levels were 1 versus 0.1 ppm, 29 versus 0.8 to 1 ppm, and 64 versus 32 to 36 ppm. The Mn content in gills of rock crabs from the same area in the Sound was 22 ppm compared with 6 ppm for Chincoteague Inlet. Digestive glands of channeled whelk collected from a disposal site in Long Island Sound contained the greatest amount of Ag, Cd, and Zn, compared to the control area, Chincoteague Inlet and a site outside the disposal area in the Sound. Levels were 20 versus 6 to 7 ppm of Ag, 24 versus 16 and 17 ppm of Cd, and 2650 versus 1,025 and 405 ppm of Zn, respectively. In addition, whelk digestive glands from the two areas in the Sound contained about 1,100 ppm of Cu compared to only 32 ppm for Chincoteague Inlet. Trace metal concentrations in the organisms used during this study were of the same order of magnitude as those reported by various investigations for a variety of organisms collected from waters in the US Atlantic and Pacific as well as British waters of the Atlantic.

Keywords: Benthos, Benthos-Cancer, Fish, Pollutants-Metals, Pollutants-Toxicity

GREIG, R.A.; WENZLOFF, D.R.; PEARCE, J.B. 1976. DISTRIBUTION AND ABUNDANCE OF HEAVY METALS IN FINFISH, INVERTEBRATES AND SEDIMENTS COLLECTED AT A DEEPWATER DISPOSAL SITE. MAR POLLUT BUL 7(10):185-187. Analyses of deep water finfish to several heavy metals indicate that deep water fish have less metal in muscle tissue than do fish taken from the continental shelf. Liver tissue from deep water fish also, generally, contain less metals. Sediments and a single invertebrate collected at deep water stations have also been analyzed for heavy metals.

Keywords: Ocean disposal-106 mile, Pollutants-Bioaccumulation

GRICE, G.D.; WIEBE, P.H.; HOAGLAND, E. 1973. ACID-IRON WASTE AS A FACTOR AFFECTING THE DISTRIBUTION AND ABUNDANCE OF ZOOPLANKTON IN THE NEW YORK BIGHT, I. LABORATORY STUDIES ON THE EFFECTS OF ACID WASTE ON COPEPODS. ESTUAR COAST MAR SCI 1(1):45-50. Laboratory experiments were conducted using three copepods to study the effects acid-iron wastes might have on zooplankton. Individuals of *Calanus finmarchicus*, *Temora longicornis* and *Pseudocalanus* sp. were maintained in bottles containing varying dilutions of acid wastes in sea water or control sea water solutions for 24 to 48 hr. to examine survival of adults exposed to high concentrations of waste. They were also maintained for time periods up to 18 days to ascertain effects on reproduction and survival of young. In addition, individuals of *C. finmarchicus* were transferred through a series of increasing dilutions of acid wastes and into filtered sea water to simulate the short-term effects of acid waste concentrations in the wake of a discharging barge.

Substantial mortality of adults of the above three copepods occurred at concentrations of acid waste producing pH's of approximately 6.5 and lower. However, this mortality is not indicative of mortality in the fields as these concentrations and pH values exist for only a short time (less than 3 min) due to rapid mixing of the acid waste with sea water. Individuals maintained in buffered acid wastes of comparable dilutions showed no mortality, while individuals maintained in test media using sulfuric acid in place of acid waste showed high mortalities at pH's of 5.5 or less. Thus, acidity of test solutions may be a principal cause of copepod mortality rather than some toxic component of the waste material. Inhibition of reproduction and deleterious effects on survival of young were observed in experiments of 18 days duration at concentrations of acid wastes which do not in fact persist for such periods on the acid grounds. No mortality was observed when *C. finmarchicus* was transferred through acid waste dilutions with pH values and time periods comparable to those they would encounter on the acid grounds during discharge of acid wastes. Mortality of species due to short term exposure to high concentrations of waste appears small, and little effect on adults or larval forms at great dilutions could be demonstrated; therefore, acid waste discharges did not appear to be responsible for the large variations in zooplankton biomass previously observed in the survey area.

Keywords: Plankton, Pollutants-Toxicity

GRICE, G.D.; HART, A.D. 1962. THE ABUNDANCE, SEASONAL OCCURRENCE AND DISTRIBUTION OF THE EPIZOOPLANKTON BETWEEN NEW YORK AND BERMUDA. ECOL MONOGR 32(4):287-307. The pioneer studies of plankton and hydrography conducted by Dr. H.B. Bigelow in the Gulf of Maine and waters adjacent to the northeast coast of the United States have been augmented in recent years by a few other similar and several more restricted investigations of these waters. A glance at the numerous titles dealing with zooplankton leads one to assume that the plankton fauna of the northwest Atlantic is fairly well known, as indeed the neritic plankton is. Yet the

proximity of the Sargasso Sea and Gulf Stream to the neritic and intervening slope waters off New York, each with more or less unique hydrographic conditions, makes synoptic studies not only interesting but essential if species distribution, occurrence, and fluctuation are to be understood in light of the hydrography and phytoplankton production. The present investigation is one of several concerned with the biology and chemistry of plankton in the region between New York and Bermuda and is a part of a continuing study of zooplankton in the Northwest Atlantic Ocean.

Keywords: Plankton

GROSS, M.G. 1972. MARINE WASTE DEPOSITS NEAR NEW YORK. MAR POLLUT BUL 3(4):61-63. The effects of effluent discharges and sludge dumping in New York Harbor and New York Bight have been surveyed. Total carbon content, loss on ignition, and lead and copper concentrations prove to be the most useful parameters for mapping the distribution of wastes in bottom deposits.

Keywords: Ocean disposal-12 mile, Pollutants-Sediment

GROSS, M.G. 1975. A SPECIAL SYMPOSIUM ON THE MIDDLE ATLANTIC CONTINENTAL SHELF AND NEW YORK BIGHT HELD AT THE AMERICAN MUSEUM OF NATURAL HISTORY IN NEW YORK CITY ON 3-4-5 NOVEMBER 1975. REPORT NO.: NOAA-76LL2414, 81 pp. This report is a collection of abstracts of 42 papers presented at a special symposium on the Middle Atlantic Continental Shelf and New York Bight. The subjects encompass all aspects of the marine sciences and fisheries, contamination or pollution, and its effects on the environment and aquatic communities. Interaction between the ocean and atmosphere is dealt with along the various pertinent aspects of marine meteorology.

Keywords: Fisheries, Pollutants, Workshops

GROSS, M.G., (ED.). 1976. MIDDLE ATLANTIC CONTINENTAL SHELF AND THE NEW YORK BIGHT. PROCEEDINGS OF THE SYMPOSIUM AMERICAN MUSEUM OF NATURAL HISTORY, NEW YORK CITY, NOVEMBER 3-5, 1975. SPECIAL SYMPOSIA VOLUME 2.

Keywords: Workshops

GROSS, M.G. 1976. NEW YORK BIGHT II: PROBLEMS OF RESEARCH. OCEANUS 19(4):11-18. Alteration of the New York Bight as a result of waste disposal is most easily documented on the ocean bottom. There the solid wastes have accumulated, changing the local topography, altering physical and chemical characteristics of the bottom, and affecting the nature and abundance of bottom-

dwelling animals near the disposal sites. Waste disposal also affects water quality and the productivity of phytoplankton. In coastal waters phytoplankton production is often limited by scarcity of nitrogen compounds, but in the New York Bight there is abundant nitrogen supplied by estuarine discharge and by decomposition of organic materials on the ocean bottom. Annual phytoplankton production amounts to 370 grams of carbon per square meter per day in the 600-square-kilometer area nearest the harbor entrance.

Public health is the bottom line. Conflicting uses of the New York Bight and their potential public health implications emerged early in the studies of the area. Present research in the Bight arose from concerns of Public Health Service officials about risks involved in harvesting surf clams from waters off Long Island and New Jersey. These studies resulted in the closure of areas to shellfishing around the sludge disposal sites.

Keywords: Management

GROSS, M.G. 1976. WASTE DISPOSAL. MESA NEW YORK BIGHT ATLAS MONOGRAPH 26, 32 pp. Waste solids (dredge spoil, rubble, sewage sludge and industrial sludge) are dumped at six major disposal sites in New York Bight. Waste disposal has been regulated since about 1890. Discharges of waste solids into the Bight in 1975 were dredge spoil, 5 million metric tons; rubble, 1.2 million metric tons; industrial sludges, 0.3 million metric tons; and sewage sludge, 0.3 million metric tons. Amounts of waste solids discharged increased between 1968-1975 although the number of individual disposal operations declined. At the various disposal sites, wastes can be detected by their black color, human artifacts, high carbon content (greater than 2% total C), and metal content (high in Ag, Cu, Cr and Pb). In the axis of the Hudson Channel, waste deposits locally are over 15 m (50 ft) thick and cover more than 150 sq km (60 mi²). The head of the Hudson Channel has been filled by waste deposits. This physical alteration of the bottom has caused obvious changes in abundance and distribution of bottom-dwelling organisms. Accumulations of sewage sludges on the ocean bottom are associated with diseases in crustacea and fin erosion in certain bottom-dwelling fishes. Low DO concentrations occur in the disposal areas during late summer.

Keywords: Anoxia, Disease, Monitoring-MESA, Ocean disposal-Dredged material, Ocean disposal-Sewage sludge, Pollutants-Metals

GROSS, M.G.; BLACK, J.A.; KALIN, R.J.; SCHRAMEL, J.R.; SMITH, R.N. 1971. SURVEY OF MARINE WASTE DEPOSITS, NEW YORK METROPOLITAN REGION. TECH. REPORT NO. 8, MARINE SCIENCES RESEARCH CENTER, STATE UNIVERSITY OF NEW YORK, STONYBROOK, 72 pp. Major sources of wastes and large waste deposits in the coastal waters around the New York Metropolitan Region were surveyed in 1970 to determine their properties. Using the most diagnostic properties of the wastes, the areas covered by the various waste deposits were sampled and approximate boundaries determined. Loss-on-ignition (volatile matter) or total carbon

concentrations provide useful measures of the abundance of carbon-rich wastes on the continental shelf. The area covered by deposits containing more than 2% total carbon or 5% volatile matter is about 50 sq km (20 sq miles). Deposits containing more than 1% total carbon cover about 100 sq km (40 sq miles). In New York Harbor, total carbon concentrations are the most useful index of the abundance of organic matter. About 160 sq km (62 sq miles) or about 40% of the harbor is covered by fine grain wastes, containing more than 2% total carbon. About one third of the total carbon content of the deposits is added as they accumulate in the harbor.

Distributions of samples containing anomalously high total concentrations of chromium, copper, lead, and silver were compared to the distribution of carbon-rich deposits on the continental shelf. Assuming that the carbon-rich deposits are indicative of waste accumulation on the shelf, the data indicate that lead and copper are the most useful elements for mapping the distribution of wastes. Concentrations of HCl-extractable metals (copper, nickel, chromium, manganese and iron) correlate well with total elemental concentrations determined by optical emission spectrochemical analyses. Typically about 1% of the total metal concentrations was extractable by HCl, except for nickel where approximately 5% was extracted. The high correlation between total and extractable concentrations of copper, chromium, and iron suggests (but does not prove) that these elements are fairly well dispersed through the samples and generally occur in chemical forms which are little affected by the HCl treatment.

Only a few groups of pollution-tolerant organisms (nematodes and capitellid worms) were abundant in sediments from the inner portions of New York Harbor. Benthic communities in most of the inner harbor are either drastically impoverished or lacking. Communities of benthic organisms in the Lower Bay are less severely affected by pollution. Near the harbor entrance the continental shelf appears to have near-normal bottom-dwelling organisms. No living foraminifera were found in sediment from the East River near Throgs Neck. Living foraminifera were present in western Long Island Sound but there were relatively few species. The total number of individual foraminifera (live plus dead) increase toward the west. Waste disposal activities have had little demonstrable effect on the diversity of distribution of foraminifera in western Long Island.

Keywords: Benthos, Pollution-Sediments

GROSSLEIN, M.D. 1976. SOME RESULTS OF FISH SURVEYS IN THE MID-ATLANTIC IMPORTANT FOR ASSESSING ENVIRONMENTAL IMPACTS. IN: MIDDLE ATLANTIC CONTINENTAL SHELF AND THE NEW YORK BIGHT. PROCEEDINGS OF THE SYMPOSIUM AMERICAN MUSEUM OF NATURAL HISTORY, NEW YORK CITY, NOVEMBER 3-5, 1975, M.G. GROSS, (ED.), SPECIAL SYMPOSIA 2:312-328. Knowledge of the distribution, biomass, and composition of the major biological communities is essential to the data base required for assessing the impact of environmental change on the marine ecosystem. Since 1967 the National Marine Fisheries Service (NMFS) has conducted regular trawl surveys in the mid-Atlantic,

providing quantitative measures of density distributions of demersal fish populations. The surveys show that each species occupies wide areas of the shelf and that there is a high degree of species mixture, particularly in the New York Bight. Significant numbers of adult stages, planktonic eggs, and larvae can be found over the whole mid-Atlantic shelf all year. Thus, there are no shelf areas free of risk from potential damage from waste disposal activities. Impacts of any change must consider a multispecies community and include all life stages. Precision of large-scale surveys is relatively low, making it difficult to detect any but major changes. Broad-scale surveys must be augmented with detailed laboratory and field experiments on physiology and behavior (especially food chains) of selected organisms and communities to get insight into probable effects of sublethal factors. The complexity and scope of marine ecosystems require long term but well coordinated research programs to ensure proper integration of small-versus large-scale studies and field versus laboratory experiments.

Keywords: Fisheries, Monitoring

GROSSLEIN, M.D.; AZAROVITZ, T.R. 1982. FISH DISTRIBUTION. MESA NEW YORK BIGHT ATLAS MONOGRAPH 15, 187 pp. The Middle Atlantic Bight is a complex ecosystem characterized by rapid latitudinal change in water temperatures and associated fauna. Subtropical and boreal fish fauna overlap in the region from Cape Hatteras to Georges Bank, resulting in a highly diverse fish community with large seasonal fluctuations in distribution. The general ecology of 43 important species of fish and shellfish in the Middle Atlantic Bight is summarized in terms of distribution and seasonal movements, population size and fisheries, reproduction-growth-life span, feeding interrelationships, and environmental sensitivity to pollutants and natural environmental factors. Most species found in the Bight also spawn there; thus, environmental conditions and water quality in the Bight control the reproductive success of the population occurring there.

Keywords: Fish, Monitoring-MESA, Reviews-Biological

GUNNERSON, C.G. 1981. THE NEW YORK BIGHT ECOSYSTEM. IN: MARINE ENVIRONMENTAL POLLUTION. VOLUME 2: DUMPING AND MINING. R.A. GEYER, (ED.), ELSEVIER, AMSTERDAM. ELSEVIER OCEANOGR. SER., 27B, pp. 313-378. Better definition of waste disposal problems and of the research, development, and monitoring protocols needed to solve them is resulting in intensive studies of the New York Bight which began with the National Oceanic and Atmospheric Administration's Marine Ecosystem Analysis (MESA) New York Bight Project in 1973. This chapter reviews the New York Bight's geological, physical, and chemical oceanography, as well as the major living marine resources. Shoreline, near-shore, and offshore effects of waste discharges are summarized. Acute effects of waste discharges, including (1) June 1976 Long Island Beach pollution, and (2) 1976 anoxia and fish kill, are described. Ecosystem modelling in the New York Bight is finally outlined. A selected bibliography on the New York Bight is also appended.

Keywords: Anoxia, Bibliographies, Fish kills, Monitoring-MESA, Ocean disposal, Reviews-Geological, Reviews-Physical, Reviews-Chemical

GUNNERSON, C.G. 1981. REPORT OF NORTHEAST REGIONAL WORKSHOP ON OCEAN POLLUTION MONITORING HELD AT STONY BROOK, NEW YORK ON SEPTEMBER 10-12, 1980. NOAA-81092515, 90 pp. The primary purpose of this report is to summarize the findings of the US NOAA/US EPA Northeast Regional Ocean Pollution Monitoring Workshop convened in Stony Brook, NY, September 10-12, 1980. It was found that existing inventories of Northeast Regional Marine Pollution Monitoring Programs were incomplete and that further investigation was needed to determine the significance of these omissions and to meet the overall objectives of the workshop. Present ocean monitoring programs include NOAA's pilot Northeast Monitoring Program (NEMP), Region 2 EPA's New York Bight Monitoring Program and Region 3 EPA's Ocean Dumping Monitoring Program, Federal Drug Administration/State shellfish sanitation programs, and a number of municipal and industrial compliance monitoring programs.

Keyword: Monitoring-NEMP, Workshops

GUNNERSON, C.G.; ADAMSKI, R.; ANDERSON, P.W.; DEWLING, R.S.; JULIUS, D.A.; KLEPPEL, G.S.; LEAR, D.W.; MEARN, A.J.; MILLER, J.T.; MYERS, E.P.; ROSWELL, J.J.; SCHROEDER, S.; SEGAR, D.A.; SINDERMAN, C.J.; STERN, C.M. 1982. MANAGEMENT OF DOMESTIC WASTES. IN: ECOLOGICAL STRESS AND THE NEW YORK BIGHT: SCIENCE AND MANAGEMENT. PROCEEDINGS OF A SYMPOSIUM ON THE ECOLOGICAL EFFECTS OF ENVIRONMENTAL STRESS, NEW YORK, NY, JUNE 10-15, 1979, G.F. MAYER, (ED.), ESTUARINE RESEARCH FEDERATION, COLUMBIA, SC, pp. 91-112. Studies of municipal waste discharges and sewage sludge dumping reveal that these sources account for more than half of the loadings of the most serious pollutants in the New York Bight region. Liquid municipal discharges account for 35-70% and municipal sludge dumping for 5-15% of total input, depending upon the contaminant under consideration. Increasing costs of conventional waste disposal practices and regulation have not been accompanied by corresponding benefits. Consequently, there is increasing need to determine willingness to pay for alternative policies or institutional and technological options for waste generation and disposal practices in the New York metropolitan area.

Keywords: Management, Ocean disposal-Sewage sludge

GUNNERSON, C.G.; SWANSON, R.L. 1975. OCEAN DUMPING IN THE NEW YORK BIGHT. NOAA TR ERL-321; MESA-2; NOAA-75091802, 83 pp. The New York Bight extends seaward over 15,000 square miles from Long Island and New Jersey to the edge of the continental shelf, some 80-100 nautical

miles off-shore. Wastes from 20 million people are discharged to the Bight. These wastes arrive by a variety of routes: ocean dumping, outfall sewers, air pollution, river discharge, land runoff, thermal discharges, vessel wastes, and occasional spills. Although impacts of these wastes on the marine environment are not clearly understood, there is evidence that the waters, bottom sediments, and living resources are under stress. An average of 7,400,000 m³ per year of dredge spoils were dumped each year between 1965 and 1970, as well as waste acid and construction and demolition debris. The hazards of this dumping are not known, however, above normal incidence of fin-rot disease in fish in the area and the closing of the area to shellfishing are indications that something is wrong.

Keywords: Disease, Ocean disposal

HAEFNER, P.A., JR. 1976. DISTRIBUTION, REPRODUCTION, AND MOLTING OF THE ROCK CRAB *CANCER IRRORATUS* IN THE MID ATLANTIC BIGHT. J NAT HIST 10(4):377-397. Rock crabs, *C. irroratus*, were collected in October 1971, and April and June 1973, during trawl surveys of the continental shelf of the Mid-Atlantic Bight. More than 1,700 rock crabs were captured in 58 trawls. They were distributed within a depth range of 18-390 m. Maximum abundance occurred within 40-60 m and 6-9 degrees C. Male crabs ranged from 8-127 mm in carapace width, females from 11-113 mm. Two modal size groups for males and females were recognized: less than 50 mm and 51-100 mm. There was a third group of male crabs over 100 mm width. Crabs less than 50 mm were more abundant than larger crabs at depths from 15-150 m; they were most abundant at 40-60 m. Crabs 51-100 mm were more abundant than other size groups in the 150-400 m depth stratum. Males greater than 101 mm were most abundant at 20-60 m. Male crabs predominated in June. Sex ratios (M:F) ranged from 1.2-1.9:1. In October the ratios ranged from 1:2.1-4:1. In April the ratio was 1.7:1. The ratios for crabs less than 50 mm were essentially 1:1. Significant ratios occurred in the 51-100 mm size group. The species was actively molting in April and June, but recent or incipient ecdysis was not observed in October. Gonad development in June was related to size. Male crabs larger than 101 mm were well developed. Gonads of males less than 50 mm were undeveloped or in very early stages of maturation. Most females smaller than 70 mm were in early ovarian development. No ripe ovaries were observed; only one ovigerous individual and one with egg remnants were captured. No berried females were taken in April or Oct. The incidence of epizootes on crabs reflected the molting history of the crabs. Twenty percent of hard and peeler crabs and 1.6% of papershell crabs in June were fouled. Predominant organisms were the fleshy ectoproc *Alcyonidium* sp. and the lepadid barnacle *Octolasmis lowei*. The rock crab was significantly associated with *Cancer borealis* and *Homarus americanus* in June. Positive association of *C. irroratus* and *C. borealis* was shown for the October Chesapeake Bight data, whereas negative association was indicated for the New York Bight area.

Keywords: Benthos, Benthos-Cancer, Benthos-Homarus

HAEFNER, P.A., JR. 1977. ASPECTS OF THE BIOLOGY OF THE JONAH CRAB, *CANCER BOREALIS* STIMPSON, 1859 IN THE MID-ATLANTIC BIGHT. J NAT HIST 11:303-320. Jonah crabs, *Cancer borealis*, were collected in October 1971, June 1973, and March and April 1974, during trawl surveys of the continental shelf of the Mid-Atlantic Bight and the shelf and slope east of Beaufort, NC. Crabs were contagiously distributed within a depth range of 20-400 m. Maximum abundance occurred within 150-400 m and 8-13.9 °C.

Male crabs ranged from 12 to 175 mm in carapace width; females from 13 to 152 mm. Three modal size groups for males and females were recognized: 13-40 mm, 41-80 mm and 81-110 mm. There was a fourth group of male crabs over 110 mm width. Crabs <40 mm were most abundant at depths of 75-150 m; crabs 41-80 mm were not captured in depths <150 m, but were the dominant group strata >150 m. Larger crabs (81-110 mm) occurred from 40 to 400 m and reached maximum numbers at 150-400 m. Male crabs >111 mm were found only in 150-400 m.

The species was actively moulting in June, but recent or incipient ecdysis was not observed in October. Only one recently moulted crab was noted in March. The incident of fouling organisms on crabs reflected the moulting history of the crabs. Sixty percent of crabs in anecdyosis and 14% of those in postecdysis were fouled. The predominant organism was the lepadid barnacle, *Poecilasma inaequilaterale* Pilsbry, which was attached to the gills in the barnchial chamber. Gonad development in June was related to size. Most crabs <80 mm width were underdeveloped or only slightly developed. Mature gonads were seen only in crabs >100 mm width. Testes and vasa deferential of most males >150 mm were well to very well developed. No ripe ovaries were seen and no ovigerous individuals were taken in June. One berried female was observed in March.

Keywords: Benthos-Cancer

HALL, JR., J.B.; PEARSON, A.O. 1977. RESULTS FROM THE NATIONAL AERONAUTICS AND SPACE ADMINISTRATION REMOTE SENSING EXPERIMENTS IN THE NEW YORK BIGHT, 7-17 APRIL 1975. NATIONAL AERONAUTICS AND SPACE ADMINISTRATION. REPORT NO.: NASA-TM-X-74032, 190 pp. A cooperative operation was conducted in the New York Bight to evaluate the role of remote sensing technology to monitor ocean dumping. Six NASA remote sensing experiments were flown on the C-54, U-2, and C-130 NASA aircraft, while NOAA obtained concurrent sea truth information using helicopters and surface platforms. The experiments included: (1) a Radiometer/Scatterometer (RADSCAT), (2) an Ocean Color Scanner (OCS), (3) a Multichannel Ocean Color Sensor (MOCS), (4) four Hasselblad cameras, (5) an Ebert spectrometer; and (6) a Reconafax IV infrared scanner and a Precision Radiation Thermometer (PRT-5). The results of these experiments relative to the use of remote sensors to detect, quantify, and determine the dispersion of pollutants dumped into the New York Bight are presented.

Keywords: Remote sensing

HAMMER, P.E. 1959-1963. CONSTRUCTION OF AN ARTIFICIAL REEF. (ARTIFICIAL REEF STUDIES, APRIL 1, 1959 TO MAY 31, 1963). NJ, USFWSFA, PROJECT F-15-R-(1-4), JOB 5, 16 pp. This series of reports describes reef building projects. Ballasted wood boats and weighted auto tires are not recommended for use in shallow water due to damage and loss in storms. Later reefs made of rubble were developed into fish havens but were subsequently covered by sand.

Keywords: Artificial reefs

HAMMON, A. 1976. PORT FACILITIES AND COMMERCE. MESA NEW YORK BIGHT ATLAS MONOGRAPH 20, 41 pp. The Port of New York is geographically situated in the 1,500 mi² (3,900 km²) Port District within a 25 mi (40 km) radius of the Statue of Liberty. The port is linked to the Atlantic via Long Island Sound, Raritan Bay, and Lower New York Bay and is served by a network of federal waterways and anchorages. A wide array of waterborne commerce, heavily dominated by petroleum, is moved through these waterways aboard all kinds of tankers, freighters, and containerships.

Navigational safety in the port is in the hands of several agencies. The Sandy Hook Pilots Benevolent Association and other pilot groups furnish vessel pilotage in and out of the harbor; docking pilots, assisted by tugboats, handle actual docking and undocking maneuvers. The US Coast Guard cares for the various navigation aids marking the federal waterways, enforces the navigation laws, and provides harbor security and safety. To keep the federal waterways clear for safe and efficient use at prescribed depths and widths, the Corps of Engineers does maintenance dredging. Though the port is among the finest marine terminals in the world, technological change and geographical shifts have left deteriorating shore structures and sunken hulks, which can become navigation hazards. In 1974 the federal government, with local participation, authorized a program for removing waterfront blight; the program began in 1976.

Keywords: Miscellaneous, Monitoring-MESA

HAN, G.; HANSEN, D.V.; CANTILLO, A. 1979. DIAGNOSTIC MODEL OF WATER AND OXYGEN TRANSPORT. IN: OXYGEN DEPLETION AND ASSOCIATED BENTHIC MORTALITIES IN NEW YORK BIGHT, 1976, NOAA PROFESSIONAL PAPER 11, R.L. SWANSON AND C.J. SINDERMAN, (EDS.), pp. 165-192. The first conclusion to be drawn from the use of the diagnostic model is that even during May and June 1976, the replacement time of water in New York Bight was relatively short compared to the general seasonal cycle of property changes for the Bight as a whole and for the inshore segments of principal interest. A second conclusion is that oxygen depletion in the critical region during the May-June period was due to oxygen utilization about 3 times greater than in other regions of the inner shelf and nearly 10 times greater than that occurring over the outer shelf, rather than simply being

due to the length of stratified season, stagnation, or advection of low-oxygen water. The most critically affected regions, in fact, had a relative advection oxygen input substantially greater than other areas. The key problem in examining the anoxia episode is explaining the high consumption rates that occurred off New Jersey during spring and summer 1976. Numerous causes have been suggested, including ocean dumping, estuarine discharge, primary production, and an anomalous bloom of dinoflagellate organisms.

For reasons not well understood but probably related to the pattern of surface wind, and quite possibly to the heavy discharge from the Hudson River during early 1976, the circulation in and near the Apex was kinematically equivalent to that commonly occurring in coastal plain estuaries for the entire period from May 18 to June 29. A similar situation existed in the average along the entire inner New Jersey shelf over the last 26 days of the period. Such circulations tend to trap and concentrate suspended particulate matter having a small sinking velocity. This concentration process functions irrespective of where such particulate materials are introduced into the circulation pattern. Hence, particulates from the Hudson River, the dumping activities, and plankton productivity would have concentrated in the Apex and over the inner shelf off New Jersey. This concentration of oxidizable material had an exorbitant biochemical oxygen demand that depleted the oxygen supply in spite of reasonably active ventilation of waters below the thermocline. If *Ceratium tripos*, which are capable of relatively rapid movement, seek a position below the thermocline, this behavior will couple to the circulation just as do inanimate particle distributions.

Keywords: Anoxia, Modeling, Sediment transport

HAN, G.; HANSEN, D.V.; GALT, J.A. 1980. STEADY-STATE DIAGNOSTIC MODEL OF THE NEW YORK BIGHT. J PHYS OCEANOGR 10(12):1998-2020. A qualitative evaluation is made of the output from a finite-element, steady-state diagnostic model to observed time-averaged currents. The model uses a vorticity balance equation with linear bottom friction and inputs observations of near-bottom currents on the model boundary, density field, and bottom topography. The output is the near-bottom (barotropic) velocity field over the entire modeled region. Velocity profiles are constructed using the thermal wind equation with the observed density field from May 1976 and a turbulent closure scheme model of Mellor and Durbin to reproduce the top and bottom Ekman layers. Transport is computed in layers above and below the pycnocline.

Keywords: Modeling-Hydrodynamic

HAN, G.; NIEDRAUER, T. 1981. HYDROGRAPHIC OBSERVATIONS AND MIXING PROCESSES IN THE NEW YORK BIGHT, 1975-1977. LIMNOL OCEANOGR 26(6):1126-1141. A series of 15 hydrographic cruises in the New York Bight over 1975-1977 is described and analyzed. The cruises cover all seasons but focus primarily on spring and summer. Temperature and salinity data show wide seasonal and interannual variability. Each of the three regions

(inner bight, midshelf, and outer shelf slope) has distinctive properties and dynamics. The inner bight properties are affected primarily by river flow and wind-driven flows up the shelf valley which often split the freshwater surface layer into two plumes, one east and one west of the valley head. The "cold pool" temperature structure on the midshelf is different each year. The water with the lowest recorded temperature (2.58 °C) was on the bottom after thermocline formation in May 1977.

Keywords: Reviews-Physical

HANSEN, D.V. 1977. CIRCULATION. MESA NEW YORK BIGHT ATLAS MONOGRAPH 3, 23 pp. The major feature of the New York Bight circulation is a relatively slow flow (4-5 cm/sec at the surface, decreasing to J2 cm/sec closer to the bottom) to the southwest over most of the outer continental shelf with some indication of a clockwise eddy in the inner Bight. There is the expected exchange circulation, characterized by seaward flow of estuarine waters near the surface and landward flow of deeper waters between the Hudson/Raritan estuary and the offshore waters. The landward flow may extend as far as 64 km offshore in the Hudson Shelf Valley. All of these features are masked primarily by stronger but variable wind-driven currents on a day-to-day basis, and may be drastically altered for periods of several weeks. This is especially so during summer in conjunction with sustained periods of little rainfall or strong southerly winds. Methods of observing and representing ocean currents are discussed and include dynamic and kinematic (indirect) and Lagrangian and Eulerian (direct). Average currents over the open continental shelf, the Hudson Shelf Valley, the Hudson/Raritan estuary, and the inner Bight are described. Temporal variation mechanisms operating on these currents include winds, tides, and seasonal meteorological variables.

Keywords: Circulation, Monitoring-MESA, Reviews-Physical

HARRIS, W.H. 1976. SPATIAL AND TEMPORAL VARIATION IN SEDIMENTARY GRAIN-SIZE FACIES AND SEDIMENT HEAVY METAL RATIOS IN THE NEW YORK BIGHT APEX. IN: MIDDLE ATLANTIC CONTINENTAL SHELF AND THE NEW YORK BIGHT. PROCEEDINGS OF THE SYMPOSIUM AMERICAN MUSEUM OF NATURAL HISTORY, NEW YORK CITY, NOVEMBER 3-5, 1975, M.G. GROSS, (ED.), SPECIAL SYMPOSIA 2:102-123. In the northwest part of the New York Bight a pronounced spatial and temporal variation occurs in sediment grain-size, heavy metal ratios, and concentrations. Substrate mobility is most pronounced near Long Island and in northern Christiaensen Basin. Near Long Island mud patches are most extensive during late spring through summer and may coalesce across intervening sand-wave crests obliterating the shore-zone sand-wave topography. Mud patches are either restricted to sand-wave trough axes or are absent or covered during early fall through early spring, suggesting that muddy sediments are either flushed from the nearshore sand-wave system by bottom currents or undergo in situ microbial degradation.

The northwest periphery of the Christiaensen Basin mud-sandy mud facies apparently oscillates in position. Mud patches in the peripheral zone expanded shoreward from 6.9 km to within 5.0 km of the Long Island shoreline between winter and summer 1974 and contracted seaward to within 9.3 km of the shoreline by early spring 1975; isolated mud patches remained within 6.5 km of the shoreline. Shoreward expansion and seaward contraction of the mud facies of the northwestern Christiaensen Basin occurred during the same months as did nearshore mud patch growth and size reduction or disappearance; probably both instances were the result of the same processes. Individual mud patches near Long Island have not existed for a long time. Mud patches off Atlantic Beach and Lido Beach, Long Island, began to develop as early as summer 1972; others developed later.

The Cr:Zn ratio varies in mud deposits at the sludge disposal area, northern Christiaensen Basin, and Hempstead Bay and in mud patches near Long Island. Maximum Cr:Zn values occur during late spring through early fall, minimum values during early winter. Zinc was released to bight waters preferentially relative to Cr for which carbon-rich muds apparently served as a sink during the spring-summer 1974 expansion of northwest Christiaensen Basin mud facies and growth of mud patches near Long Island. During later contractions of the northwestern Christiaensen Basin mud facies and attendant decrease in size or disappearance of nearshore mud patches from fall 1974 through early spring 1975, Zn and Cr both were released at nearly equal rates or Zn was preferentially retained in the sediment. The Cr:An annual maximum may be explained by preferential zinc desorption from sludge or mud solids by cation exchange, or preferential adsorption of organic chromium chelates from solution by organic mud substrates, or zinc uptake by phytoplankton or bacteria. The Cr:Zn annual minimum may be explained by dissolution of Mn and Fe hydroxides releasing absorbed Zn and Cr or oxidation of the organosulfur compounds of the two metals at nearly equal rates.

Keywords: Miscellaneous-Geological, Pollutants-Metals

HART, T.F. JR; MILLIKEN, A.S. 1991. SIGNIFICANT COASTAL FISH AND WILDLIFE HABITAT PROTECTION IN NEW YORK'S COASTAL MANAGEMENT PROGRAM. COAST MANAG 19:55-72. Diversity of animal species inhabiting New York State's coastal area is recognized through the designation of significant habitats based on their importance. Protection of these habitats and species diversity throughout the coast, is available through the implementation of a habitat policy within New York's Coastal Management Program. Approximately 240 habitat areas are in various stages of designation and approval processes throughout the state's coastal area for protection under this policy. The implementation of the habitat policy has been limited, due in part to the difficulty of using an ecological approach for determining possible habitat impairment. Despite difficulties encountered in implementing habitat protection, the Coastal Zone Management Act provides a useful approach for protection of species diversity.

Keywords: Management

HATCHER, P.G.; KEISTER, L.E. 1976. CARBOHYDRATES AND ORGANIC CARBON IN NEW YORK BIGHT SEDIMENTS AS POSSIBLE INDICATORS OF SEWAGE CONTAMINATION. IN: MIDDLE ATLANTIC CONTINENTAL SHELF AND THE NEW YORK BIGHT. PROCEEDINGS OF THE SYMPOSIUM AMERICAN MUSEUM OF NATURAL HISTORY, NEW YORK CITY, NOVEMBER 3-5, 1975, M.G. GROSS, (ED.), SPECIAL SYMPOSIA 2:240-243. Sediments of the New York Bight were analyzed for total organic carbon (TOC) and total carbohydrates (TCH). The TCH:TOC ratio was significantly more elevated than comparable sediments from other areas. High TCH:TOC values (>30) may be attributed to sewage-derived materials which contribute significant quantities of refractory organic matter to the bight annually. Nonanthropogenic sources of organic matter to these sediments have little or no influence on TCH:TOC except near the shelf break. The TCH:TOC ratio may be useful as a qualitative and semiquantitative indicator of sewage-derived organic matter in sediment deposits. The observed TCH:TOC ratios suggest that organic material being deposited in both the Christiaensen Basin and mud patches near Long Island is predominantly of sewage origin, and that seaward of the apex, the sedimentary organic matter becomes less influenced by sewage-derived organic matter, and oceanic organic matter becomes a more significant fraction.

Keywords: Ocean disposal-12 mile, Pollutants-Sediment

HATCHER, P.G.; KEISTER, L.E.; MCILLIVARY, P.A. 1977. STEROIDS AS SEWAGE SPECIFIC INDICATORS IN NEW YORK BIGHT SEDIMENTS. BULL ENVIRONM CONTAM TOXICOL 17(4):491-498. Sediments of the New York Bight were examined for steroidal compounds and found to contain relatively large amounts of coprostanol and 24 *B*-ethyl coprostanol. These steroids were found to be derived from sewage, and it is suggested that they be used as sewage tracers in marine sediments.

Keywords: Ocean disposal-12 mile, Pollutants-Sediment

HATCHER, P.G.; MCGILLIVARY, P.A. 1979. SEWAGE CONTAMINATION IN THE NEW YORK BIGHT. COPROSTANOL AS AN INDICATOR. ENVIRON SCI TECHNOL 13(10):1225-1229. Sediments of the New York Bight are analyzed for coprostanol, a fecal steroid, to determine the degree of sewage contamination. Coprostanol, when reported as a percentage of total steroids (% coprostanol), can be quantitatively related to the amount of sewage-derived organic matter. Furthermore, coprostanol is quite persistent in anoxic silts of the Bight and, thus, can be used to delineate historical contamination in these silts. Based on the sediments analyzed, the New York Bight is shown to be highly contaminated with sewage (most likely ocean-dumped

sewage sludge), especially in the topographically low areas near the dump site, where black silts have been known to accumulate.

Keywords: Ocean disposal-12 mile, Pollutants-Sediments

HAZELWORTH, J.B.; CUMMINGS, S.R. 1979. PHYSICAL CONDITIONS COMPARED WITH PREVIOUS YEARS. IN: OXYGEN DEPLETION AND ASSOCIATED BENTHIC MORTALITIES IN NEW YORK BIGHT, 1976, NOAA PROFESSIONAL PAPER 11, R.L. SWANSON AND C.J. SINDERMANN, (EDS.), pp. 125-135. Seasonal density stratification began about 1 month earlier in 1976 than in 1975 (April versus May), because of early seasonal heating (thermal stratification) and, more importantly, strong and sustained river discharge (salinity stratification). Subsequently, the rate of bottom replenishment of dissolved oxygen from the sea surface was less than that of 1975.

Keywords: Anoxia

HAZELWORTH, J.B.; DARNELL, M.E. 1976. MESA NEW YORK BIGHT PROJECT, EXPANDED WATER COLUMN CHARACTERIZATION CRUISES (XWCC-2 AND 3) NOAA SHIP RESEARCHER, 22 FEBRUARY - 5 MARCH, 9-12 APRIL 1975. MARINE ECOSYSTEMS ANALYSIS PROGRAM OFFICE, NOAA DATA REP ERL MESA-23, 235 pp. During Spring 1975, two oceanographic cruises, denoted XWCC-2 and 3, were made by the NOAA Ship Researcher in the New York Bight. Current meter arrays and bottom-mounted pressure gauges were deployed and recovered on XWCC-2. Geological oceanographic data were collected on XWCC-3. In addition, physical and chemical oceanographic data were collected on both cruises. The objective of the cruises was to supply data to provide a base for analysis of the water movement in the highly impacted ecosystem. This report presents the corrected water column data from these two cruises and preliminary descriptive analysis.

Keywords: Miscellaneous-Physical, Monitoring-MESA

HICKS, D.C.; MILLER, J.R. 1980. METEOROLOGICAL FORCING AND BOTTOM WATER MOVEMENT OFF THE NORTHERN NEW JERSEY COAST. ESTUAR COAST MAR SCI 11(5):563-571. Cold bottom water is found during the summer months in a region extending from the shelf break to the nearshore zone in the area of the New York Bight. This cold bottom water, some of which is in the temperature range of the cold cell (8 °C or less), is observed to move onshore in response to upwelling events initiated by a strong wind stress from the south. Surf temperatures, nearshore temperature sections off Monterey Beach, N.J., wind velocities, and offshore temperature sections are combined to document the cold cell's formation during 1974 and to demonstrate that the shoreward boundary of the cold bottom water and possibly cold cell water can move into the surf zone causing rapid decreases in surf temperature. In addition, under upwelling conditions, such onshore movements may have significant

biological impacts, such as were observed during the summer of 1976 when anoxic conditions prevailed in much of this region.

Keywords: Anoxia, Circulation

HIRSCH, A. 1974. NOAA'S NEW YORK BIGHT MARINE ECOSYSTEMS ANALYSIS PROJECT: AN INTERDISCIPLINARY STUDY OF THE MARINE ENVIRONMENT. MAR TECHNOL SOC J 8(9):29-34. In 1972, NOAA initiated a new program--the Marine Ecosystems Analysis Program (MESA). The objective of MESA is to develop information on the biological, physical, and chemical processes of selected coastal areas, which will improve our ability to assess and predict the impact of man-made alterations or natural phenomena. The first area selected for study is the New York Bight, one of the nation's most complex and heavily used coastal areas. The New York Bight MESA project involves a number of NOAA organizational elements, outside cooperators and contractors in an integrated study approach. The scope, objectives and management of the New York Bight project will be described. The evolution of the project's scientific design will be discussed. Other aspects of the project to be described will be data and information management, field programs, and interagency cooperation.

Keywords: Monitoring-MESA

HO, J.S. 1985. COPEPOD PARASITES OF DEEP SEA BENTHIC FISHES FROM THE WESTERN NORTH ATLANTIC. PARASITOLOGY 90(3):485-498. Nine species of parasitic copepods are reported: (1) *Chondracanthodes deflexus* Wilson from *Antimora rostrata* Gunther, *Coryphaenoides (Chalinura) brevibarbis* (Goode and Bean), *Coryphaenoides (Nematonurus) armatus* (Hector), *Coryphaenoides (Chalinura) leptolepis* (Gunther), and *Coryphaenoides (Lionurus) carapinus* (Goode and Bean); (2) *Chondracanthodes radiatus* (Muller) from *Macrourus berglax* Lacepede; (3) *Lernaeopodina pectinata* sp. nov. from *Alepocephalus agassizi* (Goode and Bean); (4) *Neobrachiella pinguis* (Wilson) from *Antimora rostrata* Gunther; (5) *Clavella adunca* (Strom) from *Macrourus berglax* Lacepede; (6) *Sphyrion lumpi* (Kroyer) from *Antimora rostrata* Gunther; (7) *Lophoura gracilis* Wilson from *Synphobranchius kaupii* Johnson; (8) *Lophoura pentaloba* sp. nov. from *Coryphaenoides (Nematonurus) armatus* (Hector) and *Nezumia bairdii* (Goode and Bean) and (9) *Lophoura tetraphylla* sp. nov. from *Antimora rostrata* Gunther. The infected fishes were collected with trawls from depths of 828 to 4,815 m in the New York Bight and 403 to 1,294 m near the Grand Banks south of Newfoundland.

Keywords: Fish, Parasites

HOOK, S.M. 1978. DRIFT REMOVAL IN NEW YORK HARBOR: IMPACT AND OPPORTUNITY. PRESENTED AT: COASTAL ZONE '78 SAN FRANCISCO, CA 14 MARCH 1978. U.S. CORPS OF ENG., ENVIRON.

AND ECON. BRANCH, NEW YORK, NY. COASTAL ZONE '78. SYMPOSIUM ON TECHNICAL, ENVIRONMENTAL, SOCIOECONOMIC AND REGULATORY ASPECTS OF COASTAL ZONE MANAGEMENT. SAN FRANCISCO, CA MARCH 14-16, 1978. AMERICAN SOCIETY OF CIVIL ENGINEERS, NEW YORK, VOL. 2:1128-1144. The procedures utilized in both the removal and the disposal of the drift sources are described, and the socioeconomic and environmental impacts associated with these procedures are outlined, including the effects on fish, wildlife, cultural resources, and land use. A specific case study reflecting the productive use of land adjacent to an area cleared by the Corps of Engineers in New Jersey is also discussed.

Keywords: Parasites, Fish

HORNE, R.A.; MALHLER, A.J.; ROSSELLO, R.C. 1971. THE MARINE DISPOSAL OF SEWAGE SLUDGE AND DREDGE SPOIL IN THE WATERS OF THE NEW YORK BIGHT. 163 pp. The dumping of sewage sludge and dredge spoil in the waters of the New York Bight and the effect of this waste disposal practice on the marine environments is reviewed. The quantities and composition of these wastes are described, together with their physical, chemical, and biological effects on the environment. At the center of the sludge dump, the bearing capacity of the waters has been exceeded, and an anoxic bottom area devoid of life formed. Both spoil and sludge contain large quantities of toxic heavy metal, and the spoil also contains large quantities of petrochemicals and pesticides.

Keywords: Anoxia, Ocean disposal-Sewage sludge, Ocean disposal-Dredged material

HORNIBROOK, C.; LILLEY, W. 1982. THE COAL WASTE ARTIFICIAL REEF PROJECT OVERVIEW OF AN EVOLVING DISPOSAL TECHNOLOGY. NORTHEAST ENVIRON SCI 1(3-4):211-219. Solidified coal waste was used to construct reefs which offered both an economic and environmental benefit. No increase in trace metals was detected in the vicinity of the blocks or in associated organisms.

Keywords: Artificial reefs

HOUGHTON, R.W.; SCHLITZ, R.; BEARDSLEY, R.C.; BUTMAN, B.; LOCKWOOD CHAMBERLIN, J. 1982. THE MIDDLE ATLANTIC BIGHT COLD POOL: EVOLUTION OF THE TEMPERATURE STRUCTURE DURING SUMMER 1979. J PHYS OCEANOGR 12(10):1019-1029. Temperature data spanning the entire Middle Atlantic Bight during 1979 are used to study the structure and evolution of the cold pool. The Nantucket Shoals and New England Shelf appear to be the source of the coldest water found in the Mid-Atlantic Bight in late winter. During the spring and summer, water within the cold pool in the New York Bight north of Hudson Canyon remains colder than any

shelf water either to the northeast or southwest. Thus, the coldest cold-pool water persists there as a remnant of winter-cooled water rather than being replenished by a colder upstream source, and south of Hudson Canyon, cold-pool temperatures decrease in June and July as colder water from upstream is advected southwestward along the coast. Both temperature data and direct current measurements suggest that the mean alongshore current has a minimum between Nantucket Shoals and Hudson Canyon. The alongshore variation of shelf topography appears to be responsible for the spatial variation in both the alongshelf drift speed and the thermal structure of the cold pool.

Keywords: Circulation, Miscellaneous-Physical

HOWE, M.A.; CLAPP, R.B.; WESKE, J.S. 1978. MARINE AND COASTAL BIRDS. MESA NEW YORK BIGHT ATLAS MONOGRAPH 31, 87 pp. This report presents an overview of the bird inhabitants of the Bight region with an emphasis on waterbirds that characteristically breed in the area. It attempts to generally summarize historical population changes, relating them to the activities of man which have most affected the avifauna. General information is also given on habitat utilization and seasonal variation in patterns of occurrence. Effects of man on birds and birds on man are discussed, although they are not treated in detail. Instead, concentration is on those that are believed to historically have had the greatest impact and those that may be of consequence in the future. The effects of habitat changes of hunting and feather-gathering, of collisions by birds with airplanes and other objects, of environmental pollution by heavy metals and pesticides, and the role of birds as transmitters and reservoirs of disease are among the topics briefly covered.

Keywords: Miscellaneous-Biological, Monitoring-MESA

HSUEH, Y. 1980. ON THE THEORY OF DEEP FLOW IN THE HUDSON SHELF VALLEY. J GEOPHYS RES 85(C9):4913-4918. The time-averaged near-bottom current in the New York Bight for a selected three day period is idealized as a steady-state response to the mean wind at the John F. Kennedy International Airport and the mean inflow condition across the Long Island shelf. The idealization invokes potential vorticity conservation in a homogeneous ocean subject to a linear bottom friction and results in shelf currents whose longshore components are in general agreement with the averages of the observed. In the Hudson Shelf Valley, qualitative agreement with the observation is achieved in the onshore component which is directed nearly along the valley axis. Nearshore, within 40 km or so of the coast, the response is, to a substantial degree, wind driven. Nearshore upvalley mean flow is due partly to shore-parallel wind stresses that are directed away from the valley and is due partly to topographic deflection of an alongshore current that is driven in part by the inflow condition and in part by the alongshore component of the mean wind stress. Because of the important role of bottom friction, an alongshore current driven by longshore winds undergoes sharper (and more realistic) deflection across the valley than does an alongshore current driven by the inflow condition.

Keywords: Circulation, Hudson Shelf Valley

HUGHES, B.A.; GASPAROVIC, R.F. 1988. INTRODUCTION (SPECIAL SECTION ON GEORGIA STRAIT AND SAR INTERNAL WAVE SIGNATURE EXPERIMENTS). J GEOPHYS RES C OCEANS 93(C10):12217. The special collection of papers in this issue is a compendium of results from two major experiments, the Joint Canada-U.S. Ocean Wave Investigation Project (JOWIP) and the SAR Internal Wave Signature Experiment (SARSEX) conducted in 1983 and 1984, respectively, to investigate SAR imaging of internal waves and surface ship wakes. For both experiments, predictions from wave-current interaction models based on the principle of wave action balance have been compared with measured surface wave modulations. The results demonstrate that the combined hydrodynamic-electromagnetic model predictions are in general agreement with many of the observations from the experiments.

Keywords: Circulation-Internal waves, Modeling-Hydrodynamic

HUGHES, J.B.; HEBERT, A.T. 1991. ERYTHROCYTE MICRONUCLEI IN WINTER FLOUNDER *PSEUDOPLEURONECTES AMERICANUS* RESULTS OF FIELD SURVEYS DURING 1980-1988 FROM VIRGINIA USA TO NOVA SCOTIA AND IN LONG ISLAND SOUND. ARCH ENVIRON CONTAM TOXICOL 20(4):474-479. Erythrocyte micronuclei (MN) frequencies of 280 winter flounder (*Pseudopleuronectes americanus*) from Chesapeake Bay to the southern Scotian Shelf including Long Island Sound were measured. The MN data were combined with data previously reported for 224 flounder and the combined data sets were analyzed. Incidences of MN were elevated sixfold in flounder from the New York Bight Apex as compared to frequencies for fish from the inshore Gulf of Maine and Block Island Sound, and twice those found in Georges Bank and Long Island Sound flounder. Inshore New Jersey fish had higher MN frequencies than those from inshore Gulf of Maine and Block Island Sound. The occurrence of MN in flounder from inshore Virginia was higher than in flounder from inshore Gulf of Maine and Block Island Sound. The large subset of stations from Long Island Sound indicated higher frequencies of MN in flounder from Hempstead and Shoreham as compared to most other sites in the Sound. There was no significant difference between males and females in the frequency of MN, however males had significantly more MN than sexually immature flounder. Flounder over the entire sampling area had higher levels of MN during the fall than other months, which may be influenced by the maternal cycle of gonadal maturation.

Keywords: Apex, Fish-*Pseudopleuronectes*

HULBERT, E.M. 1963. THE DIVERSITY OF PHYTOPLANKTONIC POPULATIONS IN OCEANIC, COASTAL, AND ESTUARINE REGIONS. J MAR RES 21:81-93. In the deep ocean north of Bermuda, during spring and

summer, conditions for growth are poor, but physical conditions, such as high salinity and great depth, are favorable to the marine phytoplankton. The dominant species in a sample constitute a modest proportion of the cells counted, and a considerable diversity of species is observed. When very good growth conditions, resulting in extreme dominance, are coupled with an adverse physical environment, there is a reduction in diversity. These conditions are found in several New England estuaries, where the lower salinity would appear to be unfavorable to the marine phytoplankton and where extreme shoalness may strand the larger, more rapidly settling types of diatoms. Populations from the open ocean and coastal waters off New York in fall and winter typify an intermediate situation. Moderately good growth is associated with pronounced dominance, and diversity is low in very small samples of the populations. When a large number of cells is counted, however, there exists the considerable diversity that might be expected where the salinity and depth are favorable.

Keywords: Plankton

HULBERT, E.M. 1966. THE DISTRIBUTION OF PHYTOPLANKTON, AND ITS RELATIONSHIP TO HYDROGRAPHY, BETWEEN SOUTHERN NEW ENGLAND AND VENEZUELA. J MAR RES 24:67-81. Data obtained on numerous cruises, from southern New England to the Caribbean Sea, between September 1956 and August 1963, form the basis for this study on the relationship of flora to hydrography. Seward from the southern New England coast, with salinity increasing, the quantity of phytoplankton in near-surface water (0-25 m) decreases while the proportion of oceanic species increases. In the Sargasso Sea, in summer, the stratification and flora are similar from north to south, but in winter, when there is a difference in stratification of the upper 200 m in the northern and southern portions, there is a parallel difference in the abundance of many species. Along the coast of Venezuela, the variation in phytoplankton correlates with the variation in upwelling. At stations near land (southern New England, Caribbean Is., and S. America), where the thermocline is more marked, the vertical distribution of plankton is more variable than in the open ocean, where lesser temperature differences occur in 100 m.

Keywords: Plankton

HUMASON, A.W.; GADBOIS, D.F. 1982. DETERMINATION OF POLYNUCLEAR AROMATIC HYDROCARBONS IN THE NEW YORK BIGHT AREA. BULL ENVIRON CONTAM TOXICOL 29(6):645-650. With increased offshore oil drilling along the eastern coast of the United States, the monitoring of organic contamination in this area has received greater attention. Polynuclear aromatic hydrocarbon (PAH) contamination is of particular concern, since many of these compounds are known or suspected carcinogens. The National Marine Fisheries Service, Gloucester Laboratory, has undertaken a study of PAH levels in specimens found in the New York Bight and Long Island Sound region for comparison with future levels. Samples of fish, shellfish, crab, and lobster were collected from 25 sites by the Kelez Research Vessel during the

Kelez-8008 cruise. These specimens have been analyzed quantitatively for the presence of 15 PAHs.

Keywords: Pollutants-Bioaccumulation, Pollutants-Organic

ICES. 1984. THE ICES COORDINATED MONITORING PROGRAM FOR CONTAMINANTS IN FISH AND SHELLFISH, 1978 AND 1979 AND SIX-YEAR REVIEW OF ICES COORDINATED MONITORING PROGRAM. INTERNATIONAL COUNCIL FOR THE EXPLORATION OF THE SEA, COPENHAGEN (DENMARK), 101 pp.

Keywords: Monitoring, Pollutants-Bioaccumulation

ITALIANO, M.L. 1976. MARINE WASTE DISPOSAL IN THE NEW YORK BIGHT-PUBLIC POLICY, ENVIRONMENTAL IMPACTS AND ALTERNATIVE FUTURES. MLI-76/1, 299 pp. The following ten conclusions provide a brief summary of this paper: (1) little baseline scientific information on waste disposal effects exist before 1970; (2) no constructive public policy to control waste disposal exist before the 1972 Marine Protection, Research, and Sanctuaries Act; (3) considerable scientific disagreement exists concerning disposal effects; (4) scientific knowledge on waste impacts is preliminary and incomplete; (5) the Apex receives a multitude of pollutants, many in large volumes such as polluted dredge spoil and sewage sludge; (6) the sludge and dredge spoils are the major pollutants entering the Apex; (7) the trend of submarine sludge and dredge spoil movements is correlated with currents, heavy metal organic matter, and coliform bacteria distribution; (8) finfish may be adversely impacted by barge waste disposal; (9) disposal has changed the characteristics of the sludge and dredge spoil sites; and (10) alternative methods of disposal are available, but will take time, proper coordination, and large sums of money to implement.

Keywords: Apex, Management, Ocean disposal

JEFFERIES, H.P.; JOHNSON, II, W.C. 1976. PETROLEUM, TEMPERATURE, AND TOXICANTS: EXAMPLES OF SUSPECTED RESPONSES BY PLANKTON AND BENTHOS ON THE CONTINENTAL SHELF. MARINE REPRINT-69; NOAA-77011708, 17 pp. Gross population changes carefully enumerated over time in natural communities of the New York Bight and nearby areas are examined. From such comparisons a basic appreciation of sensitivity within natural systems can be obtained. It is suggested that for open-coastal areas in the Mid-Atlantic Bight, the direct effect of energy-related activities on copepod populations, by far the major component in the zooplankton, is not a concern at present. Limited, short-term effects are seen only at point discharges. Lasting damage to the benthos, however, is another matter. Experience suggests that on the bottom persistent, small-scale environmental changes have cumulative effects that are enhanced by ecosystem processes, rather than dissipated as in the plankton.

Keywords: Benthos, Plankton, Pollutants-Toxicity

JENSEN, A.C. 1975. ARTIFICIAL FISHING REEFS. MESA NEW YORK BIGHT ATLAS MONOGRAPH 18, 23 pp. Artificial fishing reefs are underwater structures designed to attract and concentrate fishes, making them more available to anglers. In contrast to natural fishing reefs, such as rock ledges or coral formations, which are rare in New York Bight, artificial reefs consist of both natural and man-made materials. Some artificial reefs have originated from sunken ships, but most artificial reefs are of solid materials deliberately sunk as part of fisheries management plans under the direction of governmental agencies. Research has shown that discarded automobile tires are among the best materials for reefs. Tires are easily obtained, inexpensive, attract a variety of organisms, and are long-lasting in the destructive environment of seawater. Seven planned artificial fishing reefs, constructed in New York Bight, were studied intensively. They are offshore of Shinnecock Inlet, Moriches Inlet, Fire Island Inlet, Atlantic Beach, Rockaway Beach, Monmouth Beach, and Sea Girt. The reefs attract sport fishes like tautog, scup, black sea bass, red hake, Atlantic cod, winter flounder, summer flounder, striped bass, bluefin tuna, Atlantic mackerel, and bluefish. In addition to being part of good fisheries management, a well-designed reef building program could help solve some of the solid waste problems plaguing most communities.

Keywords: Artificial reefs, Monitoring-MESA, Reviews-Biological

JOHNSON, A.A. 1970. WATER POLLUTION IN THE GREATER NEW YORK AREA. WATER POLLUTION IN THE GREATER NEW YORK AREA SYMPOSIUM PROCEEDINGS. (HELD IN NEW YORK, N.Y., DEC. 13, 1969). SPONSORED BY NEW YORK CITY OCEANOGRAPHIC ADVISORY COMMITTEE AND NEW YORK STATE, DEPT. OF WATER RESOURCES. GORDON AND BREACH, SCIENCE PUBLISHERS, NEW YORK, 222 pp. In the spring of 1969 the New York City Mayor's Oceanographic Advisory Committee was formed to study the problems relating to water pollution in the New York area. It immediately became apparent that work in this field was fragmented and uncoordinated although quite extensive. The committee therefore decided to bring together all of the people working the field in an attempt to harness them in a coordinated effort to study the present state of the waters in and around New York. Thus, the symposium whose proceedings are published in this volume came to be organized. Included are twelve reports covering the physical, chemical, biological, and engineering aspects of water pollution in the greater New York area.

Keywords: Management, Pollutants, Workshops

JOHNSON, R.W. 1978. MAPPING OF CHLOROPHYLL A DISTRIBUTIONS IN COASTAL ZONES. PHOTOGR E R 44(5):617-624.

Chlorophyll *a* is an important environmental parameter for monitoring water quality, nutrient loads, and pollution effects in coastal zones. Remotely sensed data may be calibrated by concurrently measured sea truth. Regression equations from the analysis may be used to map quantitative distributions of chlorophyll *a* in coastal zone areas, thereby providing information that is not readily available from other sources. Results of experiments with aircraft multispectral scanners over the turbid James River, Virginia, and the New York Bight ocean area, indicate that statistically significant quantitative relationships exist between remotely sensed data and chlorophyll *a* measurements in these environmentally different areas. In a James River experiment on May 28, 1974, the linear regression equation used data in the 440-490 nm, 620-660 nm, and 700-740 nm spectral bands from a Nodular Multispectral Scanner (M2S) flown at 2.4 km altitude. The correlation coefficient was 0.96 with a standard error of estimate of 1.75 mg/m³. In an April 13, 1975, New York Bight experiment, the linear regression equation used radiances in the 499-519 nm and 610-630 nm spectral bands of the Ocean Color Scanner (OCS) flown at a 19.7 km altitude. The correlation coefficient was 0.83 and the standard error of estimate was 3.87 mg/m³ for a measured range of 2.20 to 24.30 mg/m³. In both experiments, suspended sediments were a factor in interpreting results of the analyses. Quantitative maps of synoptic chlorophyll *a* distributions were made for both the James River and New York Bight.

Keywords: Plankton, Remote sensing

JOHNSON, R.W. 1980. REMOTE SENSING AND SPECTRAL ANALYSIS OF PLUMES FROM OCEAN DUMPING IN THE NEW YORK BIGHT APEX. REMOTE SENS ENVIRON 9:197-209. Experiments conducted in the Atlantic Coastal Zone indicate that plumes resulting from ocean dumping of acid wastes and sewage sludge have distinguishable spectral characteristics. Remotely sensed wide-area synoptic coverage provides information on these pollution features that is not readily available from other sources. Photographic and multispectral scanner data remotely sensed from aircraft were interpreted by two methods. First, qualitative analyses in which pollution features are located, mapped, and identified without concurrent sea truth and, second, quantitative analyses in which concurrently collected sea truth is used to calibrate the remotely sensed data and to determine quantitative distributions of one or more parameters in a plume. For the qualitative analyses an in-scene calibration technique was developed that "normalizes" environmental effects, thereby potentially providing a means of plume identification that is independent of the specific scene and the multispectral scanner used. Application of this technique to data from several experiments indicates that plumes resulting from acid wastes and sewage sludge have distinctive spectral characteristics over a range of environmental conditions. In addition to qualitative analyses that used the in-scene calibration, quantitative analysis techniques were applied to sewage sludge dump plumes. A calibrated regression equation that related remotely sensed radiances to suspended solids concentrations was developed in order to map synoptic suspended solids distributions in plumes.

Keywords: Ocean disposal, Remote sensing

JOHNSON, R.W.; DUEDALL, I.W.; GLASGOW, R.M.; PRONI, J.R.; NELSON, T.A. 1977. QUANTITATIVE MAPPING OF SUSPENDED SOLIDS IN WASTEWATER SLUDGE PLUMES IN THE NEW YORK BIGHT APEX. J WATER POLLUT CONTROL FED 49(10):2063-2073.

Calibrated regression equations that relate remotely sensed data to sea-truth measurements may be used to provide maps of the synoptic distributions of water quality parameters associated with ocean disposal of wastewater sludge. These maps provide information for location and quantitative assessment of dispersion characteristics of plumes resulting from ocean dumping of wastewater sludge. Spectral responses, or signatures, from the plume may be used to identify the type of plume without concurrent water sampling. This would provide a basis for enforcement of dumping regulations by local, state, and federal agencies.

Sea-truth measurements indicate that particle size distributions associated with this pollutant plume are different from those of natural water in the same area. Specifically, there is a peak in the smaller particle sizes in the plume, while natural ocean water has a more even distribution of both large and small particles. Results of this experiment are encouraging for the use of remote sensing techniques for locating, identifying, and mapping spectral anomalies that may be related to pollutant plumes. Additional experiments should be performed in different environmental settings in order to more accurately establish the role of remote sensing in monitoring and studying pollution.

Keywords: Ocean disposal-Sewage sludge, Remote sensing

JOHNSON, R.W.; GLASGOW, R.M.; DUEDALL, I.W.; PRONI, J.R. 1979. MONITORING THE TEMPORAL DISPERSION OF A SEWAGE SLUDGE PLUME. PHOTOGR E R 45(6):763-768. Sewage sludge from the Metropolitan New York City area is dumped in the apex of the New York Bight. Possible environmental effects due to this dumping are being studied. Results of a joint National Aeronautics and Space Administration (NASA), National Oceanic and Atmosphere Administration (NOAA), and State University of New York (SUNY) experiment on July 15, 1976, indicate remotely sensed monitoring and data analysis techniques may be used to study temporal dispersion characteristics of plumes resulting from dumping of sewage sludge. Remotely sensed data were collected by multispectral scanner and photography from a NASA aircraft platform. Multiple flights were made over the plume from a spot dump (rapid discharge from a stationary barge) at about 15 min intervals for 2 hrs after the dump, which was made at 1000 (local time). Afternoon flights over the dump area indicated that the plume was well dispersed by about 5 hrs after the dump. Concurrent sea-truth measurements were made from NOAA and SUNY ships in and around the dump plume. Concentrations of suspended solids in the plume were correlated with multispectral scanner radiance data to obtain a regression equation which was then used to map quantitative distributions of suspended solids in the plume. For the spot dump monitored, reflected radiances from the surface waters reached peak values about 45 min after the dump. After this time,

spectral analysis indicated that the calibrated equation could be applied. The plume was dispersed within about 5 hrs. Spectral characteristics of the experiment plume were similar to sewage sludge plumes that have been monitored in other experiments in the Atlantic Coastal Zone. These plumes are readily distinguished from acid wastes that are dumped in the same geographical area.

Keywords: Ocean disposal-Sewage sludge, Remote sensing

JONES, H.G.M.; BRONHEIM, H.; PALMEDO, P.F. 1975. ELECTRICITY GENERATION AND OIL REFINING. MESA NEW YORK BIGHT ATLAS MONOGRAPH 25, 22 pp. The New York Bight region is diverse in economic activity and energy-related services. It is dependent on oil for its energy: oil provides 76% of all energy regionally versus 44% nationally. New York City is characterized by a low average energy use in commercial and industrial activity, but on a per household basis the city used in 1970 roughly the same total energy, 148 million BTU, as the national average of 150 million BTU. In 1972 the Bight region had about 19% of its electric capacity in nuclear units versus less than 4% nationally. New Jersey, the oil refining center of the region, had a total crude handling capability of 592,000 barrels per day in 1972; 79% of this crude oil was imported. While energy projections are today fraught with uncertainty, major increases in the demand for electricity in the Bight region clearly will occur in the future. Fuel types and sources, as well as the kind of capacity to generate this electricity, are in doubt.

Keywords: Miscellaneous, Monitoring-MESA

JUDKINS, D.C.; WIRICK, C.D.; ESAIAS, W.E. 1979. COMPOSITION, ABUNDANCE, AND DISTRIBUTION OF ZOOPLANKTON IN THE NEW YORK BIGHT, SEPTEMBER 1974-SEPTEMBER 1975. FISH BULL 77(3):669-683. Zooplankton taxa were counted in 8 to 19 samples from each of 11 cruises in the New York Bight between September 1974 and September 1975. Major seasonal events were an influx into the region of tropical-subtropical copepod species during autumn 1974 and summer 1975: an offshore (>50m water depth) zooplankton abundance maximum in March dominated by the pteropod *Limacina retroversa*, a second offshore maximum in May characterized by high abundance of the copepods *Pseudocalanus* sp., *Calanus finmarchicus*, and *Oithona similis*, an onshore (<50m water depth) maximum in July characterized by high abundance of the copepods *Centropages typicus* and *Temora longicornis*. The offshore maxima occurred during or shortly after the local spring phytoplankton bloom (March-April). Advection of pteropod and copepod stocks into the region from the northeast probably contributed to these peaks. The July *C. typicus*-*T. longicornis* peak was associated with summer warming of the water column within the highly productive waters in the Bight apex and off the New Jersey coast. Comparison of our results with those of a study conducted in 1959-60 shows that the most abundant species of copepods were essentially the same during the two periods.

Keywords: Plankton

KANETA, P.J.; LEVANDOWSKY, M.; ESAIAS, W. 1985. MULTIVARIATE ANALYSIS OF THE PHYTOPLANKTON COMMUNITY IN THE NEW YORK BIGHT USA. MAR ECOL PROG SER 23(3):31-240. Distributions of the phytoplankton taxa in the New York Bight, August 1977, were analyzed by principal component analysis. The first two components defined by the abundances of phytoplankton taxa were related to salinity and temperature. Sample point projections onto the two-dimensional subspaces defined by these two axes fell into two distinct groups which corresponded to distinct geographic location and depths: (1) inshore New Jersey; (2) inshore Long Island; (3) offshore on the shelf. These groups were not simply correlated with temperature, salinity or other hydrographic variables and may represent different histories of the water masses; the first two groups were mainly inshore of the cold pool of deepwater below 10 °C, the third group comprised most of the samples within, above, or seaward of the cold pool.

Keywords: Plankton

KAPLAN, M.; REIS, R.I., (EDS.). 1980. NEW YORK SEA GRANT LAW AND POLICY JOURNAL, NTIS NO. PB81-211120. NY SEA GRANT REPORT 3: 150 pp. Third volume of articles by coastal law scholars.

Keywords: Management

KASISCHKE, E.S.; LYZENGA, D.R.; SHUCHMAN, R.A.; WACKERMAN, C.C. 1988. CONTRAST RATIOS OF INTERNAL WAVES IN SYNTHETIC APERTURE RADAR IMAGERY: A COMPARISON OF SAR INTERNAL WAVE SIGNATURE EXPERIMENT OBSERVATIONS WITH THEORY. J GEOPHYS RES C OCEANS 93(C10):12355-12369. Techniques were developed to extract radar scattering coefficient (σ^0) signatures associated with the internal wave patterns observed in the SAR Internal Wave Signature Experiment (SARSEX) data set. The SARSEX experiment was conducted in the New York Bight region of the Atlantic Ocean in August-September 1984. A theoretical model was exercised which uses environmental conditions and radar imaging parameters to calculate the changes in the synthetic aperture radar (SAR) image intensity due to internal waves. Comparisons showed that the SAR-observed modulations were somewhat underpredicted by the theoretical model, especially for the azimuth-traveling internal wave case.

Keywords: Circulation-Internal waves

KESTER, D.R. 1978. THE OCEAN AS A DUMP SITE: STUDIES BASIC TO A NATIONAL POLICY. MARITIMES 22(2):10-11. Despite concern in recent years about man's pollution of the marine environment ocean disposal is practiced

widely along the Atlantic, Gulf, and Pacific coasts of the United States. For many wastes there is no satisfactory alternative to ocean disposal, and for others dumping them in the ocean represents the most economical, and presumably least detrimental, disposal method. In 1972 Congress passed a law which prohibited unregulated waste disposal in the ocean, and since 1973 the EPA has established regulations and issued permits for ocean dumping. These provisions have been followed by an increase in oceanographic studies to assess the effects of ocean dumping on the marine environment. The consequences of ocean dumping are not well understood. There may be some positive benefits such as the formation of new habitats for fish and the provision of food for plankton. There are negative effects such as the contamination of shellfishing grounds, and there are indications that fin-rot in fish increases near dump sites. The materials dumped at sea include sewage sludge from waste treatment facilities, industrial chemical wastes, dredge materials from harbor construction projects, construction and demolition debris from urban projects, and solid wastes (garbage). Previously ocean dump sites were used for disposing of military munitions and containerized radioactive wastes. In the New York Bight, between the shores of New Jersey and Long Island, specific geographic areas have been designated for the dumping of particular wastes. During the past two years the laboratory at the University of Rhode Island has been working with investigators at Woods Hole Oceanographic Institution and the National Oceanic and Atmospheric Administration (NOAA) in a study at DWD-106. This study has been sponsored by the Ocean Dumping Program of NOAA and has led to cooperative research studies between the Narragansett Laboratory of The National Marine Fisheries Service and the University of Rhode Island.

Keywords: Management, Ocean disposal

KETCHUM, B.H.; VACCARO, R.F.; CORWIN, N. 1958. THE ANNUAL CYCLE OF PHOSPHORUS AND NITROGEN IN NEW ENGLAND COASTAL WATERS. J MAR SCI 17:282-301. Distributions of phosphorus and nitrogen in New England coastal waters at various times of year are described. In surface waters the nitrate-nitrogen content is sometimes completely exhausted, even though small concentrations (0.2-0.5 ug-at/l) of phosphorus are always available. The ratio of concentrations by atoms, N:P, varies in surface waters from maximum values of about 10:1 to values approaching zero as the nitrate is exhausted. However, the ratio of change, change N:change P, is approximately 15:1 except during summer months when it decreases. During summer, vertical mixing supplies nitrogen and phosphorus to the euphotic zone at higher ratios than the ratios of concentration in the euphotic zone. In deep offshore waters the N:P ratio is about 12:5:1, and no significant seasonal variation in either the phosphorus or nitrate concentration at the oxygen minimum-nutrient maximum layer could be detected.

Keywords: Miscellaneous-Chemical

KNEIP, T.J.; CUTSHALL, N.H.; FIELD, R.; HART, F.C.; LIOY, P.J.; MANCINI, J.; MUELLER, J.A.; SOBOTOWSKI, C.; SZELIGOWSKI, J. 1982. MANAGEMENT OF NON-POINT SOURCES. IN: ECOLOGICAL STRESS AND THE NEW YORK BIGHT: SCIENCE AND MANAGEMENT. PROCEEDINGS OF A SYMPOSIUM ON THE ECOLOGICAL EFFECTS OF ENVIRONMENTAL STRESS, NEW YORK, NY, JUNE 10-15, 1979, G.F. MAYER, (ED), ESTUARINE RESEARCH FEDERATION, COLUMBIA, SC, pp. 145-161. Three classes of materials have major non-point source contributions to the New York Bight: polychlorinated biphenyls, petroleum hydrocarbons, and nutrients. Concern that these materials may be causing potentially significant but non-specific effects led the panel on the Management of Non-Point Sources to recommend the continuation or initiation of programs to control inputs of these materials to the New York Bight. Recommended steps include: (1) removal of Hudson River sediments heavily contaminated with PCBs, with either incineration or permanent regulated landfills as the ultimate control; (2) collection of used crankcase oils and control of oil tanker discharges; and (3) continuation of programs aimed at reducing soil and nutrient losses from farmlands. Concern was expressed that controls on point sources may shift pollutants to non-point source discharges. This, in turn, may require modification of non-point source control programs. Panel recommendations were based, in part, on reports or proposals whose benefits have not been tested fully. Consequently, non-point source control programs such as dredging require simultaneous monitoring and process modification to assure achievement of expected results.

Keywords: Management, Pollutants-Loadings

KODITSCHKE, L. 1976. ANTIMICROBIAL RESISTANT BACTERIA IN THE NEW YORK BIGHT. IN: MIDDLE ATLANTIC CONTINENTAL SHELF AND THE NEW YORK BIGHT. PROCEEDINGS OF THE SYMPOSIUM AMERICAN MUSEUM OF NATURAL HISTORY, NEW YORK CITY, NOVEMBER 3-5, 1975, M.G. GROSS, (ED.), SPECIAL SYMPOSIA 2:383-393. Sediment samples and overlying water from stations around the sewage dump site in the New York Bight were analyzed for coliform and noncoliform bacteria resistant to mercury and antibiotics. Few or no coliforms could be found in these samples, but a pollution gradient was identified in a northeasterly direction, toward Long Island. About 1% of the sediment bacteria desorbed was consistently resistant to $\text{HgCl}_2 10^{-3} \text{ M}$ and/or tetracycline 40 mcg/ml at MESA station 34. The antibiogram of a majority of the isolates from these sediments showed multiple antibiotic resistance.

Sediments from which antimicrobial resistant bacteria were isolated had high bound water content, much debris, little or no evidence of normal benthic macrofauna and a black, gelatinous consistency. In contrast, sediment taken from the Sandy Hook transect showed no resistant bacteria, and demonstrated no other parameters related to pollution. Analysis of water and sediments containing very small numbers of coliforms from a beach at Sandy Hook State Park revealed a significant number of bacteria resistant to seven or more antibiotics. These data

suggest that techniques used in these studies may detect pollution gradients which are not measurable by coliform counts.

Keywords: Bacteria, Ocean disposal-12 mile, Pollutants-Toxicity

KODITSCHKE, L.; GUYRE, P. 1974. ANTIMICROBIAL-RESISTANT COLIFORMS IN NEW YORK BIGHT. MAR POLLUT BULL 5(5):17-74. A preliminary study of sediments and overlying water samples obtained at the approximate center of the sewage sludge bed in the New York Bight, revealed significant numbers of coliforms resistant to antibiotics and heavy metals. Some of the isolates were shown to transfer antibiotic resistance during conjugation with a recipient strain of *Salmonella gallinarum*. The selection of bacterial populations resistant to antimicrobials may be significant in the ecology of this impoverished area and requires further study.

Keywords: Bacteria, Ocean disposal-Sewage sludge, Pollutants-Sediments

KOEBEL, C.T.; KRUECKEBERG, D.A. 1975. DEMOGRAPHIC PATTERNS. MESA NEW YORK BIGHT ATLAS MONOGRAPH 23, 43 pp. From 270 European inhabitants on Manhattan in 1628 the New York Bight region grew slowly, restrained by epidemics, wars, and commercial disadvantages, to encompass the nation's largest city, New York, by 1810. Since the early 1800s, growth has been rapid, furthered by migration, first from northern Europe, then from southern Europe, and most recently from the southern United States and Puerto Rico. Today the 28-country region is comprised of a high-density core of 10 countries with over 7,000 persons per square mile, a suburban inner ring, and a low-density outer ring. In 1970 the region held 19.3 million people, 9.5 % of the nation's 203 million. Forecasts show a possible 25.8 million people in the region by 2000.

Keywords: Miscellaneous, Monitoring-MESA

KOEPP, S.J.; SANTORO, E.D.; ZIMMER, R.; NADEAU, J. 1987. BIOACCUMULATION OF HG, CD, AND PB IN *MYTILUS EDULIS* TRANSPLANTED TO A DREDGED-MATERIAL DUMPSITE. IN: OCEANIC PROCESSES IN MARINE POLLUTION VOL. 1, BIOLOGICAL PROCESSES AND WASTES IN THE OCEAN. J.M. CAPUZZO AND D.R. KESTER, (EDS.), pp. 51-58. This study assesses changes in Hg, Cd, and Pb concentrations in *Mytilus edulis* transplanted to eight New York Bight locations in and around the dredged-material dumpsite. Incubation bags containing 100 mussels were suspended 1 m above the seafloor on platforms designed to allow periodic retrieval by divers. Six platforms were deployed in August 1980, and two platforms were deployed in January 1981 following completion of sand-capping at the dredged-material dumpsite. Four stations were located in and around the dumpsite, three were located in Lower New York Harbor, off Jones Beach, NY, and one was located offshore of Barnegat Light, NJ. Stations were

sampled weekly for the first month (August 1980), after which bimonthly collections were conducted through July 1981. Pooled whole soft-tissue samples were analyzed for total concentrations of Hg, Cd, and Pb. Mercury, Pb, and Cd were consistently detected in mussels from all stations. Variability in metal concentrations was observed for the mussels deployed in August during the first five weeks of incubation; this was followed by a rise to maximum concentrations in early spring. Mercury concentrations were significantly greater for mussels incubated in the dumpsite (station E); however, at no time were Hg concentrations observed in excess of the 1.0 $\mu\text{g/g}$ (wet wt) U.S. Food and Drug Administration guideline. Increases in Cd and Pb appear to reflect long-term urban contamination of the New York Bight and not necessarily dredged-material dumping. The result of sand-capping could not be assessed due to delayed deployment of the sampling platforms and minimal sampling opportunities prior to the termination of the study.

Keywords: Benthos-Mytilus, Capping, Ocean disposal-Dredged material, Pollutants-Bioaccumulation

KOLITZ, B.L.; HACELOWORTH, J.B.; STARR, R.B.; CUMMINGS, S.R. 1976. MESA NEW YORK BIGHT PROJECT, EXPANDED WATER COLUMN CHARACTERIZATION CRUISES (XWCC-4-5), NOAA SHIP KELEZ, MAY-JUNE 1975. NOAA DR ERL MESA-24; NOAA-77072520, 234 pp. During the period May - June 1975, two oceanographic cruises, denoted XWCC 4 and 5, were made by the NOAA Ship Kelez in the New York Bight. The objective of the cruises was to supply data to provide a base for analysis of the water movements in the highly impacted ecosystem. This report presents the corrected physical data from these cruises.

Keywords: Miscellaneous-Physical, Monitoring-MESA

KONOP, D. 1978. MONITORING OCEAN DUMPING. NOAA SEA TECHNOL 19(10):26-28. The US National Ocean Survey's (NOS) Ocean Dumping Program is a series of ocean dumping field studies being carried out around the US coasts. Before the effects of waste dumping can be understood, a complete picture of the physical, chemical, biological and geological characteristics of the dumpsite area must be developed. Levels of heavy and transition metals and other wastes at a site are measured; water temperature and salinity are measured to determine density layers; current patterns are analyzed to develop patterns of surface and sub-surface water movement, and samples of the dumping area's plant and animal life are collected to identify the types of distribution of the area's biota. Once a site has been characterized, it must then be monitored to detect any adverse effects from dumping. However, since site monitoring may be required on a monthly basis over a period of several years, and the ship time can run as high as several thousand dollars a day, other monitoring methods, such as remote aerial sensing and moored and free-floating sensors, are being investigated. Work being undertaken around the New York Bight, DWD-106, Puerto Rico, and the Gulf of Mexico are discussed.

Keywords: Management, Ocean disposal

KORLIPARA, R.; ZATORSKI, R.A.; HERMAN, H. . THE PROPERTIES OF ELECTRODEPOSITED MINERALS IN SEAWATER. MAR TECH SOC J 32 pp. Accreted mineral crystals deposited by passing current across electrodes in saltwater were analyzed, and their structured integrity under differing current density, cathode surface roughness, and relative placement of electrodes were tested. The role of biological organisms on the quality of the deposits is discussed.

Keywords: Miscellaneous-Chemical

KRISTENSEN, E.; ALLER, R.C.; ALLER, J.T. 1991. OXIC AND ANOXIC DECOMPOSITION OF TUBES FROM THE BURROWING SEA ANEMONE *CERIANTHIOPSIS AMERICANUS*: IMPLICATIONS FOR BULK SEDIMENT CARBON AND NITROGEN BALANCE. J MAR RES 49:589-617. Many marine infaunal animals form organic tube and burrow linings. The role of these materials in organic after cycling and preservation in sediments is largely unknown. In the case examined here, the infaunal sea anemone, *Cerianthiopsis americanus*, (a common component of bottom communities along the east coast of North America) forms a leathery, fibrous tube lining 2-3 mm thick, ~1 cm in diameter, and typically extends 20-30 cm into deposits. Tube fibers (~2 mm long, 2-m um thick) formed from discharged specialized nematocyst cells, ptychocysts, are composed of a silk-like protein copolymer, cerianthin. Tubes incubated under oxic and anoxic conditions over a period of 122 days demonstrate that initial rates of whole tube decay are 10-100 times slower than usually found for fresh planktonic debris and aquatic macrophytes despite a relatively low molar C:N ratio of ~5.1. First order decomposition rate constants in oxic water, anoxic water, and anoxic sediment are ~0.76, 0.41 and ~0.22 yr⁻¹ for particulate tube carbon and ~0.2, ~0.1 and ~0.1 yr⁻¹ for particulate nitrogen, respectively (20 °C). There are no obvious (under SEM) morphological changes in tube fibers during initial tube decomposition, implying slower long term rates. Although slow, tube decomposition stimulates bacterial activity in sediments from below ~10 cm depth where any organic matter present is even more refractory than the tubes themselves. In central Long Island Sound muds, tubes apparently account for a minimum of ~0.6-1.8% and 2.8-8.4% of the steady state C and N detrital pools in the upper 10-30 cm of the sediment. *C. americanus* tube production apparently accounts for ~9% of the average particulate carbon and ~12% of the nitrogen fluxes to the benthos. Tube construction by infaunal benthos may thus represent an important pathway for refractory compound formation and organic matter preservation.

Keywords: Benthos-*Cerianthiopsis*

KUMPF, H.E. 1977. ECONOMIC IMPACT OF THE EFFECTS OF POLLUTION ON THE COASTAL FISHERIES OF THE ATLANTIC AND

GULF OF MEXICO REGIONS OF THE UNITED STATES OF AMERICA.

FAO FISH TECH PAP, 172, 79 pp. This report reviews and evaluates the economic impact on the fisheries of the Atlantic and Gulf of Mexico coasts of the United States of other human activities. Four types of impact were considered: production of oil and gas, direct fish mortalities caused by effluent, habitat deterioration, and closure of molluscan fisheries for health reasons. An attempt is made to obtain quantitative (dollar) estimates of the impacts, both negative and positive. The main quantifiable effects are of habitat destruction on species requiring estuaries and similar areas as nurseries (particularly in the Gulf and Middle Atlantic region), and molluscan fisheries (again the Gulf region is particularly affected). Fish kills seem highly variable from year to year. A massive kill (including large-scale destruction of valuable surf clam stocks) occurred in the New York Bight in 1976 that was associated with anoxic conditions. These conditions were at least partly due to natural events.

Keywords: Anoxia, Disease, Benthos-*Spisula*, Disease, Fisheries, Fish kills

KUO, J.T.; CHEN, N.M.; CHU, Y.H. 1986. TIME-DOMAIN TOTAL TIDES AND CURRENTS OF NORTH ATLANTIC OCEAN WITH NEW YORK BIGHT INCLUDED. PROCEEDINGS OF THE TENTH INTERNATIONAL SYMPOSIUM ON EARTH TIDES (WITH SPECIAL SESSIONS DEVOTED TO OCEAN TIDES), MADRID, SEPTEMBER 23-27, 1985. R. VIEIRA, (ED.), pp. 577-586.

Keywords: Circulation

LAEVASTU, T.; CALLAWAY, R.; STROUD, A.; CLANCY, M. 1974. COMPUTATION OF TIDES, CURRENTS, AND DISPERSAL OF POLLUTANTS IN THE NEW YORK BIGHT FROM BLOCK ISLAND TO ATLANTIC CITY WITH LARGE GRID SIZE, SINGLE AND TWO- LAYER HYDRODYNAMICAL-NUMERICAL MODELS. PART 4. REPORT NO.: ENVPREDRSCHF-TECH NOTE-4-74; EPRF-TN-13, 89 pp. The application of a large grid HN model to the New York Bight is to a large extent a problem of treating two long open boundaries. The input at these open boundaries serves also for tuning of the results inside the computational area. A few earlier current measurements by two lightships in the Bight as reported by Haight (1942) have been used for verification. The tidal currents predominate in the New York Bight proper, with a superimposed slow net flow toward the south. This net flow can be simulated in the models and tuned with the prescription of a proper slope to the two open boundaries.

Keywords: Modeling-Hydrodynamic

LANDIS, A.T. 1970. ARTIFICIAL FISHING REEF. UNDERSEA TECH 11(7):15. The New York State conservations department is encouraging

construction firms to dump materials at a site off Rockaway Beach to expand an artificial reef.

Keywords: Artificial reefs

LAVELLE, J.W.; KELLER, G.H.; CLARKE, T.L. 1975. POSSIBLE BOTTOM CURRENT RESPONSE TO SURFACE WINDS IN THE HUDSON SHELF CHANNEL. J GEOPHY RES 80(15):1953-1956. Current measurements made in the Hudson Shelf Channel during the summer of 1973 show essentially channel axial bottom current even though the channel aspect ratio is small in the area of measurement. Although the current record is of short duration, correlation of water movement with surface winds is suggested by the data. The sense of summertime nontidal bottom flow in the channel (up or down channel) would appear to be controlled by the surface wind direction (offshore or onshore). These results would suggest the likelihood of net down-channel flow during the summer months.

Keywords: Circulation, Hudson Shelf Valley

LEAR, D.W.; O'MALLEY, M.L.; MUIR, W.C.; PENCE, G. 1982. ENVIRONMENTAL EFFECTS OF SEWAGE SLUDGE AT THE PHILADELPHIA DUMPING SITE. IN: ECOLOGICAL STRESS AND THE NEW YORK BIGHT: SCIENCE AND MANAGEMENT. PROCEEDINGS OF A SYMPOSIUM ON THE ECOLOGICAL EFFECTS OF ENVIRONMENTAL STRESS, NEW YORK, NY, JUNE 10-15, 1979, G.F. MAYER, (ED.), ESTUARINE RESEARCH FEDERATION, COLUMBIA SC, pp. 481-493. The Philadelphia sewage sludge disposal site is located about 70 km east of Ocean City, Maryland. Sludge has been dumped at this site since 1973, and the environmental effects of the practice have been under detailed observation since that time. The site showed no evidence of departures from typical, temperate mid-shelf conditions prior to the onset of sludge dumping. Since then, trends of environmental modification and degradation have appeared in areas contaminated by sludge-derived materials. The changes seem limited to the ocean bottom environment and include increased concentrations of metals in organisms, elevated metals and total organic carbon levels in sediments, changes in abundance of some species, apparent mortalities of molluscan shellfishes, unique occurrences of sewage bacteria, and appearance of pathological conditions in endemic crustaceans.

Keywords: Bacteria, Benthos, Disease, Ocean disposal-Sewage sludge

LEE, R.; LONGWELL, A.C.; MALONE, T.C.; MURPHY, L.S.; NIMMO, D.R.; O'CONNORS, H.B., JR.; PETERS, L.S.; WYMAN, K.D. 1982. EFFECTS OF POLLUTANTS ON PLANKTON AND NEUSTON. IN: ECOLOGICAL STRESS AND THE NEW YORK BIGHT: SCIENCE AND MANAGEMENT. PROCEEDINGS OF A SYMPOSIUM ON THE

ECOLOGICAL EFFECTS OF ENVIRONMENTAL STRESS, NEW YORK, NY, JUNE 10-15, 1979, G.F. MAYER, (ED.), ESTUARINE RESEARCH FEDERATION, COLUMBIA, SC, pp. 39-52. A non-technical summary of the known and potential effects of environmental stress on plankton/neuston populations in the New York Bight is presented. This summary was prepared by the plankton/neuston panel. The panel concluded that field investigations have detected no significant pollution-induced changes in the growth and distribution of New York Bight plankton populations. However, the potential for chronic and acute impacts on plankton/neuston populations has been demonstrated in controlled laboratory situations investigating chemical pollutants that occur in the Bight and adjacent waters. The problems associated with interpreting field studies conducted in the Bight and extrapolating laboratory studies to plankton populations in the Bight are discussed. Recommendations for future research and regulatory efforts are provided.

Keywords: Plankton, Pollutants-Toxicity

LEE, J.J.; MASTROPAOLO, C.A.; MCENERY, M.E.; TIETJEN, J.H.; GARRISON, J.R. 1982. *IN SITU* MONITORING OF THE EFFECTS OF WATER QUALITY ON BENTHIC DETRITAL DECOMPOSITION. IN: ECOLOGICAL STRESS AND THE NEW YORK BIGHT: SCIENCE AND MANAGEMENT. PROCEEDINGS OF A SYMPOSIUM ON THE ECOLOGICAL EFFECTS OF ENVIRONMENTAL STRESS, NEW YORK, NY, JUNE 10-15, 1979, G.F. MAYER, (ED.), ESTUARINE RESEARCH FEDERATION, COLUMBIA, SC, pp. 569-585. Detrital decomposition is an important process that contributes to the fertility of seas, particularly in estuarine and coastal waters. The process involves a complex community of microorganisms and small animals, which interact in a manner similar to that observed in forest litter and composts. Plastic chambers to measure the decomposition rates of *Spartina alterniflora* (a marsh grass that is a major contributor of detritus on United States East and Gulf coasts) were placed subtidally at five sites in the northeast: Towd Point, Southampton, New York; the effluent quarry of the Millstone power plant on Niantic Bay, Connecticut (Long Island Sound); a control site near the Millstone effluent quarry; Winsor Cove, Cataumet, Massachusetts (the site of an oil spill); and Sippewissett marsh, Falmouth, Massachusetts (a control site for Winsor Cove). Stations were visited monthly. Several techniques were used to measure rates of decomposition and growth of sediment microbial and animal populations. A long-term method involving the capture of mineralized $^{14}\text{CO}_2$ is described. This appears to be a promising measure of the integrated effects of pollution stress on important but slow environmental processes. The procedures may be more environmentally meaningful than LD_{50} 's or similar short-term measures of transient stress.

Keywords: Miscellaneous-Biological, Monitoring

LESHT, B.M. 1978. FIELD MEASUREMENTS OF THE BOTTOM FRICTIONAL BOUNDARY LAYER IN THE NEW YORK BIGHT. NOAA

TM-ERL-MESA-28, 168 pp. A detailed field study of the bottom frictional boundary layer on the inner continental shelf in the Apex of the New York Bight used an instrumentation system designed to measure horizontal velocities at three levels within 1 m of the bottom, the pressure fluctuations due to surface waves, the direction of mean current and the turbidity 15 cm above the sea floor. The four experiments of the study were designed to investigate the influence of the higher frequency (up to 0.3 Hertz) components of the flow on the structure of the bottom boundary layer and on sediment transport in typical inner continental shelf environments. They were conducted in waters 18 to 20 m deep over coarse sand, medium sand, and muddy silt bottoms. Shear stress values, calculated from longer period averages were generally 50% lower than those calculated from shorter averages. Surface waves did not seem to affect the value of the mean shear stress calculated from the von Karman-Prandtl equation. Although near bottom turbidity was generally correlated with mean velocity, the range of the fluctuations of calculated shear stress values made it impossible to establish one value of shear stress as critical for the erosion of the sediments studied. It was possible to relate sediment resuspension to the distribution of shear stress values.

Keywords: Apex, Circulation, Sediment transport

LESHT, B.M. 1980. BENTHIC BOUNDARY-LAYER VELOCITY PROFILES: DEPENDENCE ON AVERAGING PERIOD. J PHYS OCEANOGR 10(6):985-991. The relationship between benthic boundary-layer velocity profiles and current meter averaging time is investigated using detailed (0.61 Hz) current measurements recorded within 1 m of the bottom on the inner continental shelf. The percentage of velocity profiles which correspond to the von Karman-Prandtl model of the neutrally stratified turbulent boundary layer increases rapidly as the averaging period is lengthened from a few seconds. When the averaging period exceeds ~20 times the characteristic time scale of the flow, the percentage of logarithmic profiles becomes independent of averaging period. This relationship is found for both wave and turbulence dominated flows. Increasing the average period beyond the minimum required to define stable mean values does not significantly change either estimates of mean friction velocity or the statistical distribution of the drag coefficient C_{100} computed from the observations.

Keywords: Circulation

LETTAU, B.; BROWER, W.A., JR.; QUAYLE, R.G. 1976. MARINE CLIMATOLOGY. MESA NEW YORK BIGHT ATLAS MONOGRAPH 7, 239 pp. The marine climatology of the New York Bight is presented both as summaries of available data on those meteorological variables that make up the climate and as interactive processes among land, sea, and air that influence the meteorological variables and produce the distinctive marine climate. The data summaries consist of monthly averages of temperature, temperature anomalies, heating degree days, relative humidity, precipitation, wind, fog, and haze over the eastern, central, and southern portions of the Bight. The climate-forming processes active over the Bight include the effect of the heat reservoir on the sea

surface, the sea breeze, and the effect of coastal geography on storms. The maps and graphs in the atlas present a detailed climatic profile of the Bight. Statistics include means, extremes, and percent frequency of occurrence of threshold values for these parameters: wind, visibility, present weather, sea level pressure, temperature, clouds, and waves. The National Climatic Center (Asheville, NC) processed and analyzed data from 130,000 surface marine observations, 500,000 observations for six coastal land stations, and 50,000 observations at two light stations for the general period 1949 to 1974. These data provide the best possible climatological picture of the Bight's data-sparse, near-coastal zone, an area of sharp gradients and complex climates.

Keywords: Miscellaneous-Physical, Monitoring-MESA

LEWIS, E.J.; SAWYER, T.K. 1979. DISTRIBUTION OF *ACANTHAMOEBA AMOEBIDA* ACANTHAMOEBIDAE IN SEDIMENTS FROM AN OFFSHORE SEWAGE DISPOSAL SITE. J PROTOZOOLOG 26(3 PART 1):20A.

Keyword: Benthos, Ocean disposal-Sewage sludge

LI, Y.H.; FEELY, H.W.; SANTSCHI, P.H. 1979. ²²⁸TH-²²⁸RA RADIOACTIVE DISEQUILIBRIUM IN THE NEW YORK BIGHT AND ITS IMPLICATIONS FOR COASTAL POLLUTION. EARTH PLANET SCI LETT 42(1):13-26. In the summer of 1975, the half removal time of ²²⁸Th by settling particles, t^c , was about 11 ± 4 , 29 ± 8 and 70 ± 10 days in the shelf surface respectively. In the fall of 1974, t^c was about 17 ± 1 to 28 ± 2 days from the inner shelf to the outer shelf surface waters and about 70 ± 10 days in the slope surface water. A simple box model of the shelf water in the Middle Atlantic Bight shows that (1) the exchange rate between the shelf and the slope waters is about $2,500 \pm 800 \text{ km}^3/\text{yr}$, (2) the mean residence time of the shelf water is only about 132 ± 36 days, and (3) the average ²²⁶Ra and ²²⁸Ra fluxes per unit area of the coastal sediments are about $0.05 \text{ dpm } ^{226}\text{Ra}/\text{cm}^2 \text{ yr}$ reported results. The implication of these rates to pollutants in the coastal environment is discussed.

Keywords: Circulation, Modeling-Hydrodynamic, Sediment transport

LILLEY, W.D.; HORNIBROOK, C. 1982. COAL WASTE ARTIFICIAL REEF PROGRAM IN NEW YORK STATE. GEOLOGICAL SOCIETY OF AMERICA 14:1-2, 35. Feasibility of using blocks of coal-fired power plant waste for artificial reef construction.

Keywords: Artificial reefs

LISSAUER, I.M.; BACON, J.C.; MILLER, M.C. A COMPUTER SIMULATION TECHNIQUE FOR OIL SPILLS OFF THE NEW JERSEY-DELAWARE COASTLINE. PRESENTED AT: OIL SPILL CONFERENCE

NEW ORLEANS, LA 8 MAR 1977. PUBL: AMERICAN PETROLEUM INST., WASHINGTON, DC 1977. API-PUBL 4284, pp. 437-440. Predictions of the trajectories of oil slicks and their impact locations along the shoreline of New Jersey and Delaware were determined for two potential deepwater ports and two potential drilling sites. A hydrodynamical-numerical model for the New York Bight area was coupled with a wind generating model to produce temporal patterns of oil concentration. The wind model employs pressure distributions and storm movement to produce hourly patterns of the wind field produced by any storm for a predetermined grid area. Shoreline impact determinations were made for the four spill sites for the average winter storm conditions and average summer high pressure systems generated by the models. Winter storms moving through the study area do not pose a high risk to the shoreline should a spill occur. The maximum transport from the four sites toward the shore was 18 miles. This left the slick well offshore so that the ensuing wind shift from the frontal passage would rapidly transport the oil seaward. During a stagnant summer high pressure system, spills occurring within fifty miles of the shoreline have a high probability of impacting the shoreline if the spill should occur at the beginning of the period in which the system affects the area.

Keywords: Modeling

LITCHFIELD, C.D.; DEVANAS, M.A.; ZINDULIS, J.; MESKILL, M.; FREEDMAN, J.; MCCLEAN, C. 1982. INFLUENCE OF CADMIUM ON THE MICROBIAL POPULATIONS AND PROCESSES IN SEDIMENTS FROM THE NEW YORK BIGHT APEX. IN: ECOLOGICAL STRESS AND THE NEW YORK BIGHT: SCIENCE AND MANAGEMENT. PROCEEDINGS OF A SYMPOSIUM ON THE ECOLOGICAL EFFECTS OF ENVIRONMENTAL STRESS, NEW YORK, NY, JUNE 10-15, 1979, G.F. MAYER, (ED.), ESTUARINE RESEARCH FEDERATION, COLUMBIA, SC, pp. 587-604. The effects of cadmium on the ecology of bacteria from selected New York Bight Apex sediments were studied during a two-year period. Cadmium chloride supplementation to media and mineralization experiments indicated a reduction in the numbers of aerobic heterotrophic bacteria but either no effect or slight stimulation of the rates of decomposition of urea and glycolic acid. This pattern was observed repeatedly during the sampling period and indicated that a rather constant percentage of cadmium-resistant bacteria in sediments accounts for the majority of the microbial mineralization capacity. Microbial strains demonstrating resistance to cadmium on initial isolation were cultured, purified, and identified, and their antibiotic patterns were established. Seventy-two percent of the isolates were resistant to multiple classes of antibiotics, indicating a widespread distribution of both cadmium resistance and antibiotic resistance in non-enteric sedimentary bacteria. Additional studies with isolate A-4-20 confirmed that both the uptake of amino acids and their incorporation into protein by cadmium-resistant bacteria were unaffected by the presence of cadmium at concentrations tested during field studies.

Keywords: Benthos, Pollutants-Metals, Pollutants-Toxicity

LIU, A.K. 1988. ANALYSIS OF NONLINEAR INTERNAL WAVES IN THE NEW YORK BIGHT. J GEOPHYS RES C OCEANS 93(C10):12317-329.

This paper presents the results on internal wave analysis of the current meter mooring data in the New York Bight from the SAR Internal Wave Signature Experiments (SARSEX). Selective sets of current and temperature measurements are analyzed for a parametric study of internal wave characteristics, and shear effects on wave parameters are studied based on the limited data from moorings. The solitary wave theory has been extended for the wave evolution on a continental shelf by including dissipation and shoaling effects; a series of numerical simulations are performed to demonstrate the relative importance of dissipation and shoaling effects.

Keywords: Circulation-Internal waves

LONGWELL, A.C. 1976. CHROMOSOME MUTAGENESIS IN DEVELOPING MACKEREL EGGS SAMPLED FROM THE NEW YORK BIGHT. NOAA TM ERL MESA-7, 68 pp. Altogether 30,689 embryo cells were scored in 452 eggs from the 14 different stations in the New York Bight collected from surface water. Less than 205 of all the eggs have all their dividing cells free from chromosome and division abnormalities. One-third of the 30,689 division figures scored for all the embryos was abnormal. All but an insignificant number of eggs sampled were those of *Scomber scombrus*, the Atlantic mackerel. Abnormalities of the chromosomes extended through the entire range of radiometric effects on the chromosomes and their division apparatus, including extreme stickiness of chromosomes having obvious division difficulties and irregularities, failure of chromosomes to orient on spindles, with consequent loss of chromosomes, and chromosome breakage. The earlier stage zygotes, so chromosomally abnormal that they could not gastrulate, are not represented. Differences between best and worst stations are minimal.

Keywords: Disease, Fish-*Scomber*, Monitoring-MESA

LONGWELL, A.C. 1977. A GENETIC LOOK AT FISH EGGS AND OIL. OCEANUS 20(4):46-58. The "Argo Merchant" oil spill in 1976 provided an opportunity to study the genetic effects of oil on fish eggs, which are highly susceptible to errors of chromosome separation and gene-level mutations. Data on this subject is scarce, apart from a previous study of mackerel eggs in the polluted New York Bight. Ichthyoplankton samples taken after the "Argo Merchant" spill showed extensive fouling of the chorion of cod and pollack eggs, and cytogenetic studies revealed great deterioration including abnormal chromosome divisions and other mutagenic effects. Mortalities occurred in up to 46% of eggs, with haddock more susceptible than cod. Among the constituents of oil, benzene and polynuclear aromatic hydrocarbons are known to cause mutations and alter the surface properties of egg membranes, and the lipid content of eggs encourages their dissolution. Full interpretation of the effects of the oil spill was hindered by a lack of quantitative data, but many important implications can be drawn.

Genetic damage of fish would not be immediately apparent but would show up in recruitment. Intensive research is necessary to increase knowledge in this field.

Keywords: Disease, Fish, Fish-*Scomber*, Plankton, Pollutants-Toxicity

LONGWELL, A.C.; HUGHES, J.B. 1980. CYTOLOGIC, CYTOGENETIC, AND DEVELOPMENTAL STATE OF ATLANTIC MACKEREL EGGS FROM SEA SURFACE WATERS OF THE NEW YORK BIGHT, AND PROSPECTS FOR BIOLOGICAL EFFECTS MONITORING WITH ICHTHYOPLANKTON. RAPPORTS & PROCES-VERBAUX REUNIONS CONSEIL INT. EXPLOR. MER, COPENHAGUE, DENMARK VOL. 179.

Buoyant, early-developing stages of fish eggs are expected to be a most sensitive component of plankton responding to various environmental cytotoxins, mutagens and teratogens. The risk of contaminant exposure must be increased by the position near the ocean surface, as well as by the location of important spawning grounds in polluted coastal areas. Rather standard procedures have been modified for simple, direct examination of the mitoses and cells of fish embryos as sampled in plankton. Also, it has been determined that the yolk-sac membrane of such fish eggs is suitable for detailed chromosome analysis. Accordingly, cytologic, cytogenetic, and embryologic measures were made on about 10,000 early-stage eggs of the Atlantic mackerel (*Scomber scombrus*). Eggs were sampled in May 1974 and May 1977 from surface waters at a total of about 80 sites in the New York Bight. Development rates as calculated by mitotic index, viability as calculated from early indicators of cell death, and chromosome-mitotic abnormalities of the mackerel embryos varied widely over the sample sites in both 1974 and 1977.

Keywords: Disease, Fish-*Scomber*, Plankton

LONGWELL, A.C.; HUGHES, J.B. 1981. CYTOLOGIC, CYTOGENETIC, AND EMBRYOLOGIC STATE OF ATLANTIC MACKEREL EGGS FROM SURFACE WATERS OF THE NEW YORK BIGHT IN RELATION TO POLLUTION. THE EARLY LIFE HISTORY OF FISH: RECENT STUDIES. R. LASKER AND K. SHERMAN, (EDS.). RAPP P-V REUN CIEM 178:76-78.

Cytologic, cytogenetic, and embryologic measures were made on about 10,000 eggs (cleavage through tail-free embryo stages) of the Atlantic mackerel (*Scomber scombrus*). Eggs were sampled in May 1974 and 1977 from surface waters at 80 sites in the pollution-impacted New York Bight. Development rates as calculated by mitotic index, viability as calculated from early cytological indicators of cell death, and chromosome-mitotic abnormalities of the mackerel embryos varied widely over the Bight sample sites in both 1974 and 1977. Early-stage embryos that had ceased to undergo chromosome and cell divisions, and embryos that had grossly irregular and arrested mitoses, had little chance for any further normal development. In 1977 gross embryo malformations were frequent and these too varied widely from station to station. Generally, there were significant correlations between different measures on chronologically related development stages and in 1974 between all stages, excluding cleavage.

Keywords: Fish-*Scomber*, Plankton, Pollution-Toxicity

LONGWELL, A.C.; HUGHES, J.B. 1982. CYTOLOGIC, CYTOGENETIC, AND EMBRYOLOGIC STATE OF ATLANTIC MACKEREL EGGS FROM SURFACE WATERS OF THE NEW YORK BIGHT IN RELATION TO POLLUTION. IN: ECOLOGICAL STRESS AND THE NEW YORK BIGHT: SCIENCE AND MANAGEMENT. PROCEEDINGS OF A SYMPOSIUM ON THE ECOLOGICAL EFFECTS OF ENVIRONMENTAL STRESS, NEW YORK, NY, JUNE 10-15, 1979, G.F. MAYER, (ED.). ESTUARINE RESEARCH FEDERATION: COLUMBIA, SC, pp. 381-388. Cytologic, cytogenetic, and embryologic investigations were conducted on developing Atlantic mackerel (*Scomber scombrus*) eggs collected from the surface waters of the New York Bight. Samples were taken in May 1974 and May 1977. Cleavage through tail-free embryo stages was examined. Development rates (as calculated by mitotic index), viability (as calculated from early indicators of cell death), and chromosome-mitotic abnormalities in mackerel embryos varied widely over the sampling area in both 1974 and 1977. In 1974, sufficient sites were sampled to enable their grouping for statistical tests of area differences in mackerel egg health. The 1974 stations showed significantly lower egg viability in areas of the Bight that generally are impacted by contaminants from the Hudson-Raritan estuary and Apex dumpsites. In 1977, gross embryo malformations were frequent but geographically variable. The 1977 data exhibited statistically significant associations between cytologic, cytogenetic, and embryologic measures of mackerel egg health, toxic metal levels in surface water samples, and toxic metal and toxic hydrocarbon levels in zooplankton samples from the Bight.

Keywords: Disease, Fish-*Scomber*, Workshops

LONGWELL, A.C.; PERRY, D.; HUGHES, J.; HEBERT, A. 1984. EMBRYOLOGICAL, CYTO-PATHOLOGICAL AND CYTOGENETIC ANALYSES OF '74, '77 AND '78 PLANKTONIC ATLANTIC MACKEREL EGGS IN THE NEW YORK BIGHT. 1984 COUNCIL MEETING OF THE INTERNATIONAL COUNCIL FOR THE EXPLORATION OF THE SEA (COPENHAGEN DENMARK) 8 OCTOBER 1984. PUBL: ICES, COPENHAGEN (DENMARK) REPORT NO.: ICES-CM-1984/E:13, 20 pp.

Keywords: Fish-*Scomber*, Plankton

LUCZKOVICH, J.J.; WATTERS, G.M.; OLLA, B.L. 1991. SEASONAL VARIATION IN USAGE OF A COMMON SHELTER RESOURCE BY JUVENILE INQUILINE SNAILFISH (*LIPARIS INQUILINUS*) AND RED HAKE (*UROPHYCIS CHUSS*). COPEIA 1991(4):1104-1109. The inquiline snailfish, *Liparis inquilinus*, and the red hake, *Urophycis chuss*, are marine fishes that have overlapping shelter requirements. During the first months after settlement from the plankton, juveniles of each species seek refuge in the mantle

cavity of the sea scallop, *Placopecten magellanicus*. *Liparis inquilinus* and *U. chuss* were collected along with sea scallops at regular monthly intervals between June 1980 and July 1982. Sea scallops were taken from a scallop bed in the Mid-Atlantic Bight off the coast of New Jersey (40°15'N, 73°50'W) using a 1.21 m scallop dredge with 75 mm diameter steel rings in the collection bag in water depth of 30 m. Sea scallops were collected by making 3-4 tows with the dredge (one tow with the two 3.65 m dredges) over fixed distances between known LORAN C bearings. Coolers filled with ambient sea water were used to hold sea scallops until their valves opened and any fish trapped inside the mantle cavity escaped. Most fishes were recovered during dissections of all sea scallops.

Liparis inquilinus were most abundant on the sea scallop bed from June through September, whereas *U. chuss* were most abundant from September through January with peaks on November 20, 1980 and December 30, 1981. From February through May, both fishes were uncommon or absent from the sea scallop bed. The average total lengths of both *U. chuss* and *L. inquilinus* increased during the periods when the fish were found in inquiline relationship with the sea scallops. A difference in settlement times for *U. chuss* and *L. inquilinus* is the most likely explanation for the observed shelter usage pattern. *Liparis inquilinus* was the first fish to settle from the plankton to the sea scallop bed in both years, recruiting in June and July. *L. inquilinus* was able to persist through November, concurrent with increases in the abundance of *U. chuss*. Settlement times of both could be influenced by physical factors such as thermal boundaries that routinely occur each summer over the continental shelf of the Mid-Atlantic Bight.

Keywords: Benthos-*Placopecten*, Fish, Fish-Urophycis

LYZENGA, D.R.; BENNETT, J.R. 1988. FULL-SPECTRUM MODELING OF SYNTHETIC APERTURE RADAR INTERNAL WAVE SIGNATURES. J GEOPHYS RES C OCEANS 93(C10):12345-354. An integrated hydrodynamic-electromagnetic model which combines a full-spectrum numerical solution of the wave action equation with a two-scale composite radar backscatter model is described, and results are presented for several internal wave cases observed during recent synthetic aperture radar experiments. The combined model predicts radar backscatter modulations significantly larger than those predicted by a simple Bragg scattering model under relatively high wind speeds (> 5 m/sec), particularly at short wavelengths (X band) and for horizontal polarization. Furthermore, these predictions are in general agreement with observations in some cases where the simple Bragg model fails.

Keywords: Circulation-Internal waves, Modeling-Hydrodynamic

MACKENZIE, C.L.JR.; RADOSH, D.J.; REID, R.N. 1985. DENSITIES GROWTH AND MORTALITIES OF JUVENILES OF THE SURF CLAM *SPISULA SOLIDISSIMA* DILLWYN IN THE NEW YORK BIGHT NORTHERN NEW JERSEY. J SHELLFISH RES 5(2):81-84. The objective of

this study was to examine recruitment of surf clams. Bottom samples were collected with a hydraulic suction device and a Smith-McIntyre grab; and observations were made using SCUBA. Densities were nearly 2,500 clams m^{-2} off of the northern New Jersey coast, and about 8,000 m^{-2} off of the western Long Island coast in September 1980. The clams had a mean length of 33 mm in March 1981, 6 to 8 months after setting. By May 1981 the clams suffered 100% mortality, primarily from crab predation. This study and others show that surf clams set in high densities suffer mortalities of nearly 100% every year.

Keywords: Benthos-*Spisula*

MACLEAN, S.A.; RUDELL, C.L. 1978. THREE NEW CRUSTACEAN HOSTS FOR THE PARASITIC DINOFLAGELLATE *HEMATODINIUM PEREZI* (DINOFLAGELLATA, SYNDINIDAE). J PARASITOL 64(1):158-160. Three crabs, *Cancer irroratus*, *C. borealis*, and *Ovalipes ocellatus*, are added to the list of crustacean hosts of *Hematodinium perezii*, extending the geographical range of the parasite to include the inshore and offshore waters of the Mid-Atlantic Bight. Grossly infected crabs were unremarkable histologically, the haemal spaces were found to contain small rounded cells (9-14 μm diameter) which resembled crab haemocytes and occasionally appeared in the form of multinucleate masses. The nuclei of these cells were atypical for crab haemocytes and had 5 V-shaped chromosomes, and on this basis the identification of *H. perezii* was made. Conclusions concerning the host-parasite relationship of *H. perezii* could not be drawn because so few infected crabs were found. However, the infection rate for *C. borealis* was high in comparison to that of the other species examined.

Keywords: Benthos-*Cancer*, Benthos-*Ovalipes*, Parasites

MACLEOD, W.D., JR.; RAMOS, L.S.; FRIEDMAN, A.J.; BURROWS, D.G.; PROHASKA, P.G.; FISHER, D.L.; BROWN, D.W. 1981. ANALYSIS OF RESIDUAL CHLORINATED HYDROCARBONS, AROMATIC HYDROCARBONS AND RELATED COMPOUNDS IN SELECTED SOURCES, SINKS, AND BIOTA OF THE NEW YORK BIGHT. NMFS, NORTHWEST AND ALASKA FISH. CENT., SEATTLE, WA, USA. OFFICE OF MARINE POLLUTION ASSESSMENT, BOULDER, CO. NOAA TECH. MEMO. The New York Bight is the repository of wastes from over twenty million people and numerous industries. Annually, the Bight receives about nine million metric tons of sewage sludge and industrial waste and five million tons of dredge spoil. Abundant commercial and recreational fisheries occupy these waters, and wildlife sanctuaries dot the less populated shores. The New York Bight Project was initiated in 1973 to determine the condition of the ecosystem and where significant environmental problems are or could develop in the future. The project was intended to provide information and data upon which management and planning decisions could be based. The goals were to develop an extensive understanding of the ecosystem processes and to study pollutants and other man-related stresses on the New York Bight. This report presents results of chemical

research and analysis performed by the NOAA National Analytical Facility from June 1977 to October 1979. A single overall objective of NAF's role was to determine the levels of arenes and PCBs and related compounds in samples of the marine environment and biota from the New York Bight.

Keywords: Pollutants-Bioaccumulation, Pollutants-Organic

MAHONEY, J.B. 1978. THE SEASONAL MAXIMA OF *CERATIUM TRIPOS* WITH PARTICULAR REFERENCE TO A MAJOR NEW YORK BIGHT BLOOM. NATIONAL MARINE FISHERIES SERVICE, NORTHEAST FISHERIES CENTER. TECH SER REP 16; NOAA-78092001. Bottom water oxygen deficiency was apparently responsible for a catastrophic kill of marine animals off the New Jersey coast during the summer of 1976. Investigation has indicated that the decline and decomposition of an immense bloom of the dinoflagellate *C. tripos* contributed to the oxygen depletion. An estimated area of over 14,000 km² was affected by the oxygen depletion; lethal levels of hydrogen sulfide were produced in part of the area. Mortalities occurred among finfish and invertebrates; of special economic significance was the mortality of the surf clam *Spisula solidissima*. If the *Ceratium* bloom in fact has a major role in the oxygen depletion, this is the first documented instance of a mass mortality of marine animals associated with a bloom of *C. tripos*, an apparently nontoxic species. The unusual nature and ecological importance of the 1976 event warrants the examination of available information on the biology of *C. tripos*, particularly on this species' seasonal maxima or blooms.

Keywords: Anoxia, Benthos-*Spisula*, Plankton-*Ceratium*

MAHONEY, J.B. 1979. PLANKTON DYNAMICS AND NUTRIENT CYCLING. PART 2: BLOOM DECOMPOSITION. IN: OXYGEN DEPLETION AND ASSOCIATED BENTHIC MORTALITIES IN NEW YORK BIGHT, 1976, NOAA PROFESSIONAL PAPER 11, R.L. SWANSON AND C.J. SINDERMAN, (EDS.), pp. 219-229. *Ceratium tripos* remained a significant portion of the bottom floc in the oxygen-deficient area between Manasquan and Barnegat at least until mid-July. Around the end of July, no *C. tripos* were seen in bottom samples from off Sandy Hook, and it had almost disappeared from the bottom floc off Manasquan, but it was still evident in the Barnegat area. The floc from the Manasquan area was equally black and white under the microscope, but the Barnegat floc retained much of the earlier yellow-brown appearance. By mid-August, the bottom samples from off Barnegat had no *C. tripos* and little floc; what was present appeared generally decayed. J. Vaughan surveyed the *C. tripos* population in southern New Jersey coastal waters between Great Bay and Cape May from July 21 to its complete disappearance around August 20. The decline of *C. tripos* abundance he observed had a pattern similar to that seen in the more northerly regions but occurred later. During late July and the first half of August *C. tripos* were found present nearly always, even inshore, as individual, intact cells retaining cytoplasmic contents. The cells were not disrupted or aggregated in a detrital mass as they were to the north when the

first samples were examined on July 4. The combined observations indicate that the decomposition proceeded earlier or at a more rapid rate in the Sandy Hook--Manasquan area and progressed southward

Based on some microscopic observations, some bacterial presence was associated with aggregates of phytoplankton material in the water column, but it was greatest at or near the bottom where most of the floc was also found. Also, general bacteria presence seemed to be associated with the presence of *C. tripos* (the notable exception was in the August 16 Atlantic City bottom sample in which abundant bacteria but no *C. tripos* were seen). Unmistakable bacterial decomposition of *C. tripos* cells was observed several times; fungus attack on *C. tripos* was also seen. Vigorous activity and clustering around the floc by ciliate protozoans seen in a number of samples does suggest feeding behavior. The presence of numerous *Olisthodiscus luteus* (many individuals apparently in a senescent state) as a floc constituent in locations from Sandy Hook to Sea Girt, NJ, between July 22 and August 4 is interesting. This species bloomed intensely throughout the southern half of lower New York Bay between June 6 and 13, 1976. Tidal action gradually washed the bloom water to the ocean. The *Olisthodiscus* bloom may not have added measurably to the 1976 oxygen depletion because it was small compared to the *C. tripos* bloom.

Keywords: Anoxia, Bacteria, Plankton-*Ceratium*

MAHONEY, J.B.; MIDLIGE, F.H.; DEUEL, D.G. 1973. A FIN ROT DISEASE OF MARINE AND EURYHALINE FISHES IN THE NEW YORK BIGHT. TRANS AM FISH SOC 102(3):596-605. A fin rot disease reached epizootic proportions in 1967 among at least 22 species of marine and euryhaline fishes in the New York Bight and has continued to occur annually to the present time. Fin necrosis was the consistent external sign of the disease; other external pathological changes included skin hemorrhages, skin ulcers and, occasionally, blindness. Bluefish, summer flounder, winter flounder, and weakfish were the principal species affected. Results of these studies indicate a bacterial cause. Bacteria of three genera, *Aeromonas*, *Vibrio* and *Pseudomonas* are likely implicated. Similar epizootics among freshwater fishes have been associated with unsanitary conditions in aquaria and with water pollution in nature. The epizootic primary center, lower New York Harbor, is grossly polluted with sewage and industrial wastes. We suspect pollution had a role in the disease.

Keywords: Bacteria, Bacteria-*Vibrio*, Disease, Fish

MALONE, T.C. 1976. PHYTOPLANKTON PRODUCTIVITY IN THE APEX OF THE NEW YORK BIGHT: ENVIRONMENTAL REGULATION OF PRODUCTIVITY/CHLOROPHYLL A. IN: MIDDLE ATLANTIC CONTINENTAL SHELF AND THE NEW YORK BIGHT. PROCEEDINGS OF THE SYMPOSIUM AMERICAN MUSEUM OF NATURAL HISTORY, NEW YORK CITY, NOVEMBER 3-5, 1975, M.G. GROSS, (ED.), SPECIAL SYMPOSIA 2:260-272. Phytoplankton productivity within a 600-km² area of the

New York Bight Apex ranged from a December minimum of $0.1 \text{ g C m}^{-2} \text{ d}^{-1}$ to a June maximum of $6 \text{ g C m}^{-2} \text{ d}^{-1}$. Netplankton productivity peaked in February ($1.7 \text{ g C m}^{-2} \text{ d}^{-1}$) and June ($2.2 \text{ g C m}^{-2} \text{ d}^{-1}$); nanoplankton productivity was highest in June ($2.1 \text{ g C m}^{-2} \text{ d}^{-1}$) and July ($3.7 \text{ g C m}^{-2} \text{ d}^{-1}$). Productivity above $2 \text{ g C m}^{-2} \text{ d}^{-1}$ was restricted to within 20 km of the mouth of the Hudson-Raritan estuary. Netplankton and nanoplankton accounted for 41% and 59% of the annual phytoplankton production (370 g C m^{-2}).

The supply of dissolved inorganic nitrogen from the Hudson estuary exceeded phytoplankton demand except during June, July, and August when regeneration within the apex was an important source of nitrogen. No evidence of nitrogen-limited phytoplankton growth was found. Evidence shows that chlorophyll *a* specific phytoplankton productivity was regulated by light and temperature. Ocean dumping had no observable effect on phytoplankton assimilation numbers or on the distribution of environmental factors regulating phytoplankton growth in the Apex.

Keywords: Ocean disposal, Plankton

MALONE, T.C. 1977. LIGHT-SATURATED PHOTOSYNTHESIS BY PHYTOPLANKTON SIZE FRACTIONS IN THE NEW YORK BIGHT, USA. MAR BIOL 42(4):281-292. The relationships between netplankton and nanoplankton assimilation numbers, temperature, and major nutrient concentrations were studied and evaluated in the context of seasonal patterns in the biomass of these phytoplankton size fractions. Netplankton and nanoplankton blooms typically occur during late winter (2 to 8 °C) and summer (18 to 24 °C), respectively. Variations in nanoplankton and netplankton assimilation numbers were not statistically related to the development or collapse of specific blooms based on weekly sampling, but assimilation numbers were higher during the bloom periods than during transition periods of rapid temperature change (8 to 18 °C). Differences in the assimilation numbers between size fractions could account for the dominance of the nanoplankton fraction during the summer bloom period but not for the dominance of netplankton during the winter bloom period. Nanoplankton and netplankton assimilation numbers were exponential functions of temperature between 8 and 24 °C and 8 and 20 °C, respectively. Below 8 °C the assimilation numbers of both fractions were higher than expected on the basis of temperature. Above 20 °C netplankton assimilation numbers declined with temperature. Netplankton and nanoplankton assimilation numbers were occasionally correlated with dissolved inorganic nitrogen concentrations from less than 1.0 to more than 15 $\mu\text{g at l}^{-1}$. Under these conditions, nanoplankton growth rates (calculated from assimilation number and carbon:chlorophyll) were higher and increased more rapidly with dissolved inorganic nitrogen than netplankton growth rates.

Keywords: Plankton

MALONE, T.C. 1977. PLANKTON SYSTEMATICS AND DISTRIBUTION. MESA NEW YORK BIGHT ATLAS MONOGRAPH 13, 45 pp. This paper uses published and unpublished data collected over the past 75 years to describe the distributions of phytoplankton and zooplankton species in New York Bight. Phytoplankton and zooplankton densities were found to decrease with distance from the Raritan-Hudson River estuary. Phytoplankton populations were dominated by diatoms (cold months) and chlorophytes (warm months) in the estuary and apex and by diatoms in the outer Bight. Zooplankton populations were dominated by copepods and meroplankton (summer only) in the estuary and by copepods in the Bight. Among phytoplankton assemblages, the strongest similarities were between those in estuary waters and in apex waters; in the outer Bight, phytoplankton groups were different. Diatoms abundant throughout the area, both estuarine and Bight were *Skeletonema costatum*, *Asterionella japonica*, *Leptocylindrus danicus*, *Thalassionema nitzschioides*, and *Chaetoceros debilis*. In the outer Bight, proportionately more of the following diatoms were present than in apex waters: *Rhizosolenia alata*, *Rhizosolenia faeroense*, *Chaetoceros socialis*, and *Nitzschia closterium*. Peaks in diatom abundance occurred from late autumn through spring in the apex and during winter in the outer Bight. Nanoplankton, dominated by the chlorophyte *Nannochloris atomus*, became abundant during summer and early autumn in estuarine waters and in the Apex. Among zooplankton assemblages, in contrast to phytoplankton, the strongest similarities were between those in the Apex and in the outer Bight. The zooplankton of the apex and outer Bight were dominated by estuarine-marine (*Oithona similis*), euryhaline-marine (*Paracalanus parvus*, *Pseudocalanus minutus*, *Temora longicornis*), and stenohaline-marine copepods (*Centropages typicus*). Warm-water, oceanic species, not reported at all from the estuary were present throughout the Bight during summer and autumn months. Estuarine species assemblages were dominated by estuarine (*Eurytemora* spp.) and estuarine-marine (*Acartia* spp.) copepods and, during summer, by polychaete, lamellibranch, gastropod, and barnacle larvae.

These observations suggest that phytoplankton species composition in New York Bight is strongly influenced by estuarine processes, whereas zooplankton species composition is more strongly influenced by oceanic processes. Increases in zooplankton abundance may reflect growth within the Bight or advective transport into the region. Decreases in copepod abundance during late summer and autumn appear to be due to ctenophore predation. The data are insufficient to assess the effects of man's activities on plankton populations in the Bight.

Keywords: Monitoring-MESA, Plankton, Reviews-Biological

MALONE, T.C. 1978. THE 1976 *CERATIUM TRIPOS* BLOOM IN THE NEW YORK BIGHT: CAUSES AND CONSEQUENCES. NMFS TECH REP NMFS CIRC-410, 18 pp. An extensive bloom of the dinoflagellate *C. tripos* occurred between January and July 1976. Population size peaked during April-June and declined rapidly during July. A floc consisting primarily of decaying *C. tripos* cells covered the bottom during July between Sandy Hook and Atlantic City between 5 and 50 km offshore. The distribution of the floc roughly coincided both

temporally and spatially with the development of a subthermocline oxygen minimum layer and extensive fish kills. Prior to the onset of thermal stratification (January-March), the *C. tripos* population was uniformly distributed throughout the water column and was growing photosynthetically. As the water column began to stratify in April, the population aggregated in a layer 1-3 m thick near the base of the thermocline between the 0.1 and 10% light depths. The *C. tripos* bloom resulted in a gradual accumulation of a large quantity of particulate organic matter which did not enter pelagic food chains. Respiration of this biomass and its decay below the thermocline were probably major factors in the development of oxygen-poor bottom waters in June and July. The bloom was unique only in terms of the size of the population produced, areal extent, and duration. The bloom probably did not occur in response to local nutrient enrichment (related to the disposal of domestic and industrial wastes) during the period of the bloom. However, causes of the bloom and its collapse cannot be determined based on existing information.

Keywords: Anoxia, Fish kills, Plankton-*Ceratium*

MALONE, T.C. 1982. FACTORS INFLUENCING THE FATE OF SEWAGE-DERIVED NUTRIENTS IN THE LOWER HUDSON ESTUARY AND NEW YORK BIGHT. IN: ECOLOGICAL STRESS AND THE NEW YORK BIGHT: SCIENCE AND MANAGEMENT. PROCEEDINGS OF A SYMPOSIUM ON THE ECOLOGICAL EFFECTS OF ENVIRONMENTAL STRESS, NEW YORK, NY, JUNE 10-15, 1979, G.F. MAYER, (ED.), ESTUARINE RESEARCH FEDERATION, COLUMBIA, SC, pp. 389-400. The lower Hudson River estuary receives large quantities of sewage wastes and associated plant nutrients. Most of the nutrient load is transported into adjacent coastal waters where it is taken up by phytoplankton within a relatively small area (<1,500 km²). A better understanding of the effects of freshwater flow of the Hudson River on this nutrient flux is required before urban use of fresh water is increased above current levels. Arguments based on the dynamics of phytoplankton productivity and nutrient uptake lead to the conclusion that secondary sewage treatment is having a beneficial effect on water quality in the lower estuary and Apex of the New York Bight but that tertiary treatment could have a negative impact on commercial and sport fisheries of the region.

Keywords: Ocean disposal-Sewage sludge, Workshops

MALONE, T.C.; ESAIAS, W.; FALKOWSKI, P. 1979. PLANKTON DYNAMICS AND NUTRIENT CYCLING. PART 1: WATER COLUMN PROCESSES. IN: OXYGEN DEPLETION AND ASSOCIATED BENTHIC MORTALITIES IN NEW YORK BIGHT, 1976, NOAA PROFESSIONAL PAPER 11, R.L. SWANSON AND C.J. SINDERMAN, (EDS.), pp. 193-218. Although data were not collected synoptically in time or space, coastal observations correlated well with those in the Apex and outer Bight. Temporal variations in *Ceratium tripos* cell density at Fire Island Inlet reflect the early stages of the bloom before stratification, and mean cell densities along the New

Jersey shore appeared to reflect at least the latter stages of the bloom during the period of thermal stratification. The *C. tripos* bloom apparently began throughout the New York Bight in January; maximum cell densities developed in the midshelf to shelf break region in late March before the onset of thermal stratification. The temporal and spatial distributions of cells indicate that the population was increasing most rapidly in the outer Bight during March or that the outer Bight received a larger initial inoculum of cells than the inner Bight. The larger area over which the bloom occurred indicates that it did not develop in response to local nutrient enrichment of the coastal zone during the actual period of the bloom. This is supported by the observation that *C. tripos* cell densities were lowest in the Apex where local nutrient enrichment is greatest.

The temporal and spatial development of the bloom during April and May suggest an onshore transport of cells once the population began to aggregate below the thermocline. By mid-June a large population of cells was present below the thermocline in a relatively flat region of the New Jersey shelf between the 20- and 40- m isobaths. Much of this population was below the euphotic zone in a subthermocline layer about 10 m thick. Maximum population size was probably achieved after March and before July; population size declined rapidly during July.

The role of *C. tripos* in the development of the oxygen minimum layer off New Jersey is difficult to evaluate in the absence of data on the time and space distribution of DO in the bottom layer and more complete information of the time and space distributions of POC, chlorophyll *a*, and *C. tripos*. The Bight Apex has been subjected to considerable organic loading over the past two decades, and the development of oxygen minimum layers and local anoxia have occurred previously during summer. Based on the effect of *C. tripos* on the content of POC in the water column and on the development of large, subthermocline populations, it is likely that *C. tripos* made a very significant contribution to the oxygen demand required to account for the oxygen minimum layer. A computer simulation model was used to explore the combined effects of benthic respiration and *C. tripos* respiration on the rate of oxygen depletion below the thermocline. The model output indicated that within two months the oxygen concentration in the bottom 5-m layer reaches a steady state concentration that is 45% of the initial oxygen concentration. The simulated rate of oxygen depletion below the thermocline is extremely sensitive to changes in eddy diffusivity, and small changes in diffusivity are sufficient to cause simulated anoxia.

Nanoplankton productivity per se was not a major factor in the 1976 oxygen depletion even though it normally accounts for most of the input of POM to the region. With the exception of winter-spring diatom blooms, there is no evidence that a significant portion of phytoplankton production normally accumulates below the thermocline during summer. The dominance of small-celled phytoplankton (usually less than 10 μm in diameter), vertical chlorophyll-*a* distributions, the importance of ammonia as a nitrogen source for phytoplankton, and the rapid increase in zooplankton grazing pressure during May and June are consistent with the rapid turnover of POC calculated for the Apex in the absence of *C. tripos*. In effect *C. tripos* bloom provided a mechanism by which large

quantities of POC were accumulated over several months. The change in the relative abundance of phytoplankton species and the effects of this change on the distribution and quantity of POC in the subthermocline water column resulted in exceptionally high BOD in 1976.

Keywords: Anoxia, Modeling, Plankton-*Ceratium*

MALONE, T.C.; HOPKINS, T.S.; FALKOWSKI, P.G.; WHITLEDGE, T.E. 1983. PRODUCTION AND TRANSPORT OF PHYTOPLANKTON BIOMASS OVER THE CONTINENTAL SHELF OF THE NEW YORK BIGHT. CONT SHELF RES 1(4):305-337. Seasonal and event scale variations in the distribution and growth of phytoplankton in different hydrographic regions of the continental shelf are compared and evaluated in terms of floristic composition and the evolution of density and nutrient structure across the shelf. Annual cycles of phytoplankton biomass inshore of the 1,000-m isobath are characterized by a March maximum and a July minimum. Cross-shelf biomass gradients usually increase in an offshore direction, a phenomenon that is most pronounced during March and April when biomass is high, diatoms dominate, and growth rate is light limited. This is a consequence of the combined effects of growth along the stratified side of the shelf-break front and offshore transport of biomass produced nearshore. Similar but less-pronounced gradients develop during summer due to the development of a chlorophyll maximum layer below the pycnocline where growth rate is also light limited. Export during the diatom bloom period is balanced mainly by nitrate inputs from the Gulf of Maine and adjacent slope water while summer export may be balanced by anthropogenic nitrogen input. In general, export is greatest when diatoms dominate, growth is light limited, and biomass distributions are physically forced. Export is lowest when nanoplankton dominate, growth is nitrogen limited, and biomass distributions are controlled by grazing.

Keywords: Plankton

MALONE, F.; KUO, J.T.; CHEN, N.M. 1982. FINITE ELEMENT MODELING OF TIDES AND CURRENTS OF THE NEW YORK BIGHT. OCEANS 82 CONFERENCE RECORD: INDUSTRY, GOVERNMENT, EDUCATION PARTNERS IN PROGRESS. WASHINGTON, D.C., SEPTEMBER 20-22, 1982, pp. 781-783. Semi-implicit time-integration schemes have been combined with finite-element space discretization in developing a numerical scheme for the solution of the classical shallow water equations. The scheme has been applied to determine the M2 tides and currents in the New York Bight. Comparison of the M2 tides and currents in the New York Bight with those of the MESA project gives good agreement.

Keywords: Modeling-Hydrodynamic, Monitoring-MESA

MANDELLI, E.F.; BURKHOLDER, P.R.; DOHENY, T.E.; BRODY, R. 1970. STUDIES OF PRIMARY PRODUCTIVITY IN COASTAL WATERS OF SOUTHERN LONG ISLAND, NEW YORK. MAR BIOL 7:153-160.

Phytoplankton productivity of the tidal estuaries and coastal waters of southern Nassau County, Long Island, NY, was determined monthly at 28 stations during 1966. Diatoms alternated with dinoflagellates in dominating the standing crop in the coastal area. The estuaries were characterized by sustained blooms of green flagellates and dinoflagellates during the spring/summer period, 1966.

Chlorophyll *a* ranged from 1.0 to 27.6 mg/m³ in the estuarine area, and 1.45 to 10.15 mg/m³ in adjacent coastal waters. Rate of photosynthesis per unit weight chlorophyll *a* for surface samples in the region under study averaged from 3.1 to 3.5 mgC/mg chlorophyll *a*/h. At light saturation, however, the ratio varied according to water temperature and species' composition. Primary productivity decreased seawards, with mean values for 1966 of 0.35, 0.22, and 0.16 gC/m³/d for the estuarine, nearshore and offshore areas, respectively.

Keywords: Miscellaneous-Chemical, Plankton

MANSKY, J.M. 1984. CAPPING OF DREDGED MATERIAL DISPOSAL MANAGEMENT FOR NEW YORK HARBOR. FINAL REPORT: MANAGEMENT OF BOTTOM SEDIMENTS CONTAINING TOXIC SUBSTANCES: PROCEEDINGS OF THE 8TH U.S./JAPAN EXPERTS MEETING. T.R. PATIN, (ED.), WATER RESOURCES SUPPORT CENTER, FORT BELVOIR, VA, pp. 78-93. The results of monitoring studies conducted on a capped mound of dredged material in the New York Bight are presented. Studies consisted of a comparison of the physical and chemical characteristics of the sediment dredged from each project, an evaluation of the short- and long-term stability of the cap, and an investigation to quantify contaminant release through the cap using biological monitors. Study results indicate that capping of contaminated sediments is a feasible mitigation measure. In addition, information is presented on a proposed study to investigate the use of depressions in the bottom of the harbor formed by sand mining for the disposal of dredged material with subsequent capping.

Keywords: Capping

MARR, P.D. 1979. JURISDICTIONAL ZONES AND GOVERNMENTAL RESPONSIBILITIES. MESA NEW YORK BIGHT ATLAS MONOGRAPH 22, 48 pp. Government agencies, with their associated regulations and jurisdictions, pervade the New York Bight area. Each level of governmental activity operates within a legally defined space and conforms to six jurisdictional zones: the shore, the coastal rim, the territorial sea, the contiguous zones, the outer continental shelf, and the high seas. The responsibilities of public agencies at each level of governmental activity, including minor civil divisions, substate regions, state, interstate commissions, the federal government, and international agencies, conform to one or more of the jurisdictional zones. The zones and governmental activities are in a state of flux, reflecting technological change and the continually

increasing demand and competition for coastal and offshore resources. Changes have resulted in the development of new resource management agencies and the extension of established program responsibilities.

Keywords: Management, Monitoring-MESA

MAYER, D.A.; HANSEN, D.V.; MINTON, S.M. 1979. WATER MOVEMENT ON THE NEW JERSEY SHELF, 1975 AND 1976. IN: OXYGEN DEPLETION AND ASSOCIATED BENTHIC MORTALITIES IN NEW YORK BIGHT, 1976, NOAA PROFESSIONAL PAPER 11, R.L. SWANSON AND C.J. SINDERMAN, (EDS.), pp. 149-163. The differences between currents observed in 1975 and 1976 were explored as possible cause of, or contributors to, the important differences in dissolved oxygen concentrations observed during these 2 years. Insufficient flushing of the coastal waters could be an important factor in the depletion of the dissolved oxygen reservoir. A distinct difference was observed in the flow beneath the pycnocline in the area of anoxia off New Jersey. The weakened flow and reversal of direction in 1976 altered the usual pattern of material transports in the Bight. During the period of observations, upwelling occurred primarily in association with the current perturbation off New Jersey, but not off Long Island. Before this time, however, upwelling occurred consistently off Long Island and may have contributed indirectly to the low dissolved oxygen concentrations observed by advection of nutrients into the region. It is inferred from the relatively minor response of water below the pycnocline, that even though Hurricane Belle's winds were intense, her rapid rate of passage was such that its impact on vertical mixing below the thermocline in the Bight was not especially significant. It is also inferred that reduced vertical mixing as a result of anomalously low summer wind speeds is not likely a cause of the low dissolved oxygen concentration observed during some years. In the New York Bight every summer the density stratification is sufficiently strong that normal or even greater than normal wind-induced mixing cannot effectively transfer dissolved oxygen across the pycnocline.

Keywords: Anoxia, Circulation

MAYER, D.A.; MOFJELD, H.O.; LEAMAN, K.D. 1981. NEAR-INERTIAL INTERNAL WAVES OBSERVED ON THE OUTER SHELF IN THE MIDDLE ATLANTIC BIGHT IN THE WAKE OF HURRICANE BELLE. J PHYS OCEANOGR 11(1):87-106. On August 10, 1976, Hurricane Belle passed rapidly over the highly stratified shelf of the New York Bight. Records from Aanderaa current meter moorings show that the response to the hurricane depended strongly on bathymetry. At deeper stations (similar to 70 m depth), intense, first-mode, internal near-inertial oscillations were generated at frequencies similar to 1% less than the local inertial frequency. At shallower stations (similar to 50 m depth), only weak, heavily damped second-mode oscillations were observed in the current records, with no corresponding inertial signals in temperature. In the Hudson Shelf Valley, inertial motion occurred only near the surface. This was probably due to topographic effects. The divergence and curl

of the wind stress contributed equally to the forcing. The response at the deeper stations is consistent with Geisler's (1970) theory for the open ocean in which a hurricane leaves a wake of internal-inertial oscillations if it travels faster than the internal phase speed and if its horizontal scale is comparable to the internal Rossby radius.

Keywords: Circulation-Internal waves, Hudson Shelf Valley

MAYER, G. F. 1977. NEW YORK BIGHT PROJECT ANNUAL REPORT FOR FY 1976-76T. NOAA TM ERL MESA-25, 105 pp. The Annual Report for fiscal year 1976 describes MESA New York Bight Project activities between July, 1975, and September 30, 1976. Specifically, it summarizes research efforts sponsored by the project and reviews significant technical, operational, and administrative achievements during the period. Some of the oceanographic inventory studies cover water circulation, biological productivity, ocean dumping, sediment transport, water pollution, and effects of pollutants on the Bight.

Keywords: Monitoring-MESA

MAYER, G.F. (ED.). 1982. ECOLOGICAL STRESS AND THE NEW YORK BIGHT: SCIENCE AND MANAGEMENT. PROCEEDINGS OF A SYMPOSIUM ON THE ECOLOGICAL EFFECTS OF ENVIRONMENTAL STRESS, NEW YORK, NY, JUNE 10-15, 1979. ESTUARINE RESEARCH FEDERATION: COLUMBIA, SC, 715 pp. An often-voiced criticism of the environmental regulatory process is the failure to maintain adequate lines of communication among legislators and managers charged with developing and implementing environmental policy and scientists engaged in environmental research. The former two groups have a need for definitive information and unequivocal pronouncements on the environmental effects or ecological implications of specific actions. Members of the latter group, on the other hand, often are unable to respond precisely. They are trained to report on observations, avoid speculation, and enumerate the strengths and weaknesses of conclusions. Such opposing approaches have estranged these groups and have limited their interactions. The organization of the volume reflects that of the symposium. In all, nine panels were convened: five on science and four on management. Three science panels reviewed organismic effects of pollutants on fishes, bottom-dwelling organisms, and plankton/neuston (i.e., effects on cells, tissues, and individual plants and animals). The remaining two science panels explored implications of toxicant additions and nutrient and carbon loadings to communities and ecosystems of the New York Bight. Reports of the science panels are presented in the first section of the volume. By adopting a two-part format, the Editorial Board sought to produce a volume of use on the New York Bight to a range of readers from technical specialists to governmental leaders, decision-makers, members of the public, and students who may lack extensive technical backgrounds.

Keywords: Management, Workshops

MAYHUE, R.J.; LOVELADY, R.W. 1977. ACOUSTIC TRACKING OF WOODHEAD SEABED DRIFTERS. TECH. NOTE U.S. NAT. AERO. SPACE ADM., (NO.8392), REPORT NO.: NASA TN D-8392, 22 pp. An investigation was conducted to determine the feasibility of tracking Woodhead seabed drifters that were instrumented with miniature acoustic transmitters having a range in water in excess of 1.0 nautical mile. With the R.V. Annandale as the sonar-tracking vessel, a trial cruise at the entrance of Delaware Bay verified acoustic communications and positioning of the bottom drifters. A demonstration cruise with the R.V. Annandale was also performed in the New York Bight to attempt to collect information on bottom water movement near the sewage-sludge dump site. Results from the tracking mission in the New York Bight suggested that bottom water currents were negligible near the dump site during the time interval from November 7-12, 1975, and that shipboard sonar tracking of acoustic Woodhead seabed drifters could provide useful Lagrangian information on bottom water movement caused by tidal and other nonstorm effects.

Keywords: Circulation, Ocean disposal-12 mile

MCCAIN, B.B.; MALINS, D.C. 1982. EFFECTS OF PETROLEUM HYDROCARBONS ON SELECTED DEMERSAL FISHES AND CRUSTACEANS. IN: ECOLOGICAL STRESS AND THE NEW YORK BIGHT: SCIENCE AND MANAGEMENT. PROCEEDINGS OF A SYMPOSIUM ON THE ECOLOGICAL EFFECTS OF ENVIRONMENTAL STRESS, NEW YORK, NY, JUNE 10-15, 1979, G.F. MAYER, (ED.), ESTUARINE RESEARCH FEDERATION, COLUMBIA, SC, pp. 315-326. Investigations dealing with the effects of petroleum hydrocarbons on marine fishes and crustaceans are described. In one study conducted in our laboratory, three species of flatfishes (of the family Pleuronectidae) were exposed to crude oil-contaminated sediments for periods ranging from one to four months. English sole (*Parophrys vetulus*) was the only species to undergo significant adverse effects, including weight loss, liver structure aberrations, and hematological changes. In another study conducted in our laboratory, the feeding behavior of spot shrimp (*Pandalus platyceros*) exposed to the seawater-soluble fraction of crude oil was monitored. Concentrations of as low as 100 ppb caused significant disruption of shrimp feeding behavior. Investigations by other researchers pertinent to possible adverse effects of hydrocarbons on species of fishes and crustaceans similar to those found in the New York Bight are also reported.

Keywords: Benthos, Fish, Pollutants-Organic, Pollutants-Toxicity, Workshops

MCEACHRAN, J.D.; MUSICK, J.A. 1975. DISTRIBUTION AND RELATIVE ABUNDANCE OF SEVEN SPECIES OF SKATES (PISCES: RAJIDAE) WHICH OCCUR BETWEEN NOVA SCOTIA AND CAPE HATTERAS. FISH BULL 73(1):110-136. Data collected during eight groundfish surveys of the area from Nova Scotia to Cape Hatteras, North

Carolina, and during five seasonal surveys of Chesapeake Bight were used to define the distribution and relative abundance of *Raja eglanteria*, *R. garmani*, *R. erinacea*, *R. ocellata*, *R. senta*, and *R. radiata*. Ancillary distributional data for the area from the Straits of Florida to Cape Hatteras and the areas off northern Nova Scotia and the Gulf of St. Lawrence were used quantitatively to extend the distributional study.

Raja eglanteria is a Carolinian species abundant north of Cape Hatteras only during the warmer months. *Raja garmani*, a skate of the outer continental shelf and upper slope, consists of two populations which have different temperature preferences. *Raja laevis* is the most widespread species studied and does not appear to be as abundant as the other skates in any region of the study. *Raja erinacea*, a Virginian to boreal species, occurs from southern Nova Scotia to Cape Hatteras in shallow water but is present at depths down to 384 m. *Raja ocellata* is a Virginian to boreal species distributed similarly to *R. erinacea* except that the former is widespread in the Gulf of St. Lawrence and off northern Nova Scotia. *Raja senta*, a boreal species, frequently occurs on the northern offshore banks of Nova Scotia and at temperatures as low as -1.3 °C. *Raja radiata* is a boreal to arctic species. *Raja erinacea* and *R. ocellata* are sympatric over the greater part of their ranges as are *R. senta* and *R. radiata*. The two pairs of species have complementary distributions. *Raja ocellata* has slightly lower temperature preferences than *R. erinacea* and *R. radiata* is more widespread and has wider temperature tolerances than *R. senta*.

Keywords: Fish-*Raja*

MCHUGH, J.L. 1972. MARINE FISHERIES OF NEW YORK STATE. FISH BULL 70(3):585-610. Review of the history of landings of fish and shellfish in New York shows that the record since 1880 can be divided into three periods. The first was a period of development of coastal fisheries in shallow waters, which ended about 1930. The second, which lasted until the early 1950's, was a period of extension to fishing grounds farther offshore, the era of the trawl fisheries. The third was a period of steady decline in landings, still under way, characterized by a return to inshore resources. The 90-year record has seen the rise and virtual collapse of the industrial fisheries of the state, steady decline of the oyster industry to a relatively minor status, and growth and decline of many other once-important fisheries. The variable level of total annual landings has been maintained by constant shifting from one resource to another as the stocks of each have declined in turn. This is a classic example of the evolution of coastal fishery under a regime which offers no effective management. Popular opinion is almost unanimous in blaming foreign fishing for the ills of the domestic fisheries. It is believed that unilateral extension of national jurisdiction would remedy the situation. In reality, although foreign fishing is not without effect, it impinges on relatively few of the coastal fishery resources of New York State. The major problems are domestic, and they will be most difficult to solve.

Keywords: Fisheries

MCHUGH, J.L. 1974. BIOLOGICAL CONSEQUENCES OF ALTERNATIVE REGIMES. REPORT NO.: CONTRIB-102; NYSSGP-SS-75-003; NOAA-75060510, 23 pp. Most fishery disputes rage around two distinct issues: (1) management of the fishery and the resource for maximum sustainable yield and (2) who gets the catch. Solution of problems would probably be easier if the scientific questions related to conservation and the social-political issues take precedence over scientific matters, or various regimes are viewed in the light of past performance, domestic and international, with emphasis on the region known as New York Bight. Observations appear to emphasize the extreme importance of international agreement on a fishery management regime that will be acceptable to most nations.

Keywords: Fisheries, Management

MCHUGH, J.L. 1977. FISHERIES AND FISHERY RESOURCES OF NEW-YORK BIGHT. NOAA TECH REP NMFS CIRC 401, 55 pp. The history of total fish and shellfish landings in the two states (New York and New Jersey) that form the landward boundaries of New York Bight is a history of change. Resource after resource has produced maximum landings, then declined. Total landings dropped from about 115,000 metric tons in 1956 to about 23,000 in 1967 and have risen only moderately since that time. The rise and fall of the industrial fisheries, mostly menhaden, was responsible for most of this decline, and this has masked trends in the food fisheries. Altogether about 132 species or groups of species of fishes and invertebrates have been reported as landed in New Jersey or New York since 1880. Fifty of these are discussed and illustrated with figures and tables of landings. Edible finfish species as a group reached peak landings in 1939 and declined fairly steadily to about one-third that level in the 1970's. Molluscan and crustacean shellfish production reached two peaks, in 1950 and 1966, the second considerably higher than the first. This recovery of shellfish landings in 1966 would not have occurred were it not for the rapid development of the surf clam fishery in the 1950's. The timing of the declines makes it clear that foreign fishing was not the cause, for foreign fishing probably could not have affected the fisheries of the New York Bight before the mid-1960's. Actually, total catches of resources taken only by domestic fishermen have declined more sharply than total domestic catches of species shared with foreign fleets. Foreign fishing is but a symptom of the troubles of the domestic fisheries, some of which are imagined. The ills of the domestic fisheries are economic and socio-political, and they will not yield easily to scientific solutions.

Keywords: Fisheries, Reviews-Biological

MCHUGH, J.L. 1978. HISTORIC FISH AND SHELLFISH LANDINGS AND TRENDS. MESA NEW YORK BIGHT ATLAS MONOGRAPH 16, pp. 4-79. The New York Bight area has been an important fishing ground since the 17th century. Records of domestic commercial landings in New York and New Jersey are available from 1880 for many marine fish and shellfish species; records of

saltwater sportfish catches are available for 1960, 1965, 1970, and not yet available in detail for 1974. Recreational catches are by broader sections of the coast, not by states. Fishing by foreign vessels began in the Bight during the 1960's; annual records are available since that time. Total domestic commercial landings in the two Bight area states reached a peak of about 315,000 metric tons as recently as 1956, but dropped to less than 30,000 metric tons in 1975. Most of this decline was caused by the decline of the menhaden industry, based on a species not used for human food. The catch of food finfish has been declining since 1939, but the catch of shellfish has followed an upward trend since 1942. To some degree, the declining food finfish catch was balanced by increases in saltwater sportfish catches. Details of trends in landings and their causes are given for 14 major food finfish, 6 spp. or groups of species used primarily for industrial purposes (bait, oil and fish meal), and 6 major crustacean and molluscan shellfish resources. Briefer accounts of 17 minor species are given.

Keywords: Monitoring-MESA, Reviews-Biological

MCHUGH, J.L.; GINTER, J.J.C. 1978. FISHERIES. MESA NEW YORK BIGHT ATLAS MONOGRAPH 16, 129 pp. Statistics of fisheries, both domestic and foreign, in the New York Bight area are presented. Maps and graphs provide an historical picture of past trends. Details of trends in commercial fishery landings are given for 14 major food finfish, 6 species or groups of species used mostly for industrial purposes, and 6 crustacean and molluscan shellfish resources. Brief accounts of 17 minor species are included. Foreign pressure in the international waters of the Bight began to increase steadily in the 1960's. The problem improved in 1977 when the U.S. extended its domestic fishery jurisdiction to 200 miles, thus assuming total responsibility for fishery management over the U.S. continental shelf. Foreign fishing within the 200-mile economic zone is now permitted only by special permit. The Mid-Atlantic Regional Fishery Management Council was formed to develop management plans for major fisheries 3 miles from the coast between Montauk Point, Long Island, and Chesapeake Bay; to oversee catch limits and assess surpluses; and to approve permits allowing foreign fleets access to designated surpluses. New York, New Jersey, Pennsylvania, Delaware, Maryland, and Virginia form the basis of membership in the council.

Keywords: Fisheries, Monitoring-MESA, Reviews-Biological

MCHUGH, J.L.; WILLIAMS, A.D. 1976. HISTORICAL STATISTICS OF THE FISHERIES OF THE NEW YORK BIGHT AREA. NEW YORK SEA GRANT INSTITUTE PUBLICATION, NYSSGP-RS-76-013, 75 pp. A compilation of available information on fish catches of this area since 1880 is divided into three categories: domestic commercial landings off New York and New Jersey, recreational, and foreign catches. The migratory habits of many species valuable to domestic fisheries make it useful to include certain catch statistics from the entire southern New England and Middle Atlantic Bight regions. Comparability and accuracy of weight estimates of foreign and domestic catches

are discussed. The ICNAF quotas for the immediate coastal area are charted for catches of species for which adequate scientific information is not available to estimate allowable catches. The major provisions of the Fishery Conservation and Management Act of 1976 set out U.S. fishery policy and authority, describe how the Act relates to foreign fishing and existing international agreements, establish national standards for fishery conservation and management, and provide mechanisms for implementation.

Keywords: Fisheries, Management

MCLAUGHLIN, D.B.; ELDER, J.A. 1976. A CONCEPTUAL REPRESENTATION OF THE NEW YORK BIGHT ECOSYSTEM. IN: MIDDLE ATLANTIC CONTINENTAL SHELF AND THE NEW YORK BIGHT. PROCEEDINGS OF THE SYMPOSIUM AMERICAN MUSEUM OF NATURAL HISTORY, NEW YORK CITY, NOVEMBER 3-5, 1975, M.G. GROSS, (ED.), SPECIAL SYMPOSIA 2:249-259. Large scientific enterprises need effective techniques for organizing and relating research findings from different fields. Graphical representations (or models) of the ecosystem can be particularly useful organizational tools. These conceptual models help lay the groundwork for detailed mathematical or empirical descriptions of ecological processes; they also demonstrate the scope of the problem being studied. The New York Bight ecosystem model discussed here is based on a descriptive technique developed by H.T. Odum and widely applied by others. The model is constructed from a few basic components which fall into the following categories: energy or mass storage compartments; energy or mass sources; energy or mass flow regulators. These components are pieced together into a comprehensive representation of physical, chemical, and biological processes in the Bight. Selected aspects of the representation are examined and, where possible, mass and energy fluxes are estimated.

Keywords: Modeling, Reviews-Biological

MCLAUGHLIN, D.; ELDER, J.A.; ORLOB, G.T.; KIBLER, D.F.; EVENSON, D.E. 1975. A CONCEPTUAL REPRESENTATION OF THE NEW YORK BIGHT ECOSYSTEM. NOAA TM ERL MESA-4; NOAA-76022003, 373 pp. The technical memorandum offers a comprehensive, conceptual representation of the physical, geological, chemical and biological processes that affect the New York Bight ecosystem, as well as some specific recommendations suggesting where field and laboratory research efforts should be undertaken to support a satisfactory evaluation of management alternatives in the New York Bight. The report identifies the important problems in the New York Bight, in order to develop effective undesirable material onto beaches, shellfish contamination, and a decline and instability in migratory fisheries. The problem is described, the critical subsystems are identified, they are reviewed in the light of present knowledge, and a set of recommendations (or research tasks) for future implementation is proposed.

Keywords: Modeling, Monitoring-MESA, Reviews-Biological

MCLAUGHLIN, J.J.A.; KLEPPEL, G.S.; BROWN, M.P.; INGRAM, R.J.; SAMUELS, W.B. 1982. THE IMPORTANCE OF NUTRIENTS TO PHYTOPLANKTON PRODUCTION IN NEW YORK HARBOR. IN: ECOLOGICAL STRESS AND THE NEW YORK BIGHT: SCIENCE AND MANAGEMENT. PROCEEDINGS OF A SYMPOSIUM ON THE ECOLOGICAL EFFECTS OF ENVIRONMENTAL STRESS, NEW YORK, NY, JUNE 10-15, 1979, G.F. MAYER, (ED.), ESTUARINE RESEARCH FEDERATION, COLUMBIA, SC, pp. 469-479. A four year study was conducted to identify the importance of nutrients in regulating phytoplankton growth and productivity in New York Harbor. While nitrogen (occurring primarily as ammonia in yearly concentrations of 25-88 $\mu\text{g-at/l}$) and phosphorus appear to be present well in excess of concentrations capable of limiting phytoplankton growth, silicon delivery to the estuary and the New York Bight Apex decreases sharply in May and June. The phytoplankton community at this time changes from diatom-dominated to chlorophyte- and dinoflagellate-dominated. Primary productivity reflects this change, initially decreasing between April and May, then increasing toward summer as the chlorophytes become dominant. Data from laboratory experiments suggest that diatom growth during the late spring could be restored by the addition of silicon, trace elements, and vitamins. During peak photosynthesis periods (February-March, May-July), productivity seems to be regulated by light intensity, but during the fall, when productivity is low, unidentified constituents in the water appear to inhibit photosynthesis. Water quality management strategies for the harbor must address all aspects of the system (planktonic, benthic, pelagic regimes) and consider the influence of the Bight Apex and Long Island Sound as sources of biomass.

Keywords: Plankton

MEARNS, A.J.; HAINES, E.; KLEPPEL, G.L.; MCGRATH, R.A.; MCLAUGHLIN, J.J.A.; SEGAR, D.A.; SHARP, J.H.; WALSH, J.J.; WORD, J.Q.; YOUNG, D.K.; YOUNG, M.W. 1982. EFFECTS OF NUTRIENTS AND CARBON LOADINGS ON COMMUNITIES AND ECOSYSTEMS. IN: ECOLOGICAL STRESS AND THE NEW YORK BIGHT: SCIENCE AND MANAGEMENT. PROCEEDINGS OF A SYMPOSIUM ON THE ECOLOGICAL EFFECTS OF ENVIRONMENTAL STRESS, NEW YORK, NY, JUNE 10-15, 1979, G.F. MAYER, (ED.), ESTUARINE RESEARCH FEDERATION, COLUMBIA, SC, pp. 53-65. Waters of the Hudson River estuary and the New York Bight Apex experience unpleasant and costly ecological problems that are caused, in part, by excessive inputs of nitrogen and carbon from shore-based sewage discharges. A principal problem is summertime depression and localized depletion of dissolved oxygen in the estuary and bottom waters of the Apex. In the estuary, decay of organic matter (carbon) from sewage and runoff, and from phytoplankton blooms stimulated by nitrogen from sewage, reduces dissolved oxygen levels insufficient for diverse and abundant populations of typical estuarine organisms. Most of the nitrogen discharged into the estuary is

flushed into surface waters of the Apex, where it is assimilated by coastal phytoplankton in an area of up to 1,350 km² (late winter and early spring). Organic matter produced by this excess growth, coupled with appropriate oceanographic conditions, may contribute to episodes of oxygen depletion in limited portions of Apex bottom waters. Oxygen-demanding materials from sludge dumping do not appear to contribute greatly to oxygen depletion. The large-scale anoxic episode of 1976 was not caused by these inputs. A large-scale reduction in nitrogen input (i.e., <90%), especially in the summer, might alleviate low oxygen episodes in the estuary and Apex, but would not prevent the kind of episode that occurred in 1976. Nutrients other than nitrogen and toxic materials may encourage the growth of some species and inhibit others, depending on location and time of year. It is still unclear what changes might result from controlling these substances.

Keywords: Anoxia, Ocean disposal, Pollutants-Loadings, Pollutants-Toxicity

MESA NEW YORK BIGHT PROJECT ANNUAL REPORT FOR FISCAL YEAR 1977. MESA NEW YORK BIGHT PROJECT ANNUAL REPORT 1977 OCTOBER 1978 147 pp. MESA New York Bight project background, goals and objectives, organization, management, facilities, and research vessels are given. Scientific research results for the fiscal year 1977 are discussed in terms of the 11 project objectives. Extensive wash-up of litter and sewage-related materials on Long Island beaches and mass mortalities of benthic organisms on the New Jersey coast occurred in 1976. It is suggested that concentration of average environment conditions is not adequate for management purposes but that extremes and worst cases must be emphasized. The most significant chemical contaminants were cadmium, chlorinated pesticides, mercury, polynuclear aromatic hydrocarbons, PCBs, and plutonium. Mercury concentrations in several fish and shellfish exceeded FDA limits, that of lobsters having a mean level of 0.75 ppm and a high of 2.31 ppm. Sewage sludge was the major source of PCBs and DDT. The project responded to 2 crises-a Hudson River oil spill in February and anoxia monitoring for results from the escape of raw sewage in the marine ecosystem during the New York City 1976 power failure. Means of information transfer and advisory and cooperative activities are discussed. Appendixes include bibliographies of publications of the project and those (by others) resulting from its support; grants and contracts; MESA-associated cruises; and a list of advisory and consultative services provided.

Keywords: Anoxia, Monitoring, Monitoring-MESA, Pollutants-Bioaccumulation, Pollutants-Metals, Pollutants-Organic

MEYER, T.L.; ANDERSON, E.L.; ROPES, J.W.; PHOEL, W.C. 1987. UNDERWATER OBSERVATIONS OF A SURF CLAM, *SPISULA SOLIDISSIMA* (DILLWYN), COMMUNITY AND THE RELATIVE EFFICIENCY OF A PROTOTYPE AIRLIFT CLAM SAMPLER. MAR FISH REV 49(4):23-33. A benthic infaunal community dominated by the surf clam, *Spisula solidissima* (Dillwyn), was monitored near Rockaway Beach, Long

Island, N.Y., during the summers of 1977 and 1978. An airlift system tested was designed to collect quantitatively a 0.25 m² sample.

Keywords: Benthos-*Spisula*, Monitoring

MICHAEL, A.D. 1982. THE POTENTIAL CONTRIBUTION OF PETROLEUM HYDROCARBONS TO CHANGES IN BENTHIC COMMUNITIES OF THE NEW YORK BIGHT. IN: ECOLOGICAL STRESS AND THE NEW YORK BIGHT: SCIENCE AND MANAGEMENT. PROCEEDINGS OF A SYMPOSIUM ON THE ECOLOGICAL EFFECTS OF ENVIRONMENTAL STRESS, NEW YORK, NY, JUNE 10-15, 1979, G.F. MAYER, (ED.), ESTUARINE RESEARCH FEDERATION, COLUMBIA, SC, pp. 621-630. Contaminant levels in the lower Hudson River estuary and New York Bight have affected the distribution and abundance of benthic invertebrates. One of the major contaminants, petroleum hydrocarbons, includes persistent and toxic components such as polyaromatic hydrocarbons. Input levels, mostly from non-point sources, are high and difficult to control. Since a large number of contaminants are present in the New York Bight, it is difficult, if not impossible, to identify individual contaminants that have caused changes in benthic communities. However, oil spills have occurred where levels of other contaminants were extremely low and where the effects on benthos can be traced directly to hydrocarbons. These effects include reductions in the numbers of species and individuals and increases in the number of opportunistic species. Changes in benthic community patterns observed in parts of the New York Bight and the Hudson River estuary are similar to those caused by oil spills and theoretically could be attributed solely to petroleum hydrocarbons.

Keywords: Benthos, Pollutants-Organic, Pollutants-Toxicity

MILSTEIN, C.B.; GARLO, E.V.; JAHN, A.E. 1977. A MAJOR KILL OF MARINE ORGANISMS IN THE MIDDLE ATLANTIC BIGHT DURING SUMMER 1976. BULL 15, ICHTHYOLOGICAL ASSOCIATES, INC., ABSECON, NJ, 56 pp. During summer 1976, widespread and persistent anoxic conditions in bottom waters of the Middle Atlantic Bight caused mortalities of marine organisms. Although the cause of anoxia is uncertain, it has been ascribed to a combination of factors including a major bloom of ceratium, unusual physical conditions, and the contributions of nutrients and organic material from a variety of sources in the Bight. Information presented to date indicates that anomalous meteorological events in early 1976 led to the early establishment of a vertically stable water column which in turn may have enhanced the development and maintenance of the anoxia.

Keywords: Anoxia

MOHNEN, V.A. 1977. AIR QUALITY. MESA NEW YORK BIGHT ATLAS MONOGRAPH 28, 43 pp. The air quality of New York Bight is determined by

anthropogenic and natural emissions of particulate and gaseous material from the continent and the ocean, and by chemical and physical processes that occur in the atmosphere. The concept of natural cycles for water, sulfur, and nitrogen containing molecules, and for suspended particulates is introduced. These highly interactive cycles (emissions-transport and chemical/physical processes-sinks) are first discussed on a global basis where assumptions can be made that they proceed until completion. Anthropogenic emissions are then treated as a perturbation in the natural cycles. Air quality in the Bight is governed mainly by anthropogenic emission sources located inland of the bight shorelines. Estimates are derived, using transport models, for the ambient level of pollutant material (mainly suspended particulate matter and sulfur dioxide) and for the deposition rate of pollutant material in New York Bight. While reasonably good air quality data exist from measuring stations located on land, similar data over the Bight are nonexistent.

Keywords: Miscellaneous, Monitoring-MESA, Pollutants-Loadings

MONAHAN, R.K.; MAYER, G.F.; STANFORD, H.M. 1988. THIRTY-FIVE YEARS OF DUMPING TITANIUM DIOXIDE WASTES IN U.S. WATERS; WHAT HAVE WE LEARNED? OCEANIC PROCESSES IN MARINE POLLUTION, VOL. 5, URBAN WASTES IN COASTAL MARINE ENVIRONMENTS. D.A. WOLFE AND T.P. O'CONNOR, (EDS.), pp. 79-90.

Keywords: Ocean disposal

MOORE, K. 1991. FORMER SEWAGE SLUDGE DUMPSITE BEGINS TO RECOVER. NATIONAL FISHERMAN, SEPTEMBER 1991, pp. 20-21.

Keywords: Monitoring, Ocean disposal-Sewage sludge

MUELLER, J.A.; ANDERSON, A.R. 1978. INDUSTRIAL WASTES. MESA NEW YORK BIGHT ATLAS MONOGRAPH 30, 39 pp. The offshore water in the bend of the Atlantic coastline from Long Island on one side to New Jersey on the other is the New York Bight. This 15,000 mi² of the Atlantic coastal ocean reaches seaward to the edge of the continental shelf, 80-120 miles offshore. Lying just offshore New York City, it is one of the world's most intensively used coastal areas for recreation, shipping, fishing and shellfishing, and for dumping sewage sludge, construction rubble, and industrial wastes. Its potential is being considered for resources like sand and gravel and oil and gas. The character and importance of industrial wastes discharged in the New York Bight region are evaluated. The magnitude of Bight area industrial wastes is considered as compared to that of the nation. Also considered are geographic distribution and input locations; mass loads from industrial waste discharges by source, by geographic location, and in comparison to waste inputs from other sources; industrial treatment methods; and official policies. Much wastewater in the Bight area is now discharged through primary and secondary treatment plants. New

federal regulations prescribing treatment levels and phasing out some ocean dumping should improve water quality. Industrial discharges contribute significant portions of the contaminant input loads to New York Bight. Future decisions on waste management must consider interrelationships among all contaminant sources.

Keywords: Monitoring-MESA, Ocean disposal

MUELLER, J.A.; ANDERSON, A.R.; JERIS, J.S. 1976. CONTAMINANTS IN THE NEW YORK BIGHT USA. J WATER POLLUT CONTROL FED 48(10):2309-2326. The location and magnitude of contaminant inputs into the New York Bight are estimated, their relative importance indicated, and data gaps identified. Four sources of contaminant inputs were evaluated: barge dumps and atmospheric fallout as direct Bight inputs and wastewater and runoff as coastal inputs to waters ultimately draining to the Bight. For each source, in addition to flow or volume, recent data on 23 separate contaminants were used to estimate the inputs of solids, organic matter, nutrients, heavy metals and microbes (fecal and total coliforms). A summary of the contribution by source and location is presented as well as an estimate of the annual or seasonal variability for selected sources. To evaluate the significance of the mass loads generated, they were compared with an estimate of the background mass loads entering the Bight as a result of a net current across the ocean boundaries.

Keywords: Ocean disposal, Pollutants-Loadings

MUELLER, J.A.; ANDERSON, A.R.; JERIS, J.S. 1976. CONTAMINANTS ENTERING THE NEW YORK BIGHT: SOURCES, MASS LOADS, SIGNIFICANCE. IN: MIDDLE ATLANTIC CONTINENTAL SHELF AND THE NEW YORK BIGHT. PROCEEDINGS OF THE SYMPOSIUM AMERICAN MUSEUM OF NATURAL HISTORY, NEW YORK CITY, NOVEMBER 3-4, 1975, SPECIAL SYMPOSIA 2:162-170. Major contaminant inputs to the New York Bight originate from the New York metropolitan area and the Hudson River drainage basin, principally from wastewater, runoff, and barge discharges. Major sources of the microbial load are unchlorinated municipal wastewater discharges and urban runoff. Sewage sludge barge dumps constitute an insignificant microbial load on bight waters. The seasonal variability of municipal wastewater and gauged runoff and annual variability of barge discharges range from a maximum of 1.5-2.0 to a minimum of 0.5-0.7 times the average mass loads. Between 1960 and 1975 the sludge volume as well as fraction digested shows a definite increasing trend. Few data are available on atmospheric and urban runoff inputs. The mass loads reaching the Bight are highly related. Poor quality of the dredged materials is caused by contaminants settling from poorly treated wastewater and urban runoff. Increasing levels of wastewater treatment produce more municipal and industrial sludge for disposal. For conservative substances, such as heavy metals, various control measures may redistribute the load among the sources but cause no net decrease in the total.

Keywords: Pollutants-Loadings

MUELLER, J.A.; JERIS, J.S.; ANDERSON, A.R.; HUGHES, C.F. 1976. CONTAMINANT INPUTS TO THE NEW YORK BIGHT. NOAA TM ERL MESA-6, MARINE ECOSYSTEM ANALYSIS PROGRAM OFFICE, BOULDER, CO, 347 pp. An estimate of the location and magnitude of contaminant inputs into the New York Bight is presented, their relative importance indicated, and data gaps identified. Four sources of contaminant inputs were evaluated in the study: barge dumps and atmospheric fallout (as direct bight inputs) and wastewater and runoff (as coastal input to waters ultimately draining to the Bight). The sources were further subdivided into their various constituents: dredge spoils, sewage sludge, acid wastes, chemical wastes and rubble for the barge dumps; gaged stream flow, urban runoff, and groundwater outflow for the runoff, and municipal and industrial wastewater inputs. The wastewater inputs were evaluated only downstream of the gaged stream stations because all inputs above these points are reflected in the gaged runoff values. In addition to flow or volume for each source, 23 separate contaminants were investigated to estimate the inputs of solids, organic matter, nutrients, heavy metals, and microbes. Because of their usefulness in water quality modeling, the raw dredge spoil, wastewater discharge, and gaged runoff data for each source are included as appendices.

Keywords: Monitoring-MESA, Pollutants-Loading

MUELLER, J.A.; JIN-LUNG SU, W. 1972. BENTHAL OXYGEN DEMANDS AND LEACHING RATES OF TREATED SLUDGES. J WATER POLLUT CONTROL FED 44(12):2303-2315. After many years of wastewater sludge and spoil disposal in coastal waters, sludge deposits of varying depths have formed on the ocean bottom. Extensive biological studies in the New York Bight have shown that the typical biota normally expected on the uncontaminated ocean floor does not exist in the area of sludge deposits. Significantly, DO, necessary to all aerobic bottom organisms, is markedly depleted in this region. If use of the ocean floor for ultimate disposal of wastewater sludges is to continue, it is essential to obtain more information on the effects of these sludges on the ocean environment. This study was designed to compare the effect of sludge treatment on the benthal oxygen demands and nutrient leaching rates of wastewater sludges.

Keywords: Anoxia, Ocean disposal-12 mile, Pollutants-Sediment

MURAMOTO, J.A. 1991. PATHOGENIC MICROORGANISMS IN NEW YORK BIGHT SEDIMENTS AND BIOTA. SAIC REPORT NO. 90/7616 & 261, 33 pp. The distribution and abundance of disease-causing microorganisms in the New York Bight are of great concern because of their potential and real impacts upon human health and coastal ecosystems. Most pathogenic microorganisms of concern in the aquatic and sedimentary environment will be associated with fecal contamination. Due to its proximity to the New York

metropolitan area, input of such pathogenic microorganisms to the Bight can occur in many ways: effluents from the Hudson and Raritan Rivers, from municipal wastewater discharges, past sewage sludge disposal practices at the Sewage Sludge site in the Bight Apex, and disposal of sediments dredged from harbors and waterways.

Dredged sediments and their disposal are of concern because the sediments often originate from areas which can be highly contaminated with pathogens. These areas include harbors, marinas, tidal channels, and rivers receiving municipal and/or agricultural livestock discharges; shipping traffic also poses a hazard from disposal of human wastes. The following potential impacts are of concern: (1) disposal of contaminated dredged sediments may be a source of further contamination for the rest of the Bight Apex; (2) transfer of pathogenic microorganisms from lower to higher steps in the food chain may occur, affecting benthic invertebrates, fish, and potentially humans through consumption of contaminated seafood; and (3) potential for human contact or ingestion of sediments containing pathogenic microorganisms, or water contaminated by contact with contaminated sediments, resulting in illness.

In the New York Bight Apex, interpreting the distribution and sources of sediment pathogens is complex because of the many different possible sources. The Mud Dump site is adjacent to the Sewage Sludge site to the east, where disposal of sewage sludge took place until the end of 1987. However, the long survival time for spores of sewage pathogens allows for long-term dispersal of this material. An important factor to be considered in a high-energy coastal environment such as the Bight Apex is the potential transport of pathogenic microorganisms in contaminated sediments and water masses due to normal tidal and storm resuspension, currents, estuarine and river flow, and anthropogenic and animal disturbances of contaminated sediments.

Keywords: Apex, Disease, Ocean disposal, Pollutants-Sediments, Reviews-Biological

MURAMOTO, J.A.; CAREY, D.A. 1991. A REVIEW OF STUDIES OF METAL AND ORGANIC CONTAMINANTS IN SEDIMENTS AND BIOTA OF THE NEW YORK BIGHT APEX AND MUD DUMP SITE. SAIC REPORT NO. SAIC-91/7602 & 251, SCIENCE APPLICATION INTERNATIONAL CORPORATION, NEWPORT, RI. Disposal of dredged material has accounted for the largest single source of sediment input in the New York Bight. These sediments have been the major source of anthropogenic contaminants in the Bight, containing heavy metals, pesticides, PCBs, dioxins, PAHs, and other potentially hazardous organic compounds. Contaminants are associated with the fine silt-clay fraction of sediments, which also contains the highest concentrations of organic matter. Highest concentrations of metals, silt-clay muds, organic matter and organic pollutants were measured in sediments collected near the dumpsites, in the nearby Christiaensen Basin, and along the axis of the upper Hudson Shelf Valley downslope from the Bight Apex. Because the Bight is a high-transport sedimentary regime and has received large volumes of

easily dispersed material (sewage sludge), contaminants are widely dispersed throughout surface sediments, particularly in the Christiaensen Basin and in the upper Hudson Shelf Valley, as well as in the immediate vicinity of the disposal sites. Farther out on the edge of the continental shelf, sediments of the outer Bight are relatively uncontaminated.

Contaminant levels in biota of the New York Bight Apex vary according to the species involved and the nature of the contaminant. In general, individuals in the vicinity of the Mud Dump dredged material or in the nearby Christiaensen Basin have higher levels of contaminants than individuals living in uncontaminated outer shelf environments. In the past, restricted consumption or closure of fishing grounds have occurred as a result of levels of compounds (e.g., PCBs) in fish and shellfish. Levels of dioxins and PCBs in benthic infauna were higher than in the surrounding sediment and reflected distributions of sediment-bound organic contaminants. In contrast, metal concentrations in demersal and epibenthic fauna were lower than measurements from sediments and did not reflect distributions of sediment-bound metals.

Keywords: Apex, Ocean disposal-Dredged material, Pollutants-Bioaccumulation, Pollutants-Sediment, Reviews-Biological

MURAWSKI, W.S. 1969. A STUDY OF SUBMERGED DREDGE HOLES IN NEW JERSEY ESTUARIES WITH RESPECT TO THEIR FITNESS AS FINFISH HABITAT. MIS. REPT. 2-M, NJ DEPT CONS AND ECON DEVEL, 32 pp.

Keywords: Estuaries, Fish, Miscellaneous-Biological

MURCHELANO, R.A. 1975. THE HISTO PATHOLOGY OF FIN ROT DISEASE IN WINTER FLOUNDER FROM THE NEW YORK BIGHT. J WILDL DIS 11(2):263-268.

Keywords: Disease, Fish-*Pseudopleuronectes*

MURCHELANO, R.A. 1982. SOME POLLUTION ASSOCIATED DISEASES AND ABNORMALITIES OF MARINE FISHES AND SHELLFISHES: A PERSPECTIVE FOR THE NEW YORK BIGHT. IN: ECOLOGICAL STRESS AND THE NEW YORK BIGHT: SCIENCE AND MANAGEMENT. PROCEEDINGS OF A SYMPOSIUM ON THE ECOLOGICAL EFFECTS OF ENVIRONMENTAL STRESS, NEW YORK, NY, JUNE 10-15, 1979, G.F. MAYER, (ED.), ESTUARINE RESEARCH FEDERATION, COLUMBIA, SC, pp. 327-346. In recent years there has been a tendency to associate environmental degradation with diseases of marine fishes and shellfishes. A brief review is provided of pollution-associated diseases caused by viruses and bacteria and of a number of pollution-associated diseases whose etiology is uncertain. Microbial diseases discussed include lymphocystis,

herpeslike virus, *Baculovirus*, vibriosis, and shell disease; diseases of uncertain etiology include fin rot, skeletal anomalies, and "black gill"; neoplastic diseases include epidermal papilloma, stomatopapilloma, hepatoma, and several neoplastic diseases of shellfishes. The prevalence of these diseases varies geographically, and in any one area usually has not been statistically compared to an acceptable reference area. The prognosis for the animal also varies; some diseases are fatal and others have little effect on their hosts. The only pollution-associated diseases that are numerically prevalent in the New York Bight are shell disease, fin rot, and "black gill" disease.

Keywords: Disease

MURCHELANO, R.A.; ZISKOWSKI, J. 1976. FIN ROT DISEASE STUDIES IN THE NEW YORK BIGHT. IN: MIDDLE ATLANTIC CONTINENTAL SHELF AND THE NEW YORK BIGHT. PROCEEDINGS OF THE SYMPOSIUM AMERICAN MUSEUM OF NATURAL HISTORY, NEW YORK CITY, NOVEMBER 3-5, 1975, M.G. GROSS, (ED.), SPECIAL SYMPOSIA 2:329-335. Surveys from February 1974 through June 1975 showed the prevalence of fin rot disease in winter flounder (*Pseudopleuronectes americanus*) from the New York Bight Apex was 3.9%, compared to 0.7% outside the Apex. Prevalence of the disease in winter flounder from Apex areas of low carbon deposits was 2.9%; whereas, in Apex areas of high carbon deposits, disease prevalence was 5.1%. The prevalence of fin rot disease in summer flounder (*Paralichthys dentatus*) from the Apex was 0.6% and in summer flounder from Sandy Hook-Raritan Bay was 3.4%. No summer flounder with fin rot were noted in Great Bay, a control area outside the Apex. Although the numbers of diseased fish are small, incidence of fin rot disease in summer flounder from Sandy Hook-Raritan Bay increased monthly from June-November 1974. Attempts to induce fin rot disease in winter flounder in cages submerged in the sewage sludge area of the Bight Apex produced active fin lesions on the caudal fins more often than on the dorsal and anal fins. These flounder were in substantially worse condition than fish in cages at the control site.

Keywords: Disease, Fish-*Paralichthys*, Fish-*Pseudopleuronectes*, Pollutants-Sediment

MURCHELANO, R.A.; ZISKOWSKI, J. 1977. HISTO PATHOLOGY OF AN ACUTE FIN LESION IN THE SUMMER FLOUNDER *PARALICHTHYS DENTATUS* AND SOME SPECULATIONS ON THE ETIOLOGY OF FIN ROT DISEASE IN THE NEW YORK BIGHT. J WILDL DIS 13(1):103-106. The histopathology of acute fin rot disease in summer flounder, *P. dentatus*, from the New York Bight is described. Grossly, caudal and dorsal fin lesions appeared ragged or frayed with no evidence of resolution. Microscopically, there was epidermal and dermal necrosis, congestion, edema, focal and diffuse hemorrhage, and Zenkers necrosis of underlying muscle. Gram-negative bacteria were present in the fin tissues and in heart muscle and liver parenchyma. The inflammatory response consisted mostly of macrophages. The significance of the acute disease

in summer flounder is discussed in relation to the etiology of fin rot disease in winter flounder from the Bight.

Keywords: Bacteria, Disease, Fish-*Paralichthys*

MURCHELANO, R.A.; ZISKOWSKI, J. 1979. SOME OBSERVATIONS ON AN ULCER DISEASE OF RED HAKE, *UROPHYCIS CHUSS*, FROM THE NEW YORK BIGHT. PRESENTED AT: COUNCIL MEETING, 1979, OF THE INTERNATIONAL COUNCIL FOR THE EXPLORATION OF THE SEA CHARLOTTENLUND (DENMARK) 1 OCTOBER 1979. NOAA/NMFS, NORTHEAST FISH. CENT., OXFORD, MD 21654, USA.

Keywords: Disease, Fish-*Urophycis*

MURCHELANO, R.A.; ZISKOWSKI, J. 1982. FIN ROT DISEASE IN THE NEW YORK BIGHT (1973-1977). IN: ECOLOGICAL STRESS AND THE NEW YORK BIGHT: SCIENCE AND MANAGEMENT. PROCEEDINGS OF A SYMPOSIUM ON THE ECOLOGICAL EFFECTS OF ENVIRONMENTAL STRESS, NEW YORK, NY, JUNE 10-15, 1979, G.F.MAYER, (ED.), ESTUARINE RESEARCH FEDERATION, COLUMBIA, SC, pp. 347-358. The results of research on the prevalence and etiology of fin rot disease of New York Bight winter flounder, *Pseudopleuronectes americanus*, are presented. Except for 1975 and 1976, significant differences ($P < 0.05$) in disease prevalence were found between the apex and Sandy Hook/Raritan Bays, the apex and control area, and Sandy Hook/Raritan Bays and control area. The apex had the highest prevalence of the disease (7.4%) for the five year period from 1973 to 1977. It was not possible to determine whether the etiology of the fin rot is infectious or noninfectious. Bacteria do not appear to be involved in the pathogenesis of the disease, and the concentrations of trace metals and PCBs in tissues were not elevated consistently. Based on bacteriologic, histopathologic, and immunologic studies, the disease probably is not fatal; however, behavioral modification may result in some mortalities. Negligible mortality and the absence of an extensive winter flounder fishery in the New York Bight both make it unlikely that there is a major effect on the population dynamics of the species. The disease is unlikely to reduce the marketability of fish since muscle tissue is not affected and since the fish are not sold in the round. The most important aspect of the presence of fin rot disease in Bight winter flounder rests in its value as an indicator of environmental stress.

Keywords: Disease, Fish

MURPHY, L.S.; GUILLARD, R.R.L.; GAVIS, J. 1982. EVOLUTION OF RESISTANT PHYTOPLANKTON STRAINS THROUGH EXPOSURE TO MARINE POLLUTANTS. IN: ECOLOGICAL STRESS AND THE NEW YORK BIGHT: SCIENCE AND MANAGEMENT. PROCEEDINGS OF A SYMPOSIUM ON THE ECOLOGICAL EFFECTS OF ENVIRONMENTAL

STRESS, NEW YORK, NY, JUNE 10-15, 1979, G.F. MAYER, (ED.), ESTUARINE RESEARCH FEDERATION, COLUMBIA, SC, pp. 401-412. We evaluated the responses of 17 clones of marine diatoms, isolated from a range of environments, to two industrial wastes now disposed of at deep-ocean dumpsites. The clones showed a wide range of sensitivity to the stress, and there were no correlations with latitude of isolation, distance from shore, temperature regime, salinity, or general environmental stability. Three neritic clones from heavily polluted waters were much less sensitive than were other neritic and ocean clones. Further, we surveyed cupric ion sensitivity in 15 clones of phytoplankton isolated from different neritic environments. All extremely resistant clones came from regions known or presumed to be heavily polluted. These data suggest that some phytoplankters can develop strains resistant to a marine pollutant.

Keywords: Plankton, Pollutants-Toxicity

MUSICK, J.A. 1973. SEASONAL DISTRIBUTION OF SIBLING HAKES, *UROPHYCIS CHUSS* AND *U. TENUIS* (PISCES, GADIDAE) IN NEW ENGLAND. FISH BULL 72(2):481-495. The seasonal distribution patterns of sibling hakes, *Urophycis chuss* and *U. tenuis*, differ from one another in depth and geographic area and within each species by life history. *Urophycis chuss* spawns off southern New England in depths of less than 60 fm and probably at temperatures between 5 and 10 °C. Two major spawning concentrations occur, one east of Block Island, the other on the southwest part of Georges Bank. Spawning in the Gulf of Maine probably occurs inshore at depths shoaler than 30 fm. After spawning, the adult fish disperse, and the larger individuals move offshore into water 60 fm or deeper where the mature fish remain until the following spring. Juvenile *U. chuss* are inquiline within sea scallops, *Placopecten magellanicus*, until they outgrow their hosts or until water temperatures, colder than about 4 °C, either kill the hake or force them to seek out warmer temperatures in deeper water. Immature *U. chuss* remain in the vicinity of the scallop beds if water temperatures are compatible until the fish are in their second year of life. During that autumn, the fish migrate inshore to within 30 fm and remain until water temperatures drop to about 4 °C, at which time they move to warmer, deeper water along the offshore shelf. The following spring, these fish migrate inshore with the older adult fish during April and by summer are mature and attain the typical seasonal behavior of adults. Immature *U. tenuis* in the Gulf of Maine occur at all depths but tend to remain in shallower water than the adults during the winter. Mature *U. tenuis* migrate inshore in the northern Gulf of Maine in the summer, disperse in the fall, and move into the deepest area of the Gulf in the winter. Along the eastern edge of Georges Bank and west of there, both immature and mature *U. tenuis* are fish of the continental slope. Both stages occur over the shelf in small numbers, but at all seasons the highest concentration is found deeper than 100 fm. The distribution patterns of these two sibling species are not coincidental, as assumed in the past. Rather, they are complementary. *Urophycis chuss* is more abundant in the Mid-Atlantic Bight, whereas *U. tenuis* is more abundant on the Scotian shelf, in the Gulf of St. Lawrence, on the Grand Banks. They occur together most often in the Gulf of Maine. But even there, *U.*

chuss is more abundant in the southwest sector and *U. tenuis* predominates in the northern part and in the Bay of Fundy.

Keywords: Benthos-*Placopecten*, Fish-*Urophycis*

MYATT, D.O. 1982. APPLICATION OF MIDWATER FISH ATTRACTORS FOR RECREATIONAL FISHERY IMPROVEMENT IN THE SOUTH ATLANTIC BIGHT. IN: MID-ATLANTIC ARTIFICIAL REEF CONFERENCE, A COLLECTION OF ABSTRACTS, J.D. MURRAY, (ED.), NJ SEA GRANT REPORT 78:10.

Keywords: Artificial reefs

MYTELKA, A.I.; CIANCIA, J.; DELGADO, R.R.; LEVINSON, A.M.; O'CONNOR, T.P.; PRAGER, J.C.; PRESSMAN, W.B.; REGNA, E.A.; SADAT, M.M.; TRIPP, J.T.B.; WENDELL, M. 1982. MANAGEMENT OF INDUSTRIAL WASTES. IN: ECOLOGICAL STRESS AND THE NEW YORK BIGHT: SCIENCE AND MANAGEMENT. PROCEEDINGS OF A SYMPOSIUM ON THE ECOLOGICAL EFFECTS OF ENVIRONMENTAL STRESS, NEW YORK, NY, JUNE 10-15, 1979, G.F. MAYER, (ED.), ESTUARINE RESEARCH FEDERATION, COLUMBIA, SC, pp. 135-143. A management system for the New York Bight must be capable of achieving and protecting water quality by preventing pollutants that adversely affect marine life and the ecosystem from entering Bight waters. Although the continental shelf beyond the New York and New Jersey coasts has not yet been damaged severely by waste disposal, the Bight Apex is degraded. Improved environmental conditions may permit greater industrial and recreational use of those portions of the Bight closest to urban population centers. Interdisciplinary research is needed to understand and control the effects of various pollutants on the Bight. Resulting information must be generally available. National effluent limitations and industrial pretreatment regulations must be developed and enforced. Public and private treatment facilities should be required to monitor their discharges for designated toxic materials. New and innovative approaches to attain industrial pretreatment and direct discharges standards must also be encouraged.

Keywords: Management, Ocean disposal

NATIONAL MARINE FISHERIES SERVICE. 1972. THE EFFECTS OF WASTE DISPOSAL IN THE NEW YORK BIGHT. FINAL REPORT. SUBMITTED TO U.S. ARMY CORPS OF ENGINEERS, COASTAL ENGINEERING RESEARCH CENTER, WASHINGTON, DC. NOAA/NMFS, MACF, SANDY HOOK LABORATORY, 9 SECTIONS, 82 pp. This report summarizes results of studies conducted to obtain data to assess the effects of waste disposal on the marine environment of the New York Bight. The studies involved the following: benthic macrofauna and meiofauna, crustacean diseases,

heavy metals, coliform bacteria, zooplankton, bottom-dwelling finfishes, chemical analyses, and nearshore water circulation.

Keywords: Benthos, Circulation, Ocean disposal, Pollutants-Metals, Pollutants-Water quality

NATIONAL MARINE FISHERIES SERVICE. 1972. THE EFFECTS OF WASTE DISPOSAL IN THE NEW YORK BIGHT. SECTION 4. FINFISH STUDIES. NOAA/NMFS, 27 pp. The report describes results of studies conducted to obtain data to assess the effects of waste disposal on the marine environments of the New York Bight. It concerns finfish studies involving species distribution and relative abundance, feeding habits, and somatic effects and parasites of fish found in the area.

Keywords: Fish, Ocean disposal, Parasites

NATIONAL MARINE FISHERIES SERVICE. 1972. THE EFFECTS OF WASTE DISPOSAL IN THE NEW YORK BIGHT. SECTION 2. BENTHIC STUDIES. NOAA/NMFS, 277 pp. The report describes results of studies conducted to obtain data to assess the effects of waste disposal on the marine environment of the New York Bight. It reports investigations of the benthic meiofauna and macrofauna distribution in the New York Bight, benthic microbiology, pathological effects of wastes on larger benthic crustaceans, and investigation of basic chemical variables affecting species diversity.

Keywords: Benthos, Disease, Ocean Disposal, Pollutants-Water quality

NATIONAL MARINE FISHERIES SERVICE. 1988. CHARACTERIZATION OF THE MIDDLE ATLANTIC WATER MANAGEMENT UNIT OF THE NORTHEAST REGIONAL ACTION PLAN. NOAA TECH. MEMO. NMFS-F/NEC-56.

Keywords: Fisheries

NATIONAL MARINE FISHERIES SERVICE. 1989. SHELL DISEASE OF CRUSTACEANS IN THE NEW YORK BIGHT. NOAA TECH MEMO NMFS-F/NEC74, 58 pp. A detailed examination has been made of the available information of shell disease of crustaceans, especially in those from the New York Bight, but including data from other areas as well. The study addressed three key questions: (1) Does shell disease constitute a serious problem in crustacean populations of the New York Bight, including continental shelf canyons near the Deepwater Municipal Sludge Dump Site; (2) is shell disease related to pollution; (3) does shell disease result in mortalities of crustaceans.

Keywords: Benthos, Disease

NATIONAL MARINE FISHERIES SERVICE. 1991. FISHERMAN'S REPORT. NORTHEAST FISHERIES CENTER BOTTOM TRAWL SURVEY, CAPE HATTERAS-WESTERN SCOTIAN SHELF, 5 MARCH-16 APRIL, 1991, *R/V DELAWARE II*.

Keywords: Fisheries, Monitoring

NATIONAL MARINE FISHERIES SERVICE. 1991. FISHERMAN'S REPORT. NORTHEAST FISHERIES SCIENCE CENTER BOTTOM TRAWL SURVEY, CAPE HATTERAS-WESTERN SCOTIAN SHELF, 9 SEPTEMBER-24 OCTOBER, 1991, *R/V DELAWARE II*.

Keywords: Fisheries, Monitoring

NATIONAL MARINE FISHERIES SERVICE, MIDDLE ATLANTIC COASTAL FISHERIES CENTER, SANDY HOOK LABORATORY. 1972. THE EFFECTS OF WASTE DISPOSAL IN THE NEW YORK BIGHT. SUMMARY FINAL REPORT SUBMITTED TO COASTAL ENGINEERING RESEARCH CENTER, U.S. ARMY CORPS OF ENGINEERS, WASHINGTON, D.C., 70 pp. The disposal of dredging spoils and sewage sludges has had a significant, and often deleterious effect on the living resources of the New York Bight. Heavy metals accumulated in sediments directly receiving the sludges and spoils had values often 100 times the background values found in apparently uncontaminated sediments collected at stations surrounding the disposal areas, off Barnegat Bay Inlet and in Delaware Bay. More important than the actual presence of these metals is their spread outward from the designated points of disposal. Heavy metals were found at stations north of both dumping sites as well as south along the length of the Hudson Canyon. Coliform bacteria were present in high concentrations throughout the areas receiving dredged spoils and sewage sludges. The bacteria has been transported outside the actual dumping areas; their pattern of distribution generally follows that found for heavy metals and organic materials. In our field studies we were unable to detect any effect of sewage sludge on the species composition or distribution of zooplankton. Although it is difficult to quantitatively determine the rate of change in environments receiving solid wastes and sewage, it is more difficult to predict the rate at which recovery would proceed following pollution abatement. Recovery of impoverished areas is low and waters which have been heavily polluted cannot be expected to return to their former condition or productivity. Ocean disposal of sewage sludges and dredging spoils has had deleterious effects in a number of different marine environments. We believe that it would be imprudent to shift ocean dumping further offshore unless it is done with considerable caution and supervision

Keywords: Ocean disposal, Reviews-Biological

NELSEN, T.A. 1979. SUSPENDED PARTICULATE MATTER IN THE NEW YORK BIGHT APEX: OBSERVATIONS FROM APRIL 1974 THROUGH JANUARY 1975. NOAA TECH MEMO ERL MESA, BOULDER, CO. 81 pp. Suspended particulate matter (SPM) concentration, distribution, and composition in the New York Bight Apex was studied. This report covers SPM data for the period April 1974 through January 1975 and extends the time series initiated in 1973. Suspended particulate matter in the New York Bight Apex can be broadly classified as natural and anthropogenic. Natural sources include the mineral and biological components of river runoff, plankton, eolian sources, resuspended bottom sediments, and material advected into the Apex by continental shelf currents. To this natural particulate matrix man introduces a complex mixture of particles derived from dredged materials, construction debris, sewage sludge, and industrial acid waste material. Observations reported here were taken on cruises separated by approximately one month and designated as Water Column Characterization (WCC) cruises.

Keywords: Apex, Particulates, Sediment transport

NELSEN, T.A.; GADD, P.E.; CLARKE, T.L. 1978. WIND-INDUCED CURRENT FLOW IN THE UPPER HUDSON SHELF VALLEY. J GEOPHYS RES 83(C12):6073-6082. Drawing from wind and current meter data, an empirical, semiquantitative model was developed for wind-induced current flow in the New York Bight Apex portion of the Hudson Shelf Valley. Data have shown that winds from 270°T (F50°), blowing for at least 9 hrs at speeds of K5 m/sec, can cause northward (upchannel) bottom flow in the shelf valley at velocities K40 cm/sec. Southern (downchannel) flow is initiated by winds from 75°T (F35°) blowing for at least 6 hrs at speeds of 4 m/sec. Seasonal variation in the wind field results in predominant upchannel flow from October to April with downchannel flow throughout the rest of the year.

Keywords: Circulation, Hudson Shelf Valley

NELSON, W.R.; INGHAM, M.C.; SCHAAF, W.E. 1976. LARVAL TRANSPORT AND YEAR-CLASS STRENGTH OF ATLANTIC MENHADEN, *BREVOORTIA TYRANNUS*. FISH BULL 75(1):23-41. A Ricker spawner-recruit model was developed for Atlantic menhaden, *Brevoortia tyrannus*, from data on the 1955-70 year classes. The number of eggs produced by the spawning stock was calculated as the independent variable to account for changes in fecundity due to changes in population size and age structure. A survival index was developed from deviations around the Ricker curve and was regressed on several environmental parameters to determine their density-independent effects. The recruit-environmental model accounted for over 85% of the variation in the survival index. Zonal Ekman transport, which acts as a mechanism to transport larval menhaden from offshore spawning areas to inshore nursery grounds, was the most significant parameter tested. Ricker functions for good and poor environmental years were developed, indicating the wide range of

recruitment that can be expected at different stock sizes. Comparisons of spawner-recruit relations for Pacific sardine and Atlantic menhaden indicated striking similarities. Surplus yield for the Atlantic menhaden fishery was calculated from observed and predicted survival, and compared with the actual performance of the fishery.

Keywords: Fisheries, Fish-*Brevoortia*

NEVES, R.J.; DEPRES, L. 1978. THE OCEANIC MIGRATION OF AMERICAN SHAD, *ALOSA SAPIDISSIMA*, ALONG THE ATLANTIC COAST. FISH BULL 77(1):199-212. The migratory route of American shad, *Alosa sapidissima*, in the Atlantic Ocean was studied using 14 years of catch data collected during bottom trawl surveys by the U.S. National Marine Fisheries Service (and its predecessor) and cooperating foreign countries. All shad catches occurred at bottom temperatures from 3 to 15 °C, with the most frequent catches between 7 and 13 °C. Water temperatures between initial and peak entry of shad into home estuaries along the Atlantic coast are within the same thermal regime (3-15 °C). During the summer, all shad catches occurred north of latitude 40°N in two primary areas: Gulf of Maine and an area south of Nantucket Shoals. Previous studies on food habits and differences in time of capture during National Marine Fisheries Service surveys indicated that shad were vertical migrators, probably following the diel movements of large zooplankters in the water column. Shad were generally absent from the Gulf of Maine by late autumn, and concentrations were found between latitude 39° and 41° N and then proceed north or south to natal rivers. Coastal surveys for river herring by North Carolina's anadromous fishery research program and commercial shad catches reported to the International Commission for the Northwest Atlantic Fisheries by member nations concur with our proposed bottom temperature (3-15 °C)-migratory route hypothesis for shad.

Keywords: Fish-*Alosa*

NEW YORK UNIVERSITY MEDICAL CENTER, INSTITUTE OF ENVIRONMENTAL MEDICINE, LANZA LAB. 1982. IDENTIFYING CHEMICAL SIGNATURES FOR DISPOSED DREDGED MATERIALS. FINAL REPORT TO U.S. ARMY ENGINEERS NEW YORK DISTRICT. 85 pp.

Keywords: Management, Ocean disposal

NEWMAN, L.M. 1982. CAN FISH AND FUEL COEXIST ON GEORGES BANKS? SEA GRANT TODAY 12(1):14-15.

Keywords: Management

NICHOLSON, W.R. 1978. MOVEMENTS AND POPULATION STRUCTURE OF ATLANTIC MENHADEN INDICATED BY TAG RETURNS. ESTUARIES 1(3):141-150. Over 968,000 adult Atlantic menhaden *Brevoortia tyrannus*, were tagged from 1967 to 1969 and over 85,000 juvenile menhaden were tagged from 1969 to 1973. Recoveries of these tagged fish through 1975 provide direct evidence that Atlantic menhaden consist of a single population that over-winters in offshore waters off the southern coast of the United States, moves northward in spring and stratifies along the coast by age and size during summer, and moves southward in late autumn.

Keywords: Fish-*Brevoortia*

NICHOLSON, W.R. 1972. POPULATION STRUCTURE AND MOVEMENTS OF ATLANTIC MENHADEN, *BREVOORTIA TYRANNUS*, AS INFERRED FROM BACK-CALCULATED LENGTH FREQUENCIES. CHESAPEAKE SCIENCE 13(3):161-174. As part of a continuing program begun in 1955, catches of Atlantic menhaden, *Brevoortia tyrannus*, were sampled for age and length at reduction plants from Florida to Massachusetts. For the years 1955-1964, lengths at the time of first annulus formation were back-calculated from age-1, -2, and -3 menhaden collected at each port. Length frequency distributions, derived from monthly and seasonal totals were plotted for the 1953-1963 year classes. Meristic data on population structure were reviewed. General conclusions drawn from these and other supporting data were (1) mixing of menhaden of all ages from all areas occurs south of Cape Hatteras, NC, during the winter, (2) at the time of first annulus formation in early spring, age-1 menhaden segregate along the coast by size, which increases from south to north, (3) all menhaden do not return to the same area they occupied the previous year, (4) for normal year classes, recruitment into the fishable population may not be complete until late in the second summer of life (age-1); for exceptionally large year classes recruitment may not be complete until the beginning of the third summer (age-2), and (5) Atlantic menhaden constitute a single homogeneous population, rather than two or more subpopulations as previously hypothesized.

Keywords: Fish-*Brevoortia*

NIMMO, D.R.; HAMAKER, T.L.; MATTHEWS, E.; YOUNG, W.T. 1982. THE LONG-TERM EFFECTS OF SUSPENDED PARTICULATES ON SURVIVAL AND REPRODUCTION OF THE MYSID SHRIMP, *MYSIDOPSIS BAHIA*, IN THE LABORATORY. IN: ECOLOGICAL STRESS AND THE NEW YORK BIGHT: SCIENCE AND MANAGEMENT. PROCEEDINGS OF A SYMPOSIUM ON THE ECOLOGICAL EFFECTS OF ENVIRONMENTAL STRESS, NEW YORK, NY, JUNE 10-15, 1979, G.F. MAYER, (ED.), ESTUARINE RESEARCH FEDERATION, COLUMBIA, SC, pp. 413-422. Methods are described for conducting short- and long-term laboratory tests to determine effects of suspended particulates on the life cycle of the mysid, *Mysidopsis bahia*. No apparent effects were observed on adults within 96 hrs; however, total populations were reduced to about 75% of controls within 28 days,

if tests were begun with a mixture of juveniles and gravid adults. At least two effects were noted: reduction in the number of juveniles released and mortality of the initial animals with time. Factors responsible for reduced populations included interference with feeding or mating, clogging of respiratory apparatus, and disorientation in water currents. These findings are discussed with respect to turbidity produced by mining of fossilized shells or dredging in estuaries.

Keywords: Benthos, Pollutants-Toxicity

NITKOWSKI, M.J.; DUDLEY, S.; GRAIKOSKI, J.T. 1977. IDENTIFICATION AND CHARACTERIZATION OF LIPOLYTIC AND PROTEOLYTIC BACTERIA ISOLATED FROM MARINE SEDIMENTS. MAR POLLUT BULL 8(12):276-279. Lipolytic and proteolytic bacteria were isolated from sediments at two sampling stations in the New York Bight Apex and one sampling station each in Sandy Hook Bay and Great Bay, New Jersey. The stations in the Bight Apex and Sandy Hook Bay have received industrial wastes and sewage for several decades, while Great Bay has received little of such materials. Proteolytic counts were 2-4 times higher and lipolytic counts generally 4 times higher in the polluted areas. Of the isolates taken from casein and lipid plates, 76% were gram-negative rods 80% of the latter were identified as *Vibrio* and *Pseudomonas*. The vibrios comprised >60% of the isolates from Station 4 (Great Bay) and Station 1 (Bight Apex), and were tested for their ability to break down casein, lipid, starch, and chitin. From Station 1, 75% of the *Vibrio* were active in degrading one or more substrates in addition to the substrate of the initial isolation medium from Station 4, 50% of the *Vibrio* were active.

Keywords: Apex, Bacteria, Bacteria-*Vibrio*

NOAA. 1977. ANNUAL INFORMAL WORKSHOP ON PHYSICAL OCEANOGRAPHY AND METEOROLOGY OF THE MIDDLE ATLANTIC AND NEW YORK BIGHTS. 2. ANNUAL WORKSHOP ON PHYSICAL OCEANOGRAPHY AND METEOROLOGY OF THE MIDDLE ATLANTIC AND NEW YORK BIGHTS PALISADES, NY, 15 NOV 1977. NOAA TECH. MEMO, C. PARKER, (ED.).

Keywords: Circulation, Remote sensing, Workshops

NORTON, M.G.; CHAMP, M.A. 1989. THE INFLUENCE OF SITE-SPECIFIC CHARACTERISTICS ON THE EFFECTS OF SEWAGE-SLUDGE DUMPING. OCEANIC PROCESSES IN MARINE POLLUTION, VOL. 4, SCIENTIFIC MONITORING STRATEGIES FOR OCEAN WASTE DISPOSAL. D.R. HOOD, A. SCHOENER, AND P.K. PARK, (EDS.), pp. 162-183.

Keywords: Monitoring, Ocean disposal-Sewage sludge

O'CONNOR, D.J.; THOMANN, R.V.; SALAS, H.J. 1977. WATER QUALITY. MESA NEW YORK BIGHT ATLAS MONOGRAPH 27, 104 pp. The water quality of New York Bight as measured by temperature, light, salinity, dissolved oxygen, various nitrogen and phosphorous forms, pH, heavy metals, coliform bacteria, and phytoplankton chlorophyll is described. Bottom dissolved oxygen percent saturation levels in the disposal areas of the Apex have decreased from 67% in 1949 to 30% in 1974. Surface total iron concentrations in the Apex have increased and are higher than background open ocean levels. Coliform bacteria influence appears to be confined to an area of 3.2 to 4.8 km (2 to 3 mi) radius from the discharge point of a sewage sludge barge dump. Nitrogen is generally the more important nutrient relative to phosphorous with respect to limiting phytoplankton growth in the Bight. Man's impact on the water quality of the region appears to be significant with more than 50% of the total input of iron, copper, cadmium, chromium, suspended solids, and total phosphorous attributed to barge discharges alone.

Keywords: Bacteria, Monitoring-MESA, Ocean disposal, Reviews-Chemical

O'CONNOR, J.M.; KLOTZ, J.B.; KNEIP, T.J. 1982. SOURCES, SINKS, AND DISTRIBUTION OF ORGANIC CONTAMINANTS IN THE NEW YORK BIGHT ECOSYSTEM. IN: ECOLOGICAL STRESS AND THE NEW YORK BIGHT: SCIENCE AND MANAGEMENT. PROCEEDINGS OF A SYMPOSIUM ON THE ECOLOGICAL EFFECTS OF ENVIRONMENTAL STRESS, NEW YORK, NY, JUNE 10-15, 1979, G.F. MAYER, (ED.), ESTUARINE RESEARCH FEDERATION, COLUMBIA, SC, pp. 631-653. Data are given on the concentrations of chlorinated pesticides, PCBs, and PAHs in the sediments, water, and biota of the Hudson River, New York harbor, and New York Bight. Major sources of organic contaminants to the estuarine/coastal system are, for pesticides, Hudson River transport and municipal wastewater; for PCBs, Hudson River transport, atmospheric fallout, and surface runoff; and for PAHs, atmospheric fallout, surface runoff, and oil spills. Major sinks for all contaminants are the harbor, the Lower Bay, and the Bight. Of the three classes of compounds, the most common contaminants in marine and estuarine biota are the PCBs. Pesticides and PAHs, although present in many organisms, occur at relatively low levels. Except for PCBs in striped bass from the Hudson River, no instances of contaminants exceeding U.S. Food and Drug Administration (FDA) Action Levels were recorded. The implications of these data for ecosystem management and reclamation are discussed.

Keywords: Pollutants-Loadings, Pollutants-Organic

O'CONNOR, J.M.; O'CONNOR, S.G. 1983. EVALUATION OF THE 1980 CAPPING OPERATIONS AT THE EXPERIMENTAL MUD DUMP SITE, NEW YORK BIGHT APEX. TECH REPORT D-83-3, US ARMY ENGINEER WATERWAYS EXPERIMENT STATION, 78 pp. The objective of the project was to assess the potential for placing a cap at the experimental Mud Dump site

and to determine reductions in environmental impacts related to capping. Contaminated sediment from dredging projects in the Hudson Estuary, Newark Bay, and contiguous waters were capped first with fine sediments from the Bronx River and Westchester Creek, then with sand from the Ambrose Channel. The capping resulted in a layer of sand about 1m thick lying atop the contaminated sediment. Physical, chemical, and biological studies were carried out to determine if the capping effect yielded an intact cap showing resistance to erosion, and if the effort reduced loss of organic and inorganic toxicants from the erosion, and if the effort reduced loss of organic and inorganic toxicants from the contaminated material to the water column. It was determined that a cap was successfully placed at the experimental dump site. The cap was still intact and in place after 16 months. Cap erosion was minor; prediction of cap life was in excess of 20 years under normal meteorological conditions. Major storm events, however, are capable of eroding the cap and exposing the contaminated material. During the 16 months of study, the contaminated material decreased in volume by about 4%. Part of the decrease was due to compaction, and part was due to loss of solids during dumping and deposition.

Keywords: Apex, Capping

O'CONNOR, J.M.; PIZZA, J.C. 1987. PHARMACOKINETIC MODEL FOR THE ACCUMULATION OF PCBS IN MARINE FISH. OCEANIC PROCESSES IN MARINE POLLUTION, VOL. 1, BIOLOGICAL PROCESSES AND WASTES IN THE OCEAN. J.M. CAPUZZO AND D.R. KESTER, (EDS.), pp. 119-129.

Keywords: Modeling, Pollutants-Bioaccumulation

O'CONNOR, J.M.; RACHLIN, J.W. 1982. PERSPECTIVES ON METALS IN NEW YORK BIGHT ORGANISMS: FACTORS CONTROLLING ACCUMULATION AND BODY BURDENS. IN: ECOLOGICAL STRESS AND THE NEW YORK BIGHT: SCIENCE AND MANAGEMENT. PROCEEDINGS OF A SYMPOSIUM ON THE ECOLOGICAL EFFECTS OF ENVIRONMENTAL STRESS, NEW YORK, NY, JUNE 10-15, 1979, G.F. MAYER, (ED.), ESTUARINE RESEARCH FEDERATION, COLUMBIA, SC, pp. 655-673. Despite the vast array of data on metals bioconcentration factors (BCF's) and levels of toxic metals in marine organisms, the data generally are not applicable to impact assessment. This is because adequate data are not available for defining metal species in seawater and marine sediments, and because laboratory-derived data for BCF's and toxic effects generally relate to metals species not measured in field studies. Metals partitioning from food and sediment and the potential for metals regulation in marine organisms were evaluated with the use of selected data from the New York Bight and other coastal systems. It was concluded from these data that marine organisms regulate essential and nonessential metals, although regulation by various species differed. Metals regulation is accomplished by several mechanisms, ranging from selective uptake and selective elimination to sequestration by metal-binding proteins. A general

scheme for internal metals regulation is provided, along with recommendations for future field and laboratory research.

Keywords: Modeling, Pollutants-bioaccumulation

O'CONNOR, J.S. 1979. A PERSPECTIVE ON NATURAL AND HUMAN FACTORS. IN: OXYGEN DEPLETION AND ASSOCIATED BENTHIC MORTALITIES IN NEW YORK BIGHT, 1976, NOAA PROFESSIONAL PAPER 11, R.L. SWANSON AND C.J. SINDERMANN, (EDS.), pp. 323-333. While human activities are very important sources of nitrogen and carbon loadings to the Bight, the quantities of some natural loadings have not yet been estimated. The natural contribution of carbon and nitrogen from along-shelf transport, shelf onwelling, and sediment regeneration could be major, but estimates are not available. Mathematical models of carbon/oxygen/nutrient dynamics in the Bight are being developed to refine the assessments in this volume. The extent of human contributions to this coastal eutrophication and seasonal oxygen depletion remains arguable. Annual variation in the degree of oxygen depletion is pronounced. Reductions in any significant, relatively constant BOD loading would, on the average, reduce the likelihood of anoxic events. Consequently, curbs on human waste loadings would reduce BOD in bottom waters of the inner Bight and, hence, the probability and severity of benthic mortalities.

Keywords: Anoxia, Apex, Benthos, Eutrophication, Modeling

O'CONNOR, J.S. 1981. STUDIES ON FATES AND EFFECTS OF POLLUTANTS IN THE NEW YORK BIGHT. COUNCIL MEETING, 1981, OF THE INTERNATIONAL COUNCIL FOR THE EXPLORATION OF THE SEA (WOODS HOLE, MA) (5 OCTOBER 1981). PUBL: ICES, COPENHAGEN (DENMARK) REPORT NO.: ICES-CM1981/E:21, 9 pp.

Keywords: Pollutants

O'CONNOR, T.P.; PARK, P.K. 1982. CONSEQUENCES OF INDUSTRIAL WASTE DISPOSAL AT THE 106-MILE OCEAN WASTE DISPOSAL SITE. IN: ECOLOGICAL STRESS AND THE NEW YORK BIGHT: SCIENCE AND MANAGEMENT. PROCEEDINGS OF A SYMPOSIUM ON THE ECOLOGICAL EFFECTS OF ENVIRONMENTAL STRESS, NEW YORK, NY, JUNE 10-15, 1979, G.F. MAYER, (ED.), ESTUARINE RESEARCH FEDERATION, COLUMBIA, SC, pp. 675-697. Industrial wastes are dumped beyond the edge of the continental shelf at the 106-Mile Ocean Waste Disposal Site. These wastes are mainly liquids that, in some cases, form a precipitate floc after mixing with seawater. Rather than descending to the sea floor, wastes are distributed primarily as plumes within the upper mixed layer. The method of dumping yields a plume with a maximum initial concentration of about 200 ppm waste. Within about four hours, the maximum concentration is reduced to approximately 10 ppm with a waste plume width of about 1 km. Further dilution

and plume growth proceed slowly, leading to the conclusion that storm events may be necessary to extensively dilute the waste. When compared to the frequency of dumping, the average flow through the dumpsite seems to be sufficient for each dump to be an independent event so that later dumps do not occur in previously created plumes. It is estimated that, on the average, the plumes move toward the southwest along the contour of the continental shelf. Laboratory studies have shown that oceanic strains of phytoplankton are less tolerant of waste than coastal strains of the same species, and that there is considerable variation in response to waste among species. Although no tested phytoplankton species have been found to be affected at 10 ppm waste, it is possible that within a waste plume there will be a readjustment of phytoplankton communities favoring more resilient species. Tests of this are proceeding, as are tests on the sublethal responses of zooplankton to wastes, histopathological and chemical analyses of field-collected organisms, studies of the stability of waste-derived organic compounds, and studies of the partitioning of waste constituents between dissolved and particulate phases.

Keywords: Monitoring, Ocean disposal

O'CONNORS, H.B.; DUEDALL, I.W. 1975. THE SEASONAL VARIATION IN SOURCES, CONCENTRATIONS, AND IMPACTS OF AMMONIUM IN THE NEW YORK BIGHT APEX. IN: MARINE CHEMISTRY IN THE COASTAL ENVIRONMENT, T.M. CHURCH, (ED.), pp. 636-663. Two sources of NH_4^+ input to the New York Bight have been identified: (1) Hudson River-Raritan Bay discharge into the Apex of the Bight through the Rockaway Point, New York-Sandy Hook, New Jersey, transect and (2) barge-dumped sewage sludge from the greater New York metropolitan region.

The Bight-ward flux of ammonium through the transect has been calculated for one 24-hr period in June and was found to be 5 to 10 times greater than the ammonium input from barge-dumped sludge from a typical two-day period in July. During the April bloom, the rate of phytoplankton uptake and the effect of freshwater dilution were found to decrease the NH_4^+ concentration a similar amount in the transect. The Hudson River plume was observed to be a persistent year-round feature near the New Jersey shore and was responsible for the advection of large amounts of chlorophyll *a* into the Bight.

Keywords: Hudson River plume, Pollutants-Loadings

O'CONNORS, H.B., JR.; POWERS, C.D.; WURSTER, C.F.; WYMAN, K.D.; NAU-RITTER, G.M.; ROWLAND, R.G. 1982. FATES AND BIOLOGICAL EFFECTS ON PLANKTON OR PARTICLE-SORBED PCBs IN COASTAL WATERS. IN: ECOLOGICAL STRESS AND THE NEW YORK BIGHT: SCIENCE AND MANAGEMENT. PROCEEDINGS OF A SYMPOSIUM ON THE ECOLOGICAL EFFECTS OF ENVIRONMENTAL STRESS, NEW YORK, NY, JUNE 10-15, 1979, G.F. MAYER, (ED.), ESTUARINE RESEARCH FEDERATION, COLUMBIA, SC, pp. 423-449. The adsorption and desorption of PCBs (Aroclor 1254) to and from organic and inorganic

particulates characteristic of coastal waters were examined, as were the effects of PCBs on biological processes in natural phytoplankton assemblages and common estuarine copepods. Partitioning of PCBs in aqueous particle suspensions appeared related to the amount of organic matter present. Particle-desorbed PCBs reduced growth rate, carbon fixation, and chlorophyll *a* content of natural phytoplankton assemblages incubated for several days *in situ* and were more toxic than an equivalent amount of PCBs added directly to water. When a single dose of PCBs (1 or 10 µg/l) were added directly to water containing a natural phytoplankton community, a dose-dependent suppression of cell biomass, photosynthesis, and chlorophyll *a* concentration was observed. Biomass within larger size classes predominantly diatoms, was greatly reduced. PCB uptake by two copepod species (*Acartica clausi* and *A. tonsa*) from water was asymptotic, reaching maximum concentrations in 30 hours. Mortality of *A. tonsa* in water containing 1 µg PCBs/l was greater than controls and was independent of the presence of PCB-contaminated food. However, in water containing 5, 10, or 20 µg PCBs/l, mortality was significantly greater in the presence of phytoplankton that had accumulated PCBs.

Keywords: Plankton, Pollutants-Organic, Pollutants-Toxicity

OBENCHAIN, C.L. 1981. A STUDY OF THE LARVAL FISH COMMUNITY IN THE NEW YORK BIGHT, JULY 1974 TO JUNE 1976. SECOND ICES SYMPOSIUM ON THE EARLY LIFE HISTORY OF FISH WOODS HOLE, MA 2 APRIL 1979. RAPP, P.-V. REUN, CIEM. THE EARLY LIFE HISTORY OF FISH: RECENT STUDIES. R. LASKER AND K. SHERMAN, (EDS.), VOL. 178:217-219. A 2-year study was conducted in the New York Bight west of 73 degrees 30'W and north of 40 degrees 15'N from July 1974 to June 1976 to observe the larval fish communities with an emphasis on seasonal shifts in distribution and species composition. Fifteen cruises were conducted using the standard MARMAP ichthyoplankton sampling procedures (Smith and Richardson 1977). For better comparison of data, cruises were combined into seasons according to mean surface temperatures and species composition. Seasonal trends in abundance, species composition, and distribution patterns are detailed.

Keywords: Fish, Monitoring, Plankton

OEY, L.-Y.; MELLOR, G.L.; HIRES, R.I. 1985. A THREE-DIMENSIONAL SIMULATION OF THE HUDSON-RARITAN ESTUARY. PART I: DESCRIPTION OF THE MODEL AND MODEL SIMULATIONS. J PHYS OCEANOGR 15:1676-1692. A time-dependent, three-dimensional, finite difference simulation of the Hudson-Raritan estuary is presented. The calculation covers July-September 1980. The model estuary is forced by time-dependent observed winds, tidal elevation at open boundaries, and river and sewage discharges. Turbulence mixing coefficients in the estuary are calculated according to a second-moment, turbulence-closure submodel. Horizontal diffusivities are zero in the simulation and small-scale eddies produced by the interaction of unsteady, three-

dimensional velocity and salinity fields with coastline and bottom bathymetry were resolved by the model. These eddies are important physical elements in shear dispersion processes in an estuary.

Model results show unstably stratified water columns produced by advection of waters of different densities. These instabilities produce intense mixing with vertical eddy diffusivities reaching 2-3 times their neutral values. They occur most frequently at slack currents, during initial stages of flooding currents and also during up-estuary wind events. These three-dimensional, time-dependent solutions extend previous analytical model results and are consistent with observations in partially mixed and well mixed estuaries. Model results show large subtidal response of velocity and salinity fields to wind forcing. Wind forcing modifies the density-induced flows in deep channels in the estuary and also the horizontal circulation in Raritan Bay where the average water depth is less than 5 m and tidal currents are weak.

Keywords: Estuaries, Modeling-Hydrodynamic

OEY, L-Y.; MELLOR, G.L.; HIRES, R.I. 1985. A THREE-DIMENSIONAL SIMULATION OF THE HUDSON-RARITAN ESTUARY. PART II: COMPARISON WITH OBSERVATION. J PHYS OCEANOGR 15:1693-1710. Results from a time-dependent, three-dimensional numerical simulation of the Hudson-Raritan estuary are compared with observations. The comparison includes: (1) instantaneous salinity contours across a transect in the estuary; (2) amplitudes and phases of tidal constituents at four tide gauge and five current meter stations; (3) mean currents at nine meter locations, and mean salinity in the Hudson River; (4) kinetic energy spectra; and (5) response to wind forcing of subtidal current at an observational station near the mouth of the estuary.

Observations confirm the model's prediction of existence of density advection instabilities induced by differential advection of the three-dimensional density field. These instabilities produce intense vertical mixing and should significantly modify dispersion processes in the estuary. Effects of neap-spring tides on vertical stratifications are also simulated by the model. Simulated M_2 phases at three tide gauge stations show improvement over the M_2 phases obtained from a two-dimensional model. Simulated (instantaneous and mean) currents compare reasonably well with observations, except at narrow channel regions where the model's resolution is inadequate. Simulated "density-induced" mean currents are weaker than those observed, a discrepancy attributed to neglect of temperature variations in the model. Horizontal diffusion coefficients are null in this model. The burden of horizontal dispersion is generally handled well by the model's correct simulation of the k^{-3} transfer spectrum law at high wave number k . In narrow rivers that are modeled two-dimensionally (x,z) the estimate of the horizontal dispersion due to vertical variabilities in velocity and salinity appears to be correct; however, mixing by lateral variability is absent so that the saline intrusion is somewhat underpredicted. At the mouth of the estuary, simulated subtidal current responses to wind forcing generally agree with observed responses. The response is partly barotropic, which is a result of balance between

bottom friction, sea level setup from the adjacent continental shelf and wind stress, modified by local vertical velocity shears and baroclinic responses.

Keywords: Estuaries, Modeling-Hydrodynamic

OEY, L-Y.; MELLOR, G.L.; HIRES, R.I. 1985. A THREE-DIMENSIONAL SIMULATION OF THE HUDSON-RARITAN ESTUARY. PART III: SALT FLUX ANALYSES. J PHYS OCEANOGRAPHY 15:1711-1720. Salt fluxes and volume transports in an estuary vary considerably over subtidal time scales of a few days to weeks in response to wind and neap-spring tidal forcings. Results from a numerical simulation of the Hudson-Raritan estuary are used to study subtidal variations of salt fluxes and the physical mechanisms for salt balance in the estuary. Simulated salt fluxes are compared with available observations. Observations support the model's finding that analysis of volume and salt fluxes based on short-length data records (<30 days) can lead to misleading conclusions.

"Tidal trapping" effects due to coastline irregularities contribute most to the salt balance at the Sandy Hook-Rockaway Point transect and at the Narrows. A two-week observational record is analyzed to support this finding. Simulated subtidal variation of the tidal trapping term at the Sandy Hook-Rockaway Point transect compares well with that observed. In Raritan Bay, where tidal currents are weak and effects of winds are significant, contributions to salt balance from vertical velocity and salinity gradients and comparable to transverse contributions. This occurs despite the fact that surface-to-bottom salinity differences during the simulation period, a period of low freshwater flow-never exceed 0.5% throughout most regions of the bay. A two-dimensional, depth-integrated $xy-t$ model, in which the horizontal dispersion coefficients are modeled empirically, may not perform well in this case.

Keywords: Estuaries, Modeling-Hydrodynamic

OGREN, L. 1967. AUTOMOBILE BODY REEF STUDY. IN: PROGRESS IN SPORT FISHERY RESEARCH, US BUR SPORT FISH WILDL RESOUR PUB 39:12-13. Scuba observations on fouling and fish populations on a pilot artificial reef are discussed.

Keywords: Artificial reefs

OGREN, L.; CHESS, J.; LINDENBERG, J.L. 1968. MORE NOTES ON THE BEHAVIOR OF YOUNG SQUIRREL HAKE. UNDERWATER NAT 5:38-39. Young squirrel hake were observed using gastropod egg cases for shelter while adults used the larger artificial reef materials.

Keywords: Artificial reefs, Fish-*Urophycis*

OLLA, B.L.; BEJDA, A.J.; MARTIN, D.A. 1975. ACTIVITY, MOVEMENTS, AND FEEDING BEHAVIOR OF THE CUNNER, *TAUTOGA OLABRUS ADSPERSUS* AND COMPARISON OF FOOD HABITATS WITH YOUNG TAUTOG, *TAUTOGA ONITIS* OFF LONG ISLAND, N.Y. FISH BULL 73(4):895-900. Daily and seasonal behavior studied (feeding, territorially, night, etc.) found daylight activity to be closely related to shelter.

Keywords: Artificial reefs, Fish-*Tautoga*

OLSON, D.B.; BACKUS, R.H. 1985. THE CONCENTRATING OF ORGANISMS AT FRONTS: A COLD-WATER FISH AND A WARM-CORE GULF STREAM RING. J MAR RES 43:113-137. Net hauls made in and around a warm-core Gulf Stream ring in April and June 1982 suggest a concentrating of the mesopelagic fish *Benthosema glaciale* (family Myctophidae) in the frontal zone at the east edge of the ring. In April, *Benthosema* was found in very small numbers in the two-month old ring, as was to be expected from the subpolar-temperate distribution of this fish and the warm-water origin and age of the ring. By June, age-0 fish had been recruited to the population susceptible to capture by the midwater trawl. These young fish were about five times as abundant at the frontal zone of the ring and about twice as abundant in the ring center as in the adjacent slope water. It is proposed that the increased abundance at the ring front results from a concentrating of the original slope-water population by convergence. The increase of *B. glaciale* in the center of the ring may be associated with the inwardly spiralling streamers observed in satellite images.

A simple advection/diffusion model for both the fish and a passive tracer of the fluid is used to consider a mechanism that might have concentrated the fish at the ring edge. It is assumed that the fish can counter the vertical flow in order to maintain their preferred depth. Swimming in the horizontal is assumed to be random. The result of this behavior is that the fish and the passive tracer are affected differently in flow fields such as those in rings. Solutions to the model equations lead to the conclusion that the abundance of fish at the ring front can be accounted for by convergence. The model and the divergence pattern in the ring, calculated from hydrographic data, show the time necessary to effect the hundred-fold increase in abundance that was observed in the ring front between April and June to be on the order of two weeks to a month. We suggest that the concentrating mechanism described is widely applicable to a variety of frontal phenomena and to a variety of planktonic plants and animals.

Keywords: Circulation, Fish-*Benthosema*, Modeling

OU, H.W.; BEARDSLEY, R.C.; MAYER, D.; BOICOURT, W.C.; BUTMAN, B. 1981. AN ANALYSIS OF SUBTIDAL CURRENT FLUCTUATION IN THE MIDDLE ATLANTIC BIGHT. J PHYS OCEANOGR 11(10):1383-1392. Subtidal current fluctuations in the Middle Atlantic Bight are examined from current-meter data collected in 1975 and 1976. Spectral analysis provides evidence for both locally wind-forced response and free waves that propagate

downshelf which are not correlated with the local wind. A simple empirical model has been constructed to fit two linearly independent plane waves to the observed current spectra. Application of the model to the current data obtained at a pair of stations in the New York Bight during the period of October 26, 1975, to April 4, 1976, indicates that the two waves propagate in opposite directions along the coast, and with the additional evidence from rotary-coefficient calculations, it is suggested that they correspond to the forced and free waves speculated upon earlier.

Keywords: Circulation, Modeling-Hydrodynamic

OU, H.W.; HOUGHTON, R. 1982. A MODEL OF THE SUMMER PROGRESSION OF THE COLD-POOL TEMPERATURE IN THE MIDDLE ATLANTIC BIGHT. J PHYS OCEANOGR 12(10):1030-1036. A simple one-dimensional model (in the alongshelf direction) that incorporates spatially non-uniform heating, advection, and initial temperature field is proposed to explain the summer progression of the cold-pool temperature in the Middle Atlantic Bight. The observed local cooling is shown to require an upstream cold water source at the onset of the heating season. The observed secondary temperature minimum that stagnates at the Hudson Shelf Valley and the observed thermal front in the New York Bight can be explained by the alongshelf variation of the heating rate which is attributed mainly to the varying shelf width and, hence, the heat capacity of the cold-pool. Although the model is highly idealized, a crude simulation using the input functions inferred from data has reproduced all the gross features observed in the thermal field.

Keywords: Miscellaneous-Physical, Modeling

PARARAS-CARAYANNIS, G. 1973. OCEAN DUMPING IN THE NEW YORK BIGHT: AN ASSESSMENT OF ENVIRONMENTAL STUDIES. TECH MEMO 39, COASTAL ENGINEERING RESEARCH CENTER, US ARMY ENGINEERS, 172 pp. The report summarizes short-term studies on effects of ocean dumping in the New York Bight. The studies include hydrographic, geological, chemical, and biological investigations and a feasibility study for a remote-controlled electronic sensing system to detect the location and dump status of waste disposal vessels. Circulation patterns were estimated by current meters and by seabed and surface drifters. Chemical analyses were made of the concentration of phosphorus, nitrate, total iron, dissolved oxygen, and chlorophyll *a*. Temperature, salinity, turbidity, and pH were measured. Sediment samples were analyzed for organic content and the heavy metal; and biological samples for heavy metals and mercury. Included are studies of benthic meiofauna and macrofauna, zooplankton, finfish, and bacteria and disposal of sewage sludge, dredge spoils, and acid-iron wastes. Findings are presented and analyzed for impact on ecology, water quality, and total environmental effects.

Keywords: Monitoring, Ocean disposal, Reviews-Biological

PARKER, C. (ED.). 1977. ANNUAL INFORMAL WORKSHOP ON PHYSICAL OCEANOGRAPHY AND METEOROLOGY OF THE MIDDLE ATLANTIC AND NEW YORK BIGHTS. 2. ANNUAL WORKSHOP ON PHYSICAL OCEANOGRAPHY AND METEOROLOGY OF THE MIDDLE ATLANTIC AND NEW YORK BIGHTS NOAA TECH. MEMO. MESA NEW YORK BIGHT PROJECT, STONY BROOK, NY. Twenty-one scientific presentations were given over the course of the two-day workshop. These were: Long Term Current Variability in a Midshelf Region Above the Hudson Shelf Valley, Diagnostic Model of Water and Oxygen Transport in the New York Bight, Long Wave Models of Currents in New York Bight, Remote Acoustic Sensing of Physical Processes in the Ocean, Shelf-Slope Exchange Distributions of Dissolved Rn-222 and Suspended Particulates, Time and Space Variability of Interleaving Structure at the Shelf Break in the New York Bight, Oceanographic Analyses from Data in the National Archives, Synoptic Study of the Shelf Water/Slope Water Front's Mesoscale Structure, Hydrographic Reconnaissance of the Wilmington Canyon's Impact on the Shelf Water/Slope Water Front, Small Scale Study of the Shelf Water/Slope Water Front's Convergence Zone, Forcing Mechanisms of the Shelf-Slope Front from the Chesapeake Bay through Georges Bank, Efforts of the Atlantic Environmental Group to Construct an Environmental Data Base for Fishery Climatology, Studies in the Cape Cod-Cape Hatteras Area, Operational Marine Environmental Prediction Programs of the Techniques Development Laboratory, Oil Spill Trajectory Forecast, Progress in the Development of a Three-Dimensional Baroclinic Model of the MAB, Coastal Water Variability on the Mid-Atlantic Bight, Further Studies of the Circulation in the Middle Atlantic Bight Using Box Models Spreading and Mixing of the Hudson River Effluent into the New York Bight, Fine Structure and Instability in the Shelf/Slope Front, Strong Gulf Stream Eddy Currents Indicated by Losses of Crab Traps on the Continental Slope, and Cyclosonde Measurements in the New York Bight.

Keywords: Miscellaneous-Physical, Workshops

PARKER, C.A. 1985. RECURRING HYPOXIA IN THE NEW YORK BIGHT. ESTUARIES 8(2B):46A. In summer 1976, the New York Bight experienced mass mortalities of benthic marine organisms caused by the development of hypoxic conditions in subpycnocline waters. This paper explores many of the oceanographic and meteorological processes that were hypothesized as contributors to the recurring problem. A statistical analysis of the significance of some of the processes and phenomena as they relate to dissolved oxygen concentrations is made. The pycnocline depth, mixing, current reversals, and phytoplankton blooms are included in the analysis.

Keywords: Anoxia, Benthos, Plankton

PARKER, J.H.; DUEDALL, I.W.L O'CONNORS, H.B., JR.; WILSON, R.E. 1976. RARITAN BAY AS A SOURCE OF AMMONIUM AND

CHLOROPHYLL *a* FOR THE NEW YORK BIGHT APEX. IN: MIDDLE ATLANTIC CONTINENTAL SHELF AND THE NEW YORK BIGHT. PROCEEDINGS OF THE SYMPOSIUM AMERICAN MUSEUM OF NATURAL HISTORY, NEW YORK CITY, NOVEMBER 3-5, 1975, M.G. GROSS, (ED.), SPECIAL SYMPOSIA 2:212-219. Measurements in June 1974 and 1975 in Raritan, Sandy Hook, and Lower New York Bays showed that water nearest Sandy Hook had low salinity and high Chlorophyll *a* (10-60 mg/m³) and NH₄⁺ concentrations (10-40 μ M). Sandy Hook Bay had the highest Chlorophyll *a* values (45-90 mg/m³) and low NH₄⁺ concentrations (5-8 μ M). High Chlorophyll *a* concentrations (about 50 mg/m³) were also found at the center of Raritan Bay accompanied by high NH₄⁺ concentrations (60-70 μ M). Near Rockaway Inlet, NH₄⁺ concentrations were 0-40 μ M while Chlorophyll *a* values were minimal (3-4 mg/m³). The Narrows also showed high NH₄⁺ (15-40 μ M) and low Chlorophyll *a* concentrations (0-10 mg/m³).

By comparing the salinity, ammonium, and chlorophyll *a* distributions at the Sandy Hook-Rockaway Point transect with the characteristics of the different sources of water flowing out to the Bight, an identification of water masses at the transect is possible.

Keywords: Pollutants-Loadings

PARKER, J.H.; WOODHEAD, P.M.J.; DUEDALL, I.W.; CARLETON, H.R. 1981. COAL WASTE ARTIFICIAL REEF PROGRAM, PHASE 3, VOL. 1: SUMMARY REPORT. ELECTR POWER RES INST COAL COMBUST SYST DIV REPORT EPRI CS 2009(1), 79 pp. Program objectives and basic principles which make coal waste technically feasible are presented. Initial lab bioassays and production success of the blocks are reported.

Keywords: Artificial reefs

PARKER, J.H.; WOODHEAD, P.M.J.; DUEDALL, I.W. 1981. COAL WASTE ARTIFICIAL REEF PROGRAM, PHASE 3, VOL. 2: SUMMARY REPORT. ELECTR POWER RES INST COAL COMBUST SYST DIV REPORT EPRI CS 2009(2), 451 pp. The chemical and physical characteristics of fly ash and scrubber sludge and their interactions in seawater systems are analyzed in laboratory bioassays and field tests. Block construction techniques are discussed. Results suggest the materials are compatible with the marine environment.

Keywords: Artificial reefs

PARKER, J.H.; WOODHEAD, P.M.J.; DUEDALL, I.W.; CARLETON, H.R. 1982. COAL WASTE ARTIFICIAL REEF PROGRAM, PHASE 4A, ELECTR POWER RES INST COAL COMBUST SYST DIV REPORT EPRI CS 2574, 361 pp. This program monitored a reef built of blocks of coal waste, reporting on

block deterioration, chemical leaching into the food chain, reef stability, and fish population dynamics.

Keywords: Artificial reefs

PARTCH, E.N. 1990. DISPERSION OF SINKING PARTICLES AT DEEPWATER DUMPSITE-106. OCEANIC PROCESSES IN MARINE POLLUTION, VOL. 6, PHYSICAL AND CHEMICAL PROCESSES: TRANSPORT AND TRANSFORMATION. D.J. BAUMGARTNER AND I.W. DUEDALL, (EDS.), pp. 64-72.

Keywords: Ocean disposal-106 mile, Sediment transport

PATCHEN, R.C.; GOTTHOLM, B.W. 1981. THE RESPONSE OF THE SHELF TO HURRICANE BELLE AUGUST 1976. NOAA TR NOS-89, 39 pp. On August 10, 1976, Hurricane Belle passed through the New York Bight. The data collected include meteorological information from the National Weather Service, water level information from the National Ocean Survey, and current meter and salinity/temperature/depth (STD) information from the Marine Ecosystem Analysis Program. Hurricane Belle can be classified as a fast-moving storm translating over a two-layer density structure. The STD information and the temperature records obtained at the current meter locations indicate that a cooling and mixing of the surface waters was observed at stations to the right of the storm, and that only weak mixing was observed at stations directly in the path of the storm. At current meter locations on deeper areas of the continental shelf (greater than 55 m), the baroclinic response of a generation of internal inertia-gravity waves in the lee of the hurricane was seen in two layers. For stations on the shallower area of the shelf (less than 55 m), a strong barotropic response indicated by the generation of localized quasi-geostrophic barotropic Rossby waves, 18 to 20 hours after the hurricane entered the New York Bight, was observed.

Keywords: Miscellaneous-Physical

PAULSEN, B. 1963. THE REEFS AT FIRE ISLAND. SALTWATER SPORTSMAN 165:20-21, 54. The cooperative effort that resulted in an artificial reef of building rubble off Fire Island is described.

Keywords: Artificial reefs

PAYTON, B.M. 1985. OCEAN DUMPING IN THE NEW YORK BIGHT. ENVIRONMENT 27(9):26-32. If all goes as planned this year, the U.S. Congress may take a big step toward cleaning up the New York Bight, an area some scientists have called the most polluted coastal waters in the world. House sponsors hope that an amendment to the Ocean Dumping Act and its companion bill in the Senate will be voted on before the end of November. If enacted, the

legislation would prohibit the current practice of sewage sludge dumping at a site 12 miles off the shore of New York City. In April the federal Environmental Protection Agency announced its intention to close the dump site within 18 months.

Keywords: Management, Ocean disposal

PEARCE, J. 1971. INDICATORS OF SOLID WASTE POLLUTION. MAR POLLU BULL 2(1):11. Certain solid wastes having a high organic content (dredge spoils and sewer sludge), are not easily dissolved in the aqueous phase of the environment and do not readily enter into biological systems. Such wastes can be carried considerable distances from the point at which they are initially discharged. During a period of time in which the solid organic wastes may impinge on a particular benthic environment, the waste has a significant effect, either by actually burying the benthic flora and fauna or by decreasing the ambient oxygen supply through the bacterial reduction process. After the sewer sludge or organic dredge spoil debris has moved, it becomes difficult to detect visible effects of pollution. Observations made during an investigation of communities of marine organisms which have been impinged upon by sewer sludges and dredged spoils indicate that certain species of tubicolous polychaete worms are able to mark the chronological sequence of exposure to solid wastes.

Keywords: Benthos, Ocean disposal, Pollutants-Toxicity

PEARCE, J. 1972. THE EFFECTS OF SOLID WASTE DISPOSAL ON BENTHIC COMMUNITIES IN THE NEW YORK BIGHT. IN: MARINE POLLUTION AND SEA LIFE. M. RUIVO, (ED.). SURREY, ENGLAND: FAO FISHING NEWS LTD. pp. 404-411.

Keywords: Benthos, Ocean disposal, Pollutants-Toxicity

PEARCE, J. 1979. ESTUARIES. NATIONAL MARINE FISHERIES SERVICE. REPORT NO.: NOAA-80010910, 8 pp. Recent federal legislation which mandated upgrading of point source discharges and the total elimination of ocean dumping of sewage sludge is now being contested by various municipal and state agencies as well as by citizen groups. If major pollution abatement is not implemented, it seems certain that there can be little improvement in the condition of Raritan Bay and similar, highly degraded urban estuaries. It is important to note that while there is now a prohibition on the discharge of PCBs into the waterways and on certain uses of these compounds, the residual levels associated with sediments in the Hudson River and other waters are sufficient to affect the estuarine biota for some decades to come. Estuaries such as Raritan Bay must be rehabilitated to foster necessary fisheries production and insure high quality, safe food products for human consumption.

Keywords: Estuaries, Management, Seafood

PEARCE, J.; CARACCILOLO, J.; FRAME, A.; ROGERS, L.; HALSEY, M.; THOMAS, J. 1976. DISTRIBUTION AND ABUNDANCE OF BENTHIC ORGANISMS IN THE NEW YORK BIGHT, AUGUST 1968- DECEMBER 1971. NOAA-DATA REP ERL MESA-7, 119 pp. This report was prepared in order to provide machine listed data and certain statistical calculations (diversity and equitability) concerned with the distribution and abundance of benthic invertebrates at 26 stations in the New York Bight Apex. These data are listed by latitude and longitude as well as by station number, and they can therefore provide a baseline for the distribution and abundance of benthic invertebrates prior (1968-1971) to the more recent intensive benthic studies being conducted. The benthic samples were collected at various times of the year and seasonal data are available for most stations.

Keywords: Apex, Benthos, Monitoring-MESA

PEARCE, J.B.; CARACCILOLO, J.V.; HALSEY, M.B.; ROGERS, L.H. 1976. TEMPORAL AND SPATIAL DISTRIBUTIONS OF BENTHIC MACROINVERTEBRATES IN THE NEW YORK BIGHT. IN: MIDDLE ATLANTIC CONTINENTAL SHELF AND THE NEW YORK BIGHT. PROCEEDINGS OF THE SYMPOSIUM AMERICAN MUSEUM OF NATURAL HISTORY, NEW YORK CITY, NOVEMBER 3-5, 1975, M.G. GROSS, (ED.), SPECIAL SYMPOSIA 2:394-403 Benthic biota in the New York Bight Apex is characterized by high spatial and temporal variability. A considerable reduction in numbers of individuals per sample was observed between August 1973 and August 1974; on an average, numbers of individuals per station decreased from 417 to 174. Low species diversity (<0.500) was observed at some stations inside the Christiaensen Basin, an area characterized by high organic carbon values in sediment. Certain species, apparently tolerant of carbon-rich deposits of the Christiaensen Basin, were extremely abundant at some stations located in the basin. These include the anemone *Cerianthus*, four species of polychaete, and the bivalve *Nucula*.

Keywords: Apex, Benthos, Pollutants-Sediment

PEARCE, J.; CARACCILOLO, J.; HALSEY, M.; ROGERS, L. 1977. DISTRIBUTION AND ABUNDANCE OF BENTHIC MACROFAUNA AT NESTED STATIONS IN THE SEWAGE SLUDGE DISPOSAL AREA, NEW YORK BIGHT APEX, FEBRUARY 1975. NOAA DATA REPORT ERL-MESA-36, 38 pp.

Keywords: Benthos, Ocean disposal-12 mile

PEARCE, J.; CARACCILOLO, J.; HALSEY, M.; ROGERS, L. 1977. DISTRIBUTION AND ABUNDANCE OF BENTHIC ORGANISMS IN THE

NEW YORK-NEW JERSEY OUTER CONTINENTAL SHELF. NOAA DATA REP ERL MESA-30, 84 pp. The Outer Continental Shelf Survey was undertaken to provide information on a large area of the continental shelf beyond the 20-fathom contour. The information obtained from benthic samples taken from this area will be useful as a basis against which future changes in the ecosystem, due to natural or man-induced phenomena, can be evaluated. The five replicate grab samples from each station will provide a measure of within-station variability. This data report was prepared in order to provide machine listed data and certain statistical calculations, diversity, and equitability concerned with the distribution and abundance of benthic organisms collected during this cruise.

Keywords: Benthos, Monitoring-MESA

PEARCE, J.; CARACCILO, J.; HALSEY, M.; ROGERS, L. 1977. DISTRIBUTION AND ABUNDANCE OF BENTHIC MACROFAUNA IN THE SEWAGE SLUDGE DISPOSAL AREA, NEW YORK BIGHT APEX, FEBRUARY 1975. NOAA DATA REP ERL MESA-36, 41 pp. Sandy Hook Laboratory has been examining the impact of ocean waste disposal on the ecosystem of the New York Bight Apex since 1968. The benthic community in the Apex has been used to indicate impacts because certain bottom-dwelling organisms are often the first to be demonstrably affected by pollutants. The present data report was prepared in order to provide machine listed data and certain statistical calculations, diversity and equitability concerned with the distribution and abundance of benthic organisms found at 24 stations within the sewage sludge disposal area of the standard New York Bight MESA sampling grid. These samples will yield additional information on the impact of dumping in the New York Bight by providing a better distributional statistical base and will be used in comparison with earlier data collected from the area.

Keywords: Benthos, Monitoring-MESA, Ocean disposal-12 mile

PEARCE, J.B.; CHESS, J.R. 1968. DISTRIBUTION AND ECOLOGY OF ATTACHED MARINE ORGANISMS. IN: PROGRESS IN SPORT FISHERY RESEARCH, US BUR SPORT FISH WILDL RESOUR PUB 64:179. Fouling organism preference for selected substrate materials was evaluated using a field multiple-disc sampling technique. Rubber was found to be the most suitable substance.

Keywords: Artificial reefs

PEARCE, J.; MACKENZIE, C.; CARACCILO, J.; ROGERS, L. 1978. RECONNAISSANCE SURVEY OF THE DISTRIBUTION AND ABUNDANCE OF BENTHIC ORGANISMS IN THE NEW YORK BIGHT APEX: 5-14 JUNE 1973. NOAA DATA REP ERL MESA-41, 12 pp. The Division of Environmental Assessment, Northeast Fisheries Center, conducted a reconnaissance cruise to stations within the New York Bight apex between June 5

and June 14, 1973. A baseline to be used in assessing the impacts of contaminants from all sources, particularly ocean dumping, on the sediments in the area was sought by the investigation. Data from the samples when compared with data collected at later dates were expected to provide a baseline against which seasonal and temporal changes in the Bight may be assessed. A total of some two-hundred and sixty-five .1-m² Smith-McIntyre benthic grab samples were collected from the New York Bight Apex. Twenty-nine stations were sampled, with 20 replicate grab samples collected at 8 stations and 5 replicates collected at the remaining 21 stations. At each station two 3.4-cm (internal diameter) sediment cores were removed from each grab sample for standard geological analyses and one for heavy metals analyses. One 2.5-cm sediment core was also removed from each grab for meiofauna studies. Samples were collected from on board the R/V Atlantic Twin. Machine-listed species lists and counts, diversity and equitability calculations, and data obtained from sediment and heavy metals analyses for completed stations are presented on microfiche.

Keywords: Apex, Monitoring-MESA

PEARCE, J.B.; RADOSH, D.J.; CARACCILO, J.V.; STEIMLE, F.W. 1981. BENTHIC FAUNA. MESA NEW YORK BIGHT ATLAS MONOGRAPH 14, 84 pp. Considering the importance of New York Bight in transportation, industry, commercial and recreational fisheries, and beach and aquatic recreation, relatively little is known about its benthic fauna. In the last decade, several intensive studies were initiated of benthic macroinvertebrate communities in the Bight and the effects of physical/chemical factors, including pollution, on these living resources. This monograph is a summary of those studies. The benthic macroinvertebrate fauna of the New York Bight generally resemble the fauna common to most of the Middle Atlantic Bight and show considerable spatial and temporal heterogeneity in numbers of individuals, species richness and diversity. This is due largely to natural variation in topography and sediment type as well as to considerable accumulations of organic matter and contaminants, particularly in the Christiaensen Basin of the Bight Apex, principally the result of pollution and eutrophication. In the Christiaensen Basin, species diversity is greatly reduced. The relative importance of impacts by organic matter and toxicants on bottom-dwelling organisms is unknown. Seasonal low dissolved oxygen levels resulting from excessive amounts of organic matter may also have deleterious impacts on the benthos. Opportunistic species tolerant of deteriorated environments are common at benthic stations located within the Christiaensen Basin. Disease in marine demersal finfish and shellfish is unusually prevalent in the Bight. Interactions among species are important in accounting for variability in abundance and distribution. Comparisons of the benthic fauna of relatively uncontaminated areas in the Bight and adjunct embayments with other temperate coastal environments of the western Atlantic indicate considerable similarity in species and their abundance. Several species are distributed from estuarine embayments to and beyond the shelf-slope break. While the results of a decade of intensive studies have made New York Bight benthic fauna one of the most studied in the world, many areas still need to be explored, especially long-term variability,

meio- and microfauna, and the role of benthos in transporting pollutants throughout the demersal food web.

Keywords: Benthos, Christiaensen Basin, Disease, Monitoring-MESA, Reviews-Biological

PEARCE, J.; ROGERS, L.; CARACCILO, J.; HALSEY, M. 1977. DISTRIBUTION AND ABUNDANCE OF BENTHIC ORGANISMS IN THE NEW YORK BIGHT APEX, FIVE SEASONAL CRUISES, AUGUST 1973 THROUGH SEPTEMBER 1974. NOAA DATA REP ERL MESA-32, 803 pp. Between August 1973 and September 1974, personnel of the Division of Environmental Assessment, Northeast Fisheries Center, conducted a series of five seasonal cruises to stations within the New York Bight Apex in order to assess the impacts of contaminants in sediments on the ecosystem in this area. The present data report was prepared to provide machine listed data and certain statistical calculations concerned with the distribution and abundance of benthic organisms found during these five cruises.

Keywords: Apex, Benthos, Monitoring-MESA

PEARCE, J.; ROGERS, L.; THOMAS, J.; CARACCILO, J.; HALSEY, M.; MCNULTY, K. 1976. DISTRIBUTION AND ABUNDANCE OF BENTHIC ORGANISMS IN THE OUTER NEW YORK BIGHT AND PROPOSED ALTERNATE DISPOSAL SITES, JUNE 1974-FEBRUARY 1975. NOAA DATA REP ERL MESA-10, 69 pp. In the periods June 21-30, 1974 and February 22-23, 1975, a series of benthic grab samples were collected at stations located within the two proposed interim alternate disposal sites which might be utilized by municipalities which presently barge sewer sludge to a dumping site in the New York Bight Apex. The present data report was prepared in order to provide machine listed data and certain statistical calculations (diversity and equitability) concerned with the distribution and abundance of benthic invertebrates at 69 stations. These data are listed by latitude and longitude as well as by station number, and they can therefore provide a baseline for the distribution and abundance of benthic invertebrates useful for comparing future change in benthic assemblages in the outer New York Bight which might occur as a result of dumping sewer sludge, and other solid wastes and offshore mineral exploration and development.

Keywords: Apex, Benthos, Monitoring-MESA

PEARCE, J.; THOMAS, J.; CARACCILO, J.; HALSEY, M.; ROGERS, L. 1976. DISTRIBUTION AND ABUNDANCE OF BENTHIC ORGANISMS IN THE NEW YORK BIGHT APEX, 2-6 AUGUST 1973. NOAA DATA REP ERL-MESA-8, 140 pp. During the period August 2-6, 1973 a series of benthic grab samples were collected at standard sampling stations located on the New York Bight Apex MESA grid. The cruise was designed so that five replicate

Smith-McIntyre grab samples could be taken at each station. In addition to the benthic macrofauna, samples were collected for sediment grain size analyses and sediment heavy metal burdens; benthic meiofaunal studies including the nematodes, harpacticoid copepods and ciliate protozoans; and seabed oxygen consumption rates. The data are listed by latitude and longitude as well as station number and they can therefore provide a seasonal baseline for the distribution and abundance of benthic invertebrates useful for comparison with similar data collected in October 1973, January 1974, March 1974, and August 1974 at the same MESA grid stations.

Keywords: Apex, Benthos, Monitoring-MESA

PEARCE, J.; THOMAS, J.; CARACCILO, J.; HALSEY, M.; ROGERS, L. 1976. DISTRIBUTION AND ABUNDANCE OF BENTHIC ORGANISMS IN THE NEW YORK BIGHT APEX, 26 AUGUST-6 SEPTEMBER 1974. NOAA DATA REP ERL MESA-9, 91 pp. During the period August 26 through September 6, 1974 a series of benthic grab samples were collected at standard sampling stations located on the New York Bight Apex MESA grid. These samples were collected from the R/V Delaware 11. This data report was prepared to provide machine listed data and certain statistical calculations (diversity and equitability) concerned with the seasonal distribution and abundance of benthic invertebrates. These data are listed by latitude and longitude as well as by station number, and they can therefore provide a seasonal baseline for the distribution and abundance of benthic invertebrates useful for comparison with similar seasonal data collected in August 1973, October 1973, January 1974, and March 1974 at the same MESA grid station.

Keywords: Apex, Benthos, Monitoring-MESA

PECHKO, P.B.; FREEMAN, D. 1990. SELECTION OF A REPLACEMENT DREDGED MATERIAL DISPOSAL SITE IN THE NEW YORK BIGHT. U.S. ARMY CORPS OF ENGINEERS, NEW YORK DISTRICT, 12 pp. Since 1914, most dredged material removed from the New York/New Jersey metropolitan area has been disposed of at the Mud Dump Site which was designated by the U.S. Environmental Protection Agency (USEPA). Approximately 5.9 million cubic yards of dredged material are disposed annually at this site. It is estimated that the capacity of the Mud Dump Site will soon be reached, thereby necessitating the designation of a new replacement site. In the meantime, the Water Resources Development Act (WRDA) of 1986 mandated that only "acceptable" material would be considered for disposal at the existing Mud Dump Site. All other dredged material would be disposed of at alternative sites. Section 211 of the WRDA directed USEPA to provide an alternative site to the existing Mud Dump Site, which must be greater than 20 miles offshore.

A process is now underway to find both alternative and replacement ocean disposal sites for the existing Mud Dump Site. The scope of this siting feasibility report is limited to potential replacement sites, but mention of the USEPA's

concurrent alternate site study will be made. The first task of locating a new site is to define a Zone of Siting Feasibility (ZSF) within an economically and operationally feasible area. Information on critical uses of the Bight, marine resources, and the physical environment is gathered and used to identify candidate sites within the ZSF. Existing data was used wherever possible in order to keep costs reasonable.

Keywords: Ocean disposal-Dredged material

PELLENBARG, R. 1979. SILICONES AS TRACERS FOR ANTHROPOGENIC ADDITIONS TO SEDIMENTS. MAR POLLUT BUL 10:267-269. Polyorganosiloxanes (silicones) have been measured in the sediments of the New York Bight, ranging: 50 ppm organic silicon, dry weight basis, to below detection limit. Silicones are 37.9% silicon. Silicones correlated well ($r > 0.90$) with other organic constituents in the same sediment samples which have been used to characterize sewage inputs to the sediments. Silicones are offered as a totally synthetic, specific, chemical tracer for anthropogenic additions to the environment.

Keywords: Pollutants-Sediment

PEQUEGNAT, W.E.; JAMES, B.M.; KENNEDY, E.A.; FREDERICKS, A.D.; FAY, R.R.; HUBBARD, F. 1980. APPLICATION OF THE BIOTAL OCEAN MONITOR SYSTEM TO A STUDY OF THE IMPACTS OF OCEAN DUMPING OF DREDGED MATERIAL IN THE NEW YORK BIGHT. TECH REPORT FOR DEPARTMENT OF THE ARMY CORPS OF ENGINEERS, NEW YORK DISTRICT, 61 pp. During the period from June 20 through July 2, 1979, TerEco Corporation undertook a limited biological monitoring study at the Mud Dumpsite and environs in the outer part of New York Harbor and the Bight Apex. Analyses were run on three metals: cadmium, mercury, and lead. The only significant increase in cadmium as compared with reference controls occurred in *Fundulus* at the Mud Dumpsite and Gravesand Bay. Some lowering of concentrations occurred in both *Mytilus* and *Mercenaria*, but both of these bivalves have very high natural levels of cadmium. Results of the mercury analysis suggest that tissue accumulation of this material occurred in *Mercenaria* at the Mud Dumpsite. No significant accumulation occurred in either *Mytilus* or *Fundulus*. The only statistically significant tissue accumulation of lead occurred in *Mytilus* in B-BOMs but not in P-BOMs. This was particularly noteworthy at the Mud Dumpsite.

Several toxic chlorinated hydrocarbon pesticides were found in *Fundulus*, *Mytilus*, and/or trapped *Cancer irroratus*. Among the more toxic of these were (1) the cyclodiene compounds aldrin; (2) DDT-related compounds, DDT, DDD, DDE; and (3) such others as BHC and lidane. In addition, PCBs in the form of Archlor 1254 were found in all organisms tested. Of the above, the most toxic are aldrin, heptachlor, and heptachlor epoxide, which are not safe to mammals in concentrations exceeding 0.5 ppm for prolonged periods of time. Fortunately none

of these compounds accumulated in test organisms at levels above 0.11 ppm. PCBs reported as Aroclor 1254 tended to be higher than the pesticide burdens.

The three enzyme analyses indicate that the organisms exposed for 10 days in BOMs were under considerable environmental stress. However, although the Adenylate Energy Charge (EC) ratios were lower than might be desirable, they were still well above the point of inevitable mortality. Yet one can only conjecture how much lower (if any) the values would drop had the exposure been extended beyond 10 days. The truly unfortunate aspect of the study is that EC ratios could not have been run on the *Cancer irroratus* trapped in the B-BOMs. This would give us a definite idea as to the impact of the rather heavy burdens of pesticides and PCBs that these crabs were found to be carrying.

Keywords: Apex, Monitoring, Ocean disposal-Dredged material, Pollutants-Bioaccumulation, Pollutants-Sediment

PETERS, L.S.; O'CONNOR, J.M. 1982. FACTORS AFFECTING SHORT-TERM PCB AND DDT ACCUMULATION BY ZOOPLANKTON AND FISH FROM THE HUDSON ESTUARY. IN: ECOLOGICAL STRESS AND THE NEW YORK BIGHT: SCIENCE AND MANAGEMENT. PROCEEDINGS OF A SYMPOSIUM ON THE ECOLOGICAL EFFECTS OF ENVIRONMENTAL STRESS, NEW YORK, NY, JUNE 10-15, 1979, G.F.MAYER, (ED.), ESTUARINE RESEARCH FEDERATION, COLUMBIA, SC, pp. 451-465.

Amphipods (*Gammarus daiberi*), mysid shrimp (*Neomysis americana*), and striped bass (*Morone saxatilis*) were exposed to ¹⁴C-labeled PCB's and DDT in food and in water to determine contaminant accumulations under different conditions. These organisms accumulated both contaminants rapidly from the water. Levels in organisms of about 3-5 µg/g were observed during the first 48 hr of exposure in labeled water. PCB uptake from food and in the presence of suspended particulates was lower than that determined for direct water uptake. In general, bioconcentration factors for PCBs approximated 1×10^4 for food uptake, and ranged between 2×10^4 and 4×10^4 for water uptake. Organohalogen levels attained in test organisms during dietary experiments depended upon the amount of food present. The clearance of DDT by *G. daiberi* was more rapid than the clearance of PCBs, although the rates of uptake for the two compounds were similar during 48-hr exposure. The rapidity and substantial degree of organohalogen accumulation by zooplankton suggest that zooplankton compete with fishes for direct accumulation of these compounds from water. However, the means by which foraging organisms serve to alter the transfer of organic contaminants is complex. Bioaccumulation of chlorinated organics by estuarine organisms is dependent upon a variety of factors, including adsorption to particulates in the water column, amount of food and particulates present, and route of entry into the organism (*i.e.*, via direct water uptake or with food). Each of these factors is discussed with regard to contaminant levels common in the Hudson estuary and the coastal marine environment of the New York metropolitan region.

Keywords: Benthos, Estuaries, Pollutants-Organic, Pollutants-Toxicity

PHOEL, W.C.; REID, R.N.; RADOSH, D.J.; KUBE, P.R.; FROMM, S.A. 1985. STUDIES OF THE WATER COLUMN, SEDIMENTS AND BIOTA AT THE NEW YORK BIGHT ACID WASTE DUMPSITE AND A CONTROL AREA. OCEANS '85 "ENGINEERING AND THE ENVIRONMENT" SAN DIEGO, CA 12-14 NOV 1985. OCEANS '85 PROCEEDINGS: OCEAN ENGINEERING AND THE ENVIRONMENT, VOL. 2:945-948. *In situ* studies of the New York Bight acid waste disposal site and a control site on the Cholera Bank 10 km to the north-northeast were carried out in August 1982. Visual observation and color video tapes were made and sediments samples for infaunal analyses were taken to determine if there were differences between the two sites. Visual observations revealed obvious differences in the condition of the animals at each site and only minor differences in abundance. Core samples from the disposal site had slightly lower species diversity and numbers of polychaetes and crustaceans that did control samples. The water column and sediments at the disposal site were quite different from those at the control area in that the dump-site had high concentration of floc and aggregates of this floc. No material of this kind was observed at the control site.

Keywords: Miscellaneous-Chemical, Miscellaneous-Geological, Monitoring, Ocean disposal

PIERCE, R.J.; WRIGHT, T.D.; O'CONNOR, J.M. 1981. BIOMAGNIFICATION: RELATIONSHIP TO DREDGED MATERIAL DISPOSAL IN THE COASTAL MARINE ENVIRONMENT. ESTUARIES 4(3):258-259. Trophic transfer of heavy metals and organic contaminants from dredged sediments and other potential sources appears to be negligible in the marine environment. As an example, those studies which have made a concerted effort to separate the relative contribution of bioconcentration, bioaccumulation and biomagnification have concluded that the primary source of PCB residues in marine animals is direct uptake through equilibrium partitioning and not from food or through the food-chain. Food-web enhancement would presume increased levels in predators relative to their food sources. This is not the case in the Hudson Estuary-New York Bight area. PCBs in mackerel flesh (0.2 ppm wet weight) are similar to their zooplankton food (e.g., *Gammarus oceanicus*, 0.1 ppm; *Crangon*, 0.2 ppm).

Keywords: Fish-*Scomber*, Ocean disposal-Dredged material, Plankton, Pollutants-Bioaccumulation

PIOTROWICZ, S.R.; RAY, B.J.; HOFFMAN, G.L.; DUCE, R.A. 1972. TRACE METAL ENRICHMENT IN THE SEA-SURFACE MICROLAYER. J GEOPHYS RES 77(27):5243-5254. Sea-surface microlayer samples have been analyzed for the trace metals aluminum, copper, iron, manganese, nickel, lead, and vanadium by atomic absorption and neutron activation. Samples were collected with polyethylene screens in the estuarine waters of Narragansett Bay, Rhode

Island, the coastal waters of the New York Bight, and open ocean regions between Iceland and Nova Scotia. Metal enrichment in the particulate and chloroform-extractable fraction of the surface microlayer compared to water 20 cm below the surface varied from virtually none up to approximately 50 for copper, iron, and nickel and up to 20 for lead in the Narragansett Bay samples. There was no enrichment in the soluble, inorganic fraction of the surface microlayer for those metals in Narragansett Bay. The degree of surface enrichment was correlated with the presence of observable slicks on the water surface. None of the New York Bight or open ocean samples were collected while observable slicks were present. Significant enrichments in particulate and chloroform-extractable phases in the surface microlayer still occurred in the majority of cases in both areas. The variability of its occurrence and magnitude may be due to several factors, including the presence of coherent slicks, biological activity, and local pollution sources, both atmospheric and water. On the open ocean, atmospheric input of some trace metals to the surface microlayer may be quite significant. Where surface microlayer enrichment of trace metals does not occur, enrichment of these metals on sea-salt aerosols formed at the sea surface may also occur.

Keywords: Estuaries, Pollutants-Metals, Pollutants-Water quality

POLCYN, F.C.; SATTINGER, I.J. 1979. MARINE ECOSYSTEMS ANALYSIS PROGRAM: A SUMMARY OF REMOTE SENSING INVESTIGATIONS IN THE NEW YORK BIGHT. REP. ENVIRON. RES. INST. MICH. PUBL. ERIM, ANN ARBOR, MI, REPORT NO.: ERIM-131200-1-F, 165 pp. Remote sensing experiments were conducted by or for the National Environmental Satellite Service in April 1973 and April 1975. The data were collected from multi-altitude remote sensing operations (intermediate and high-altitude aircraft and the Landsat-1 satellite) and from surface operations to obtain concurrent *in situ* data. The resulting data were analyzed to obtain information on chlorophyll *a* distribution, suspended particulate concentration, Secchi disk transparency, sea surface temperature, water mass classification, and circulation, both at the surface and at 10 m depth. The results provide significant information on various water constituents, including those resulting from sewage and acid dumping, tidal processes, pollutant dispersal, and other dynamic processes occurring in the New York Bight.

Keywords: Circulation, Monitoring, Ocean disposal, Remote sensing

PORE, N.A.; BARRIENTOS, C.S. 1976. STORM SURGE. MESA NEW YORK BIGHT ATLAS MONOGRAPH 6, 43 pp. Storm surges, which are departures of sea level from normal, are of great concern in the New York Bight area whenever hurricanes or extratropical storms approach or cross the coastline. During such storms, sea level can increase to more than 10 ft (3.1 m) above normal. Especially damaging to the Bight region were the hurricanes of September 1938 and September 1960 and the extratropical storms of November 1950 and March 1962. Factors significant in storm surge generation are direct wind, atmospheric pressure, water transport by waves, the earth's rotation,

rainfall, and coastal configuration. Knowledge of the frequency and intensity of coastal storms likely to occur is important for protecting human life and property. The National Weather Service has developed a numerical model for forecasting hurricane storm surges and a statistical model for forecasting extratropical storm surges.

Keywords: Miscellaneous, Monitoring-MESA

POSMENTIER, E.S.; HOUGHTON, R.W. 1978. FINE STRUCTURE INSTABILITIES INDUCED BY DOUBLE DIFFUSION IN THE SHELF/SLOPE WATER FRONT. J GEOPHY RES 83(C10):5135-5138.

Intervals of negative stability have been observed which appear as part of distinct loops in the T-S diagram of CTD hydrographic stations near the shelf break in the New York Bight. These features occur within the shelf break frontal zone, which is associated with active interleaving between warm salty slope water and cooler fresher shelf water. Double-diffusive mixing is suggested as the mechanism responsible for the observed T-S correlations.

Keywords: Miscellaneous-Physical

POWERS, C.D.; NAU-RITTER, G.M.; ROWLAND, R.G.; WURSTER, C.F. 1982. FIELD AND LABORATORY STUDIES OF THE TOXICITY TO PHYTOPLANKTON OF POLYCHLORINATED BIPHENYLS (PCBS) DESORBED FROM FINE CLAYS AND NATURAL SUSPENDED PARTICULATES. J GREAT LAKES RES 8(2):350-357. Polychlorinated biphenyls (PCBs Aroclor 1254) were absorbed to natural (Hudson River and New York Bight) and commercial (illite) particles in the laboratory, then allowed to desorb for several hours into the surrounding aqueous medium in the presence of either of two laboratory strains of diatom species or a complete natural phytoplankton assemblage. Cell density, photosynthesis, and chlorophyll *a* concentration in the cultures were followed for 2 to 3 days. Cultures containing 90 micro grams of illite-bound Aroclor 1254/L of water were severely damaged within 4 hrs by which time 72% of the PCBs had desorbed from particles and become available to the diatoms. Similarly, a natural phytoplankton community, incubated under natural conditions in the presence of 50 micro grams of Hudson River sediment-associated PCB/l of water, registered significant reductions of photosynthesis and chlorophyll *a* content for at least 3 days. When PCB-bearing New York Bight particles were removed from the medium prior to the introduction of algae, sufficient desorbed PCBs remained to reduce growth rates and chlorophyll *a* content of the culture. The latter experiment clearly demonstrates particles to water to cell transfer of desorbed PCBs.

Keywords: Particulates, Plankton, Pollutants-Organic, Pollutants-Toxicity

PRATT, S. 1973. BENTHIC FAUNA. IN: COSTAL AND OFFSHORE ENVIRONMENTAL INVENTORY, CAPE HATTERAS TO NANTUCKET

SHOALS. S. SAILA, PROGRAM COORDINATOR, CHAPTER 5, pp. 1-70.
KINGSTON, RI: UNIV RHODE ISLAND MAR PUBL SERIES NO. 2.

Assessment of bottom-dwelling invertebrate resources may be approached at two basic levels. The first is at the species level, taking into consideration the distribution, physiology, and behavior of each species. This type of information is particularly important in managing exploited species. Reviews of literature on the life histories of commercially important benthic species are given in the fisheries chapter of this report. A review of studies on species and taxonomic groups that are not commercially important is provided in the second part of this chapter. Due to the large numbers of taxa involved it is clear that this review is not comprehensive. However, it contains information on some major groups. A second approach in resource assessment deals with the complete assemblages of animals occupying various habitats. Some variables at this level are species abundance, species diversity, and productivity of the assemblage. These variables are important in considering man's impact on the marine environment and are useful in describing offshore areas where the biology of constituent species is not known.

Emphasis herein is placed on the benthos of the continental shelf. Exploitation of shelf areas is accelerating throughout the Mid-Atlantic Bight. New activities such as mineral recovery, compete with those displaced from estuaries, such as spoil disposal, and with the traditional but expanding activities of fishing, recreation, navigation, and cable transmission.

Various regional and state agencies are presently establishing data bases for estuaries within the study area. The Chesapeake Research Consortium made up of the Virginia Institute of Marine Science, the Chesapeake Biological Laboratory, the Chesapeake Bay Institute, and the Chesapeake Bay Center for Environmental Studies of the Smithsonian Institution are preparing a data bank on bay phenomena and plan to use a systems analysis model for management plans. A bibliography is also being prepared by the same group. Other compilations of baseline information on inshore areas include the Long Island Sound Regional Study of the New England River Basins Commission and reports of coastal zone management programs of various states.

Keywords: Benthos, Management, Monitoring

PRONI, J.R.; NEWMAN, F.C.; SELLERS, R.L.; WALTER, D.J. 1982. NEW YORK SLUDGE TRACKING EXPERIMENT STAX-1. NOAA TECH. MEMO NOAA/OMPA, BOULDER, CO. Sewage sludge in the New York Bight has been detected using a modified 200 KHz acoustic echo sounder. The three-dimensional distribution of suspended material and its rate of diffusion have been determined after digital processing of data. Increased biological activity is apparently associated with the presence of sewage sludge. The detection of internal waves in 30 m of water is reported.

Keywords: Circulation-Internal waves, Monitoring, Ocean disposal-Sewage sludge

RACHLIN, J.W.; WARKENTINE, B.E. 1984. POPULATION GROWTH OF THE ATLANTIC RED HAKE *UROPHYCIS CHUSS* FROM THE OUTER NEW YORK BIGHT USA. ANNALS OF THE NEW YORK ACADEMY OF SCIENCES. W. N. SCOTT, AND F. L. STRAND, (EDS.), VOL. 435:331-332.

Keywords: Fish-*Urophycis*

RACHLIN, J.W.; WARKENTINE, B.E. 1987. DIETARY PREFERENCE OF THE SPOTTED HAKE, *UROPHYCIS REGIA*, FROM THE INNER NEW YORK BIGHT. ANNALS OF NEW YORK ACADEMY OF SCIENCES, VOL. 494. THIRD COLLOQUIUM IN BIOLOGICAL SCIENCES: CELLULAR SIGNAL TRANSDUCTION. 4 NOVEMBER 1985. F.L. STRAND, (ED.) pp. 434-437. A total of 156 *Urophycis regia*, part of the permanent fish collection of the Department of Ichthyology of the American Museum of Natural History in New York City (collected from waters off Little Egg Harbor, north of Brigantine Shoals, New Jersey), were evaluated for their growth characteristics and diet. The size of the fish ranged from 5.3-20.6 cm (standard length). While most of the animals were juveniles, scale analysis indicated the presence of three age classes in the population. A second-order polynomial regression equation represented the curve of best fit for the length-weight data: $Y = 0.0005X^2 - 0.006X + 0.02$. Diet had a Shannon-Weaver diversity index of 1.1412, and a Heip evenness distribution of 0.111. The generalized diet, for the most part, consisted of decapod crustaceans, mysids, amphipods, polychaete worms, copepods, nematodes, and *Etrumeus teres* (round herring).

Keywords: Fish-*Urophycis*

RACHLIN, J.W.; WARKENTINE, B.E. 1988. FEEDING PREFERENCE OF SYMPATRIC HAKE FROM THE INNER NEW YORK BIGHT. 4. COLLOQUIUM IN BIOLOGICAL SCIENCES: BLOOD-BRAIN TRANSFER NEW YORK, NY 3 NOVEMBER 1986. ANN. N.Y. ACAD. SCI., VOL. 529. FOURTH COLLOQUIUM IN BIOLOGICAL SCIENCES: BLOOD-BRAIN TRANSFER. F.L. STRAND, (ED.) pp. 157-159. A total of 156 *Urophycis regia* 133 *U. chuss*, and 145 *U. tenuis* were examined for their dietary diversity, evenness, overlap, and preference. Dietary data from the pooled stomach contents indicated that the resource base consisted of mysids (*Neomysis americana*), a decapod crustacean (*Crangon septemspinosa*), amphipods (*Aeginella longicornis*, *Calliopius laevisculus*, *Gammarus annulatus*, *G. marinus*, *Microdeutopus gryllotalpa*, and *Pontogenia inermis*), an isopod (*Edotea montosa*), a copepod (*Acartia* sp.), unidentified nematodes, and a fish (*Etrumeus teres*).

Keywords: Benthos, Fish-*Urophycis*

RACHLIN, J.W.; WARKENTINE, B. 1990. REEXAMINATION OF SOME POPULATION DYNAMICS OF THE SILVER HAKE IN THE NEW YORK BIGHT USA. NORTHEAST ENVIRON SCI 9(1-2):66-68. Recent evaluations of the growth characteristics of the silver hake (*Merluccius bilinearis*) population in the New York Bight indicate a doubling of the average weight at age of fish when compared with data for this population in 1957-58. Further, current data, when fitted to a Von Bertalanffy growth model, indicate that the population is approaching its asymptotic length at a faster rate than in the late 1950's. This would tend to demonstrate that these fish are now in better condition than they were in the earlier period. This may be due to improved forage resulting from a general improvement in the waters of the New York Bight.

Keywords: Fish-*Merluccius*

RACHLIN, J.W.; WARKENTINE, B.E.; RIVLIN, K.A. 1986. GROWTH RATE OF THE SILVER HAKE WHITING *MERLUCCIVS BILINEARIS* FROM THE NEW YORK BIGHT ATLANTIC OCEAN USA. ANNALS OF THE NEW YORK ACADEMY OF SCIENCES. C.D. BURRELL, AND F.L. STRAND (EDS.), VOL. 463:209-210.

Keywords: Fish-*Merluccius*

RAPPE, C.; BERGQVIST, P.A.; KJELLER, L.O.; SWANSON, S. 1991. LEVELS AND PATTERNS OF PCDD AND PCDF CONTAMINATION IN FISH CRABS AND LOBSTERS FROM NEWARK BAY, NEW JERSEY, USA AND THE NEW YORK BIGHT. CHEMOSPHERE 22(3-4):239-266. Samples of striped bass, crabs, and lobsters were collected in Newark Bay and the New York Bight. The fish muscle, the hepatopancreas, and meat from the crabs were subjected to congener specific analysis. All samples were found to be contaminated by 2,3,7,8-tetraCDD and a series of other highly hazardous 2,3,7,8-substituted congeners as well as less hazardous PCDDs and PCDFs. A value exceeding 6,000 ppt wet tissue weight of 2,3,7,8-tetraCDD was found in a sample of crab hepatopancreas, which seems to be the highest value so far reported in a food product. The crab meat, on the other hand, contained only 100 ppt. In general, crustaceans contained many congeners while fish samples contained only 2,3,7,8-substituted compounds. An unknown compound, possibly a tetrachlorodibenzothiophene, was the dominant peak in most crustacean samples.

Keywords: Benthos-*Cancer*, Benthos-*Homarus*, Fish-*Morone*, Pollutants-Bioaccumulation

REED, M.; JAYKO, K.; FRENCH, D.; SPAULDING, M.L.; ISAJI, T.; ROSEN, J. 1986. A MODEL SYSTEM FOR ESTIMATING FATE AND EFFECTS OF POLLUTANTS IN MARINE ECOSYSTEMS APPLICATION AND SENSITIVITY ANALYSES. SYMPOSIUM ON CONTAMINANT FLUXES

THROUGH THE COASTAL ZONE, NANTES, FRANCE, MAY 14-16, 1984
RAPP P V REUN CONS INT EXPLOR MER 186:80-103.

Keywords: Modeling

REID, R.N.; FROMM, S.A.; FRAME, A.B.; JEFFRESS, D.; VITALIANO, J.J. 1991. RESPONSES OF BENTHIC MACROFAUNA TO PHASEOUT OF SEWAGE SLUDGE DISPOSAL IN THE INNER NEW YORK BIGHT. COASTAL ZONE '91 3:1859-1873. From 1924 through 1987, sewage sludge was dumped at the "12 mile site" 22 km off northern New Jersey in the inner New York Bight. Inputs in the early 1980's were, at the time, the largest ever to any oceanic sludge dumpsite. The dumping increased sediment carbon and contaminant concentrations and altered assemblages of bottom-living invertebrates, especially in deeper waters west of the dumpsite. However, cause-effect relationships were unclear, partly because the area has also received carbon and contaminant inputs from other sources, primarily a dredged material dumpsite and the Hudson-Raritan estuary. The phaseout of sludge dumping between March 1986 and December 1987 provided an opportunity to clarify past fates and effects of the sludge, by studying responses of habitats and biota to removal of the input, and to add to the limited information available on sequences and rates of recovery of former dumpsites. As part of a multidisciplinary study, triplicate samples for benthic macrofauna and numerous sediment variables were taken monthly from July 1986 through September 1989 at three inner Bight stations with similar depths and sediment types, chosen to represent greatest apparent sludge influence, little or no influence, and intermediate influence. Preliminary results indicate limited responses of the benthic macrofauna to phaseout (e.g., numbers of species increased, but the overall fauna assemblage remained highly altered). The presentation will include analysis of the complete data set and also highlights of other aspects of the overall study, such as sediment contamination, bottom water conditions, and fish and shellfish abundance and pathology.

Keywords: Apex, Benthos, Ocean disposal-12 mile

REID, R.N.; INGHAM, M.C.; PEARCE, J.B. 1987. NOAA'S NORTHEAST MONITORING PROGRAM: A REPORT ON PROGRESS OF THE FIRST FIVE YEARS (1979-84) AND A PLAN FOR THE FUTURE. NOAA TM NMFS F/NEC-44, 155 pp. The Northeast Monitoring Program (NEMP) was initiated at the beginning of Fiscal Year (FY) 1980 (October 1, 1979) by the National Oceanic and Atmospheric Administration (NOAA). The objective of NEMP is to coordinate and focus monitoring and research activities of NOAA studies of the marine environment in coastal and offshore waters of the northeastern United States. The pilot phase of NEMP was from FY 1980 through 1984. Major focuses of the four program components are water quality, sediments and benthos, trace contaminants in tissues, and biological effects.

Keywords: Monitoring-NEMP, Reviews-Biological

REID, R.N.; O'REILLY, J.E.; GADBOIS, D.F. 1982. MONITORING FATES AND EFFECTS OF CONTAMINANTS IN BENTHOS OF THE NEW YORK BIGHT. OCEANS 82 CONFERENCE WASHINGTON, D.C. 20 SEPTEMBER 1982. OCEANS 82 CONFERENCE RECORD: INDUSTRY, GOVERNMENT, EDUCATION-PARTNERS IN PROGRESS-WASHINGTON, D.C. SEPTEMBER 20-22, 1982, pp. 1005-1009. A monitoring program involving annual sampling of the New York Bight for sediments, contaminants in sediments and biota, and benthic macrofauna distribution-abundance is described. This paper concentrates on macrofauna data for summer 1980. Greatest faunal alterations were found in the center of the sewage sludge dumpsite. This condition graded into apparently unimpacted assemblages in sandy sediments off the New Jersey and Long Island coasts, and in lower Hudson Shelf Valley muds. Comparison with 1973-74 data revealed no major changes in contaminant concentrations or impacts except for possible spreading of an "enriched" zone containing elevated densities of several species which thrive on the Christiaensen Basin's elevated organic carbon levels. Four stations have not shown any obvious changes in amount of degradation over that period. The inner Bight fauna remains more highly impacted than that of any other coastal area sampled in the Northeast Monitoring Program.

Keywords: Benthos, Christiaensen Basin, Monitoring, Pollutants-Sediments

REID, R.N.; O'REILLY, J.E.; ZDANOWICZ, V.S. 1982. CONTAMINANTS IN NEW YORK BIGHT AND LONG ISLAND SOUND SEDIMENTS AND DEMERSAL SPECIES, AND CONTAMINANT EFFECTS ON BENTHOS, SUMMER 1980. NOAA TM NMFS F/NEC-16, 109 pp. In July 1980, as part of its Northeast Monitoring Program, NOAA's National Marine Fisheries Service (NMFS) began a program of annual (summer) surveys of bottom sediments and organisms to monitor fates and effects of contaminants in the New York Bight. This report discusses the rationale, objectives and methodology, and results of the first survey. The following measurements were made: sediment grain size; sediment concentrations of total organic carbon, total Kjeldahl nitrogen, coprostanol, heavy metals, PAHs and PCBs; trace metals, PAHs and PCBs in muscle of sea scallop, rock crab, lobster, red hake, winter and windowpane flounder.

Keywords: Benthos-*Cancer*, Benthos-*Homarus*, Benthos-*Placopecten*, Fish, Pollutants-Metals, Pollutants-Organic, Pollutants-Sediment, Pollutants-Toxicity

ROBERTS, A.E.; HILL, D.R.; TIFFT, E.C., JR. 1982. EVALUATION OF NEW YORK BIGHT LOBSTERS FOR PCBS, DDT, PETROLEUM HYDROCARBONS, MERCURY, AND CADMIUM. BULL ENVIRON CONTAM TOXICOL 29(6):711-718. The New York Bight is routinely exposed to waste from the neighboring urban environments. As a generalized predator of the ocean floor in adult stages and a resident of the water column during larval stages, the lobster *Homarus americanus* has potential to uptake and store those

contaminants to which it is exposed. Storage of such compounds in bodily tissue may assume toxicological importance to both the lobster and man as consumer of the lobster. Five potentially toxic compounds were chosen for study which might reflect the impact of disposal operations in the Bight. All lobsters were tested for DDT, petroleum hydrocarbons, total PCBs, mercury (Hg), and cadmium (Cd).

Keywords: Benthos-*Homarus*, Pollutants-Metals, Pollutants-Organic, Pollutants-Toxicity

ROBOHM, R.A.; MURCHELANO, R.A.; BROWN, C. 1979. COMPARISON OF ANTIBODIES IN MARINE FISH FROM CLEAN AND POLLUTED WATERS OF THE NEW YORK BIGHT: RELATIVE LEVELS AGAINST 36 BACTERIA. APPLIED AND ENVIRONMENTAL MICROBIOLOGY 38(2):248-257. Fish from polluted waters are subject to increased prevalence of disease. Because they respond to bacterial pathogens by producing serum antibodies, a seasonal serological record in 3 fish species from clean and polluted waters of the New York Bight could be constructed. Antibody levels were determined by testing sera for agglutinating activity against 36 strains of bacteria. Results of evaluations of 5,100 antibody titrations are given. During warm months, summer flounder (*Paralichthys dentatus*) from the polluted area had significantly higher antibody levels and antibody to a greater diversity of bacteria than fish from the unpolluted area. Weakfish (*Cynoscion regalis*) from the same polluted area shared with summer flounder raised titers to many bacteria. The greatest proportion of raised titers was against *Vibrio* species, although prominent titers were also seen against *Aeromonas salmonicida* and *Haemophilus piscium*, bacteria usually associated with diseases in freshwater but not marine fish. Differences between polluted and clean waters were not as evident in winter flounder (*Pseudopleuronectes americanus*) during cold months. This could be due, in part, to reduced antibody production at colder temperatures. The usefulness of the serum antibody record in identifying environmental exposure to bacteria in marine fish is illustrated. The polluted New York Bight Apex has increased levels and diversity of bacteria during warm months.

Keywords: Apex, Bacteria, Bacteria-*Vibrio*, Disease, Fish-*Cynoscion*, Fish-*Paralichthys*, Fish-*Pseudopleuronectes*

ROPES, J.W. 1968. REPRODUCTIVE CYCLE OF THE SURF CLAM, *SPISULA SOLIDISSIMA*, IN OFFSHORE NEW JERSEY. BIOL BULL 135(2):349-365. Atlantic surf clam, *Spisula solidissima* (Dillwyn), were collected from offshore New Jersey during a 3 1/2 year period to obtain their gonads for histological treatment in a study of the annual reproductive cycle. Documentation of the annual reproductive cycle on the basis of gonad distention and excision of gametes is incomplete and fragmentary. Neither gonad distention nor excision of gametes assesses the events of gamete development within the gonad. Also, parasites are a possible source of error if the technique of observing gonad distention is used. I have seen infected surf clams with distended gonads when those of uninfected individuals were shrunken. Gonad color has been used as an

indicator of sex and gonad development of the sea scallop, *Placopecten magellanicus*. The color of surf clam gonads containing mature sex products, however, is not consistent. Ovaries of females are sometimes pink, but may also be white, as are the testes.

Periodic histological examinations of gonad tissue during several successive years has been a valuable method of determining the annual frequency and duration of the reproductive cycle in many marine invertebrates. The reproductive cycles of the soft-shelled clam, *Mya arenaria*, have been recently established by describing the cytological events within the gonad. Such events within the gonads of surf clams from an area of intensive fishing off the New Jersey coast have been related to water temperature. The present study of seasonal gonad development was undertaken to determine the annual frequency and duration of spawning--information basic to understanding larval occurrence and time of setting of juvenile surf clams.

Keywords: Benthos-*Spisula*

ROPES, J.W.; MERRILL, A.S.; MURAWSKI, S.A.; CHANG, S.; MACKENZIE, C.L., JR. 1979. IMPACT ON CLAMS AND SCALLOPS. PART 1: FIELD SURVEY ASSESSMENTS. IN: OXYGEN DEPLETION AND ASSOCIATED BENTHIC MORTALITIES IN NEW YORK BIGHT, 1976, NOAA PROFESSIONAL PAPER 11, R.L. SWANSON AND C.J. SINDERMANN, (EDS.), pp. 263-275. The observations and data gathered during oxygen depletion in the New York Bight in 1976 are summarized. For surf clams, a 6,750 km² area of mortality was delimited off New Jersey. The area extended from immediately north of Manasquan Inlet to immediately south of Atlantic City, and seaward to about a 37-m depth contour. An almost complete kill (92%) took place in the mortality area, but was least intense in the 3- to 15-km wide beach zone. An estimated 61.5% of the total surf clam biomass was lost off New Jersey. Surf clam landings were substantially lower (31%) in New Jersey during 1976 than during 1975. The principal ocean quahog resource occurs deeper than 37 m and, thus, only the shoreward margin of the population was affected. The mortality area was 9,105 km², and 25.4% of the quahog biomass within it was lost. Of the entire New Jersey ocean quahog resource, 6.3% of the biomass was lost. New Jersey vessels began fishing ocean quahogs in 1976 and landed 71.7% of the US total. The principal sea scallop resource also occurs deeper than 37 m, and only the shoreward margin of the population was affected. From 8.8% to 12.9% of the entire New Jersey scallop resource was killed. Scallop landings increased four-fold in 1976.

Keywords: Anoxia, Benthos-*Artica*, Benthos-*Spisula*, Benthos-*Placopecten*, Fisheries

ROSENFELD, A. 1976. INFECTIOUS DISEASES IN COMMERCIAL SHELLFISH ON THE MIDDLE ATLANTIC COAST. IN: MIDDLE ATLANTIC CONTINENTAL SHELF AND THE NEW YORK BIGHT.

PROCEEDINGS OF THE SYMPOSIUM AMERICAN MUSEUM OF NATURAL HISTORY, NEW YORK CITY, NOVEMBER 3-5, 1975, M.G. GROSS, (ED.), SPECIAL SYMPOSIA 2:414-423. Several important molluscan and crustacean food organisms of the middle Atlantic coast of the United States are subjected to natural and man-caused perturbations and to infectious diseases. Among the naturally occurring diseases, the protozoan oyster parasites *Minchinia nelsoni* and *Minchinia costalis* cause devastating oyster mortalities, particularly in Delaware and lower Chesapeake Bays. *Minchinia nelsoni* infections continue to be prevalent in Delaware Bay, with apparent resistance to the disease having developed there. Several other infectious disease agents cause pathology or damage to these bivalve molluscs including viruses, bacteria, other protozoans, fungi, helminths, and crustacean parasites. Except for *Minchinia* and *Labyrinthomyxa marina* (= *Dermocystidium marinum*), none of these organisms is known to cause massive mortalities of adult bivalve molluscs. However, expression of herpes-type inclusions in hemocytes may be enhanced in oysters exposed to thermal effluents.

Proliferative cell conditions in marine shellfish have been reported with increased frequency and neoplasias of molluscs in epizootic proportions have been reported from both U.S. coasts. Gonadal neoplasms in soft-shell clams (*Mya arenaria*) have been found in areas associated with oil spills. Studies of benthic crustaceans from Sandy Hook Bay and the New York Bight show that the parasitic amoeba *Paramoeba pernicioso* occurs in rock crabs *Cancer irroratus* and American lobsters *Homarus americanus*. Lobsters, shrimp, and rock crabs near sludge and spoil disposal grounds in the New York Bight had shell erosion and ulcers. Naturally occurring bacteremias in lobsters and blue crabs have been reported and may play a role in crustacean epizootics.

Viruslike infections in blue crabs from Chincoteague Bay have recently been noted. PCBs may activate production of a *Baculovirus* in shrimp exposed to sublethal levels of these compounds. Viruses may be latent in shellfish and activated by the presence of certain chemicals.

Keywords: Bacteria, Benthos-*Cancer*, Benthos-*Homarus*, Benthos-*Mya*, Disease, Pollutants-Sediment

ROWE, G.T. 1971. THE EFFECTS OF POLLUTION ON THE DYNAMICS OF THE BENTHOS OF NEW YORK BIGHT. *THALASSIA JUGOSLAVICA* 7(1):353-359.

Keywords: Benthos, Pollutants-Toxicity

ROWE, G.T.; SMITH, K.L., JR.; CLIFFORD, C.H. 1976. BENTHIC-PELAGIC COUPLING IN THE NEW YORK BIGHT. IN: MIDDLE ATLANTIC CONTINENTAL SHELF AND THE NEW YORK BIGHT. PROCEEDINGS OF THE SYMPOSIUM AMERICAN MUSEUM OF NATURAL HISTORY, NEW YORK CITY, NOVEMBER 3-5, 1975, M.G.

GROSS, (ED.), SPECIAL SYMPOSIA 2:370-376. Bottom sediment oxygen consumption can be used to estimate how much of the energy incorporated by the phytoplankton is utilized by the benthos, and such rates are directly related to temperature, organic matter in the sediment, availability of dissolved oxygen, and primary production in the water column. Nutrient flux out of sediments has been measured directly by incubating areas of bottom under bell jarlike chambers. Fluxes of major inorganic plant nutrients are often high, indicating that in most nearshore environments most regeneration occurs on the bottom.

In the New York Bight, oxygen consumption by the bottom was measured in four different seasons; we concluded it was high enough to oxidize a large fraction of the daily input of sludge. Bottom water ammonia gradients suggested too that remineralization rates in the Bight were high on the bottom. Samples taken in August 1975, in Christiaensen Basin, along with measurements in situ of ammonia flux from the bottom, confirmed that the sediments enriched by sewage sludge are regenerating nutrients but at that time not at rates as high as our earlier predicted rates for the mid-Atlantic Bight.

Keywords: Christiaensen Basin, Miscellaneous-Biological

RYTHER, J.H.; YENTSCH, C.S. 1958. PRIMARY PRODUCTION OF CONTINENTAL SHELF WATERS OFF NEW YORK. LIMNOL OCEANOGR 3:327-335. The chlorophyll-radiation method of measuring primary production was employed on six oceanographic cruises during 1956-57, each occupying 25 stations across the continental shelf off New York. The relationship photosynthesis/hour (opt. light):chlorophyll *a*, using the oxygen production method, was found to agree with that determined earlier from culture and harbor waste experiments, despite wide variations of temperature, nutrients, and the abundance of phytoplankton. The same ratio, with photosynthesis measured by ^{14}C uptake, was extremely variable and usually lower than that obtained by oxygen-production photosynthesis values. Estimates of daily production beneath a square meter of sea surface by the chlorophyll-radiation method and *in situ* ^{14}C values agree within reasonable limits in 75% of the measurements; for the remainder of the times the ^{14}C values were consistently lower. Daily production throughout the year ranged roughly from 0.20 to 1.00 g carbon/m²/day within the whole area studied. Estimated annual production decreased in a seaward direction from 160 g carbon/m²/year in the shallow coastal waters to 100 g carbon/m²/year on the continental slope. These values are intermediate between Riley's estimates for Long Island Sound and the Sargasso Sea.

Keywords: Plankton, Miscellaneous-Chemical

SAIC. 1992. MONITORING CRUISE OF THE NEW YORK MUD DUMP AND EXPERIMENTAL MUD DUMP AREAS, SEPTEMBER, 1991. SCIENCE APPLICATIONS INTERNATIONAL CORPORATIONS, NEWPORT, RI. The 1991 survey at the New York Mud Dump consisted of a

broad scale monitoring effort across the entire site, as well as much more intensive investigations of the Experimental Mud Dump (EMD) in the southeast quadrant of the site. Relative to the entire site, the bathymetric survey identified depth changes in the vicinity of the active disposal buoys "KVK" and "NY." Disposal across the Mud Dump in the 1990-1991 season was confined to the site boundaries, with the exception of a thin layer of material south and west of "KVK." Given the close proximity of "KVK" to the western boundary, we would recommend that any re-positioning of this or other disposal buoys occur east of the current "KVK" location.

REMOTS sampling at the Mud Dump indicated a decrease in benthic habitat quality at most comparable stations sampled in 1990 and 1991. This was attributed to the loss of the head-down deposited feeding polychaete community. A reasonable explanation for this loss was burial by dredged sediment deposition at the active disposal buoys. The community could be expected to recover in the area following the cessation of disposal, as was seen along the flank of the northeastern mound.

The intensive investigations at the EMD included chemical, REMOTS, bathymetric, and sub-bottom surveys. Although the resolution of the sub-bottom survey was limited by the frequency needed to penetrate the sand cap, the cap depth was estimated as 5 to 7 ft below the surface of the present mound. This measurement was comparable to the 1986 measured cap depth of 6 ft, and slightly deeper but still in line with 1991 sediment core estimates of 2.3 to 5.3 ft.

REMOTS sampling at the EMD did not provide conclusive evidence of a change in sediment quality between 1986 and 1991. Both RPD and OSI values were reduced in the 1991 radial grid survey; however, this shift was probably an artifact of disposal effects on the northern and western arms of the survey. Bathymetric data in this region showed the encroachment of dredged material from active disposal at buoys "KVK" and "NY." Fresh dredged material observed at the vicinity of the sand cap may represent either incorrectly-positioned disposal, or the result of bottom currents transporting material from other areas in the Mud Dump. Some REMOTS photographs showed evidence of bottom currents in the form of bed formations and shell lag deposits.

Contaminant concentrations of sediment cores were similar to cores recovered in 1983, suggesting that little chemical or physical mobilization has taken place over a period of 7 years. In addition, sediment cores taken off the center of the EMD all recovered a sandy lithology (>75% sand) which correlated with very low contaminant concentrations, overlying more contaminated siltier dredged sediments. Only one core (WP6-10) suggested potential evidence of migration of contaminants from the siltier capped dredged material into the sand cap. The mixed lithology result from this core, however, may have been a sampling artifact. In general, this work supports previous findings that the sand cap has remained stable since its emplacement in 1980.

Keywords: Benthos, Capping, Monitoring, Ocean disposal-Dredged material, Pollutants-Sediment

SAILA, S.; PIKANOWSKI, R.A.; VAUGHAN, D.S. 1976. OPTIMUM ALLOCATION STRATEGIES FOR SAMPLING BENTHOS IN THE NEW YORK BIGHT. ESTUAR COAS MAR SCI 4:119-128. Sampling plans based on historical data available from the Marine Ecosystems Analysis (MESA) New York Bight Project are described and illustrated. These plans are efficient in the sense that they provide the requisite levels of precision for the minimum expenditure of time and effort. Sampling for a single variable (selected trace elements) is optimized directly. Sampling for several variables simultaneously in a two-stage scheme can also be optimized. The optimization procedure is explained and illustrated in detail, and the results for a realistic case are given.

Relatively few replicates (approximately five) are shown to be required to test reasonably defined hypothesis concerning differences in trace elements between two stations. It is also shown that an optimum two-stage sampling plan for *Cerianthus americanus* involved relatively few replicates within a station (3) and a fairly small number of stations (7) in order to satisfy derived variance and cost constraints for the New York Bight with an acceptance level of confidence (90%) for 50% differences in abundance of transformed mean values. Sample sizes for six other species were also determined and a compromising allocation is discussed.

Keywords: Benthos-*Cerianthiopsis*, Monitoring, Pollutants-Sediments

SAILA, S.; PRATT, S. 1973. MID-ATLANTIC BIGHT FISHERIES. IN: COASTAL AND OFFSHORE ENVIRONMENTAL INVENTORY, CAPE HATTERAS TO NANTUCKET SHOALS. S. SAILA, PROGRAM COORDINATOR, CHAPTER 6, pp. 1-125. KINGSTON, RI: UNIV RHODE ISLAND MAR PUBL SERIES NO. 2. In the Mid-Atlantic Bight, the Chesapeake Bay has a considerable influence on the fisheries of the entire area. During recent years an estimated 27,000 commercial fisherman have harvested annually about 700 million pounds of fish and shellfish valued at roughly 70 million dollars from the study area. An analysis of the value and volume landed during a 5 year period showed considerable stability among the more important species with only minor exceptions. Of the several hundred species of fish and shellfish found in the region only about 30 have significant commercial value at present. Sport fishing in the Mid-Atlantic Bight area is rapidly increasing in popularity. An estimated 2.5 million salt-water anglers generated more than 318 million dollars of business activity in 1970. This region is expected to be able to absorb considerably more sport fishing activity without major conflicts with other users and with negligible reductions in the catch. Although current use of the Mid-Atlantic Bight is minimal for mariculture, this use is expected to increase. Future developments are expected to occur in the culture of organisms with relatively high market value. Oyster culture is expected to expand in areas such as Chesapeake Bay and Long Island Sound. The possibility if using heated effluents from electric power generating stations in this region merits further study.

Keywords: Fisheries

SANDY HOOK SPORTS FISHERIES MARINE LABORATORY (SHSFML). 1972. SECTION 3: ZOOPLANKTON STUDIES. IN: THE EFFECTS OF WASTE DISPOSAL IN THE NEW YORK BIGHT. FINAL REPORT. NATIONAL MARINE FISHERIES SERVICE, HIGHLANDS, NEW JERSEY, 3 pp. Zooplankton studies were undertaken as part of a multi-disciplinary study of the effects of offshore waste disposal in the waters of the New York Bight. The main emphasis has been on copepods because they occur in this area year-round and are usually the principal constituent of the zooplankton. Sampling stations were located in and around the sewage sludge and industrial acid waste disposal areas.

Keywords: Apex, Ocean disposal

SANTSCHI, P.H.; LI, Y.H.; BELL, J.J.; TRIER, R.M.; KAWTALUK, K. 1980. PU IN COASTAL MARINE ENVIRONMENTS. EARTH PLANET SCI LETT 51(2):248-265. Analyses of water samples from the New York Bight area and Narragansett Bay reveals that a small fraction of the total Pu (probably Pu (III + IV) species) is continuously removed to the sediments at a rate similar to that of the particle-reactive isotope ^{228}Th . A more "soluble" Pu species appears to be released at times from the sediments to the water column in these nearshore regions. Sediments in shallow areas of the New York Bight south of Rhode Island and Narragansett Bay have high Pu inventories and relatively deep penetration of this element, although the net sediment accumulation rate is generally low ($<0.03\text{g/cm}^2\text{ yr}$). The high Pu inventories can be explained if both sediment resuspension and sediment mixing are assumed to be the major controlling factors for the effective transfer of Pu from the water column to the sediments. By simultaneous modelling of the depth distribution of three tracers which operate on vastly different time scales, bioturbation rates ranging from 4 to 32 cm^2/yr in the surface mixed layer (5-10 cm thick) and from 0.3 to 2.5 cm^2/yr in the layer below (up to 40 cm thick) and net sediment accumulation rates of approximately zero to 0.14 $\text{g/cm}^2\text{ yr}$ were calculated for these areas.

Keywords: Sediment transport

SAWYER, T.K. 1982. DISTRIBUTION AND SEASONAL INCIDENCE OF "BLACK GILL" IN THE ROCK CRAB, *CANCER IRRORATUS*. IN: ECOLOGICAL STRESS AND THE NEW YORK BIGHT: SCIENCE AND MANAGEMENT, PROCEEDINGS OF A SYMPOSIUM ON THE ECOLOGICAL EFFECTS OF ENVIRONMENTAL STRESS, NEW YORK, NY, JUNE 10-15, 1979, G.F. MAYER, (ED.), ESTUARINE RESEARCH FEDERATION, COLUMBIA, SC, pp. 199-211. Rock crabs, *Cancer irroratus*, from coastal sewage dumpsites near New York, New Jersey, Delaware, and Maryland were examined for evidence of stress or disease attributable to the effects of ocean dumping. Excessive gill fouling by bacteria, debris, diatoms, copepods, amoebae, and stalked ciliates frequently was noted in microscopical

studies but could not be used as evidence for environmental stress. Gills that were black over 50% or more of their tissue mass were observed in crabs collected from ocean disposal sites and appeared to be useful indicators of environmental degradation. The "black gill" condition is believed to be caused by the accumulation of black sludge sediment between the gill lamellae. Summarized data showed that blackened gills were present in 4.5% (134/2,920) of the crabs on a year-round basis, or in up to 10% when only intermolt animals were considered. Blackened gills were not observed within a second group of 268 crabs collected from control locations (Georges Bank; Montauk Point, New York; Sheepscott River, Maine). An additional 846 specimens were collected at stations from Cape Cod, Massachusetts to Cape Hatteras, North Carolina during surf clam assessment and scallop cruises. Eight percent (17/217) of the crabs from the surf clam stations and less than 1% (3/629) of the crabs from the scallop cruise had black gills. Station data from the two cruises showed that affected crabs usually were collected from locations in or near sewage disposal sites. Observations on the incidence of black gills in *C. irroratus* provided evidence that the condition occurs primarily in areas where bottom sediments are altered by the accumulation of sewage sludge deposits.

Keywords: Benthos-Cancer, Disease

SAWYER, T.K. 1989. SHELL DISEASE AND GILL BLACKENING IN THE ROCK CRAB *CANCER IRRORATUS*. J SHELLFISH RES 8(2):461.

Keywords: Benthos-Cancer, Disease

SAWYER, T.K.; LEWIS, E.J.; GALASSO, M.E.; ZISKOWSKI, J.J. 1984. GILL FOULING AND PARASITISM IN THE ROCK CRAB, *CANCER IRRORATUS* SAY. SECOND INTERNATIONAL SYMPOSIUM ON RESPONSES OF MARINE ORGANISMS TO POLLUTANTS WOODS HOLE, MA 27 APR 1983. MAR. ENVIRON. RES. RESPONSES OF MARINE ORGANISMS TO POLLUTANTS. J.J. STEGEMAN, (ED.), VOL 14(1-4):355-359. Rock crabs (*C. irroratus*) were examined grossly and microscopically to estimate the influence of molting activity, geographical source and seabottom sediments on gill color, carapace color and tissue pathology. Collections were made from deepwater stations (20-55 m) in the Hudson Shelf Valley near dredge- and sewage- sludge disposal sites in the New York Bight Apex and from nearshore waters near Boothbay Harbor, Maine. Extensive gill blackening was noted in up to 30% of the crabs from the New York stations when all specimens were in the intermolt condition. Blackening was not noted in intermolt crabs collected in Maine. Carapace blackening was present in up to 79% of the New York crabs but absent in those from Maine. Severe blackening was attributed to direct contact of *C. irroratus* with blackened, highly organic sediments in the Hudson Shelf Valley. Biofouling and parasitism was also recorded.

Keywords: Disease, Benthos-Cancer, Hudson Shelf Valley

SAWYER, T.K.; MACLEAN, S.A.; ZISKOWSKI, J. 1976. A REPORT ON *EPHELOTA* SP (CILIATA, SUCTORIDA) AS AN EPIBIONT ON THE GILLS OF DECAPOD CRUSTACEANS. TRANS AM MICROSC SOC 95(4):712-717. Histological studies on crustaceans collected from Sandy Hook Bay, New Jersey and near-shore stations in the New York Bight Apex showed that a suctorian ciliate, *Ephelota* sp., was present on the gills of five species of decapods (*Cancer irroratus*, *C. borealis*, *Ovalipes ocellatus*, *Callinectes sapidus* and *Homarus americanus*). *Ephelota* was found on about 15% of *C. irroratus*, *C. borealis*, and *H. americanus* but was rare on swimming crabs, *C. sapidus* and *O. ocellatus*. The discovery of this suctorian on gills of decapods collected from recognized sewage and dredge-spoil dump sites in the Bight Apex suggests that the ciliate may be pollution-tolerant and possibly useful as an indicator species.

Keywords: Apex, Benthos-*Cancer*, Benthos-*Callinectes*, Benthos-*Homarus*, Benthos-*Ovalipes*, Disease

SAWYER, T.K.; NERAS, T.A.; DAGGETT, P.; BODAMMER, S.M. 1987. POTENTIALLY PATHOGENIC PROTOZOA IN SEDIMENTS FROM OCEANIC SEWAGE-DISPOSAL SITES. OCEANIC PROCESSES IN MARINE POLLUTION, VOL. 1, BIOLOGICAL PROCESSES AND WASTES IN THE OCEAN. J.M. CAPUZZO AND D.R. KESTER, (EDS.), pp. 183-194. Free-living amoebae belonging to the genus *Acanthamoeba* and capable of causing granulomatous amoebic encephalitis in man and animals were isolated from sediments contaminated with sewage sludge. Strains of *Acanthamoeba* capable of infecting laboratory mice were isolated from the New York Bight dumpsite, Philadelphia-Camden dumpsite, Puerto Rico outfall, the Apalachicola River, FL, and the Gulf of Mexico seaward from Mobile Bay, AL. Seaward from the New York disposal site, amoebae were recovered from sediments that tested negative for fecal bacteria but were contaminated with organic pollutants such as coprostanol and polychlorinated biphenyls. Biochemical analyses of the amoebae enzyme systems (acid phosphates, leucine aminopeptidase, and propionyl esterase) provided enzyme patterns that showed that certain morphologically similar species differed enzymatically and, therefore, probably represent new species. Electron microscope and isoenzyme studies employed to compare two similar species, one pathogenic and the other nonpathogenic, showed that the species were probably the same and differed only in pathogenicity and temperature tolerance. Characteristics such as cyst morphology, pathogenicity, or temperature tolerance taken alone are not always sufficient for determining species identifications.

Keywords: Benthos, Disease, Ocean disposal-12 mile

SAWYER, T.K.; VISCESVARA, G.S.; HARKE, B.A. 1977. PATHOGENIC AMOEBAS FROM BRACKISH AND OCEAN SEDIMENTS, WITH A DESCRIPTION OF *ACANTHAMOEBA HATCHETTI*, N, SP. SCIENCE 196:1324-1325. *Acanthamoeba culbertsoni* was isolated from a sewage-spoil

dump site near Ambrose Light, New York Bight. A second species, *Acanthamoeba hatchetti*, n. sp., was isolated from Brewerton Channel, Baltimore Harbor, Maryland. Both species killed laboratory mice after infection by the intranasal route.

Keywords: Benthos, Disease, Ocean disposal-12 mile

SCHLEE, J.; SANKO, P. 1975. SAND AND GRAVEL. MESA NEW YORK BIGHT ATLAS MONOGRAPH 21, 26 pp. Sand and gravel deposits on the continental shelf in New York Bight cover a wide area. Sand is found over the entire shelf; gravel is distributed in patches east of northern New Jersey. The sand exists as a veneer up to several meters thick, covering older shelf deposits. Accurate estimates of the thickness of the sand cover will have to await detailed acoustic surveys coupled to core data. A rough estimate shows that 26,446 million short tons of sand plus gravel occur in a 15,112 km² (9,385 mi²) area of the inner shelf off New Jersey. An average of 5.5 million yd³/yr of sand was dredged from the Lower Bay of New York Harbor from 1966 through 1974. Most of the mined sand was used as fill and subgrade material in public construction projects and beach replenishment in New York and New Jersey. Since 1973 all sand mining in the harbor has been restricted to maintenance of Chapel Hill North Channel, Swash Channel, and Ambrose Channel.

Keywords: Mining, Monitoring-MESA, Sediment

SEGAR, D.A.; BERBERIAN, G.A. 1976. OXYGEN DEPLETION IN THE NEW YORK BIGHT APEX: CAUSES AND CONSEQUENCES. IN: MIDDLE ATLANTIC CONTINENTAL SHELF AND THE NEW YORK BIGHT. PROCEEDINGS OF THE SYMPOSIUM AMERICAN MUSEUM OF NATURAL HISTORY, NEW YORK CITY, NOVEMBER 3-5, 1975, M.G. GROSS, (ED.), SPECIAL SYMPOSIA 2:220-239. Dissolved oxygen concentrations in waters of the New York Bight Apex are near saturation except in summer when a stable thermocline exists and concentrations in the lower layer can drop to 10% of saturation. Mass balances of oxygen and carbon cycles in the apex were examined. Photosynthetically-produced carbon accounts for most of the oxygen demand, particularly in summer. Oxygen demand due to sewage sludge and dredged spoils is small compared to that from organic carbon produced *in situ*. Oxygen demand of particulate and dissolved organics in the estuarine discharge may be as great as the sewage sludge and dredge spoils together. Midsummer primary productivity in the Apex is high due to nutrient inputs, particularly nitrogen. Most nitrogen, supplied to the Apex in forms suitable to support photosynthetic production, comes from the discharge of the Hudson-Raritan-Passaic systems. Most of this nitrogen comes from liquid effluents of sewage treatment plants discharged to the rivers.

Ocean dumping in the bight apex does not cause the low oxygen concentrations found in summer. These are caused primarily by nitrogen supply from rivers.

Improvement in dissolved oxygen concentrations could be achieved by removing nitrogen from sewage-treatment-plant effluents.

Keywords: Anoxia

SEGAR, D.A.; CANTILLO, A.Y. 1976. TRACE METALS IN THE NEW YORK BIGHT. IN: MIDDLE ATLANTIC CONTINENTAL SHELF AND THE NEW YORK BIGHT. PROCEEDINGS OF THE SYMPOSIUM AMERICAN MUSEUM OF NATURAL HISTORY, NEW YORK CITY, NOVEMBER 3-5, 1975, M.G. GROSS, (ED.), SPECIAL SYMPOSIA 2:171-198. Large quantities of trace metals are introduced to the New York Bight Apex from many sources. Distributions of dissolved Mn, Fe, Cd, Cu, and Zn are extremely nonuniform in the waters of the Apex due to the many sources and complex reactions taking place. Estuarine discharge and dredge spoil dumping are major sources, while sewage sludge and acid waste dumping are minor sources for most elements studied. Much of the dissolved Cu and Fe occurs in a chemical form that is not extractable by chelation/solvent extraction, even after acidification. The quantity of this metal fraction increases with distance from the Hudson-Raritan estuary. Loss from solution of some elements, notably Mn, occurs when estuarine water mixes with oceanic water. Metals, particularly Zn, are released to solution during ocean dumping of sewage sludge and other materials. Concentrations of dissolved metals in the apex are higher than on the open shelf and higher in summer than in spring and fall. This suggests that the Apex flushes slower in summer, as inputs do not vary significantly with season.

Budget calculations show that contaminant metals, exemplified by Cu and Zn, do not accumulate in the Apex but are rapidly removed either to the estuaries or the surrounding shelf waters. Mean residence times of contaminant metals in the Apex waters are less than 6 months, perhaps considerably less.

Keywords: Ocean disposal, Pollutants-Loadings

SERCHUK, F.M.; SMOLOWITZ, R.J. 1989. SEASONALITY IN SEA SCALLOP SOMATIC GROWTH AND REPRODUCTIVE CYCLES. J SHELLFISH RES 8(2):435-436.

Keywords: Benthos-*Placopecten*

SHARP, J. H. 1976. ANOXIA ON THE MIDDLE ATLANTIC SHELF DURING THE SUMMER OF 1976. REPORT OF A WORKSHOP HELD AT WASHINGTON, D.C. OCTOBER 15-16, 1976. REPORT NO.: NSF/IDOE-77-34, 129 pp. From June through October of 1976, lower than normal oxygen contents and extensive faunal mortality were observed in a broad area south of Long Island and east of New Jersey also referred to as the New York Bight, Middle Atlantic Bight, or Middle Atlantic coastal water. This phenomenon has been called "anoxia" and a "fish-kill" where reference has described low (less than

2 ppm) to zero measured dissolved oxygen and dead or physiologically stressed invertebrates as well as finfish. Fifty university, state, and federal scientists attended the October 15-16 workshop held in Washington, D.C., sponsored by the National Science Foundation's Office for the International Decade of Ocean Exploration (IDOE). They agreed that the anoxic condition that existed during the summer and fall of 1976 was the combined result of meteorological conditions, shelf water circulation, and the degradation of organic matter, including an extensive algal bloom. The algal bloom, dominated by the organism *Ceratium tripos*, contributed significantly to the organic matter on the shelf. Probable contributing factors were a relative dearth of storm activity, anomalous surface and wind conditions, and unusually warm sea surface temperatures.

Keywords: Anoxia, Fish kills, Plankton-*Ceratium*, Workshops

SHARP, J.H. 1982. *IN SITU* PHOSPHATE REGENERATION IN MIDDLE ATLANTIC COASTAL WATERS. IN: ECOLOGICAL STRESS AND THE NEW YORK BIGHT: SCIENCE AND MANAGEMENT. PROCEEDINGS OF A SYMPOSIUM ON THE ECOLOGICAL EFFECTS OF ENVIRONMENTAL STRESS, NEW YORK, NY, JUNE 10-15, 1979, G.F. MAYER, (ED.), ESTUARINE RESEARCH FEDERATION, COLUMBIA, SC, pp. 513-525.

Concern exists over man's disposal of bioactive nutrients into the marine environment. These nutrients can stimulate microbial plant production that, if not consumed in marine food chains, can cause serious oxygen demands. To understand the impact of man's input of nutrients, it is necessary first to gain a better understanding of natural nutrient cycles. This paper attempts to quantify natural phosphate regeneration in bottom waters of three regions in Middle Atlantic coastal waters and to evaluate the contributions that *in situ* regeneration could make toward supporting microbial plant production. It is striking that the Apex of the New York Bight, with high production, receives a much smaller proportion of its phosphate supply from *in situ* regeneration than adjacent New Jersey and Long Island coastal waters. The approach taken here is the first of its kind for quantifying and comparing coastal nutrient regeneration.

Keywords: Reviews-Chemical

SHEPHERD, G.R.; GRIMES, C.B. 1984. REPRODUCTION OF WEAKFISH *CYNOScion REGALIS* IN THE NEW-YORK BIGHT USA AND EVIDENCE FOR GEOGRAPHICALLY SPECIFIC LIFE HISTORY CHARACTERISTICS. US NATL MAR FISH SERV FISH BULL 82(3):501-512. Reproduction characteristics for weakfish, *C. regalis*, in the New York Bight were examined. Spawning in 1980-1981 occurred from May to early July with spawning time being dependent on parental size. Maturity for both sexes occurred by age 1 but at a greater size in females. Annual fecundity estimates were compared with literature values for North Carolina weakfish and were considerably lower at size, yet cumulative fecundities were nearly equivalent. The latitudinal variations in fecundity may be a behaviorally and environmentally induced phenomena, and influence the long-term population stability of weakfish.

Keywords: Fish-*Cynoscion*

SHERWOOD, C.R. 1989. USE OF SEDIMENT TRANSPORT CALCULATIONS IN DREDGED MATERIAL DISPOSAL SITE SELECTION. OCEANS '89: THE GLOBAL OCEAN. VOLUME 2: OCEAN POLLUTION pp. 326-332. One of the considerations in site selection for ocean disposal of dredged material is dispersion of dredged material away from the site, either during disposal operations or afterward. This paper presents a method for quantitatively comparing *in situ* dredged material stability over a large area as an aid in the identification of regions that may contain suitable candidate sites. The method was applied to site selection studies in the New York Bight. Bottom shear stress estimates were made on a coarse grid representing the New York Bight using bathymetry, current, and wave data. The calculations successfully identified areas of the mid- and outer continental shelf that had been chosen as good candidate areas in earlier, more detailed studies. The method is a useful screening technique because it allows rapid, objective comparison and can be performed with minimal data. The approach could be refined with more sophisticated wave-current interaction algorithms and more detailed input data.

Keywords: Ocean disposal-Dredge material, Sediment transport

SHERWOOD, M.J. 1977. FIN EROSION DISEASE AND LIVER CHEMISTRY: LOS ANGELES AND SEATTLE. ANNU. REP. SO. CALIF. COAST. WATER RES. PROJ. IN: COASTAL WATER RESEARCH PROJECT. ANNUAL REPORT FOR THE YEAR ENDED 30 JUNE 1977. SOUTHERN CALIFORNIA COASTAL WATER RESEARCH PROJECT, EL SEGUNDO, USA, SCCWRP-AR-77, pp. 213-219. Marine flatfishes with fin erosion diseases have been found in three coastal regions of the United States in which toxic wastes have been discharged: southern California; the Duwamish River Estuary in Seattle, Washington; and the New York Bight. Similarities in the nature of the diseases and in the distribution of affected individuals in each region have suggested the possibility that the diseases have a common cause related to the discharge of toxic wastes. A comparison of the levels of seven trace metals in the liver tissue of Dover sole (*Microstomus pacificus*) and starry flounder (*Platichthys stellatus*) suggests that patterns in increase and decrease between specimens with fin erosion from the high-disease-prevalence sites and unaffected specimens from control sites were not the same in the two regions. A possible exception is the depression in cadmium levels, which was evident in starry flounder in this study and has been reported previously in Dover sole from southern California. The occurrence of enlarged livers in specimens from the high-disease-prevalence sites in both regions and the measurement of increased amounts of lipid in the livers of Palos Verdes Dover sole suggest, with histological observations, that liver damage is occurring at these sites and that it may precede the appearance of fin erosion.

Keywords: Disease, Fish

SHERWOOD, M.J. 1982. FIN EROSION, LIVER CONDITION, AND TRACE CONTAMINANT EXPOSURE IN FISHES FROM THREE COASTAL REGIONS. IN: ECOLOGICAL STRESS AND THE NEW YORK BIGHT: SCIENCE AND MANAGEMENT. PROCEEDINGS OF A SYMPOSIUM ON THE ECOLOGICAL EFFECTS OF ENVIRONMENTAL STRESS, NEW YORK, NY, JUNE 10-15, 1979, G.F. MAYER, (ED.), ESTUARINE RESEARCH FEDERATION, COLUMBIA, SC, pp. 359-377. Fin erosion in demersal fishes is one example of a response common to several regions receiving waste discharges. The regions include southern California, Puget Sound, and New York. Although the precise causes of the disease remain undetermined, fin erosion appears to result from the exposure of susceptible species to contaminated sediments. The present study demonstrates that in these three regions, the levels of total PCBs in muscle, liver, and brain tissues were higher in fishes with fin erosion from contaminated sites than in apparently unaffected specimens from control sites. PCB exposure may contribute to the development of the disease. A second response common to the three regions involves changes in the size and/or lipid content of the liver. This response also may be related to chlorinated hydrocarbon exposure.

Keywords: Disease, Fish, Pollutants-Bioaccumulation

SILVERMAN, M.J.; MAHONEY, J.B. 1985. PICTORIAL DOCUMENTATION OF FIN NECROSIS OF MARINE FISHES IN THE NEW-YORK BIGHT USA. BULL NJ ACAD SCI 30(1):39-42.

Keywords: Fish, Disease

SINDERMANN, C.J.; ESSER, S.C.; GOULD, E.; MCCAIN, B.B.; MCHUGH, J.L.; MORGAN, R.P. II; MURCHELANO, R.A.; SHERWOOD, M.J.; SPITZER, P.R. 1982. EFFECTS OF POLLUTANTS ON FISHES. IN: ECOLOGICAL STRESS AND THE NEW YORK BIGHT: SCIENCE AND MANAGEMENT; PROCEEDINGS OF A SYMPOSIUM ON THE ECOLOGICAL EFFECTS OF ENVIRONMENTAL STRESS, NEW YORK, NY, JUNE 10-15, 1979. G.F. MAYER, (ED.), ESTUARINE RESEARCH FEDERATION, COLUMBIA, SC, pp. 23-38. As human populations in the New York and New Jersey coastal areas have increased, there have been concomitant increases in the pollution of adjacent marine environments and in the stresses placed on local fish and shellfish populations. A variety of chemical pollutants has been found in elevated concentrations in organisms, sediments, and waters of the New York Bight. These include toxic metals, chlorinated hydrocarbons, and petroleum and its components. Response to pollutants is species-specific, but early life history stages and gonadal tissues of adults are particularly sensitive. Contaminants of particular importance to fishes and shellfishes are mercury, cadmium, silver, PCBs, DDT and its metabolites, and petroleum hydrocarbons. Only in the most severely degraded waters of the Northeast are there localized

disappearances of fish and shellfish. Catch statistics for commercially valuable species in the New York Bight reveal few changes in abundance that are directly attributable to pollution. In part, this may reflect the difficulty of distinguishing between the effects of natural environmental variations, overfishing, and pollution. It would appear that effects on individual organisms and on localized population segments are more promising indicators of pollution-related environmental stress than effects on total populations. Since toxicants may cause severe and varied effects on individual fish and shellfish, management alternatives to continued marine pollution should be explored.

Keywords: Fish, Pollutants-Toxicity

SINDERMANN, C.J.; SWANSON, R.L. 1979. HISTORICAL AND REGIONAL PERSPECTIVE. IN: OXYGEN DEPLETION AND ASSOCIATED BENTHIC MORTALITIES IN NEW YORK BIGHT, 1976, NOAA PROFESSIONAL PAPER 11, R.L. SWANSON AND C.J. SINDERMANN, (EDS.), pp. 1-16. The investigations of the 1976 environmental event in the Middle Atlantic Bight make this event one of the best-documented examples of mass mortality in the sea and of the impacts of such events on resource and food-chain species. This report brings together the results of many studies. It examines the geographical extent of the oxygen depletion and the environmental conditions preceding and during the event, and compares the 1976 conditions with historical information. An assessment is made of the causes, including the effects human activities might have had. Impacts on fishery resources and associated socioeconomic aspects are examined. Finally, monitoring and prediction of future events are discussed.

Keywords: Anoxia, Benthos, Fisheries

SLAUSON, T.P.; WOODHEAD, P.M.J.; CASTANEDA, R. 1983. AGE, GROWTH, AND MATURATION OF THE SPINY DOGFISH, *SQUALUS ACANTHIAS* L., OF THE NORTHWEST ATLANTIC. NEW YORK SEA GRANT INSTITUTE. REPORT NO.: SR-49; REF-83-5; NOAA-83112202, 53 pp. The spiny dogfish is the largest under-utilized finfish resource of the northeastern fisheries of the United States, yet little critical data is available on its biological parameters. This study describes the age-length relationships, growth, and maximum size for both males and females; estimates were also made of size at reproductive maturation. Dorsal fin spines were used to determine the age of fish. The samples for data development were collected in 1976, 1979, 1980, and 1981 at sites in the Gulf of Maine and the New York Bight and comprised 218 male and a 434 female fish.

Keywords: Fish-*Squalus*

SMITH, D.E.; JOSSI, J.W. 1984. NET PHYTOPLANKTON AND ZOOPLANKTON IN THE NEW YORK BIGHT, JANUARY 1976 TO

FEBRUARY 1978, WITH COMMENTS ON THE EFFECTS OF WIND, GULF STREAM EDDIES, AND SLOPE WATER INTRUSIONS. NOAA-84052402. Results are given of monthly net phytoplankton and zooplankton sampling from a 10 m depth in shelf, slope, and Gulf Stream eddy water along a transect running southeastward from Ambrose Light, New York, in 1976, 1977, and early 1978. Plankton abundance and temperature at 10 m and sea surface salinity at each station are listed. The effects of atmospheric forcing and Gulf Stream eddies on plankton distribution and abundance are discussed. The frequency of Gulf Stream eddy passage through the New York Bight corresponded with the frequency of tropical-subtropical net phytoplankton in the samples. Gulf Stream eddies injected tropical-subtropical zooplankton onto the shelf and removed shelfwater and its entrained zooplankton.

Keywords: Circulation, Plankton

SMITH, K.L., JR.; ROWE, G.T.; CLIFFORD, C.H. 1974. SEDIMENT OXYGEN DEMAND IN AN OUTWELLING AND UPWELLING AREA. REPORT NO.: WHOI-CONTRIB-3143; NSF/IDOE-76-72. 8 pp. *In situ* measurements of oxygen demand were made on sewage enriched sediment in the New York Bight (outwelling) and on naturally enriched sediments in the New York Bight (outwelling) and on naturally enriched sediments under the California Current off Baja California (upwelling). Measurements were made with diver-set *in situ* respirometers. Total oxygen uptake was divided into biological demand (community respiration) and chemical demand with formalin treatment. In both the outwelling and upwelling areas, the total oxygen demand of the sediments was significantly enhanced by organic enrichment.

Keywords: Anoxia, Sediments

SMITH, W.G.; SIBUNKA, J.D.; WELLS, A. 1978. DIEL MOVEMENTS OF LARVAL YELLOWTAIL FLOUNDER, *LIMANDA FERRUGINEA*, DETERMINED FROM DISCRETE DEPTH SAMPLING. FISH BULL 76(1):167-178. A 72-hr study to investigate diel movements of yellowtail flounder larvae indicated that they exhibited pronounced vertical movements that were repetitious from day to day. Collections at 3-hr intervals with 20-cm bongo nets revealed that larvae were near the surface at night, and mostly at a depth of 20 m during the day. Ascent and descent occurred largely at sunset and sunrise, respectively. Thermal gradients at 10 to 20 m and 30 to 40 m had no apparent influence on the vertical movements. Amplitude of the movements increased with the size of larvae. Recently hatched larvae remained near the shallow thermal gradient. Intermediate-sized larvae migrated from mid-depths during the day to surface and near-surface at night. Large larvae moved throughout the water column. The incidence of feeding was low, but a daily feeding pattern was evident. Most larvae with gut contents were collected from 1900 to 0100 hr on the first day, from 1600 to 2200 hr on the second day, and from 1600 to 0100 hr on the third day. The near absence of gut contents in larvae caught during morning daylight hours suggests that the onset of feeding is triggered by something other

than, or in addition to, light. Wind driven circulation near the surface was thought to transport larvae at night, when they moved towards the surface. Subsurface circulation was sluggish and ineffective as a transporting mechanism.

Keywords: Fish-*Limanda*

SMITH, W.G.; WELLS, A.; MCMILLAN, D.G. 1979. THE DISTRIBUTION AND ABUNDANCE OF ICHTHYOPLANKTON IN THE MIDDLE ATLANTIC BIGHT AS DETERMINED FROM COASTAL SURVEYS AND SITE-SPECIFIC STUDIES, 1965-1976. NATIONAL MARINE FISHERIES SERVICE. REPORT NO.: SHL-79-02; BLM/YL/SR-79/05, 279 pp.

Ichthyoplankton data from the files of the Sandy Hook Marine Laboratory are summarized from collections in the Middle Atlantic Bight between 1965 and 1976. The data are compiled from plankton samples collected on coastal surveys designed to monitor seasonal shifts in the distribution and abundance of planktonic fishes, and from site-specific studies designed to investigate the vertical distribution and diel movements of larvae representing selected species. The report describes occurrences and seasonal patterns of distribution of larvae for the numerically dominant species collected on the 13-month R/V Dolphin survey in 1965-66; a 15-month survey of the New York Bight from 1974 to 1976; and semi-annual surveys from Cape Hatteras to Martha's Vineyard from 1973 to 1976.

Keywords: Fish, Plankton, Monitoring

SPEIDEL, M.A. 1975. CONTINUOUS VERTICAL PROFILE MEASUREMENTS OF PHYSICAL VARIABLES OFF THE SOUTH SHORE OF LONG ISLAND USING A VARIABLE BUOYANCY INSTRUMENT PACKAGE. OFFSHORE TECHNOLOGY CONFERENCE: SEVENTH ANNUAL PROCEEDINGS, VOL. II, pp. 517-527.

Keywords: Miscellaneous-Physical

SQUIRES, D.F. 1981. SEA GRANT MARITIME HERITAGE SERIES: THE BIGHT OF THE BIG APPLE. PUBL. NY SEA GRANT INST, ALBANY, NY, 92 pp. REPORT NO.: NYSG-RS-81-00. The New York Bight harbors a rich story of the relationship between man and the ocean. The growth and development of the region has revolved around ocean resources and waterborne transport for nearly four centuries. A consequential segment of the economy is still based upon the resources of the ocean and the transport the ocean makes possible. The Bight has often been neglected resulting in enormous negative impacts upon the coastal ocean. Because there are opportunities to rebuild our heritage, to once again enjoy those aspects of the coastal ocean that shaped the development of the region, to undo some damage that has been done, this book is written. As other coastal communities grow and develop, they may learn from the experiences of the New York Bight and may choose to follow a different evolutionary path.

Keywords: Management

SQUIRES, D.F. 1983. THE OCEAN DUMPING QUANDARY: WASTE DISPOSAL IN THE NEW YORK BIGHT USA. STATE UNIVERSITY OF NEW YORK PRESS: ALBANY, N.Y., USA.

Keywords: Management, Ocean disposal

STANLEY, H.G.; KAPLANEK, D.W. 1976. A BIBLIOGRAPHY ON OCEAN WASTE DISPOSAL. SECOND EDITION. INTERSTATE ELECTRONICS CORP. REPORT NO.: IEC-446-0C-0417, 154 pp. This research bibliography is restricted to documents relevant to the field of ocean waste disposal. It is primarily limited to recent publications in the following categories: ocean waste disposal, criteria, coastal zone management, monitoring, pollution control, dredge spoil, dredge spoil disposal, industrial waste disposal, radioactive waste, oil spills, bioassay, fisheries resources, ocean incineration, water chemistry, and water pollution.

Keywords: Bibliographies, Ocean disposal

STARR, R.B.; HAXELWORTH, J.B.; BERBERIAN, G.A. 1976. MESA NEW YORK BIGHT PROJECT, EXPANDED WATER COLUMN CHARACTERIZATION CRUISE (XWCCD-6), NOAA SHIP GEORGE B. KELEZ, 29 SEPTEMBER - 4 OCTOBER 1975. NOAA DR ERL MESA-25, 136 pp. From September to October 1975, an oceanographic cruise denoted XWCC-6 was made by the NOAA ship George B. Kelez in the New York Bight. The objective of this cruise was to supply data to be incorporated into an analysis of the water characteristics and movements in the highly impacted ecosystem. This report presents the physical and chemical data from this cruise and describes the measurement methods and procedures for reducing the data.

Keywords: Miscellaneous-Chemical, Miscellaneous-Physical, Monitoring-MESA

STARR, R.B.; STEIMLE, F.W. 1979. TEMPORAL DEVELOPMENT OF PHYSICAL CHARACTERISTICS. IN: OXYGEN DEPLETION AND ASSOCIATED BENTHIC MORTALITIES IN NEW YORK BIGHT, 1976, NOAA PROFESSIONAL PAPER 11, R.L. SWANSON AND C.J. SINDERMAN, (EDS.), pp. 17-50. Study of the oceanic conditions and events, and their progression in the New York Bight during 1976, indicates the presence of warmer-than-normal bottom waters early in the year. This suggests a larger amount of offshore water in the Bight than usual. There may be a connection between this presence of offshore water and the large concentration of *Ceratium tripos* in the Middle Atlantic Bight in 1976. The occurrence of bottom water that was 2.5 °C warmer than normal in April and 3 to 4 °C colder than normal in the

latter half of the season indicates advection of bottom water into the region. If the continental shelf were the source of this water, then it must have been subjected to anomalous conditions upstream when it was at the surface. Hurricane Belle had some effect on the water column down to at least 25 m.

Keywords: Anoxia, Benthos, Plankton-*Ceratium*

STEGEN, G.R. 1975. RECENT EXPERIENCE WITH THE DRXBT. FLOW RESEARCH, INC., OCEAN SCIENCES DIV., KENT, WA 98031 STD CONFERENCE AND WORKSHOP PROCEEDINGS. EDITED BY W.R. DANIELSON. SAN DIEGO, CALIF.: PLESSEY ENVIRONMENTAL SYSTEMS, pp. 83-91.

Keywords: Workshops

STEHLIK, L.L.; MACKENZIE, C.L., JR.; MORSE, W.W. 1991. DISTRIBUTION AND ABUNDANCE OF FOUR BRACHYURAN CRABS ON THE NORTHWEST ATLANTIC SHELF. FISH BULL 89:473-492. Seasonal distributions and relative abundances of the Atlantic rock crab *Cancer irroratus*, Jonah crab *C. borealis*, northern lady crab *Ovalipes ocellatus*, and coarsehand lady crab *O. stephensoni* were determined from fish trawl and clam dredge surveys on the continental shelf from Nova Scotia to Cape Hatteras, NC, during 1978-87. Rock crabs have the broadest distribution, which includes coastal waters of the Gulf of Maine and depths of 6-456 m from Georges Bank to Cape Hatteras. Jonah crabs are more widely distributed in the Gulf of Maine and on Georges Bank than rock crabs. They occur most frequently in the northern offshore zones of the middle Atlantic from south of Georges Bank to off Delaware, at depths to over 400 m. Northern lady crabs occur primarily in the inner strata of the mid-Atlantic shelf in depths <27 m and on shallower portions of Georges Bank. Coarsehand lady crabs occur from southern New Jersey to Cape Hatteras, to over 200 m. *Cancer* spp. occur mainly at 3-18 °C, while *Ovalipes* spp. occur mainly at 11-24 °C. Sex ratios in rock and Jonah crab catches deviated from 1:1 by season and gear; males dominate in spring trawl surveys, females in summer dredge and fall trawl surveys. Trawl catches of all species were significantly larger at night or twilight than during the day, suggesting more nocturnal activity. Temperature, depth, and their interaction significantly affected the catches of these crabs.

Keywords: Benthos-*Cancer*, Benthos-*Ovalipes*

STEIMLE, F.W. 1978. DISSOLVED OXYGEN LEVELS IN NEW YORK BIGHT WATERS DURING 1977. TECH. SER. REP. NOAA NMFS NORTHEAST FISH CENT 34 pp. Anoxia in bottom waters of the New York Bight, and associated mass mortalities of marine organisms in 1976, caused concern that anoxia may become a chronic problem in the Bight. The Northeast Fisheries Center, National Marine Fisheries Service, established a series of

periodic surveys early in 1977 to further understand the hydrologic "climate" of the Bight and to monitor DO levels. The Bight did not become anoxic in 1977, although a band of low DO levels was found along the New Jersey coast during the summer.

Keywords: Anoxia

STEIMLE, F.W. 1978. HYDROGRAPHIC DATA FROM NEW YORK BIGHT: JULY-NOVEMBER 1976. MARINE ECOSYSTEMS ANALYSIS PROGRAM. REPORT NO.:NOAA DR ERL MESA-35, 206 pp. After extensive mortalities of demersal finfish and shellfish off the north-central New Jersey coast were reported, investigation determined that an oxygen depletion problem existed in the sub-thermocline water layer off New Jersey. A series of 39 cruises collected data in the New York Bight from July through November 1976. This report is a compilation of hydrographic data collected during these cruises. All stations were located by LORAN A or C with geographic conversions for some derived from a computer conversion program. The accuracy of computer conversions was spot checked and estimated to be within 0.5 nautical miles of actual plotted station locations. Water samples were collected in PVC Niskin water collectors. DO determinations were made by the Alsterberg-azide modification of the Winkler method, substituting phenylarsene oxide for sodium thiosulfate. Salinity values were determined with a Beckman RS-7C induction salinometer, corrected for drift and temperature compensated, except data for FK 032 which lacks drift corrections. Water temperature was measured with Hydrolab FTO 3M thermistor thermometer, glass mercury-type thermometer and X.B.T.'s.

Keywords: Anoxia, Miscellaneous-Physical, Monitoring-MESA

STEIMLE, F.W. 1981. TROPHIC RELATIONSHIPS OF ARTIFICIAL REEF FISHES. INTERN COUNC EXPLO SEC, C.M. 1981/E-3, 8 pp. The role of invertebrate epifauna as a source of food for artificial reef-associated fish is discussed. This study is based upon the literature and 309 fish gut contents (13 species) taken off artificial reefs.

Keywords: Artificial reefs, Fish

STEIMLE, F.W. 1982. ARTIFICIAL REEFS IN THE NEW YORK BIGHT: 50 YEARS OF EXPERIENCE. COUNCIL MEETING, 1982, OF THE INTERNATIONAL COUNCIL FOR THE EXPLORATION OF THE SEA (COPENHAGEN DENMARK) (OCTOBER 11, 1982). PUBL: ICES, COPENHAGEN (DENMARK), 7 pp. REPORT NO.: ICES-CM-1982/E:62.

Keywords: Artificial reefs

STEIMLE, F.W. 1985. BIOMASS AND ESTIMATED PRODUCTIVITY OF THE BENTHIC MACROFAUNA IN THE NEW YORK BIGHT: A STRESSED COASTAL AREA. ESTUAR COAST SHELF SCI 21(4):539-554.

Waste disposal in the Apex of the New York Bight has resulted in the contamination of sediments by toxic chemicals and some alteration to the community composition of the benthic macrofauna. The significance of these alterations to other communities in the area (e.g., its fishery resources) has not been clearly demonstrated. This paper presents data on an extensive survey of the macrofauna biomass that many fish and lobster feed on in the waste-disposal impacted areas of the apex, using samples from 1973 and 1980-1982. Variable mean production to biomass (P:B) ratios were used to estimate secondary production from the biomass of each major taxon. The macrofaunal biomass (wet wt.) of most of the apex area impacted by waste disposal was relatively high, with a mean biomass of 127 g m^{-2} for 1973 and 344 g m^{-2} for 1980-1982. Estimated secondary production was also high, being $201 \text{ Kcal m}^{-2} \text{ yr}^{-1}$ in 1973 and $383 \text{ Kcal m}^{-2} \text{ yr}^{-1}$ in 1980-1982. These values suggest there has been no inhibition of at least biomass, as the values were similar to or greater than values found in other areas of the Bight with similar bathymetric characteristics.

Keywords: Apex, Benthos-*Homarus*, Fish, Fisheries, Monitoring, Ocean disposal

STEIMLE, F.W. 1989. BENTHIC MACROFAUNA AND HABITAT MONITORING ON THE CONTINENTAL SHELF OF THE NORTHEASTERN USA I. BIOMASS. NOAA TECH REP NMFS 0 (86):I-IV, pp. 1-28.

Keywords: Benthos, Monitoring

STEIMLE, F.W.; BOEHM, P.D.; ZDANOWICZ, V.S.; BRUNO, R.A. 1986. ORGANIC AND TRACE METAL LEVELS IN OCEAN QUAHOG, *ARTICA ISLANDICA* LINNE, FROM THE NORTHWESTERN ATLANTIC. FISH BULL 84(1):133-140. Chemical contamination of biological resources is an important problem for resource managers. This study reports on body burden levels of several contaminants of concern: PCB, PAH (of both petroleum and combustion sources), total petroleum hydrocarbons, and seven trace metals (Ag, Cd, Cr, Cu, Ni, Pb, and Zn) in a resource species, the ocean quahog (*Artica islandica*) collected between Virginia and Nova Scotia. Organic and trace metal contaminants were detected at low levels in all samples examined, with highest levels being generally found in samples from the inner New York Bight and Rhode Island Sound. The highest PCB and PAH values were 27 and 55 ppb, respectively; Ag, Cd, and Cr values were generally $< 5 \text{ mu g/g dry weight}$; Cu, Ni, and Pb generally $< 15 \text{ mu g/g dry weight}$ with a few exceptions; and Zn ranged from 50 to $153 \text{ mu g/g dry weight}$. *A. islandica* may be a good offshore "indicator" species to monitor for trends in marine chemical pollution.

Keywords: Benthos-*Artica*, Pollutants-Bioaccumulation, Pollutants-Metals, Pollutants-Organic, Pollution-Toxicity

STEIMLE, F.W.; CARACCILO, J.; PEARCE, J.B. 1982. IMPACTS OF DUMPING ON NEW YORK BIGHT APEX BENTHOS. IN: ECOLOGICAL STRESS AND THE NEW YORK BIGHT: SCIENCE AND MANAGEMENT. PROCEEDINGS OF A SYMPOSIUM IN THE ECOLOGICAL EFFECTS OF ENVIRONMENTAL STRESS, NEW YORK, NY, JUNE 10-15, 1979, ESTUARINE RESEARCH FEDERATION, COLUMBIA, SC, pp. 213-223.

The discharge of materials in the Hudson-Raritan estuary and New York Bight Apex has altered some Apex benthic habitats physically and chemically, introducing high concentrations of a variety of pollutants (e.g., heavy metals, petroleum hydrocarbons, and organic carbon) that are known to be lethal or stressful to several groups of benthic invertebrates. Benthic invertebrate data from five survey cruises conducted during 1973-1974 at 66 stations in the Apex are reviewed, with evidence of dumping impacts discussed. The benthic community, in the vicinity of two dumpsites receiving New York harbor dredge spoils and metropolitan area sewage sludge, exhibited a reduction in the number of species present, especially small amphipod crustaceans that are highly sensitive to pollution and are important food items of many fish species.

Keywords: Monitoring, Ocean disposal

STEIMLE, F.W.; CARACCILO-WARD, J. 1989. A REASSESSMENT OF THE STATUS OF THE BENTHIC MACROFAUNA OF THE RARITAN ESTUARY. *ESTUARIES* 12(3):145-156. The benthic macrofauna of the Raritan estuary, at the mouth of New York Harbor, has been reported to be severely impacted by pollution, with a significant change occurring between surveys in the late 1950's and the early 1970's. We review this assessment using five-fold more macrofaunal data (including biomass), not reported or used before, from a 1973-1974 survey. These data are compared to previous and similar studies in the area. This reassessment suggests benthic community structure is not as degraded as previously reported and is, in many ways, similar to other relatively unpolluted mid-Atlantic estuaries.

Keywords: Benthos, Estuaries

STEIMLE, F.W.; KINNER, P.; HOWE, S.; LEATHEM, W. 1990. POLYCHAETE POPULATION DYNAMICS AND PRODUCTION IN THE NEW YORK BIGHT ASSOCIATED WITH VARIABLE LEVELS OF SEDIMENT CONTAMINATION. *OPHELIA* 31(2):105-123. Present approaches to assessing effects of anthropogenic disturbances on marine benthic macrofauna are mostly based on community or population structure analysis. There are limited studies on functional effects, (e.g., to growth or production). This paper examines the population dynamics, growth curves, and production rates for nine common species of surface-deposit feeding or carnivorous polychaetes at three locations in the contaminated New York Bight Apex. These locations were environmentally similar, except for variable levels of sediment

organic carbon (TOC) and toxic chemicals (trace metals, PCBs, and polyaromatic hydrocarbons). The results suggest little difference in the relative growth patterns of these species, with variable production or production to biomass ratios (P:B) responses between the locations and their variable contamination levels. The range of P:B ratios were similar to those reported elsewhere for the same or related species in less contaminated areas. This suggests that polychaetes are tolerant, to some degree, of elevated sediment contaminant levels found in the study area.

Keywords: Apex, Benthos, Pollutants-Metals, Pollutants-Organic, Pollutants-Toxicity

STEIMLE, F.W.; OGREN, L. 1982. FOOD OF FISH COLLECTED ON ARTIFICIAL REEFS IN THE NEW YORK BIGHT AND OFF CHARLESTON, SOUTH CAROLINA. MARINE FISHERIES REVIEW 44(6-7):49-52. The construction of artificial reefs is a popular means of countering increasing recreational fishing pressure. Despite their popularity, many questions persist about their function and effectiveness as a management tool. This paper discusses the role of the epifauna, which develops on artificial reefs and most other submerged hard surfaces, in providing food for the fish population found on or near artificial reefs. The stomach contents of 309 specimens of 13 species of fish, collected by spear or hook and line at three artificial reef sites, were examined to better define their trophic dependence on reef epifauna. Although most examined species did not appear to be highly dependent on the reef epifauna for food, there is a need for further study.

Keywords: Artificial reefs, Fish

STEIMLE, F.W.; RADOSH, D.J. 1979. EFFECTS ON THE BENTHIC INVERTEBRATE COMMUNITY. IN: OXYGEN DEPLETION AND ASSOCIATED BENTHIC MORTALITIES IN NEW YORK BIGHT, 1976, NOAA PROFESSIONAL PAPER 11. R.L. SWANSON AND C.J. SINDERMAN, (EDS.), pp. 281-293. The oxygen depletion event of 1976 killed many benthic invertebrates, especially surf clams, off central New Jersey. Some organisms, mostly polychaetes, showed tolerance. Recolonization and stabilization of the benthic invertebrate population appeared to be incomplete 1 year after the disturbance. Several years may be required for some species with nonplanktonic-larval dispersal to return to preanoxic levels.

Keywords: Anoxia, Benthos, Benthos-*Spisula*

STEIMLE, F.W.; STONE, R.B. 1973. ABUNDANCE AND DISTRIBUTION OF INSHORE BENTHIC FAUNA OFF SOUTHWESTERN LONG ISLAND, NEW YORK. NOAA TECH REPORT, NMFS SSRF-673, 50 pp.

Keywords: Benthos

STEINER, W.W.; LUCZKOVICH, J.J.; OLLA, B.L. 1982. ACTIVITY, SHELTER USAGE, GROWTH AND RECRUITMENT OF JUVENILE RED HAKE *UROPHYCIS CHUSS*. MAR ECOL PROG SER 7:125-135. Juvenile red hake *Urophycis chuss* (Walbaum) live in symbiotic association with sea scallops *Placopecten magellanicus*, immediately following the hake's descent from the planktonic post-larval stage to the benthos. Feeding behavior, activity rhythms, shelter preference and growth of juvenile fish were observed in the laboratory. Monthly field collections of juvenile red hake were used to study daily rhythms of shelter usage, size relationships between hake and scallops, recruitment patterns of hake from the plankton to the benthos, and growth rates. In the laboratory, hake activity, which included swimming and agonistic encounters, was predominantly nocturnal. Hake, ranging in size from 23 to 166 mm (TL), inhabited scallop shelters more often by day than by night in the field. Mean size of hake inhabiting scallops increased with larger scallops. Small scallops (<100 mm) contained predominantly small hake (26-65 mm), but large scallops (>120 mm) contained a wide size range of juvenile hake (26-166 mm). In shelter preference tests, juvenile hake chose non-living shelters over living scallops. Recruitment of hake from the plankton to the benthos lasted from September to December. Recruits in September ranged from 23 to 30 mm, while recruits in November were as large as 46 mm. Rates of recruitment were highest during October to November. Most hake emigrated from the scallop bed by February, at sizes approximately 90 to 100 mm (TL), but a few individuals remained until May. Growth rates (length) of juvenile hake in the laboratory averaged from 0.61 % d⁻¹ to 1.00 % d⁻¹, increasing with increasing average daily temperature. Growth (length) in the field during November to December was 0.93 % d⁻¹. Results suggest that shelter is an important resource for juvenile red hake. Variable growth rates and a prolonged recruitment period of hake to the benthos may result in overlap in size between different year classes of red hake. The abundance of juvenile red hake may be a better predictor of future year-class strength than planktonic eggs and larvae.

Keywords: Benthos-*Placopecten*, Fish-*Urophycis*

STEWART, K.R.; KODITSCHKE, L. 1980. DRUG-RESISTANCE TRANSFER IN *ESCHERICHIA COLI* IN NEW YORK BIGHT SEDIMENT. MAR POLLUT BUL 11:130-133. Sediment from the sewage sludge dump site area in the New York Bight contains bacteria resistant to antibiotics and heavy metals. The purpose of this study was to determine if antibiotic resistance could be transferred from donor to recipient *Escherichia coli* strains inoculated into glass vessels containing sediment and seawater obtained near the dump site. Temperature was maintained at 10 °C, the mean winter temperature of benthic water at the dump site. Transconjugants (recipients which inherit donor genes for tetracycline resistance) were isolated from the seawater and sediment within 1 hr after inoculation and were found in all subsequent sediment samples for one month. Donor and recipient *E. coli* remained viable in the sediment for at least one month. Our results indicate that sewage sludge polluted sediment may serve as an environment conducive to conjugal transfer of antibiotic resistance genes.

Keywords: Bacteria, Ocean disposal-12 mile, Pollutants-Sediment

STODDARD, A.; WALSH, J.J. 1988. MODELING OXYGEN DEPLETION IN THE NEW YORK BIGHT: THE WATER QUALITY IMPACT OF A POTENTIAL INCREASE OF WASTE INPUTS. OCEANIC PROCESSES IN MARINE POLLUTION, VOL 5, URBAN WASTES IN COASTAL MARINE ENVIRONMENTS. D.A. WOLFE AND T.P. O'CONNOR, (EDS.), pp. 91-102.

Keywords: Anoxia, Modeling

STONE, R.B. 1978. ANGLER PARTICIPATION IN ARTIFICIAL REEF CONSTRUCTION. WORLD RESEARCH MARINE FISHES, pp. 34-37. A brief history of reef building and angler involvement is presented.

Keywords: Artificial reefs

STONE, R.B. 1978. ARTIFICIAL REEFS AND FISHERY MANAGEMENT. FISHERIES 3(1):2-4. Artificial reefs can and should be used as a positive method for managing rough bottom fisheries within a given area by helping to maintain stocks of fish at levels that will provide acceptable catches to anglers while insuring continuance of the resource. A brief history of artificial reef construction in the U.S. is provided. Some fish, such as grunts, feed on grass beds and sand bottom at night but use reefs for shelter during the day. Reef materials also provide sheltered areas of calm water or favorable currents by damping or deflecting currents. Fish using these areas conserve energy. Many fish feed on algae or encrusting and motile invertebrates associated with the reef as well as using the shelter that reefs provide. Reefs also may be used as landmarks or visual reference points for fish; these landmarks provide a spatial reference for fish in a rather featureless environment. Many different nontoxic scrap materials were evaluated, including car bodies, building rubble, concrete culverts, ships, barges, and tires. Since there is a definite relationship between rough bottom and numbers of fish, absence of rough bottom limits the number of juvenile and adult rough-bottom fish that a given area can support. If artificial reefs could double rough-bottom carrying capacity in these areas, then areas with relatively high fishing pressure and small amounts of rough-bottom habitat could be improved considerably. An illustration of this phenomenon is presented using the New York Bight as an example.

Keywords: Artificial reefs, Fisheries

STONE, R.B.; BUCHANAN, C.C.; STEIMLE, F.W., JR. 1974. SCRAP TIRES AS ARTIFICIAL REEFS. USEPA, SOLID WASTE MANAGEMENT SERIES SW-119: 33 pp. Tire reefs showed improved angler success for rock habitat species but not for pelagic species. Reef designs and costs are discussed.

Keywords: Artificial reefs

STONE, R.B.; CLARK, J. 1970. DON'T POLLUTE ... DO SOMETHING CONSTRUCTIVE, BUILD AN ARTIFICIAL REEF. SKIN DIVER MAGAZINE 19:62-65. Suitability of reef materials and designs are examined with community cooperation emphasized.

Keywords: Artificial reefs

STONE, R.B.; PRINCE, E.D.; MAUGHAN, O.E. 1978. ARTIFICIAL FRESH AND SALTWATER REEFS: ECONOMICS, BIOLOGY, MANAGEMENT. NAT MAR FISH SER, FISHERIES 3(1):2-10. Reef construction and management to maintain stocks of fishes at angling levels without depleting the resource were surveyed at ten Atlantic coastal sites. Various building materials are evaluated.

Keywords: Artificial reefs, Fisheries

STROUD, R.H. 1959. NEW JERSEY REEF. SFI BULL 95:5. A proposed concrete rubble reef is discussed.

Keywords: Artificial reefs

STROUD, R.H. 1963. COASTAL WRECKS PROBLEM. SFI BULL 139:8. Salvage of ships along New Jersey coasts is challenged in view of the excellent fishing opportunities potentially lost.

Keywords: Artificial reefs

STROUD, R.H. 1963. FIRE ISLAND FISH REEF. SFI BULL 142:5. Early results from a new reef.

Keywords: Artificial reefs

STROUD, R.H. 1971. AUTO TIRE REEFS. SFI BULL 227:4-5. H. Mathews' early research on primary productivity at Panama City and Stone's work off Sandy Hook are reviewed.

Keywords: Artificial reefs

STROUD, R.H.; JENKINS, R.M. 1963. OFFSHORE ARTIFICIAL REEFS. SFI BULL 134:2. Construction details of the new reef off Fire Island are discussed; 3-5 ft diameter cement culverts are used on sand and clay substrates.

Keywords: Artificial reefs

STROUD, R.H.; MASSMANN, W.H. 1965. FIRE ISLAND FISH REEFS. SFI BULL 167:6-7. Concrete (40 8' by 3') units were constructed and deployed; however, their effectiveness is unknown.

Keywords: Artificial reefs

STROUD, R.H.; MASSMANN, W.H. 1966. EARLIEST ARTIFICIAL REEF. SFI BULL 174:5-6. Pierpoint's reef off New Jersey was built in 1935 and enlarged in 1937. It was built of car bodies, cement filled drums, barge and boat hulls, and concrete rubble. Suydam's reef inside Fire Island Inlet was made of 1,400 weighted butter tubs complete with short posts.

Keywords: Artificial reefs

STUBBLEFIELD, W.L.; PERMENTER, R.W.; SWIFT, D.J.P. 1977. TIME AND SPACE VARIATION IN THE SURFICIAL SEDIMENTS OF THE NEW YORK BIGHT APEX. ESTUAR COAS MAR SCI 5(5):597-607. Sidescan sonar records, grab samples, and bottom photographs were collected along 2 transects in the New York Bight Apex, on a quarterly basis for 6 quarters. Sampling was designed to determine the natural variability of bottom deposits (in time and space) and the effect of ocean dumping on these patterns.

The Hudson Shelf Valley and the Christiaensen Basin at its head are floored by fine muddy sand and mud, while the high areas on either side are covered by medium-grained sand. Bottom sands on the seaward side are relatively uniform. On the New Jersey side, and near the Long Island coast, sand ribbon-like patterns with spacing of 10-200 m appear. Separate dumpsites for sewage sludge, dredge spoil, cellar dirt, and acid waste occur within the area.

The distribution of grain sizes and bedform patterns are stable over time, indicating that the bottom is in a state of textural near-equilibrium with the hydraulic climate. The effects of ocean dumping are most obvious in the vicinity of the dredge spoil dumpsite, which has shoaled 15 m within the last years. Here an aureole of anomalously fine sediment is spreading over a bottom locally composed of artificial rubble. Cholera Bank, the area where the highly mobile sewage sludge is dumped, is floored by sand; no permanent sludge deposits form. The bottom muds of the adjacent Christiaensen Basin may, however, be contaminated with this material.

Keywords: Miscellaneous-Geological, Ocean disposal-Dredged material, Ocean disposal-Sewage Sludge

SUSZKOWSKI, D.J.; SANTORO, E.D. 1986. MARINE MONITORING IN THE NEW YORK BIGHT. NATIONAL SYMPOSIUM ON MONITORING STRATEGIES (AT) OCEANS '86 "SCIENCE-ENGINEERING-ADVENTURE" WASHINGTON, DC 23-25 SEPTEMBER 1986. OCEANS '86 CONFERENCE RECORD: SCIENCE-ENGINEERING-ADVENTURE. MONITORING STRATEGIES SYMPOSIUM. VOL. 3:754-759. REPORT NO.: IEEE-86CH2363. The ocean environment in the New York Metropolitan area has always received much public attention. In recent years problems associated with fisheries, water quality, beach quality, and ocean dumping of wastes have moved into the forefront of public awareness. Part of EPA's task is to oversee a number of permitted activities which encompass these issues including dredged material dumping and woodburning at sea (in conjunction with USACE issued permits). In addition, sewage sludge, acid waste, industrial and cellar dirt dumping, and beach water quality monitoring are all items regulated and monitored by EPA. The present paper discusses some of the major monitoring elements associated with these programs.

Keywords: Monitoring, Workshops

SWANSON, R.L. 1976. TIDES. MESA NEW YORK BIGHT ATLAS MONOGRAPH 4, 34 pp. The semidiurnal tide wave in the New York Bight region generally traverses the continental shelf such that the same phase arrives nearly simultaneously all along the New Jersey coast. New data substantiates the fact that the range of tide increases from somewhat less than a meter at the continental shelf break to approximately 1.4 m (4.6 ft) along the New Jersey coast. Long Island Sound, a major embayment, modifies the co-tide and co-range lines in the northeastern portion of the Bight. Sea level is rising relative to the land at an average representative rate of just over 3 mm (0.01 ft) per year in this region.

Keywords: Circulation, Monitoring-MESA, Reviews-Physical

SWANSON, R.L. 1977. STATUS OF OCEAN DUMPING RESEARCH IN NEW YORK BIGHT. J WATERWAY, PORT, COASTAL AND OCEAN DIV ASCE 103(WW1):9-24. The coastal areas of the United States and its possessions are among our most valuable resources. From the earliest days of the Republic, America's economic and social development has been closely linked to its coasts. The New York Bight has been prominent in this evolution. It extends seaward over 39,000 km² (15,000 sq miles) from Long Island and New Jersey to the edge of the continental shelf, some 150 m-180 km (80 nautical miles-100 nautical miles) offshore. Adjacent to one of the most populated and industrialized regions of the world, it supports nearly 10% of the nation's population. The Bight and its related shore have served as a playground, dump, sewer, transportation route, fishery, and mineral resource. Recent reconnaissance assessments have

shown that the ecosystem of this marine region has been strained beyond tolerance by man's activities.

The effects of ocean dumping of sewage sludge has been of particular concern. In 1968, the Army Corps of Engineers, Smithsonian Institution, and invited scientists convened to assess waste disposal practices in the New York Bight. The results of the associated investigations were documented in Ref. 32. Public emotion relative to sewage sludge dumping reached such a pitch in 1973 that the EPA was compelled to examine the issue in some detail, particularly considering the anticipated threefold increase in the volume of sewage sludge resulting from improved wastewater treatment facilities in the New York-New Jersey Metropolitan area. Regardless of personal opinions relative to ocean dumping, the attendant management issue is really one of adopting cost effective disposal practices that minimize environmental degradation. Considerable effort has been initiated by EPA to examine three alternatives: (1) continuation of the existing practice of ocean dumping; (2) relocation of the sewage sludge dump site farther from the coast; and (3) adoption of land-based alternatives to the existing practice of ocean disposal. This paper summarizes the results of many investigations undertaken on the New York Bight ocean dumping issue, attempting to put into perspective the relationship of sewage sludge dumping to the overall problem of contamination in the New York Bight, and concludes with recommendations of NOAA on the oceanic aspects of the sewage sludge disposal problem.

Keywords: Management, Ocean disposal-Sewage sludge

SWANSON, R.L.; KAHN, J.; YOUNG, R.R.; BELL, T.M. 1989. USE IMPAIRMENTS AND ECOSYSTEM IMPACTS OF THE NEW YORK BIGHT. EIGHTH INTERNATIONAL OCEAN DISPOSAL SYMPOSIUM, 9-13 OCTOBER 1989, INTER-UNIVERSITY CENTRE OF POSTGRADUATE STUDIES, DUBROVNIK, YUGOSLAVIA. FLORIDA INST. OF TECHNOLOGY, MELBOURNE, FL, p 21. The New York Bight is perhaps one of the most used and abused coastal areas in the world. Many of the stresses of excess population and industrialization as measured by pollutant loadings and ecosystem impacts can be crudely quantified in terms of use impairments that have measurable social and economic relevance. Five broad categories of impairment attributed to pollution in the Bight that are causing significant losses of ecological, economic, or social values are beach closures; unsafe seafoods; hazards to commercial and recreational navigation; loss of commercial and recreational fisheries; and declines in birds, mammals, and turtles.

Keywords: Management, Workshops

SWANSON, R.L.; MAYER, G.F. 1989. OCEAN DUMPING OF MUNICIPAL AND INDUSTRIAL WASTES IN THE UNITED STATES. OCEANIC PROCESSES IN MARINE POLLUTION, VOL. 3, MARINE WASTE MANAGEMENT: SCIENCE AND POLICY. M.A. CHAMP AND P.K. PARK, (EDS.), pp. 35-52.

Keywords: Ocean disposal

SWANSON, R.L.; PARKER, C.A. 1988. PHYSICAL ENVIRONMENTAL FACTORS CONTRIBUTING TO RECURRING HYPOXIA IN THE NEW YORK BIGHT. TRANS AM FISH SOC 117:37-47. DO data obtained for the nearshore areas of the New York Bight during 1974-1983 were analyzed statistically for relationships between physical environmental factors and bottom DO concentrations. A multiple linear regression expression was developed as an estimator for bottom DO both as a function of the depth of the pycnocline and as an index of wind energy and its persistence. This latter index is called the quiescence-constancy (*QC*) index. The estimator for DO explained 86% of the variability over the decade of analysis. The utility of the estimator was examined in the context of several years not included in the analysis. In general, we found that deep pycnoclines and strong persistent southerly to southwesterly winds were closely correlated with low bottom DO averaged over the region. Shallow pycnoclines and strong but variable winds were associated with higher values of regionally averaged bottom DO.

Keywords: Anoxia, Modeling

SWANSON, R.L.; SINDERMAN, C.J. (EDS.). 1979. OXYGEN DEPLETION AND ASSOCIATED BENTHIC MORTALITIES IN NEW YORK BIGHT, 1976, NOAA PROFESSIONAL PAPER 11, 345 pp. In July 1976, fishermen reported large numbers of dead surf clams and other bottom-dwelling organisms in an 8,600 km² area of the New Jersey continental shelf. The phenomenon continued through October of that year. It was determined that mortalities were caused by extremely low concentrations of dissolved oxygen and by hydrogen sulfide poisoning in some bottom waters. Mortalities were greatest among surf clams, ocean quahogs, and other benthic animals. By October 1976 more than half of the surf clam population off the central New Jersey coast had died, and a significant but smaller number of ocean quahogs and sea scallops also died. Lobster catches declined almost 50% during the period. This paper documents what has been learned about resource and economic losses caused by the decline in oxygen in these waters. It also analyzes coastal oceanographic processes and conditions that affected water quality during this period. The volume brings together knowledge of the physiochemical makeup and ecology of these coastal waters, and the likelihood of future oxygen depletion events is discussed.

Keywords: Anoxia, Benthos-*Artica*, Benthos-*Spisula*

SWANSON, R.L.; SINDERMAN, C.J.; HAN, G. 1979. OXYGEN DEPLETION AND THE FUTURE: AN EVALUATION. IN: OXYGEN DEPLETION AND ASSOCIATED BENTHIC MORTALITIES IN THE NEW YORK BIGHT, 1976, NOAA PROFESSIONAL PAPER 11. R.L SWANSON

AND C.J. SINDERMANN (EDS.), pp. 335-345. No single factor has been identified as causing the oxygen depletion and resulting mass mortalities of benthic organisms during the summer of 1976. The observed conditions seemed to develop in response to atmospheric and oceanic processes that departed from normal (average) in both intensity and time of occurrence possibly aggravated by unusually large inputs of nutrients and organic carbon from human activities and wastes in the area surrounding the Bight. The conditions causing depressed DO began early in the year. As early as January 1976 the dinoflagellate *Ceratium tripos* had a large bloom throughout New York Bight and over much of the northeastern continental shelf, peaking between April and June. Though the cause is not clear, the bloom was so large in geographic extent that nutrient inputs to the Bight from human sources cannot reasonably be regarded as the cause. After the publicity given the 1976 oxygen depletion event, a frequent question was: "Is it possible to predict oxygen depletion in waters of the New York Bight?" Complexities of the marine ecosystem and many interacting environmental conditions limit development of a reliable predictive model. Considerable attention is now given to carbon, oxygen, and nitrogen modeling of Bight waters, in order to make it possible to detect trends in DO concentrations and identify the need to observe certain indicators more closely. Despite present difficulties in reliably predicting or using information relative to DO depletion, monitoring some of the contributing factors is proposed to provide advanced warning of a severe problem.

Keywords: Anoxia, Plankton-*Ceratium*

SYLVA, D. 1985. NEKTONIC FOOD WEBS IN ESTUARIES. FISH COMMUNITY ECOLOGY IN ESTUARIES AND COASTAL LAGOONS. IN: TOWARDS AN ECOSYSTEM INTEGRATION. A. YANEZ-ARANCIBIA, (ED.), pp. 233-245. Estuarine nekton is predominantly fishes which comprise both surface-swimming species and epibenthic species. Biotic and abiotic factors affect the distribution of estuarine nekton and its food few studies of nektonic food webs have included concomitant environmental studies. Typical and atypical nektonic food webs are compared from England, the New York Bight, South Florida, Guyana, Argentina, and South Viet Nam.

Keywords: Estuaries

TAVOLARO, J.F. 1984. A SEDIMENT BUDGET STUDY OF CLAMSHELL DREDGING AND OCEAN DISPOSAL ACTIVITIES IN THE NEW YORK BIGHT. ENVIRON GEOL WATER SCI 6(3):133-140. The purpose of this study was to quantify the dry mass of dredged material involved in each stage of typical clamshell dredging and ocean disposal activities in order to identify and quantify "losses" of dredged material. Turbidity plumes generated at dredging sites were also observed. Approximately 2% of the dredged material was lost at the dredging site. Of this quantity 61% was due to the dredging itself, and 38% was due to intentional barge overflow. Approximately 3.7% of the dredged material was lost at the Mud Dump Site during disposal. Total loss of dredged material during these clamshell dredging and ocean disposal operations was

calculated to be 5.6%. Observations revealed that turbidity plumes were local features which traveled along the bottom for several hundred feet. These plumes only persisted while dredging was occurring, and ambient conditions were established within a relatively short time after dredging ceased.

Keywords: Ocean disposal-Dredged material, Sediment transport

TEETER, A.M.; CALLAWAY, R.J.; DENBO, D.W. 1978. DISPERSION OF SEWAGE SLUDGE DISCHARGED INTO NEW YORK BIGHT - PHYSICAL OCEANOGRAPHIC DATA - DECEMBER 1974. ECOL RES SER U.S. EPA CORVALLIS, OR, 60 pp. This volume contains physical oceanographic data collected at the sewage sludge disposal site near the Apex of the New York Bight December 18 through 21, 1974. An optical tracer method was used to measure the water column distribution of waste material with time after discharge. Profiles with depth were taken for 2 to 4 hrs after waste discharge. Ambient temperature-salinity-density profiles and current measurements were also taken.

Keywords: Monitoring, Ocean disposal-Sewage sludge

TEETER, A.M.; CALLAWAY, R.J.; DITSWORTH, G.R.; DENBO, D.W.; BROWNE, D.W. 1978. DISPERSION OF SEWAGE SLUDGE DISCHARGED INTO NEW YORK BIGHT. PHYSICAL OCEANOGRAPHIC DATA AND LABORATORY ANALYSES 1975. ECOL RES SER U.S. EPA CORVALLIS, OR, 208 pp. This volume contains data on the dispersion of sewage sludge subsequent to its disposal at a site near the Apex of the New York Bight. Cruises were made in May, July, and October 1975. An optical tracer method was used to measure the water column distribution of waste material for 2 to 4 hrs after discharge. Direct measurements of the concentration of suspended material were made. Ambient temperature-salinity-density profiles were taken. Currents were measured by moored and profiling instruments and by drogue tracking. Laboratory analyses on the settling characteristics, densities, and optical properties of sewage sludges from the New York area are presented.

Keywords: Apex, Monitoring, Ocean disposal-Sewage sludge

TERRY, O.W. 1977. AQUACULTURE. MESA NY BIGHT ATLAS MONOGRAPH 17, 36 pp. The oyster industry, probably the earliest form of American aquaculture, has a long and important history in the various inshore waters adjoining New York Bight. With the introduction of modern technology, the future of oyster production is now promising despite the industry's recent difficulties. Similar advances are also beginning to be accomplished in hard clam culture. These, in time, will undoubtedly lead to commercial aquaculture of other regionally important marine species. In its traditional nearshore location, the aquaculture industry will have to meet ever-increasing pressure from competing uses. But as water pollution is controlled, additional space for aquaculture may well become available. Stricter environmental protection will sometimes work to

constrain aquaculture as well as to promote it, but the overall balance promises to be favorable to the industry. The greatest long-term potential for Bight aquaculture probably lies in sharing worldwide progress toward novel high-technology systems just now beginning to be seriously considered for offshore or open sea mariculture. The Bight has unique advantages for this kind of aquaculture, which might serve to turn some of the Bight's presently most intractable waste disposal problems into resources through recycling.

Keywords: Fisheries, Monitoring-MESA, Reviews-Biological

THOMAS, J.P.; O'REILLY, J.E.; DRAXLER, A.F.J.; BABINCHAK, J.A.; ROBERTSON, C.N.; PHOEL, W.C.; WALDHauer, R.I.; EVANS, C.A.; MATTE, A.; COHN, M.S.; NITKOWSKI, M.F.; DUDLEY, S. 1979. BIOLOGICAL PROCESSES: PRODUCTIVITY AND RESPIRATION. IN: OXYGEN DEPLETION AND ASSOCIATED BENTHIC MORTALITIES IN NEW YORK BIGHT, 1976, NOAA PROFESSIONAL PAPER 11, R.L. SWANSON AND C.J. SINDERMAN, (EDS.), pp. 231-261. Between August 24 and September 6, 1976, about 2 months after the onset of oxygen depletion, data concerning primary production, water-column and seabed oxygen consumption, nutrients, organic carbon, phytoplankton identification and abundance, chlorophyll *a*, and bacteria were collected to document conditions. A strong, deep (12-20 m) pycnocline and a subpycnocline low DO area with sulfide were present. Nutrient regeneration supplied most of the nutrients required by phytoplankton, but the estuary appeared to be the major nutrient source for the Apex while in-situ nutrient regeneration appeared to be the major source for primary production offshore. In the oxygen-depleted area the subpycnocline water had high concentrations of sulfide, ammonium, silicate, and phosphate. DOC concentrations were unusually high throughout the region, relative to other coastal/shelf areas, with the highest concentrations in the middle and outer Apex. DOC concentrations appeared to counteract seaward dilution when compared to other forms of organic carbon. Beyond the Apex, adjacent to the New Jersey coast, and in oxygen-depleted areas, large increases in chlorophyll-*a* and POC concentrations were observed in the pycnocline and directly above the seabed, suggesting organic loading to the subpycnocline layer.

The most abundant phytoplankton species present was a small (1.5-3 m), spherical, unicellular green form, probably *Nannochloris atomus*. Chain-forming diatom species dominated pycnocline and near-bottom waters, while flagellated (motile) species dominated surface waters. No *Ceratium tripos* were observed in samples during the August-September 1976 cruise. Phytoplankton above the pycnocline appeared healthy, based on high productivity, high assimilation numbers, and high photosynthetic efficiencies. Phytoplankton below the pycnocline appeared less healthy, based on low chlorophyll/phaeopigment ratios, low assimilation numbers, and low photosynthesis efficiencies. Total plankton respiration rates generally were higher at or near the surface and decreased with depth except on the periphery of the oxygen-depleted area where rates were highest at or below the pycnocline.

Keywords: Anoxia, Plankton, Pollutants-Loadings

THOMAS, J.P.; PHOEL, W.; STEIMLE, F. 1976. NEW YORK BIGHT APEX DATA ON TOTAL OXYGEN CONSUMPTION BY THE SEABED, MARCH 1974 - FEBRUARY 1975. NOAA DR ERL MESA-6, 94 pp. From March 1974 to February 1975 seabed oxygen consumption and related bottom water hydrographic data (temperature, salinity, dissolved oxygen concentrations and per cent oxygen saturation) were measured on four cruises in the Apex of the New York Bight to determine baseline values and distributions. Samples for seabed oxygen consumption were taken with a Pamatmat multiple corer and incubated on shipboard in a water bath thermoregulated to *in situ* temperature. Samples from approximately 60 stations per cruise were taken in this way. The data presented are those of total oxygen consumption by the seabed and related hydrographic data. All data contained herein are part of the data bank of the NOAA/NMFS Middle Atlantic Coastal Fisheries Center, Sandy Hook Laboratory, Highlands, New Jersey.

Keywords: Anoxia, Apex, Sediments

THOMAS, J.P.; PHOEL, W.C.; STEIMLE, F.W.; O'REILLY, J.E.; EVANS, C.A. 1976. SEABED OXYGEN CONSUMPTION-NEW YORK BIGHT APEX. IN: MIDDLE ATLANTIC CONTINENTAL SHELF AND THE NEW YORK BIGHT. PROCEEDINGS OF THE SYMPOSIUM AMERICAN MUSEUM OF NATURAL HISTORY, NEW YORK CITY, NOVEMBER 3-5, 1975, M.G. GROSS, (ED.), SPECIAL SYMPOSIA 2:354-369. Seabed oxygen consumption rates, temperature, salinity, and dissolved oxygen were measured during five cruises in the New York Bight Apex between March 1974 and August 1975. The area sampled included the waste disposal sites for sewage sludge, dredge spoils, and industrial acid wastes. Samples were collected and incubated shipboard at *in situ* temperature during oxygen uptake measurements.

Total oxygen consumption by the seabed ranged from 1-68 ml O₂ m⁻² h⁻¹. An average of 444 X 10⁶ liters O₂ (183 tonnes C) are estimated to be consumed by the Apex (1,577 km²) seabed each day ranging from 288 X 10⁶ in February to 689 X 10⁶ in August. In winter the highest rates of uptake were measured in the Christiaensen Basin adjacent to the sewage sludge disposal site, in the topographically high dredge spoil disposal area west of the Christiaensen Basin, and in the Hudson Shelf Valley. In summer the highest rates were measured in the dredge spoil areas and were more like winter rates. This difference may have been caused by differential sedimentation rates of oxidizable organic carbon to the seabed, mediated by the presence or absence of the thermocline. The highest rates were measured near a municipal sewage outfall off Asbury Park, N.J. No discernible effects on seabed oxygen consumption were observed near the acid waste disposal area. Most (93%-98%) oxygen uptake in the Apex occurs in the water column and not on the seabed.

Keywords: Anoxia, Apex, Monitoring

THOMPSON, D.R.; GASPAROVIC, R.F. 1986. INTENSITY MODULATION IN SAR IMAGES OF INTERNAL WAVES. NATURE 320:345-347. During the SAR Signature Experiment (SARSEX), conducted in 1984 in the New York Bight off the eastern coast of the United States, synthetic aperture radar (SAR) images of the ocean surface and concurrent ground-truth measurements were collected in order to test quantitatively various imaging theories. These theories predict that the intensity modulations observed in SAR images of internal waves are produced by variations in the small-scale surface roughness induced by spatial variations in the internal-wave surface current field. Analysis of the SARSEX data indicates that the imaging theories can explain the observed modulation for L-band (similar to 24-cm) SAR wavelengths, but under-predict by almost an order of magnitude the observed X-band (similar to 3.2-cm) modulation. To explain this latter discrepancy, the authors hypothesize a two-step mechanism in which the observed X-band modulation results from additional small-scale roughness produced by the strong perturbation of the meter-scale surface waves by the internal wave current field.

Keywords: Circulation-Internal waves, Remote sensing

THOMPSON, D.R.; GOTWOLS, B.L.; STERNER, R.E.,II. 1988. A COMPARISON OF MEASURED SURFACE WAVE SPECTRAL MODULATIONS WITH PREDICTIONS FROM A WAVE-CURRENT INTERACTION MODEL. J GEOPHYS RES C OCEANS 93(C10):12339-343. Predictions from a wave-current interaction model based on a wave action balance equation are compared with measured surface wave modulations induced by internal waves. The comparison involves relative modulations of the surface wave spectrum at wavelengths ranging from 0.2 to 1.0 m for wind speeds of 3.5 and 7 m/s. Good agreement is found between measurements and predictions for interactions with eight internal waves in two wave packets encountered during Synthetic Aperture Radar Internal Wave Signature Experiment.

Keywords: Circulation-Internal waves, Remote sensing

THRELFALL, W.; KHAN, R.A. 1990. MYXOZA OF DEEP-SEA FISHES IN THE NORTHWESTERN ATLANTIC. J PARASITOL 76(2):288-290. The gall bladder of 5 species of deep-water fishes (*Coryphaenoides armatus*, *Coryphaenoides rupestris*, *Macrourus berglax*, *Antimora rostrata*, and *Synaphobranchus kaupii*) from the New York Bight and Carson Canyon areas in the northwestern Atlantic were examined for myxozoan parasites. *Myxidium coryphaenoidium* was found in 4 fish species, whereas *Auerbachia pulchra* and *Ceratomyxa* species were each observed in 1 fish species. Prevalence of myxozoan infections was greater in fishes taken off the New York Bight than from the Carson Canyon.

Keywords: Fish, Parasites

THURBERG, F.P.; GOODLETT, R.O. 1979. IMPACT ON CLAMS AND SCALLOPS. PART 2: LOW DISSOLVED OXYGEN CONCENTRATIONS AND SURF CLAMS-A LABORATORY STUDY. IN: NOAA PROFESSIONAL PAPER 11, OXYGEN DEPLETION AND ASSOCIATED BENTHIC MORTALITIES IN NEW YORK BIGHT, 1976. R.L. SWANSON AND C.J. SINDERMAN (EDS.), pp. 277-293. Under laboratory conditions, the surf clam survived low levels of DO for extended periods of time. Levels below 1.4 ml/l were nearly always fatal. No deaths were recorded after 8 weeks at 2.1 ml/l DO, and clams placed in water at 0.7 ml/l after previous exposure to 2.1 ml/l survived for 8 weeks, indicating that a gradual shift to anaerobic pathways is possibly advantageous. Flowing water exposures permitted better survival than did static water systems. Metabolic studies indicated that animals held under low oxygen conditions consumed oxygen at higher rates than normal.

Keywords: Anoxia, Benthos-*Spisula*, Benthos-*Placopecten*

TIETJEN, J.H. 1980. POPULATION STRUCTURE AND SPECIES COMPOSITION OF THE FREE-LIVING NEMATODES INHABITING SANDS OF THE NEW YORK BIGHT APEX. ESTUAR COAS MAR SCI 10:61-73. The free-living nematodes inhabiting silty and medium to coarse sands at nine stations in the New York Bight Apex were studied from August 1973 to September 1974. Average population densities (no. 10 cm⁻²) ranged from 221 to 1381; no significant differences in density associated with sediment type, organic carbon or heavy metal concentrations were observed. In medium sands with low organic carbon and low heavy metal concentrations the nematode fauna was characterized by: (1) dominance by members of the families Chromadoridae and Desmodoridae; (2) low relative abundance of the family Comesomatidae; and (3) high species diversity. In silty sands, and also in medium sands with high organic carbon and/or high heavy metal concentrations, the fauna was marked by: (1) low relative abundances of the Chromadoridae and Desmodoridae; (2) high dominance of the Comesomatidae; and (3) low species diversity. In medium sands species diversity was significantly inversely correlated with increased concentrations of Cr, Cu, Pb and Zn. However, no such relationship existed in silty sands. Contaminated medium sands were also marked by high relative abundances of the comesomatid *Sabatieria pulchra*, which may be able to tolerate stressed sands much better than the normal inhabitants of such sediments; species belonging to the families Chromadoridae and Desmodoridae.

Keywords: Benthos, Pollutants-Sediment

TIETJEN, J.H. 1982. POTENTIAL ROLES OF NEMATODES IN POLLUTED ECOSYSTEMS AND THE IMPACT OF POLLUTION ON MEIOFAUNA. IN: ECOLOGICAL STRESS AND THE NEW YORK BIGHT: SCIENCE AND MANAGEMENT. PROCEEDINGS OF A SYMPOSIUM ON THE ECOLOGICAL EFFECTS OF ENVIRONMENTAL STRESS, NEW

YORK, NY, JUNE 10-15, 1979, G.F. MAYER, (ED.), ESTUARINE RESEARCH FEDERATION, COLUMBIA, SC, pp. 225-233. Meiofauna are small benthic animals (usually less than 2 mm) whose densities on the shelf generally range from $10^5/m^2$ to $10^7/m^2$. Through their grazing of bacterial populations, they maintain the bacteria in a state of active growth and thus contribute significantly (along with the protozoa and macrofauna) to the organic decomposition process. Through direct excretion of phosphorus and nitrogen, meiofauna and other benthic animals also may contribute to the regeneration of nutrients, most of which are rapidly utilized by bacteria and microalgae. In sediments with high organic enrichments, such as in the New York Bight Apex and western Long Island Sound, meiofaunal densities and biomass are not depressed (compared to those of sediments with no organic enrichment). Where macrobenthic densities have been reduced by pollution, such as in the New York Bight Apex, meiofauna and protozoa may become the dominant benthic animal influence in detritus decomposition and remineralization. Pollutants that reduce meiofaunal densities or alter the manner in which the animals function thus have an impact on the organic decomposition process. In the New York Bight Apex, increased levels of heavy metals in the dredge spoil and sewage sludge dumpsites are correlated with changes in the species composition and decreased species diversity of nematodes, the dominant taxon present. The replacement fauna contains species that have been shown in laboratory studies to have slower metabolic rates than the original fauna. Such metabolically less active animals could contribute to long-term accumulation of organic matter in the deeper basins of the New York Bight and Long Island Sound.

Keywords: Benthos, Pollutants-Toxicity

TIMONEY, J.H.; PORT, J.G. 1982. HEAVY METAL AND ANTIBIOTIC RESISTANCE IN *BACILLUS* AND *VIBRIO* FROM SEDIMENTS OF NEW YORK BIGHT. IN: ECOLOGICAL STRESS AND THE NEW YORK BIGHT: SCIENCE AND MANAGEMENT. PROCEEDINGS OF A SYMPOSIUM ON THE ECOLOGICAL EFFECTS OF ENVIRONMENTAL STRESS, NEW YORK, NY, JUNE 10-15, 1979, G.F. MAYER, (ED.), ESTUARINE RESEARCH FEDERATION, COLUMBIA, SC, pp. 235-248. A large proportion of the sedimentary *Bacillus* from the waste disposal area of the New York Bight was resistant to 20µg of mercury (Hg) per ml and to high concentrations of cadmium (Cd) and zinc (Zn). Concentrations of heavy metals were much higher in these than in control sediments farther offshore where dumping of wastes has never been practiced and where heavy metal concentrations were low. Ampicillin resistance, mainly because of β-lactamase production, was significantly ($P < 0.001$) more prevalent in *Bacillus* from the dump area than from control sediments. Also, *Bacillus* with combined mercury and ampicillin resistance were six times more frequent in dump sediments than elsewhere. Mercury resistance also was prevalent in *Vibrio* from dump sediments. The resistance pattern mercury-kanamycin-streptomycin was found in 10.2% (60 out of 586) of *Vibrio* or *Vibrio-Aeromonas* from dumpsite sediments, but was found in only 1.6% (8 out of 510) of similar strains from control sediments. This resistance was transferable by conjugation and was probably plasma-mediated.

An important mechanism of mercury resistance in both *Bacillus* and *Vibrio* was reduction to volatile metallic mercury (Hg⁰). The results of this study suggest that heavy metal contamination of an ecosystem can exert a selection pressure for antibiotic resistance in bacteria in that environment.

Keywords: Bacteria, Bacteria-*Vibrio*, Pollutants-Toxicity

TIMONEY, J.F.; PORT, J.; GILES, J.; SPANIER, J. 1978. HEAVY-METAL AND ANTIBIOTIC RESISTANCE IN THE BACTERIAL FLORA OF SEDIMENTS OF NEW YORK BIGHT. APPLIED AND ENVIRONMENTAL MICROBIOLOGY 36(3):465-472. The New York Bight extends seaward some 80 to 100 miles (ca. 129 to 161 km) from the Long Island and New Jersey shorelines to the edge of the continental shelf. Over 14×10^6 m³ of sewage sludge, dredged spoils, acid wastes, and cellar dirt are discharged into this area each year. Large populations of *Bacillus* sp. resistant to 20 µg of mercury per ml were observed in Bight sediments contaminated by these wastes. Resistant *Bacillus* populations were much greater in sediments containing high concentrations of Hg and other heavy metals than in sediments from areas farther offshore where dumping has never been practiced and where heavy-metal concentrations were found to be low. Ampicillin resistance due mainly to *B*-lactamase production was significantly ($P < 0.001$) more frequent in *Bacillus* strains from sediments near the sewage sludge dump site than in similar *Bacillus* populations from control sediments. *Bacillus* strains with combined ampicillin and Hg resistances were almost six times as frequent at the sludge dump site as in control sediments. This observation suggests that genes for Hg resistance and *B*-lactamase production are simultaneously selected for in *Bacillus* and that heavy-metal contamination of an ecosystem can result in a selection pressure for antibiotic resistance in bacteria in that system. Also, Hg resistance was frequently linked with other heavy-metal resistances and, in a substantial proportion of *Bacillus* strains, involved reduction to volatile metallic Hg.

Keywords: Bacteria, Pollutants-Toxicity

TINGLE, A.G.; DIETERLE, D.A.; WALSH, J.J. 1979. PERTURBATION ANALYSIS OF THE NEW YORK BIGHT. IN: ECOLOGICAL PROCESSES IN COASTAL AND MARINE SYSTEMS, VOL. 10, R.J. LIVINGSTON, (ED.), pp. 395-436. The physical transport of pollutants, their modification by coastal food web, and their transfer to man are problems of increasing complexity on the continental shelf. In an attempt to separate cause and effect, a computer modeling technique is applied to problems involving the transport of pollutants as one tool in assessment of real or potential coastal perturbations. Approaches for further development of models of the biological response within the coastal marine ecosystem are discussed. Our present perturbation analyses consist of a circulation sub-model, a simulated trajectory of a pollutant particle within the flow field, and a time-dependent wind input for each case of the model. The circulation model is a depth-integrated, free surface formulation that responds to wind stress, bottom friction, the geostrophic pressure gradient, the Coriolis force, and bottom

topography. The transport diffusion model is based on Lagrangian mass points, or "particles," moving through an Eulerian grid. The trajectories of material moving on the surface and in the water column are computed. It has the advantage that the history of each particle is known. With these models, we have been able to successfully reproduce drift card data for determining the probabilities of a winter oil spill beaching within the New York Bight, analyze the source of floatables encountered on the south shore of Long Island in June 1976, and predict the trajectory of oil spilled in the Hudson River after it had entered the New York Bight Apex. For future analyses, the shallow water model can be modified or replaced with a numerical model that contains a more sophisticated parameterization of the physical circulation. Second, the particle-in-cell model can be modified to explicitly include chemical reactions and interactions with the biota. Any model, however, should be used in the context of the level of resolution or aggregation to which the ecosystem is known and the management decision required as an aid in selecting situations that merit further analysis with more comprehensive ecological reasoning.

Keywords: Management, Modeling, Sediment transport

TRUITT, C.L. 1986. THE DUWAMISH WATERWAY CAPPING DEMONSTRATION PROJECT: ENGINEERING ANALYSIS AND RESULTS OF PHYSICAL MONITORING. TECH REPORT D-86-2, US ARMY ENGINEER WATERWAYS EXPERIMENT STATION, VICKSBURG, MS. The US Army Engineer District, Seattle, and the US Army Engineer Waterways Experiment Station, Vicksburg, have cooperated in a project in the Duwamish Waterway that successfully demonstrated the engineering aspects of subaqueous disposal and capping of contaminated dredged material. Approximately 1,100 cu yd of silty, clayey shoal material was removed by clamshell dredging, transported by barge, and bottom dumped through 70 ft of water into an existing depression. The site was then capped with successive loads of clean sandy cover. The technique has been termed "contained aquatic disposal."

This paper summarizes the initial fieldwork and presents results through the first (6-month) monitoring effort. The engineering effectiveness of the material placement and capping operation is examined using comparisons of replicate bathymetry and side scan sonar. The analysis indicates that the contaminated material exited the barge rapidly and descended to the bottom quickly as a well-defined, cohesive mass. Clean sand was applied successfully as a cap without displacing the softer contaminated material. A columetric balance of materials is presented together with an error analysis for the calculated volumes based on the precision of the surveys used. Sufficient geotechnical information was also collected to allow for an approximate mass balance calculation. Sources for potential losses of material during the operation are examined. In particular, resuspension of sediment was measured during both the dredging and the disposal operations. A computer-aided method was developed to allow for rapid comparisons of suspended solids levels at different depth in the water column and at various sampling stations.

Keywords: Capping

TUREKIAN, K.K. 1979. ARTIFICIAL RADIONUCLIDES SUBPANEL REPORT. IN: CHEMICAL POLLUTANTS OF THE NEW YORK BIGHT: PRIORITIES FOR RESEARCH. J.S. O'CONNOR AND H.M. STANFORD, (EDS.), pp. 44-47. The abundance of plutonium in the New York Bight sediments is about 100 DPM ($^{239}\text{Pu} + ^{240}\text{Pu}$)/kg in New York Harbor sediment. If the present level of plutonium in the water, sediments, and marine life of the New York Bight poses no threat to life, then why worry about it? The answer lies in the projected increase of plutonium production and handling around the New York Bight, as nuclear energy is more extensively used. Plutonium isotopes, because of their very long half-lives, are persistent in the sense that they do not leave the environment except by radioactive decay. There are as yet no known chemical breakdown pathways conceivable as for the organic pollutants. Thus, plutonium will accumulate in coastal sediments and be subject to incorporation in the benthos. At what level this becomes a hazard is not easy to ascertain. The long-range potential threats from increasing plutonium level in the New York Bight provide the rationale for long-term monitoring and study.

Keywords: Pollutants-Metals, Pollutants-Toxicity

TUREKIAN, K.K.; COCHRAN, J.K.; NOZAKI Y.; THOMPSON, I.; JONES, D.S. 1982. DETERMINATION OF SHELL DEPOSITION RATES OF *ARTICA ISLANDICA* FROM THE NEW YORK BIGHT USING NATURAL RADIUM-228 AND THORIUM-228 AND BOMB PRODUCED CARBON-14. LIMNOL OCEANOGR 27(4):737-741. Shell deposition rates of specimens of *Artica islandica* (Mollusca: Bivalvia) from the New York Bight were determined using natural Radium-228 and Thorium-228 and bomb Carbon-14. The specimens from deep (>55 m) offshore waters show annual growth banding. A shell obtained from the inner bight <30-m depth seems to be younger than indicated by band counting.

Keywords: Benthos-*Artica*

TURGEON, K.W. 1983. MARINE ECOSYSTEM MODELING PROCEEDINGS FROM A WORKSHOP HELD APRIL 6-8, 1982, FREDERICK, MARYLAND. NATIONAL ENVIRONMENTAL SATELLITE, DATA AND INFORMATION SERVICE. REPORT NO.: NOAA-83092911, 271 pp. The report describes the workshop, held on April 6-8, 1982, in Frederick, Maryland. The major objective of this workshop was to bring together research scientists, model builders, model users, resource economists, resource managers, and administrators to discuss and assess the current and future role of ecosystem modeling as a useful and practical tool in marine environmental impact assessment and in the development and implementation of management strategies and policies for conservation and wise utilization of Maine resources.

Keywords: Workshops

VACCARO, R.F. 1963. AVAILABLE NITROGEN AND PHOSPHORUS AND THE BIOCHEMICAL CYCLE IN THE ATLANTIC OFF NEW ENGLAND. J MAR RES 21:284-301. The importance of ammonia as a source of available nitrogen for phytoplanktonic populations off New England has been evaluated for August and January 1962. During August, when only trace amounts of nitrate persist in the photic layer, ammonia appears to be the major source of available nitrogen. Therefore, meaningful estimates of the relative amounts of nitrogen and phosphorus being assimilated at such times require consideration of the nitrogen occurring as ammonia. Total available nitrogen:phosphorus ratios of *change* have been derived from the sum of the nitrogen occurring as ammonia, nitrite, and nitrate and from the concentration of phosphate. These ratios have been compared with other data (for August and April) based on the organic nitrogen and phosphorus content of particulate fractions that the ratios of change for August are somewhat lower than those for January and that the former are accompanied by a comparable depression in the N:P ratios for particulate material separated by Millipore filtration. It is speculated that during late summer, when nitrate and nitrite concentrations are minimal, ammonia forestalls the extreme degree of nitrogen deficiency known for laboratory cultures of nitrogen-starved algal cells.

Keywords: Miscellaneous-Chemical, Plankton

VACCARO, R.F.; GRICE, G.D.; ROWE, G.T.; WIEBE, P.H. 1972. ACID-IRON WASTE DISPOSAL AND THE SUMMER DISTRIBUTION OF STANDING CROPS IN THE NEW YORK BIGHT. WATER RES 6:231-256. Ecological consequences arising from the disposal of 50 million tons of acid-iron industrial waste in the coastal waters off New York over the past 22 years were assessed. Most of the data were obtained at two identical grids of stations which enable comparisons of hydrographic, chemical, and biological conditions within the acid-iron disposal area with similar parameters in a nearby control area. Supplementary information on benthos and sediment was obtained at other locations peripheral to the two station grids and in Hudson Gorge, and these were used to construct a synoptic picture of the physio-chemical conditions and standing crops in the New York Bight.

At each grid station the hydrographic measurements made were temperature, salinity, and light penetration; chemical observations consisted of dissolved oxygen, dissolved and suspended iron, total inorganic nitrogen and phosphate; while chlorophyll *a*, zooplankton, and benthos biomass provided a measure of the abundance of standing crops. Trace metals spectra (Fe, Zn, Co, Cu, Pb, Cr, Ni and Cd) were determined on selected zooplankton, benthos, and sediment samples. Laboratory toxicity studies were conducted on phytoplankton and zooplankton species at several concentrations of acid-iron waste in seawater.

The maximum concentration of iron in the water column ($832 \mu\text{g l}^{-1}$) occurred as suspended material within a restricted area of the acid grid. In terms of raw acid-iron effluent this suggests a maximum *in situ* concentration of 1 part waste in 39,000 parts of seawater, thereby providing a useful guide for the design of laboratory toxicity studies. Despite the abundance of suspended iron in the overlying water of the acid-grid the average concentrations of iron in the sediments of both the acid and control grids were remarkably similar, while sediments from the nearby Hudson Gorge were notably richer in iron. However, a comparison of previous measurements in the study area dating back to 1948 indicates that there has been no accumulation of iron within the sediments below the disposal area or Hudson Gorge over the past 22 years.

The phytoplankton toxicity experiment conducted with an acid-iron waste concentration four times greater than that observed in the field showed no adverse effect on phytoplankton growth or diversity. Similar experiments with copepods caused either failure of these organisms to reproduce or a delay in the time required to transform eggs into adults. Although the average zooplankton abundance within the control grid exceeded that of the acid grid by about 30 percent, the range of values describing zooplankton abundance in the two areas was similar. This difference was attributed to a transitory large scale patchiness in the area and not to toxicity of acid-iron waste. A positive correlation was found between Fe:C in zooplankton and the amount of particulate iron present in the seawater.

The average number of benthic animals on the bottom of the acid grid area was significantly less than in the sediment of the control grid but there was no difference in biomass or species diversity between the two areas. As well as the case with zooplankton, the higher Fe:C in the benthos corresponded to the higher iron in the sediment of Hudson Gorge and acid grid.

The heavy metal content of zooplankton, benthos, and sediment showed that samples from the acid grid were significantly richer in these elements than the comparable control area samples. However, a broader comparison showed that samples from Hudson Gorge contained the maximum amounts of lead and chromium in benthos as well as the maximum concentrations of all eight metals in the sediment. These data are consistent with the possibility that entrapment in the gorge sediments may be the ultimate fate of the heavy metal enrichment in the New York Bight area and that sources of heavy metals other than acid-iron waste may be substantial.

The remaining data reviewed in this study did not demonstrate any adverse *in situ* effects of acid-iron waste on the distribution of such parameters as dissolved oxygen, chlorophyll *a*, and plant nutrients. Present indications are that the disposal of acid-iron waste in the New York Bight appears to influence standing crops in minor ways considering the magnitude and nature of the waste material involved.

Keywords: Benthos, Ocean disposal, Plankton, Pollutants-Water quality

VERRON, J.; MOLINES, J.M.; BLAYO, E. 1992. ASSIMILATION OF GEOSAT DATA INTO A QUASIGEOSTROPHIC MODEL OF THE NORTH ATLANTIC BETWEEN 20° AND 50° N: PRELIMINARY RESULTS. OCEANOLOGICA ACTA 15(5):575-583. Geosat altimeter residuals of the sea surface height (RSSH) are combined with the mean sea surface computed from the non-linear inverse model to provide a synthetic data set of the along-track sea-surface height over the North Atlantic from November 5, 1986 to December 2, 1987. This data set is assimilated into a predictive numerical model of the North Atlantic circulations between 20° and 50° N. The model is quasigeostrophic, four-layered and has realistic coastline and topography. The ocean circulation is forced by a constant wind stress curl from Hellerman and Rosenstein's data (1983). Nudging is the assimilation technique used to insert sea-surface data information into the model and is carried along the Geosat ground tracks sequentially as data appears. The usefulness of assimilating Geosat data in this way is successfully demonstrated.

Keywords: Miscellaneous-Physical, Remote sensing

WALDMAN, J.R.; DUNNING, D. J.; ROSS, Q. E.; MATTSON, M. T. 1990. RANGE DYNAMICS OF HUDSON RIVER STRIPED BASS ALONG THE ATLANTIC COAST. TRANS AM FISH SOC 119(5):910-919. We analyzed the movements of Hudson River striped bass *Morone saxatilis* along the Atlantic coast from the results of a tagging program conducted in the Hudson River estuary between 1984 and 1988. Almost 30,000 striped bass were marked with internal anchor tags; most measured between 200 and 800 mm total length (TL). Interpretations of recoveries are conditional because the distribution and selectivity of fishing effort along the Atlantic coast are unknown. The proportion of total recaptures from outside the Hudson River increased significantly with fish length and by season from spring through autumn. The geographic range of recoveries extended from the Bay of Fundy, Nova Scotia, to Cape Hatteras, North Carolina, a coastal range of about 1,500 km. Most fish recaptured in spring had traveled north and east; recoveries from south of the New York Bight were uncommon until autumn. Many recaptures came from tributaries; far northern recaptures, in particular, tended to occur in rivers or near river mouths. Mean monthly distances between the Hudson River and recapture sites were highest from June through October and increased significantly with fish length. Comparisons with previous studies suggested that the effective coastal range of Hudson River striped bass has expanded since midcentury, especially that of 200-400-mm TL fish. Recapture of a Hudson River-tagged striped bass off Cape Hatteras supports previous winter trawling studies that suggest large Hudson River striped bass join schools of mixed origin that winter off the mid-Atlantic coast.

Keywords: Fish-*Morone*

WALKER, H.A.; PAUL, J.F.; BIERMAN, V.J. 1990. A CONVECTIVE-DISPERSIVE TRANSPORT MODEL FOR WASTES DISPOSED OF AT THE

106-MILE OCEAN DISPOSAL SITE. OCEANIC PROCESSES IN MARINE POLLUTION, VOL. 6, PHYSICAL AND CHEMICAL PROCESSES: TRANSPORT AND TRANSPORTATION. D.J. BAUMGARTNER AND I.W. DUEDALL, (EDS.), pp. 54-61.

Keywords: Modeling, Ocean disposal-106 mile, Sediment transport

WALKER, H.A.; SAILA, S.B.; ANDERSON, E.L. 1979. EXPLORING DATA STRUCTURE OF NEW YORK BIGHT BENTHIC DATA USING POST-COLLECTION STRATIFICATION OF SAMPLES, AND LINEAR DISCRIMINATE ANALYSIS FOR SPECIES COMPOSITION COMPARISONS. ESTUAR COAST MAR SCI 9(2):101-120. Techniques for exploring data structure from four cruises on a rectilinear sampling grid system on the New York Bight are presented. The problem of microenvironmental variability is handled by post-collection stratification of samples based on the physical characteristics of each grab, rather than classical spatial strata definitions. The three physical variables used to define strata are mean particle size, percent organic matter, and total concentration of selected heavy metals. Variations in species densities within strata over time are investigated. Multivariate discriminate techniques are used to search for major statistical differences in a species abundance between strata. A flexible sampling program based on post-collection stratification is suggested to detect shifts in mean species abundance within strata over time.

Keywords: Benthos, Monitoring

WALSH, J.J.; WHITLEDGE, T.E.; BARVENIK, F.W.; WIRICK, C.E.; HOWE, S.I.; ESAIAS, W.E.; SCOTT, J.T. 1978. WIND EVENTS AND FOOD CHAIN DYNAMICS WITHIN THE NEW YORK BIGHT. LIMNOL OCEANOGR 23(4):659-683. Time series of wind, current, nutrients, chlorophyll, and zooplankton are used to examine the effect of storm events on the food chain dynamics of the New York Bight. Storms cause dilution of phytoplankton concentration in the vertical plane, but lead to aggregation of chlorophyll in the horizontal field. Nutrients are made available with onshore flow in response to wind events favorable for upwelling. A series of nutrient budgets suggest that storm-induced mixing and upwelling of nitrate may satisfy at least 33% of the productivity demand of this system. Examples of the biological response to storms are drawn from 20 cruises during January, March, April-May, and August-September 1974, 1975, 1976, and 1977 under mixed and stratified conditions of the water column. The interaction of storms and seasonal stratification suggest predictable structure and frequency of chlorophyll distribution across the shelf which may influence both the survival strategies of herbivores and the loci of energy transfer to the rest of the food chain.

Keywords: Miscellaneous-Physical, Plankton

WALSH, J.J.; WHITLEDGE, T.E.; HOWE, S.O.; WIRICK, C.D.; CASTIGLIONE, L.J.; CODISPOTI, L.A. 1976. TRANSIENT FORCINGS OF THE LOWER TROPHIC LEVELS DURING THE SPRING BLOOM WITHIN THE NEW YORK BIGHT. IN: MIDDLE ATLANTIC CONTINENTAL SHELF AND THE NEW YORK BIGHT. PROCEEDINGS OF THE SYMPOSIUM AMERICAN MUSEUM OF NATURAL HISTORY, NEW YORK CITY, NOVEMBER 3-5, 1975, M.G. GROSS, (ED.), SPECIAL SYMPOSIA 2:273-274. A time-series study of the spring bloom in the New York Bight was conducted across the continental shelf, south of Long Island, from March 26 to April 9, 1975. A buoy was installed about 95 km offshore at the shelf break in a depth of 90 m, and a 2-week mesoscale and a 30-hr diel time series were conducted at this location (39° 54'N, 72° 4' W) to monitor effects of storm and shelf-break mixing. Measurements of temperature, salinity, irradiance, nutrients, chlorophyll, phytoplankton, particles, particulate nitrogen and carbon, zooplankton, primary production, respiration, and nitrate uptake over a 2-week period suggested maximum productivity and minimum grazing stress at midshelf. Seasonal storm mixing and possible breaking of internal waves appear to be mechanisms for replenishing nutrients within the spring continental shelf ecosystem; nutrient recycling through herbivore excretory products also appeared to be an important nutrient source, whereas rainfall and river discharge did not appear to add significant nitrogen at the time of the spring bloom.

The cause of the apparent decline of the spring bloom at the end of our cruise is unknown, because (1) the dissolved inorganic nitrogen was still over 4 ug-atoms N liter⁻¹ as a result of the above additional inputs; (2) the N:P ratio was as low as 2:1 inshore, presumably reflecting eutrophication; and (3) the range in NO₃:SiO₄ ratio was from 1:1 to 1.5:1 across the shelf, implying that silicic acid may not have been limiting at this time of year in the New York Bight ecosystem. Grazing stress may not have terminated the bloom either, for zooplankton biomass was minimum at midshelf, and our calculations suggest that only 5% of the algal standing crop might have been consumed each day.

Enumeration of the phytoplankton species confirmed that *Thalassiosira nordenskioldi* was the most abundant organism during the 1975 spring bloom; *Thalassiothrix frauenfeldii* and *Chaetoceros* spp. were subdominants. At most of the inshore stations, about 60% of the phytoplankton were diatoms, while diatoms constituted over 95% of the phytoplankton in the midshelf and shelf-break areas.

Keywords: Circulation-Internal waves, Plankton

WARKENTINE, B.E.; RACHLIN, J.W. 1989. WINTER OFFSHORE DIET OF THE ATLANTIC SILVERSIDE *MENIDIA MENIDIA*. COPEIA 1:195-198. As part of an ongoing study of the benthic fish populations of the New York Bight, several Atlantic silversides were collected in offshore trawls in late January 1986, presenting the opportunity to evaluate the offshore dietary ecology of this species. Data obtained from these analyses were compared to the dietary data derived from inshore populations of this species collected in December, which

represents the time period just prior to the onset of their offshore migration. As part of this study, comparisons were made of the diet similarity and diet overlap between the inshore and offshore populations.

Keywords: Fish-*Menidia*

WATLING, L.; LEATHEM, W.; KINNER, P.; WETHE, C.; MAURER, D. 1974. EVALUATION OF SLUDGE DUMPING OFF DELAWARE BAY. MAR POLLU BULL 5:39-42. Sewage sludge from Philadelphia and Camden has been dumped off the mouth of the Delaware Bay since 1961. Local residents have claimed that sludge is washed ashore, is a health hazard, and has impoverished the fauna of the seabed in the area. In the survey reported here, an assessment has been made of the composition and abundance of the benthic marine fauna of the dumping grounds. The results suggest that dominant species of the area are changing as particulate organic matter accumulates.

Keywords: Ocean disposal-Sewage sludge

WENZLOFF, R.L.; GREIG, R.A.; MERRILL, A.S.; ROPES, J.W. 1979. A SURVEY OF HEAVY METALS IN THE SURF CLAM, *SPISULA SOLIDISSIMA*, AND THE OCEAN QUAGHOG, *ARTICA ISLANDICA*, OF THE MID-ATLANTIC COAST OF THE UNITED STATES. FISH BULL 77(1):280-285. The area surveyed extended from approximately Montauk Point, NY, to Cape Hatteras, NC, and seaward to approximately the 20-fathom contour. The survey encompassed the southern distribution of both surf clams and ocean quahogs in the United States. Samples were collected at 151 stations during June and August 1974, for chemical analysis using arsenic, cadmium, chromium, copper, lead, mercury, nickel, silver, and zinc. A small hydraulic surf clam dredge was used throughout the survey. At each station, 4-6 marketable size clams were dissected, using stainless steel equipment. The foot was removed from each animal, drained, then combined and frozen in plastic bags. At the laboratory the tissues were homogenized in an electric blender equipped with a glass jar and stainless steel blades then stored for analysis in plastic ointment jars. Greater average concentrations of silver, arsenic, cadmium, copper, and zinc (122, 44.5, >230, 56.0, and 10.9% greater, respectively) were found in ocean quahogs than in surf clams. Concentrations of several metals in both clams decreased southward.

Keywords: Benthos-*Artica*, Benthos-*Spisula*, Pollutants-Bioaccumulation

WEST, R.H.; HATCHER, P.G. 1980. POLYCHLORINATED BIPHENYLS IN SEWAGE SLUDGE AND SEDIMENTS OF THE NEW YORK BIGHT. MAR POLLU BULL 11(5):1126-129. Sediments of the New York Bight were analyzed for PCBs and found to be heavily contaminated by such substances. The highest concentrations are adjacent to an offshore sludge dump zone, implying that the primary source of PCBs is sewage sludge in the area under consideration.

Widespread transport of PCBs out of the Bight is not evident as the area of contamination is limited to areas of mud accumulation. The PCB profile in a core of these mud facies can be historically correlated to the commercial production of PCBs.

Keywords: Ocean disposal-Sewage sludge, Pollutants-sediment, Sediment transport

WEYL, P.K.; BOWMAN, M.J. 1972. HYDROGRAPHIC STUDY OF THE SHELF AND SLOPE WATERS OF NEW YORK BIGHT. NEW YORK STATE UNIV. MAR. SCI. RES. CENT. TECH. REP. SERIES NO. 16, 49 pp. This report presents results obtained from three oceanographic cruises made by the Marine Sciences Research Center during 1970 and 1971 to investigate the physical characteristics of the shelf and slope waters of New York Bight. The existence of a sharp temperature-salinity front over the continental slope was confirmed during the months of June 1970 and April 1971. Associated with this front is a subsurface warm tongue delineated by a temperature maximum which intersects the edge of the shelf at a depth of about 150 m. Data obtained in August 1971 showed no evidence of any temperature front over the slope but suggested the existence of an irregular salinity gradient in this region. Three factors appear to be important in the dynamics of the formation and dispersion of the subsurface warm tongue over the continental slope. These are the existence of the temperature-salinity front and the associated convergence zone, the meanderings of the Gulf Stream and the creation of warm eddies, and the intrusion of Labrador water into the Bight.

Keywords: Miscellaneous-Physical

WEZERNAK, C.T.; LYZENG, D.R.; POLCYN, F.C. 1975. REMOTE SENSING STUDIES IN THE NEW YORK BIGHT. ENVIRONMENTAL RESEARCH INST. REPORT NO. ERIM-109300-5-F; NOAA-75082104, 75 pp. Described in the report are the results of a remote sensing program of data collection and analysis undertaken in the New York Bight. Aircraft multispectral missions were carried out on April 7, 1973. The morning mission on that date coincided with the ERTS-1 satellite pass over the area. The principal objectives of the program were to provide data, which when combined with shipboard measurements, would describe the surface waters of the area and their general circulation. Specifically the remote sensing program was designed to provide the following information: (1) sea surface temperature distribution, (2) surface chlorophyll concentrations, (3) secchi disc transparency, (4) document ocean dumping practices, and (5) movement of water masses as evidenced by dye tracer materials.

Keywords: Remote sensing

WIEBE, P.H.; GRICE, G.D.; HOAGLAND, E. 1973. ACID-IRON WASTE WAS A FACTOR AFFECTING THE DISTRIBUTION AND ABUNDANCE OF ZOOPLANKTON IN THE NEW YORK BIGHT, II. SPATIAL VARIATIONS IN THE FIELD AND IMPLICATIONS FOR MONITORING STUDIES. ESTUAR COAS MAR SCI 1(1):51-64. A study was undertaken in the New York Bight in an effort to understand small scale variations of single species populations and coastal zooplankton communities as they relate to the disposal of acid wastes. Two grids of eight locations each, one day and one night station per location, were placed so that one covered the acid grounds and the other a similar area functioning as a control 9 km to the northeast. Thirty-nine taxonomic categories of zooplankton were counted from oblique net tow samples collected at the 32 stations. Biomass was determined from length measurements of individuals of 24 taxa.

Species composition of the samples was typical of neritic waters of the northeast Atlantic coast. The spatial distribution of the majority of the species was markedly aggregated, but no trend was observed which would suggest that the acid wastes were an important factor in shaping the distributions. Species did not show collective agreement as to the area in which a higher average abundance for each occurred; and no significant trends in percent similarity or diversity (Simpson's D and the information theory H') were evident. Although Vaccaro *et al.* (1972) found zooplankton biomass to be approximately 30% higher from the control area than from the acid grounds, comparison of the biomass difference between the two areas on a species by species basis showed that 95% of the overall difference was accounted for by only three species, *Pseudocalanus* sp. and its copepodids, *Calanus finmarchicus* copepodids, and *Temora longicornis*. The acid-iron wastes appeared to be a minor factor affecting the distribution and abundance of zooplankton species during the time of this investigation. Empirical measures of the variability of single species populations and community indices presented in the text may be useful guides for future surveys or monitoring studies.

Keywords: Ocean disposal, Plankton, Pollutants-Water quality

WIGLEY, R.L.; THEROUX, R.B. 1981. ATLANTIC CONTINENTAL SHELF AND SLOPE OF THE UNITED STATES--MACROBENTHIC INVERTEBRATE FAUNA OF THE MIDDLE ATLANTIC BIGHT REGION--FAUNAL COMPOSITION AND QUANTITATIVE DISTRIBUTION. GEOGRAPHICAL SURVEY AND PROFESSIONAL PAPER 529-N, 198 pp. In the early 1960's, a quantitative survey of the macrobenthic invertebrate fauna was conducted in the Middle Atlantic Bight region. Purposes of this survey were to obtain a preliminary measure of the macrobenthic standing crop, particularly of biomass, and secondarily, to determine the principal taxonomic components of the fauna and the general features of their distribution. Sampling was conducted at 563 locations; water depths ranged from 4 to 3,080 m. An analysis of faunal composition and of quantitative distributions from the survey is presented in this report. Quantities are expressed in terms of density and biomass.

Dominant taxonomic components in numbers of individuals were (in percentage of total fauna): Anthropoda (46), Mollusca (25), Annelida (21), Echinodermata (4), and Coelenterata (1). Dominant biomass were (in percentage of total fauna): Mollusca (71), Echinodermata (12), Annelida (7), Anthropoda (5), and Ascidiacea (2). The quantity of fauna, both density and biomass, decreased substantially from shallow to deep water. Another major trend was the marked decrease in quantity from north to south within the Middle Atlantic Bight. Bottom sediment composition strongly influenced both the kind and the quantity of macrobenthic animals. Coarse-grained sediments generally supported the largest quantities of animals, including many sessile forms. Fine-grained sediments usually contained a depauperate fauna; attached organisms were uncommon. No obvious correlations were detected between the amount of organic carbon in bottom sediments and the quantity of benthic animals present. Marked seasonal changes in bottom water temperature were associated with an abundant fauna composed of diverse forms, whereas uniform temperatures throughout the year were associated with a sparse fauna composed of a moderate variety of species. Taxonomic groups that were dominant in a significant number of samples, in terms of number of individuals, were Bivalvia, Annelida, Echinoidea, Ophiuroidea, Crustacea, and the bathyal assemblage. Groups dominant in terms of biomass were Bivalvia, Annelida, Echinoidea, Ophiuroidea, Holothuroidea, and the bathyal assemblage.

Keywords: Benthos

WILK, S.J.; BAKER, B.M. 1989. RESULTS OF A FISH-MEGAINVERTEBRATE SURVEY OF THE NEW YORK BIGHT APEX USA LATE SUMMER 1983. BULL NJ ACAD SCI 34(2):1-14. Summary tabulations for 37 species representing 26 families of fish and megainvertebrates as well as associated environmental observations are given for 47 trawl stations occupied in the New York Bight Apex from August 29 through September 2, 1983. The ten most frequently occurring species were lady crab, *Ovalipes ocellatus* (35 stations = 78%); longfin squid, *Loligo pealei* (76%); butterfly, *Peprilus triacanthus* (62%); little skate, *Raja erinacea* (58%); windowpane, *Scophthalmus aquosus* (58%); spotted hake, *Urophycis regia* (51%); winter flounder, *Pseudopleuronectes americanus* (47%); fourspot flounder, *Paralichthys oblongus* (42%); rock crab, *Cancer irroratus* (38%); and northern searobin, *Prionotus carolinus* (29%). Four recurrent species groups (RSG) were identified, with a single group dominating the area (i.e., it occurred at every station where catches were made). This dominant group was made up, in order of rank dominance, of the following species: spotted hake, windowpane, longfin squid, little skate, and fourspot flounder. In addition, the relationship of RSGs to physical characteristic (variables) is also discussed.

Keywords: Apex, Benthos, Fish, Monitoring

WILK, S.J.; MORSE, W.W.; RALPH, D.E. 1978. LENGTH WEIGHT RELATIONSHIPS OF FISHES COLLECTED IN THE NEW YORK BIGHT USA. BULL NJ ACAD SCI 23(2):58-64. Average length-weight relationships

are presented for 78 species. of teleost fish collected during a trawl survey in the New York Bight conducted June 1974 through June 1975. Significant differences in length-weight relationships were found between males and females for 18 of 27 species examined.

Keywords: Fish

WILK, S.J.; MORSE, W.W.; RALPH, D.E.; AZAROVITZ, T.R. 1977. FISHES AND ASSOCIATED ENVIRONMENTAL DATA COLLECTED IN NEW YORK BIGHT JUNE 1974 TO JUNE 1975. NOAA TECH REP NMFS SSRF-716, 57 pp. Tabulations of fishes and associated environmental observations are given for 700 trawl stations made during 30 collecting intervals in the New York Bight from June 1974 to June 1975. Summary tables included give the following information: collecting interval data (vessel, dates, stations sampled, gear, and area); station data (date, location, time of day, total catch, and environmental observations); and catch data for 127 species, representing 67 families (location, number, and weight).

Keywords: Fish

WILK, S.J.; MORSE, W.W.; RALPH, D.E.; STEADY, E.J. 1975. LIFE HISTORY ASPECTS OF NEW YORK BIGHT FINFISHES (JUNE 1974-JUNE 1975). ANNUAL REPORT, NATIONAL MARINE FISHERIES SERVICE, REPORT NO. SHL 75-1.

Keywords: Fish

WILK, S.J.; MORSE, W.W.; STEHLIK, L.L. 1990. ANNUAL CYCLES OF GONAD-SOMATIC INDICES AS INDICATORS OF SPAWNING ACTIVITY FOR SELECTED SPECIES OF FINFISH COLLECTED FROM THE NEW YORK BIGHT. FISH BULL 88(4):775-786. Gonad-somatic index (GSI), the relation of ovarian to somatic weight, was calculated for 14 species of finfish that are year-long residents of the New York Bight. Specimens were collected monthly from June 1974 through June 1975 in the ocean and associated estuarine waters of the Bight. Analysis indicated that alewife (*Alosa pseudoharengus*) and yellowtail flounder (*Limanda ferruginea*) are spring spawners; silver (*Merluccius bilinearis*) and red hake (*Urophycis chuss*), black sea bass (*Centropristis striata*), butter fish (*Peprilus triacanthus*), striped searobin (*Prionotus evolans*), and northern searobin (*Prionotus carolinus*), and fourspot flounder (*Paralichthys oblongus*), are summer spawners; and summer (*Paralichthys dentatus*) and winter flounder (*Pseudopleuronectes americanus*) are fall-winter spawners. Offshore hake exhibited a protracted spawning season with ripe females collected from spring through fall, while spotted hake (*Urophycis regia*) and windowpane (*Scophthalmus aquosus*) exhibited bimodal spawning patterns with two GSI peaks per year. The co-occurrence of spawning with appropriate food supply and

environmental conditions is discussed on an individual-species as well as species-complex basin.

Keywords: Fish

WILLIAMS, S.J. 1979. GEOLOGIC EFFECTS OF OCEAN DUMPING ON THE NEW YORK BIGHT INNER SHELF. IN: OCEAN DUMPING AND MARINE POLLUTION--GEOLOGICAL ASPECTS OF WASTE DISPOSAL, H.D. PALMER AND M.G. GROSS, (EDS.), pp. 51-72. High resolution seismic reflection records, sediment cores and deep borings, and comparison of bathymetric charts from 1845 to 1973 provide evidence that ocean dumping of assorted solid materials has significantly filled parts of the Hudson Shelf channel and is an important geologic process. Ocean disposal of natural and man-made wastes was officially initiated seaward of New York Harbor in 1888 to relieve health problems, congestion, and accelerated shoaling of navigation channels long associated with uncontrolled disposal within the city and adjacent waterways. Records show that about 850 million m³ of liquid and solid wastes have been dumped in the past 85 years. This has resulted in creation of several mounds with relief of about 15 m covering an area of about 9 thousand hectares. The calculated volume of anthropogenic solids filling the Hudson channel is 318 million m³. Much of the material is similar in character to indigenous sediment. The results indicate most materials except sewage sludge are fairly stable and remain in the original dump sites. In spite of large volumes of sludge dumped at the same site since 1924, no evidence of significant accumulation on the seafloor has been found.

Keywords: Hudson Shelf Valley, Ocean disposal, Sediment

WOLFE, D.A.; BOESCH, D.F.; CALABRESE, A.; LEE, J.J.; LITCHFIELD, C.D.; LIVINGSTON, R.J.; MICHAEL, A.D.; O'CONNOR, J.M.; PILSON, M.; SICK, L.V. 1982. EFFECTS OF TOXIC SUBSTANCES ON COMMUNITIES AND ECOSYSTEMS. IN: ECOLOGICAL STRESS AND THE NEW YORK BIGHT: SCIENCE AND MANAGEMENT. PROCEEDINGS OF A SYMPOSIUM ON THE ECOLOGICAL EFFECTS OF ENVIRONMENTAL STRESS, NEW YORK, NY, JUNE 10-15, 1979, G.F. MAYER, (ED.), ESTUARINE RESEARCH FEDERATION, COLUMBIA, SC, pp. 67-86. The New York Bight receives a variety of wastes dumped into the Hudson River and the Hudson-Raritan estuary, as well as direct barged inputs of dredged materials, sewage sludge, and chemical wastes. These pollutant additions have caused widespread degradation of the marine and estuarine environments, with effects being most severe in the western portions of Raritan Bay and the New York Bight Apex. Beyond the inner Apex, there is an uneven, seasonably variable gradient of decreasing impacts. The scientific evidence that the changes are caused by pollutant additions is overwhelming and conclusive; it is supported by extensive field observations of ecological degradation and measurements of occurrences of pollutants, laboratory experiments on organism responses to toxicant exposures, and comparisons with observations on disturbed and

undisturbed systems in other coastal areas. The evidence shows a progressive deterioration of the marine environment caused by the discharge of pollutants into the area. The trend of these changes is away from the traditional aesthetic and resource values associated with the marine environment. Unfortunately, the New York Bight has been subjected to a wide variety of pollutants for such a long time that it is not possible at this time to ascribe specific effects to specific pollutants. Observed changes represent cumulative effects of combinations of toxic materials, nutrient and organic loading, and habitat modifications. The selection of approaches for stopping or reversing the environmental degradation, therefore, is exceedingly difficult. Despite the current shortcomings of ecological science, environmental managers should develop management alternatives for alleviating the impacts of pollution in the New York Bight. Environmental managers and environmental scientists must approach environmental problem-solving jointly and cooperatively. Managers and scientists should develop mutually agreeable plans that consider the range of options available for environmental management and the specific risks and costs associated with each option. Proposed courses of actions should be field-tested on a limited, experimental scale to assess their probable ecological consequences prior to full-scale implementation.

Keywords: Management, Pollutants-Toxicity

WONG, K.C.; WILSON, R.E. 1979. AN ASSESSMENT OF THE EFFECTS OF BATHYMETRIC CHANGES ASSOCIATED WITH SAND AND GRAVEL MINING ON TIDAL CIRCULATION IN THE LOWER BAY OF NEW YORK HARBOR. NEW YORK STATE UNIV. MAR. SCI. RES. CENT. SPEC. REP., 28 pp. Present sand and gravel mining operations within the Lower Bay of New York Harbor are restricted to the east bank of Ambrose Channel and to the vicinity of Chapel Hill North Channel because of the concern that mining in other areas might adversely affect water quality and shore erosion. As part of an evaluation of environmental effects associated with expanded sand and gravel mining, the authors have numerically simulated tidal circulation patterns and tidal elevations in the Lower Bay for a number of altered bathymetrics corresponding to hypothetical mining operations. Results suggest that tidal currents will decelerate over the mined region and accelerate outside of them, and that the tidal stream will be deflected towards the region. It is also clear that the mining near the mouth of the Bay could increase tidal range along Staten Island substantially.

Keywords: Circulation, Mining

WOODHEAD, P.M.J.; ALEXANDER, M.S. 1985. PATTERNS OF FISH HABITATION IN A NEW ARTIFICIAL REEF, QUANTITATIVE STUDIES. BULL MAR SCI 37(1):402. An artificial reef approximately 77 m long and 14-18 m wide (1,230 m²), with a profile of 0.7-1.6 m, was constructed with 15,000 solid bricks in the New York Bight on a sandy seabed at 20 m. The new reef was rather quickly visited by pioneering populations of fishes and the subsequent processes of inhabitation by fishes were measured over 3 years, from 1980 to 1983. The principle method of sampling the fish was by setting fish traps, which

was effective for the most numerous reef fish. Size of catches changes seasonally and was directly related to sea temperatures. The species inhabiting the reef changed seasonally, with few species remaining as year-round residents. The numerically dominant resident species was a labrid, *Tautoglabrus adspersus*, the cunner; its population was studied in detail. Quantitative comparisons were made with a population of the same fish on a nearly mature artificial reef, the well studied Fire Island Reef established in the mid-1960s. Changes with time in the sizes and sex-ratio of the colonizing fish populations on the new reef are described. Hundreds of reef fish were tagged and then replaced at their sites of capture. Subsequent recaptures showed that once established, the cunner population resident on the new reef was very stationary and did not regularly move from the reef to mix with other populations. This static behavior of the reef population allowed accurate estimates of population size and density to be made during the first, second, and third years after placement of the new reef, and quantitative comparisons were made in each year with the densities, standing stock, of the cunner population on the mature Fire Island Reef system.

Keywords: Artificial reefs, Fish

WOODHEAD, P.M.J.; DUEDALL, I.W.; LANSING, N.F. 1979. COAL WASTE ARTIFICIAL REEF PROGRAM. PHASE I, 74 pp. The objectives of the program, the construction of an artificial reef made of stabilized coal waste, are discussed.

Keywords: Artificial reefs

WOODHEAD, P.M.J.; DUEDALL, I.W.; PARKER, J.H. 1981. COAL COMBUSTION BY-PRODUCTS--NEW MATERIAL FOR ARTIFICIAL REEF CONSTRUCTION. INTR COUNC EXP SEA, WOODS HOLE, MA, OCTOBER 6, 6 pp.

Keywords: Artificial reefs

WOODHEAD, P.M.J.; DUEDALL, I.W.; PARKER, J.H. 1981. ACCEPTABILITY OF COAL-FIRED POWER PLANT WASTE FOR OCEAN DISPOSAL IN NEW YORK. CONF GOV OFFICE - EXPANDING USE OF COAL IN NEW YORK, MAY 21-22, ALBANY, pp. 32-37. Preliminary tests indicate that this disposal technique is environmentally acceptable.

Keywords: Artificial reefs

WOODHEAD, P.M.; JACOBSON, M.E. 1985. EPIFAUNAL SETTLEMENT AND THE PROCESSES OF COMMUNITY DEVELOPMENT AND SUCCESSION OVER TWO YEARS ON AN ARTIFICIAL REEF IN THE NEW YORK BIGHT. BULL MAR SCI 37(1):364-376. An experimental reef of

16,000 solid blocks (500 tons) of synthetic, cementitious materials was established at a depth of 20 m in the New York Bight in 1980. The reef covers an area of 1,230 m² and has a profile of 70 to 130 cm. Measurements of epifaunal settlement and growth on test bricks retrieved from the reef site allowed the processes of community development and seasonal succession to be followed in detail over 2 years.

Test bricks were made from concrete, and from two coal waste materials (fixated mixtures of fly ash and FGD scrubber sludge) from two modern power stations. The bricks were compared for their suitability as substrates for colonization by organisms characteristic of reefs. Comparative settlement and growth of communities on the different bricks are described in terms of species richness, abundance, and the surface area of brick covered. Altogether 36 species of attached epibenthic organisms were recorded colonizing the bricks. About the same number of species occurred on all bricks, and although several dominant species settled year-round, seasonality played a role in structuring colonization patterns; a few animals (*Balanus crenatus*, *Zirfaea crispata*, *Polydora socialis*) had associations with a particular type of material. There were differences in settlement and in the rate of community development between the two coal wastes and the concrete. Concrete tended to be overgrown more quickly than either coal waste. Differences between communities persisted after 2 years in the sea; nevertheless, coal waste bricks appeared suitable substrates for development and growth of epifaunal communities.

Keywords: Artificial reefs, Benthos

WOODHEAD, P.M.J.; PARKER, J.H.; DUEDALL, I.W. 1980. ENVIRONMENTAL COMPATIBILITY AND ENGINEERING FEASIBILITY FOR UTILIZATION OF FGD WASTE IN ARTIFICIAL FISHING REEF CONSTRUCTION. IN: SYMP FLUE GAS DESULF, HOUSTON, TX, OCTOBER 28-31, 2:695-700.

Keywords: Artificial reefs

WOODHEAD, P.M.J.; PARKER, J.H.; DUEDALL, I.W. 1981. COAL COMBUSTION PRODUCTS-NEW SUBSTRATES FOR ARTIFICIAL REEF. IN: ARTIFICIAL REEFS: PROCEEDINGS OF A CONFERENCE HELD SEPTEMBER 13-15, 1979 IN DAYTONA BEACH, FLORIDA. D.Y. ASKA (ED.) REPORT NO. FSG-R-41, pp. 219-224. A multidisciplinary team at the Marine Sciences Research Center (MSRC) and the Materials Science Laboratory (MSL) of State University of New York at Stony Brook is investigating the long term interactions in the ocean of solid blocks made of combustion wastes from coal-fired power plants. The objective is to assess the feasibility of using blocks of the coal waste materials for underwater construction of artificial fishing reefs. Results of a variety of experiments conducted over the past three years, first in the laboratory and later in the sea, have suggested that coal waste blocks are environmentally acceptable in the ocean. The program will build a demonstration

pilot reef of waste blocks in the Atlantic Ocean in the spring of 1980 for three to four years of *in situ* studies. An industrial company, IU Conversion Systems, Inc., has developed a marketable stabilized coal waste by combining the scrubber filtercake with the fly ash. Basically this system treats sludge and fly ash with lime additives and cementitious reactions convert the mix into the stable material that can range from a clay-like substance to hard blocks. The bottom ash can be included as an aggregate.

Keywords: Artificial reefs

WOODHEAD, P.M.J., PARKER, J.H.; DUEDALL, I.W. 1982. THE COAL-WASTE ARTIFICIAL REEF PROGRAM (C-WARP): A NEW RESOURCE POTENTIAL FOR FISHING REEF CONSTRUCTION. MAR FISH REV 44(6-7):16-23. Epifaunal colonization and attraction of fish, crabs and lobster to stabilized fly ash and flue-gas desulfurization sludge is discussed.

Keywords: Artificial reefs, Benthos, Fish

WOODHEAD, P.M.J.; PARKER, J.H.; DUEDALL, I.W. 1985. THE USE OF FLY ASH FROM COAL COMBUSTION FOR ARTIFICIAL REEF CONSTRUCTION. IN: 1983 PROCEEDINGS FOR ARTIFICIAL REEFS IN THE GREAT LAKES, LANSING, MI, JUNE 1-2, D'ITRI, (ED.), 39 pp. ALSO IN: ARTIFICIAL REEFS: MARINE AND FRESHWATER APPLICATIONS, F. D'ITRI, (ED.), LEWIS PUBLISHERS, INC., PO DR 519, CHELSEA, MI, PART II: DESIGN AND CONSTRUCTION OF ARTIFICIAL REEFS, CHAPTER 8: 265-292. A 500 ton demonstration reef of 15,000 blocks of stabilize fly ash and flue gas sludge was placed in 20 m of water and called the C-Warp reef. Physical, chemical (leaching, toxicity and composition tests), and biological aspects of this three year project are discussed.

Keywords: Artificial reefs

YASSO, W.E.; HARTMAN, E.M., JR. 1976. BEACH FORMS AND COASTAL PROCESSES. MESA NEW YORK BIGHT ATLAS MONOGRAPH 11, 50 pp. Headlands, estuaries, a barrier split, and barrier bars and islands separated from the mainland by shallow lagoons are the major landforms of the New York Bight coast. Bight beaches are subject to both annual and long-term changes in shape and position typical of ocean-facing shorelines. Wave refraction causes littoral drift of beach sand in a predominantly westward direction along the south shore of Long Island. At Fire Island Inlet the westward drift rate is 366,440 m³/year (480,000 yd³/year). Northward littoral drift predominates along the New Jersey coast north of Dover Township. At Sandy Hook the northward drift rate reaches a maximum of 376,300 m³/year (493,000 yd³/year). South of Dover Township the drift is predominantly southward, reaching a maximum of 152,700 m³/year (200,000 yd³/year) at Cape May Inlet.

Jetties and groins temporarily block littoral drift; they do not stop beach erosion entirely. Jetties retard inlet migration and groins slow erosion of updrift beaches; but in so doing, both accelerate downdrift beach erosion. Sand dredged from filled inlets is used for artificial beach nourishment, which temporarily stabilizes shorelines without adversely affecting downdrift beaches. Coastal storms and man's encroachment onto beaches amplify the normal erosion of waves, wind, and tide. A 1960 hurricane and a major 1962 coastal storm caused extensive damage to Bight beaches and shoreline structures. Many people fail to learn from those storms and from natural erosion that building on beaches and dunes should be avoided.

Keywords: Monitoring-MESA, Reviews-Geological, Sediment

YENTSCH, C.S. 1977. PLANKTON PRODUCTION. MESA NEW YORK BIGHT ATLAS MONOGRAPH 12, 25 pp. The principal mechanism for regulating primary production in the waters of New York Bight is vertical mixing. The intensity of this mixing is caused by a unique blend between local meteorological conditions and the physiology of photosynthetic phytoplankton. In winter the distribution of phytoplankton is largely due to the intensity of vertical mixing and water depth: primary productivity in slope waters is limited by vertical mixing, which in effect reduces the amount of sunlight received by the phytoplankton. The spring bloom arises from the reduction in vertical mixing because of heat (via sunlight) being added to surface waters and the relaxation of winds. During summer, primary production is low throughout most of the Bight, apparently because of the limited quantities of nitrogen in the euphotic zone. Intense production occurs in autumn as a result of the breakdown of the summer thermocline with the onset of winter temperatures and strong winds.

Keywords: Monitoring-MESA, Plankton, Reviews-Biological

YOUNG, D.L.K.; BARBER, R.T. 1973. EFFECTS OF WASTE DUMPING IN NEW YORK BIGHT ON THE GROWTH OF NATURAL POPULATIONS OF PHYTOPLANKTON. ENVIRON POLLUT 5(3)7-252. In New York Bight waters from outside those areas highly affected by sewage sludge or dredge-spoil dumping, the growth of natural phytoplankton populations was initially exponential. Waters sampled from the disposal areas were temporally and spatially inconsistent in supporting initial rapid growth. Inhibition occurred only as a temporary lag. The dominant phytoplankter that grew exponentially was, with a single exception, a typical coastal bloom species. The temporary inhibition was more probably due to toxic organic materials than to heavy metals.

Keywords: Ocean disposal, Plankton, Pollutants-Water quality

YOUNG, D.R. 1982. CHLORINATED HYDROCARBON CONTAMINANTS IN THE SOUTHERN CALIFORNIA AND NEW YORK BIGHTS. IN: ECOLOGICAL STRESS AND THE NEW YORK BIGHT: SCIENCE AND

MANAGEMENT. PROCEEDINGS OF A SYMPOSIUM ON THE ECOLOGICAL EFFECTS OF ENVIRONMENTAL STRESS, NEW YORK, NY, JUNE 10-15, 1979, G.F.MAYER, (ED.), ESTUARINE RESEARCH FEDERATION, COLUMBIA, SC, pp. 263-276. Submarine discharge of municipal wastewater has been the dominant source of several important chlorinated hydrocarbons to the Southern California Bight. Seawater concentrations of PCBs and DDTs near the urban coast seldom exceed a few parts per trillion; in contrast, concentrations in surface sediments in the vicinity of Los Angeles outfalls range from 10 to 100 parts per million, respectively. Contaminated particulates apparently are the dominant mechanism of input and dispersion, and accumulations of these materials on the sea bottom are believed to control levels in the benthos. PCB concentrations in muscle tissue of seafood organisms around major outfalls range to approximately 1 ppm, and values for liver tissue are an order of magnitude higher. Mussels suspended at several depths near one diffuser system revealed gradients of PCB and DDT in the water column, with a ten-fold increase from the surface to the bottom. These chlorinated hydrocarbons are concentrated by organisms at higher trophic levels. Also, relatively high PCB concentrations have been reported in the New York Bight. The severe contamination of Hudson River sediments by PCB wastes may lead to extensive and persistent contamination of the New York Bight and the Hudson River estuary.

Keywords: Pollutants-bioaccumulation, Pollutants-organic, Workshops

YOUNG, D.R. 1982. A COMPARATIVE STUDY OF TRACE METAL CONTAMINATION IN THE SOUTHERN CALIFORNIA BIGHT AND NEW YORK BIGHTS. IN: ECOLOGICAL STRESS AND THE NEW YORK BIGHT: SCIENCE AND MANAGEMENT. PROCEEDINGS OF A SYMPOSIUM ON THE ECOLOGICAL EFFECTS OF ENVIRONMENTAL STRESS, NEW YORK, NY, JUNE 10-15, 1979, G.F.MAYER (ED.), ESTUARINE RESEARCH FEDERATION: COLUMBIA, S.C., pp. 249-262. Estimated annual inputs of trace metals to the New York Bight are from four to thirty-four times higher than those for the Southern California Bight. Typical seawater concentrations of dissolved and particulate metals in major harbors adjacent to these regions are remarkably similar and usually are at least several times higher than those for non-contaminated control sites. However, reported concentrations of dissolved metals above the New York Bight dumpsites are sometimes one or more orders of magnitude above values measured in the vicinity of submarine municipal wastewater discharges off southern California. In contrast, sediment concentrations of metals around the two major southern California outfalls are from two to five times higher than those at the New York dumpsites for dredged materials and sewage sludge. Metals levels in flocculent material inshore of one California outfall often are an order of magnitude above those at control sites; such particulates may be a significant vector for metals contamination of filter-and deposit-feeding invertebrates in this discharge zone. However, it is not known yet whether elevated tissue burdens are damaging to invertebrates from the vicinity of the outfalls. Fishes from the same area exhibit little or no metals contamination of their tissues; a similar finding is reported for

the New York Bight. With the exception of mercury, concentrations of target trace metals do not appear to increase with trophic level in marine food webs.

Keywords: Ocean disposal, Pollutants-Metals, Pollutants-Toxicity

YOUNG, J.S. 1973. A MARINE KILL IN NEW JERSEY COASTAL WATERS. MAR POLLUT BUL 4:70. A kill of lobsters around wrecks off the New Jersey coast seem not to be a direct result of pollution but may have been due to an influx of water causing reduced oxygen levels combined with high temperatures. Mortalities of this kind have been observed before in the area, but it is not known if this is an annual event or due to abnormal circumstances. It would be worth keeping the situation under review in the future.

Keywords: Benthos-*Homarus*, Fish kills

YOUNG, J.S.; PEARCE, J.B. 1975. SHELL DISEASE IN CRABS AND LOBSTERS FROM NEW YORK BIGHT. MAR POLLUT BUL 6:101-105. Dumping grounds in New York Bight receive very large quantities of sewage sludge. Lobsters and rock crabs collected in or near the dumping grounds sometimes show various pathological conditions of the shell and gills. In this study the histopathology of "shell disease," the causative agents and its effects on respiration are discussed in connection with a possible association with the disposal of solid wastes into the ocean.

Keywords: Benthos, Disease, Ocean disposal-Sewage sludge

YOUNG, R.A. 1978. SUSPENDED-MATTER DISTRIBUTION IN THE NEW YORK BIGHT APEX RELATED TO HURRICANE BELLE. GEOLOGY 5(6):301-304. Suspended matter and hydrographic properties of the New York Bight Apex were studied three days after passage of Hurricane Belle (August 1976). Distributions of suspended matter were found to be similar to those present during previous periods of calm summer weather. By comparing the present poststorm observations with previous poststorm sampling, it is hypothesized that during summer a stratified water column can restrict vertical mixing of resuspended bottom material to the relatively thin near-bottom layer, whereas mixing throughout the water column takes place during unstratified winter conditions. Clearing times for resuspended material, therefore, are shorter in summer than in winter. Both extent of vertical mixing and clearing times are important considerations for those concerned with problems of marine ecology.

Keywords: Apex, Particulates

YOUNG, R.A.; CLARKE, T.L.; MANN, R.; SWIFT, D.J.P. 1981. TEMPORAL VARIABILITY OF SUSPENDED PARTICULATE CONCENTRATIONS IN THE NEW YORK BIGHT. J SEDIMENT PET

51(1):293-306. Temporal variability observed in several time series of suspended matter measurements, obtained by light scattering and conventional water sampling, has been examined to identify significant time scales with respect to synoptic characterization of regional suspended matter distributions in the inner New York Bight. Processes with periods corresponding to surface waves (seconds) and storms (days) apparently make the strongest contributions to overall concentration variability, and tidal motions appear to have only a weak influence on near-bottom suspended load. An empirical model is proposed which assumes that concentration variance is linearly related to the mean concentration, both increasing in response to such processes as wind-wave mixing and boundary layer interactions with the bottom. Data obtained during the study support the model.

Keywords: Circulation, Modeling, Particulates

YOUNG, R.A.; HILLARD, B.F. 1984. SUSPENDED MATTER DISTRIBUTIONS AND FLUXES RELATED TO THE HUDSON-RARITAN ESTUARINE PLUME. NOAA TECH. MEMO NOS/OMA-8, 39 pp. Particle flux through the New York Bight Apex was calculated using current meter and suspended matter concentration data obtained from March to September 1979 to gain insight into the particle dynamics within the Hudson-Raritan estuarine plume discharged on the shelf. Suspended particulate matter (SPM) concentrations show the expected rapid decrease seaward (10 to 1 mg/l), but high concentrations often extended seaward around Shrewsbury Rocks on the New Jersey shore.

Keywords: Estuaries, Particulates, Sediment transport

YOUNG, R.R. 1989. SHELL DISEASE AMONG RED CRABS INHABITING SUBMARINE CANYONS OF THE NEW YORK BIGHT. NOAA TECH. MEMO REPORT-NMFS-F/NEC77, 17 pp. The study was undertaken to assess the extent and severity of shell disease among New York Bight deep sea red crabs (*Geryon quinquedens*). The shell disease syndrome is a contagious condition which occurs among many crustacean species and habitats, and is caused by a variety of chitinoclastic bacteria and fungi. Crabs from the three canyons sampled, Hudson, Block, and Atlantis, had overall disease prevalences of 92, 92, and 86 percent, respectively. Of the Hudson Canyon specimens, 13 percent were rated as moderately to severely diseased. (Prepared in cooperation with Environmental Protection Agency, Washington, DC. Sponsored by State Univ. of New York at Stony Brook.)

Keywords: Benthos-*Geryon*, Disease, Hudson Shelf Valley

ZAWACKI, C.S. 1971. AN ECOLOGICAL STUDY OF THE UTILITY OF AUTO TIRES AS AN ARTIFICIAL REEF SUBSTRATE. MASTERS THESIS, LONG ISLAND UNIVERSITY, NY, 75 pp. Details of the construction and evaluation of a geometric-designed tire reef are discussed with relative values of different tire structures as substrate.

Keywords: Artificial reefs

ZAWACKI, C.S. 1974. AMERICAN LOBSTERS AT ARTIFICIAL REEFS IN NEW YORK. NY FISH GAME J 21(1):73-77.

Keywords: Artificial reefs, Benthos-*Homarus*

ZISKOWSKI, J.J.; ANDERSON, V.T.; MURCHELANO, R.A. 1980. A BENT-FIN RAY CONDITION IN WINTER FLOUNDER, *PSEUDOPLEURONECTES AMERICANUS*, FROM SANDY HOOK AND RARITAN BAYS, NEW JERSEY, AND LOWER BAY, NEW YORK. COPEIA 1980 (4):895-899. Flounder were observed with a bent-ray condition in the heavily polluted waters of the inner New York Bight. Of 4,493 flounder captured in 1976, 25 had bent fin rays. Eighteen fish were subject to soft-X-ray examination. Dorsal and anal fin rays were bent to the right, typically at mid and posterior positions of the fins. The caudal fin was most affected. Although vertebral fusion and accessory arch frequencies were not significantly different in normal and bent-finned fish, there was a consistently higher vertebral anomaly frequency in bent-finned fish. The prevalence of the bent-finned condition appeared to increase with the length of the fish, suggesting that bending occurs after larval development and may continue throughout life. There appeared to be a relationship between the bent ray condition and caudal fin rot.

Keywords: Disease, Fish-*Pseudopleuronectes*

ZISKOWSKI, J.; MURCHELANO, R. 1975. FIN EROSION IN WINTER FLOUNDER. MAR POLLUT BUL 6(2):26-29. Diseased fish showing erosion of the fins have been recorded from polluted waters in several parts of the world. This article gives the results of a year's survey of fin erosion among fish in oceanic and estuarine waters of the New York Bight. The pristine Great Bay was chosen as a control for the heavily contaminated Sandy Hook-Raritan Bay system. Almost all fin erosion was confined to demersal flat fish, particularly the winter flounder, a species which spends a long time in polluted estuaries near Sandy Hook.

Keywords: Disease, Fish-*Pseudopleuronectes*, Pollutants-Sediment

List of Keywords Used

Anoxia (hypoxia)

Apex

Artificial reefs

Bacteria-

Vibrio

Benthos-

Artica

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- 12 mile
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 Greig et al., 1977
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 Hook, 1978
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| Wilk and Baker, 1989 | Wilk et al., 1990 |
| Fish- <i>Alosa</i> (American shad)
Neves and Depres, 1978 | |
| Fish- <i>Benthosema</i> (lantern fish)
Olson and Backus, 1985 | |
| Fish- <i>Brevoortia</i> (manhaden)
Nelson et al., 1976
Nicholson, 1978 | Nicholson, 1972 |
| Fish- <i>Carcharodon</i> (white shark)
Casey and Pratt, 1985 | |
| Fish- <i>Centropristis</i> (black sea bass)
Briggs, 1978 | |
| Fish- <i>Clupea</i> (Atlantic hering)
Bradford and Stephenson, 1992 | |
| Fish- <i>Cynoscion</i> (weakfish)
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| Fish- <i>Limanda</i> (yellowtail flounder)
Greig and Wenzloff, 1977 | Smith et al., 1978 |
| Fish- <i>Menidia</i> (Atlantic silverside)
Warkentine and Rachlin, 1989 | |
| Fish- <i>Merluccius</i> (silver hake)
Rachlin and Warkentine, 1990 | Rachlin et al., 1986 |
| Fish- <i>Morone</i> (striped bass)
Alevras and Edwards, 1985
Rappe et al., 1991 | Clark, 1968
Waldman et al., 1990 |
| Fish- <i>Musteles</i> (spiny dogfish)
Greig and Wenzloff, 1977 | |
| Fish- <i>Paralichthys</i> (summer flounder)
Deubler and White, 1962
Murchelano and Ziskowski, 1976
Robohm et al., 1979 | Murchelano, 1975
Murchelano et al., 1977 |
| Fish- <i>Pomatomus</i> (bluefish)
Chiarella and Conover, 1990 | |

- Fish-Pseudopleuronectes* (winter flounder)
 Greig and Wenzloff, 1977
 Murchelano and Ziskowski, 1976
 Ziskowski and Murchelano, 1975
 Hughes and Hebert, 1991
 Robohm et al., 1979
 Ziskowski et al., 1980
- Fish-Raja* (skate)
 McEachran and Musick, 1975
- Fish-Scomber* (Atlantic mackerel)
 Chang and Longwell, 1984
 Longwell, 1977
 Longwell and Hughes, 1981
 Longwell et al., 1984
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 Longwell and Hughes, 1980
 Longwell and Hughes, 1982
 Pearce et al., 1981
- Fish-Sebastes* (redfish)
 Buchanon, 1973
- Fish-Squalus* (spiny dogfish)
 Slauson et al., 1983
- Fish-Tautoga* (tautog)
 Briggs, 1977
 Olla et al., 1975
- Fish-Urophycis* (red and white hake)
 Greig and Wenzloff, 1977
 Musick, 1973
 Rachlin and Warkentine, 1984
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 Murchelano et al., 1979
 Ogren et al., 1968
 Rachlin and Warkentine, 1988
- Fish-Kills*
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 Figley et al., 1979
 Kumpf, 1977
 Sharp, 1976
 Bergmann, 1979
 Gunnerson, 1981
 Malone, 1978
 Young, 1973
- Fisheries*
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 Esser, 1982
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 Kumpf, 1977
 McHugh, 1974
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 McHugh and Ginter, 1978
 Nat. Mar. Fish. Ser., 1988
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 Ropes et al., 1979
 Sindermann and Swanson, 1979

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| Steimle, 1985 | Stone, 1978 |
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Hudson Shelf Valley (Canyon) | |
| Ali et al., 1975 | Buchanon, 1973 |
| Drake, 1977 | Gadd et al., 1978 |
| Hsueh, 1980 | Lavelle et al., 1975 |
| Mayer et al., 1981 | Nelson et al., 1978 |
| Sawyer et al., 1984 | Williams, 1979 |
| Young, 1989 | |
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Hudson River plume | |
| Charnell and Maul, 1973 | O'Connor and Duedall, 1975 |
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Management (Policy) | |
| Achrem, 1973 | Anonymous, 1973 |
| Anonymous, 1976 | Anonymous, 1977 |
| Anonymous, 1978 | Anonymous, 1983 |
| Boxer, 1984 | Coch and Stern, 1988 |
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| Goldberg, 1979 | Gordon et al., 1982 |
| Gross, 1976 | Gunnerson et al., 1982 |
| Hart and Milliken, 1991 | Italiano, 1976 |
| Johnson, 1970 | Kaplan and Reis, 1980 |
| Kester, 1978 | Kneip, 1982 |
| Konop, 1978 | Marr, 1979 |
| Mayer, 1982 | McHugh, 1974 |
| McHugh and Williams, 1976 | Mytelka et al., 1982 |
| Newman, 1982 | Payton, 1985 |
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| Tingle et al., 1979 | Wolfe et al., 1982 |
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| Anonymous, 1977 | Schlee and Sanko, 1975 |
| Wong and Wilson, 1979 | |
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| Anonymous, 1976 | DeYoung, 1984 |
| Jones et al., 1975 | Koebel and Krueckeberg, 1975 |
| Mohnen, 1977 | Pore and Barrientos, 1976 |
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Miscellaneous-Biological | |
| Howe et al., 1978 | Lee et al., 1982 |
| Murawski, 1969 | Rowe et al., 1976 |

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Duce et al., 1976
Hammon, 1976
Korlipara et al., no date
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Oey et al., 1985
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Lyzenga and Bennett, 1988
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Anonymous, 1988

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 ICES, 1984
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 Nat. Mar. Fish. Ser., 1991
 Norton and Champ, 1989
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 Anonymous, 1977
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 Longwell, 1976
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 Freeland and Merrill, 1977
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 Gunnerson, 1981
 Hansen, 1977
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 Lettau et al., 1976
 Malone, 1977
 Mayer, 1977
 McHugh and Ginter, 1978
 MESA, 1977
 Mueller et al., 1976
 O'Connor et al., 1977
 Pearce et al., 1976
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 Pearce et al., 1978
 Pore and Barrientos, 1976
 Starr et al., 1976
 Terry, 1977

- Yasso and Hartman, 1976
- Yentsch, 1977
- Monitoring-NEMP
- Anonymous, 1981
- Reid et al., 1987
- Gunnerson, 1981
- Ocean disposal
- Achrem, 1973
- Anonymous, 1978
- Betzer, 1978
- Caracciolo-Ward and Steimle, 1984
- Greig and McGrath, 1977
- Gunnerson, 1981
- Johnson, 1980
- Konop, 1978
- Mearns et al., 1982
- Mueller et al., 1976
- Muramoto, 1991
- Nat. Mar. Fish. Ser., 1972
- Nat. Mar. Fish. Ser., 1972
- O'Connor and Parker, 1982
- Payton, 1985
- Pearce, 1972
- Phoel et al., 1985
- Sandy Hook Sp. Fish. Mar. Lab., 1972
- Squires, 1983
- Steimle et al., 1982
- Swanson and Mayer, 1989
- Wiebe et al., 1973
- Young, 1982
- Anonymous, 1973
- Anonymous, 1983
- Buzas et al., 1972
- Charnell and Maul, 1973
- Dewling and Anderson, 1976
- Italiano, 1976
- Kester, 1978
- Malone, 1976
- Monahan et al., 1982
- Mueller and Anderson, 1978
- Nat. Mar. Fish. Ser., 1972
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- O'Connor et al., 1982
- Pararas-Carayannis, 1973
- Pearce, 1971
- Pearce et al., 1977
- Polcyn and Sattinger, 1979
- Segar and Cantillo, 1976
- Steimle, 1985
- Stanley and Kaplanek, 1976
- Vaccaro et al., 1972
- Williams, 1979
- Young and Barber, 1973
- Ocean disposal-Dredged material (also see Capping)
- Anonymous, 1973
- Charles and Muramoto, 1991
- Farrington, 1977
- Gordon et al., 1982
- Horne et al., 1971
- Muramoto and Carey, 1991
- Pierce et al., 1981
- SAIC, 1992
- Stubblefield et al., 1977
- Bokuniewicz, 1979
- Coch and Stern, 1988
- Freeland et al., 1976
- Gross, 1976
- Koepp et al., 1987
- Pechko and Freeman, 1990
- Pequegnat et al., 1980
- Sherwood, 1989
- Tavolaro, 1984
- Ocean disposal-Sewage sludge
- Anonymous, 1976
- Anonymous, 1988
- Botton, 1979
- Conrad, 1985
- Duedall et al., 1977
- Gift et al., 1989
- Anonymous, 1978
- Bobinchak et al., 1977
- Caracciolo and Steimle, 1983
- Duedall and Connors, 1976
- Duedall et al., 1977
- Gross, 1976

- Gunnerson et al., 1982
Horne et al., 1971
Johnson et al., 1979
Lear et al., 1982
Malone, 1982
Norton and Champ, 1989
Stubblefield et al., 1977
Teeter et al., 1978
Watling et al., 1974
Young and Pearce, 1975
- Ocean disposal-106 Mile site
Anonymous, 1977
Anonymous, 1977
Fry and Butman, 1991
Greig et al., 1976
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Anonymous, 1976
Callaway et al., 1976
Duedall et al., 1975
Hatcher and Keister, 1976
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Mayhue and Lovelady, 1977
Pearce et al., 1977
Sawyer et al., 1977
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- Parasites
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- Particulates
Betzer, 1978
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- Plankton
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Austin, 1976
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Garside et al., 1976
Grice and Hart, 1962
Hulbert, 1963
- Gunnerson and Swanson, 1975
Johnson et al., 1977
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- Anonymous, 1977
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- Anonymous, 1988
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 Mandelli et al., 1970
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 Vaccaro, 1963
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 Mahoney, 1979
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 Sharp, 1976
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Falkowski et al., 1980
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Anonymous, 1977
 Anonymous, 1978
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Anonymous, 1977
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Ali et al., 1977
 Anonymous, 1977
 Anonymous, 1980
 Charles and Muramoto, 1991
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Pollutants-Metals

Ali et al., 1977
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Anderson, 1982
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 Stewart and Koditschek, 1980

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 Gross et al., 1971
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 Koditschek and Guyre, 1974
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Calabrese et al., 1982
Chang and Longwell, 1984
Devanas et al., 1980
Greig and Wenzloff, 1977
Jefferies and Johnson, 1976
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Timoney and Port, 1982
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Malone, 1977
McHugh, 1978
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Pearce et al., 1981
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Jensen, 1975
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Reid et al., 1987
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Hansen, 1977

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Anonymous, 1980
Gibson et al., 1979

Atwood et al., 1979
Pearce, 1979

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Biscaye, 1978
Kristensen et al., 1991
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Williams, 1979

Cochran and Aller, 1979
Schlee and Sanko, 1975
Thomas et al., 1976
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Cochran and Aller, 1979
Drake, 1974
Duedall et al., no date
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Boesch, 1982
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13. ABSTRACT (Maximum 200 words) The New York Bight Biological Review Program (BBRP) was one portion of a larger effort to determine the feasibility of various modeling and monitoring strategies for measuring effects from pollution in the NY Bight. The specific goal of the BBRP was to identify the information gaps that need to be filled in order to efficiently examine impacts to marine biological resources from large-scale projects within the Bight. The early stages of the BBRP involved searching various databases for published studies about the Bight. Results of these searches were compiled in an annotated bibliography to facilitate preparation of the final BBRP report and various working documents during the 2-year effort of the BBRP. The BBRP focused on potential biological impacts, so the bibliography primarily has a biological focus. There are 579 entries, most related to the hypoxia event observed during 1976 or the Marine Ecosystems and Analysis Program conducted by the NY Sea Grant Program and the National Oceanic and Atmospheric Administration. A cross-referenced keyword index is provided at the end to facilitate use. Copies in electronic format are available upon request.				
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