NOAA Technical Memorandum ERL MESA-25

NEW YORK BIGHT PROJECT

ANNUAL REPORT FOR FY 1976-76T

Marine Ecosystems Analysis Program
Boulder, Colorado
December 1977

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MESA New York Bight Project
Stony Brook, New York

Marine Ecosystems Analysis Program
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December 1977

UNITED STATES
DEPARTMENT OF COMMERCE
Juanita M. Kreps, Secretary

NATIONAL OCEANIC AND
ATMOSPHERIC ADMINISTRATION
Richard A. Frank, Administrator

Environmental Research
Laboratories
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FOREWORD

The time covered in this report (July 1, 1975, to September 30, 1976) has been a period of maturation for the MESA New York Bight Project during which it has made considerable progress in fulfilling its scientific objectives. More than fifty major research efforts were funded in physical, geological, chemical, and biological oceanography and health-related disciplines, more than in any previous fiscal year. Results from MESA research, supplemented by the Project's at-sea capability, helped regional leadership to deal with environmental crises affecting the Bight. In both the marine pollution event on Long Island's south shore beaches and the anoxic episode along the New Jersey coast, the Project initiated monitoring efforts and investigated the causes and effects of these incidences.

During this period the MESA New York Bight Project was recognized by academic, industrial, and governmental groups in the region as an authoritative source of environmental information relating to the Bight and its uses.

A large measure of the Project's success is due to the close contact maintained with and the cooperation received from the public, academia, and federal, state, and local government agencies. We look forward to continued interaction and collaboration with these groups and anticipate that MESA research will continue to be timely and relevant to the needs of the New York Bight area.

R. Lawrence Swanson
Project Manager

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ACKNOWLEDGMENTS

The MESA New York Bight Project appreciates the cooperation received from many organizations. In particular, the Project would like to acknowledge those that contributed significant resources of their own to further the Project's research. These include the National Marine Fisheries Service, Northeast Fisheries Center; the Environmental Research Laboratories, Atlantic Oceanographic and Meteorological Laboratories; Engineering Development Laboratory, Oceanographic Division, and Office of Fleet Operations, all of the National Ocean Survey; the National Weather Service, Eastern Region; the New York Sea Grant Institute; the Environmental Protection Agency, Region II; Brookhaven National Laboratory; and the Marine Sciences Research Center, State University of New York at Stony Brook. Special gratitude is expressed to the officers and crew of the NOAA Ship George B. Kelez for their continued outstanding support to the Project.

Recognition and appreciation is also expressed to Garry F. Mayer for the preparation of this report.

ACRONYMS AND ABBREVIATIONS

ACE	-	U. S. Army Corps of Engineers
ACS	-	American Chemical Society
AGS	-	American Geographical Society
AOML	-	Atlantic Oceanographic and Meteorological Laboratories
ASLO	-	American Society of Limnology and Oceanography
BC	-	Brooklyn College
BLM	-	Bureau of Land Management
BLOS	-	Bigelow Laboratory of Ocean Sciences
BNL	-	Brookhaven National Laboratory
BOD	-	Biological Oxygen Demand
C-33	-	NOS - Oceanographic Division
CBI	-	Chesapeake Bay Institute
CEDDA	-	Center for Experiment Design and Data Analysis
CENS	-	Centre d'Etudes Nucléaires de Saclay
CNEXO	-	Centre National pour l' Exploration des Océans
CU	-	Columbia University
CUNY	-	City University of New York
DEIS	-	Draft Environmental Impact Statement

DESS	-	Department of Earth and Space Sciences, SUNY at Stony Brook
DOM	-	Dissolved Organic Matter
EDF	-	Environmental Defense Fund
EDL	-	Engineering Development Laboratory
EDS	-	Environmental Data Service
EIS	-	Environmental Impact Statement
EPA	-	U. S. Environmental Protection Agency
ER	-	NWS Eastern Region
ERDA	-	Energy Research and Development Administration
ERL	-	Environmental Research Labor atories
FDA	-	Food and Drug Administration
FSU	-	Florida State University
FU	-	Fordham University
IDOE	-	International Decade of Ocean Exploration
INSTEP	-	Inner Shelf Sediment Transport Experiment
ISC	-	Interstate Sanitation Commission
JMA	-	John McCormick Associates, Inc.
L-DGO	-	Lamont-Doherty Geological Ob- servatory
LIEC	-	Long Island Environmental Council
MACFC	-	Middle Atlantic Coastal Fish- eries Center (NMFS)

MC	-	Manhattan College
MESA	-	Marine Ecosystems Analysis
MG&GL	-	Marine Geology and Geophysics Laboratory (AOML)
MIT	-	Massachusetts Institute of Technology
ML	-	Milford Laboratory (NMFS)
MSRC	-	Marine Sciences Research Center, SUNY at Stony Brook
NCDPH	-	Nassau County Department of Public Health
NASA	-	National Aeronautics and Space Administration
NDBO	-	National Data Buoy Office
NEFC	-	Northeast Fisheries Center (NMFS)
NESS	-	National Environmental Satellite System
NJDEP	-	New Jersey Department of Environmental Protection
NMFS	-	National Marine Fisheries Service
NOAA	-	National Oceanographic and Atmospheric Administration
NOAA-EM	-	NOAA Environmental Monitoring and Prediction, Oceanic Services Office
NOAA-MR	-	NOAA, Marine Resources
NODC	-	National Oceanographic Data Center

NOS	-	National Ocean Survey
NPS	-	National Park Service
NSF	-	National Science Foundation
NTIS	-	National Technical Information Service
NWS	-	National Weather Service
NYCDWR	-	New York City Department of Water Resources
NYCEPA	-	New York City Environmental Protection Administration
NYDEC	-	New York Department of Environmental Conservation
NYSDEC	-	New York State Department of Environmental Conservation
NYSGP	-	New York Sea Grant Program
NYSGI	-	New York Sea Grant Institute
OCL	-	Ocean Chemistry Laboratory (AOML)
OL	-	Oxford Laboratory (NMFS)
OOE	-	Office of Ocean Engineering
ORSL	-	Ocean Remote Sensing Laboratory (AOML)
OTTS	-	Offshore Tide Telemetry System
PDP	-	Project Development Plan
PhOL	-	Physical Oceanography Laboratory (AOML)
PMEL	-	Pacific Marine Environmental Laboratory

POC	-	Particulate Organic Carbon
RFI	-	Rensselaer Freshwater Institute
RSMAS	-	Rosenstiel School of Marine and Atmospheric Sciences
RU	-	Rutgers University
SCCWRP	-	Southern California Coastal Water Research Project
SHL	-	Sandy Hook Laboratory (NMFS)
SINC	-	Synoptic Investigation of Nutrient Cycling
STAX	-	Sludge Tracking Acoustic Experiment
SUNY	-	State University of New York
SURC	-	Southeast Utilization Research Center
TAC	-	Technical Advisory Committee
TCH	-	Total Carbohydrate
TOC	-	Total Organic Carbon
UC	-	University of Chicago
UD	-	University of Delaware
UM	-	University of Massachusetts
URI	-	University of Rhode Island
USCG	-	U. S. Coast Guard
USF	-	University of South Florida
USFWS	-	U. S. Fish and Wildlife Service

USGS	-	U. S. Geological Survey
USN	-	U. S. Navy
WCC	-	Water Column Characterization
WHOI	-	Woods Hole Oceanographic Institution
WUSB	-	SUNY campus radio station
XBT	-	Expendable Bathythermograph
XWCC	-	Expanded Water Column Characterization
YU	-	Yale University

New York Bight Project

Annual Report for FY 1976-76T

1. INTRODUCTION

1.1 Purposes of the Report

The Annual Report for Fiscal Year 1976-76T describes MESA New York Bight Project activities between July 1, 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. It is used as a management tool by the MESA Program Office and by administrators of the Environmental Research Laboratories (ERL) and National Oceanographic and Atmospheric Administration (NOAA). It 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. Finally, the Report describes Project activities to groups and individuals with interests in the Bight, including the MESA New York Bight Advisory Committee, Project investigators, users of MESA-generated information, and members of the concerned public.

1.2 Project Background and Aims

The Project is generally recognized as the first comprehensive, multidisciplinary effort to study the problems of the New York Bight on a regional basis. Since its inception in 1972, the Marine Ecosystems Analysis (MESA) Program has served as a focus for cooperative efforts between components of NOAA, other federal agencies, state and local governments, universities, industries, and various private organizations for investigating regional problems arising from man's use of marine and estuarine resources. The approach of the Program has been to select discrete projects dealing with impacted or potentially impacted areas, and to fund them over several years. Projects have been chosen on the basis of the unique value of the affect environment, the nature and extent of the human impact on the environment, and the need for better understanding of the environment's functioning so that more effective management might be instituted.

The New York Bight was selected as the site of MESA's prototype project because of the significance and urgency of the region's environmental problems. The New York Bight extends 150 to 180 km (80 to 100 nautical miles) seaward from Long Island and New Jersey to the edge of the continental shelf and encompasses over 39,000 km^2 (15,000 square miles) (Figure 1.1). It is adjacent to one of the most populated and industrialized regions of the world, supporting nearly 10 percent of the nation's population. It is the repository for wastes from over 20

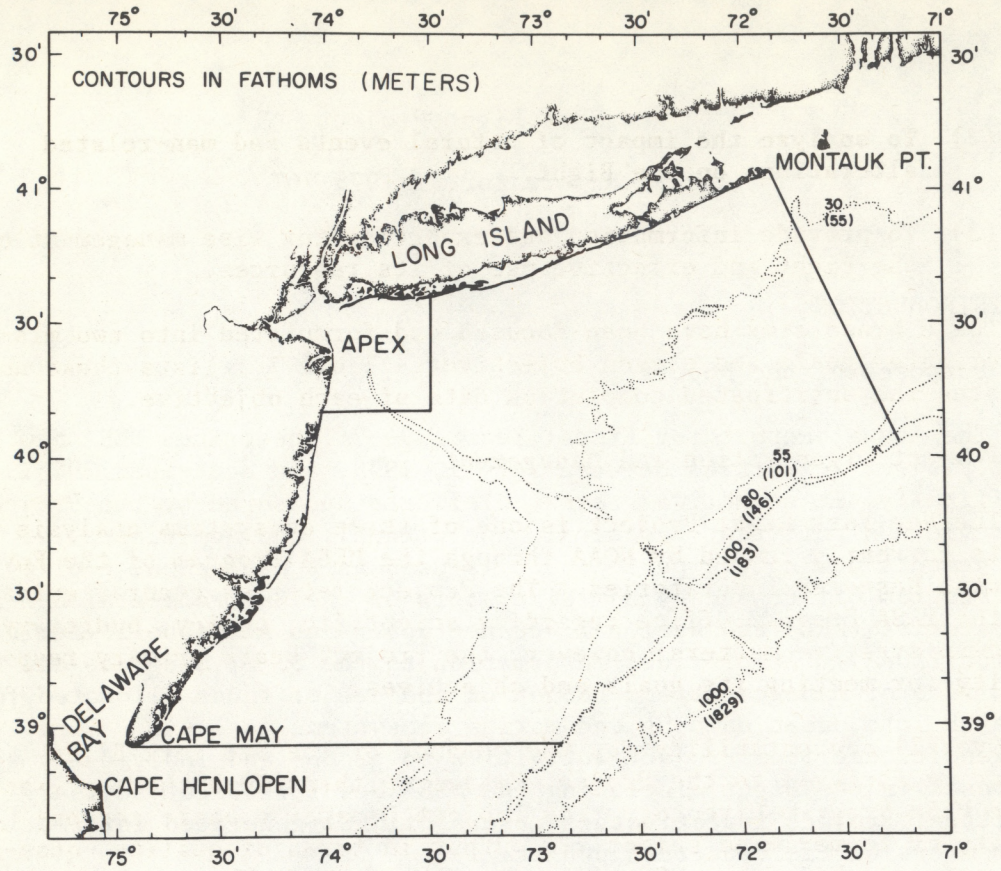

Figure 1.1. The New York Bight.

million people as well as a host of major industries, and is the recipient of the nation's largest ocean dumping operation (about 13 million cubic meters, or 460 million cubic feet of domestic wastes per year). The Bight is also the site of major shipping activities and soon may bear the burden of offshore oil production activities.

Despite the intense uses of the area, the Bight is an important environmental resource. Rich and abundant commercial and recreational fisheries occupy its waters, and wildlife sanctuaries dot the less populated shores. The area is the setting for the Fire Island National Seashore and Gateway National Recreation Area; both provide oceanic recreational opportunities in relatively natural environments for millions of area residents.

The MESA New York Bight Project has been investigating the consequences of disparate uses of the Bight since 1973. Throughout this period, the Project has attempted the following:

(1) To understand and describe the natural processes that govern the functioning of the Bight.

(2) To analyze the impact of natural events and man-related alterations on the Bight.

(3) To provide information and expertise for wise management of the Bight and effective use of its resources.

These broad aims have been focused and formulated into two mission-oriented goals and eleven objectives. Table 1.1 lists these and indicates the anticipated completion date of each objective.

1.3 Project Organization and Management

The New York Bight Project is one of three ecosystems analysis efforts currently funded by NOAA through the MESA Program of the Environmental Research Laboratories. The Project receives general guidance from the MESA Program Office regarding scientific, policy, budgetary, and administrative matters; however, the Project bears primary responsibility for meeting its goals and objectives.

Overall accountability for the conduct of the New York Bight Project is assigned to the Project Manager within the authority granted by the MESA Program Director. The Project Manager's basic responsibility is to maximize scientific output in terms of quality, quantity, and user benefits. Specifically, the Project Manager defines tasks, responsibilities, and lines of authority within the Project Office, interfaces with supporting agencies and organizations, provides the planning and administrative framework for scientific activities, and determines the day-to-day progress and direction of the Project.

The Project Manager is assisted by a permanent staff of 14 that provides support for and administers scientific and technical programs. Although research activities largely are accomplished by NOAA components, universities, and other contractors, staff members participate in data analyses, synthesis, and advisory services and thus help to fulfill Project aims. Responsibilities of the staff are divided into four major areas: scientific support, data management and information exchange, administrative support, and operations and logistical support. Table 1.2 provides a list of Project personnel during FY 1976-76T and indicates how they fit into the categories mentioned above.

Table 1.1. New York Bight Project Goals and Objectives (Anticipated completion dates are in parentheses.)

Goal A:	Characterize major Bight ecological systems, processes, stresses, and responses, and define their relationships and rates of change.
Objective 1:	Identify the characteristics and distributions of the New York Bight sediments. (December 1976)
Objective 2:	Identify the major factors influencing primary productivity and food chain dynamics. (June 1976)
Objective 3:	Identify the major organisms and their distribution in the New York Bight. (December 1977)
Objective 4:	Characterize the driving forces and responses of tides, major currents, and water masses. (June 1978)
Objective 5:	Determine the ecological effects of organic enrichment and nutrient loading. (September 1978)
Objective 6:	Identify the cumulative ecological effects of environmental stress. (September 1980)
Goal B:	Determine the types, transport rates, fates, and impacts of pollutants and other man-related stresses on the Bight ecosystem.
Objective 7:	Identify the pollutants that are most critical to the New York Bight ecosystem. (June 1978)
Objective 8:	Identify transfer routes and fates of major chemical pollutants. (November 1980)
Objective 9:	Determine how the alteration of input rates and/or locations of pollutant sources would affect the distribution, cycling, and fate of contaminants. (September 1981)
Objective 10:	Define the inputs, concentration, distribution, pathways, and fates of contaminants and pathogens in the New York Bight ecosystem. (September 1980)
Objective 11:	Determine the requirements for an efficient monitoring program that will detect environmental change. (September 1981)

Table 1.2. MESA Project Staff, July 1, 1975 to September 30, 1976

Name	Status	Position
R. Lawrence Swanson	N	Project Manager
Scientific Support		
Garry F. Mayer	C	Biological Oceanographer
Joel S. O'Connor	C	Biological Oceanographer
Charles A. Parker	C	Physical Oceanographer
Robert C. Roush*	N	Geological Oceanographer
Harold M. Stanford	C	Chemical/Geological Oceanographer
Anthony J. Adinolphi*	-	Student/Trainee
Edward B. Assaf*	-	Student/Trainee
Michel R. Griben*	-	Student/Trainee
Joseph Lucca*	-	Student/Trainee
Kathleen McDonough*	-	Student/Trainee
Mary J. Young*	-	Student/Trainee
Data Management and Information Exchange		
Paul A. Eisen	C	Data Manager
Susan Z. Robbins*	-	Student/Trainee
Arleamon Sadler*	-	Student/Trainee
Administrative Support		
Stanley Chanesman	C	Program Analyst
George L. Dick	C	Administrative Officer
Lori Crane*	C	Clerk-Typist
Diane DeLuca	C	Secretary
Cindy Lou Hines*	C	Clerk-Typist
Betty Maligno*	C	Secretary
Beatrice Metzler	C	Clerk-Typist
Ruby Obenauer*	C	Clerk-Typist
Janet Schiavo	C	Clerk-Typist
Operations and Logistical Support		
Theodore T. Falkowski	C	Electronics Technician
David Pasciuti	N	Logistics Officer
Stanley Marcenkiewicz	C	Electronics Technician
Claude A. Robinson	C	Electronics Technician
Clarence W. Tignor	N	Operations Officer
Bruce M. Davis	-	Student/Trainee

C = Civil Service
N = NOAA Corps Officer
* left the Project before the end of the reporting period.

1.4 Facilities

The New York Bight Project Office is located on the campus of the State University of New York (SUNY) at Stony Brook (Figures 1.2 and 1.3) and houses the offices of all administrative, scientific support, and data management personnel, as well as the MESA library, a working collection of documents pertinent to MESA activities in the Bight. In 1975 the library was designated by the U.S. Environmental Protection Agency, Region II (EPA-RII) one of three public information centers for the New York-New Jersey area. Center libraries were augmented to include all documents pertinent to EPA-RII's environmental impact statement on ocean disposal of sewage sludge.

Logistics and operations are centered at the Project's Floyd Bennett Field Operations Base in Brooklyn, New York (Figure 1.2). This facility includes areas for ship berthing and staging, equipment storage, and temporary accommodations for visiting scientists. In addition, it provides facilities for the repair, maintenance, and calibration of instruments and hardware, and the laboratory analysis of chemical, physical, and geological samples. Activities at the Operations Base are under the direction of the MESA Operations Officer.

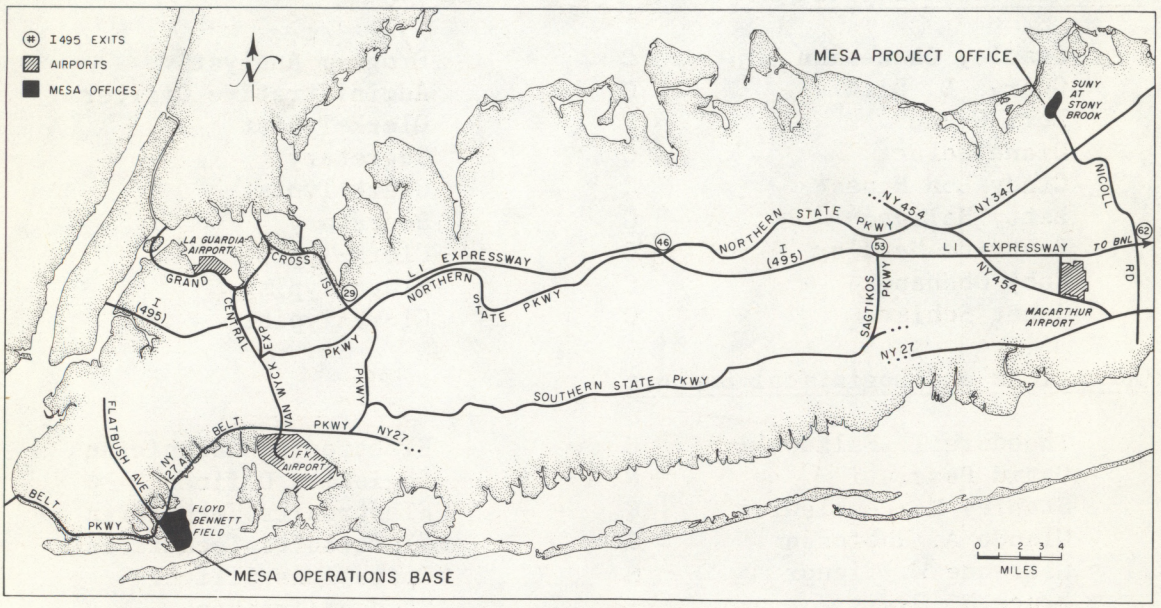

Figure 1.2. Locations of the MESA New York Bight Project Office at SUNY, Stony Brook, and the MESA Operations Base at Floyd Bennett Field.

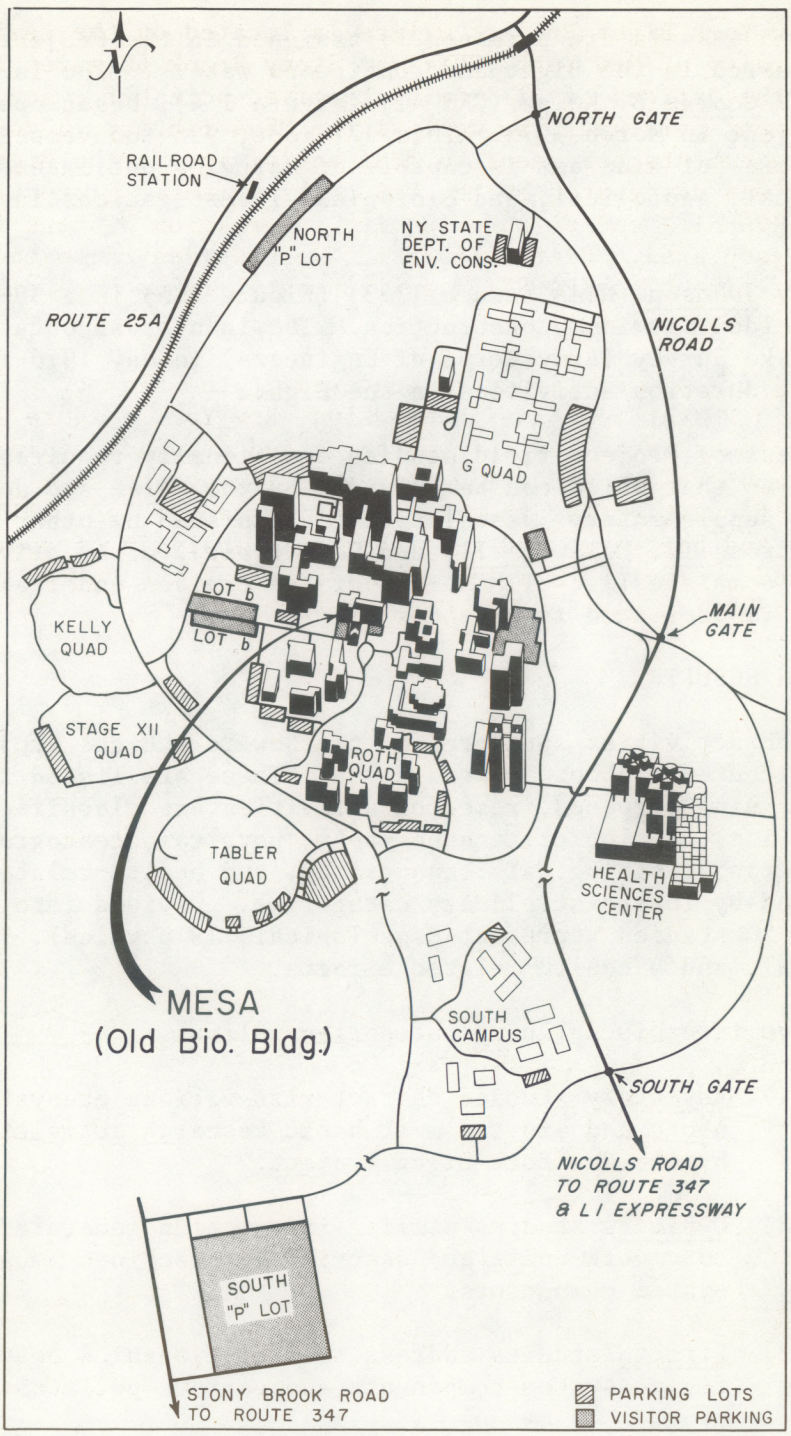

Figure 1.3. Location of the Mesa New York Bight Project Office on the SUNY Stony Brook Campus.

1.5 Research Vessels

Two NOAA vessels are permanently assigned to the Project for conducting research in the Bight and contiguous waters. The larger of the two, the R/V George B. Kelez (CRS 41) (Figure 1.4), began operations for the Project in March 1975. This 177-foot, 936-ton vessel carries a scientific crew of nine and is capable of carrying out extended physical, chemical, geological, and biological investigations in all parts of the Bight.

The R/V Johnson (NOAA Launch 1263) (Figure 1.5) is a 50-foot catamaran of welded aluminum construction. The launch was obtained from the U. S. Lake Survey (Army Corps of Engineers) in May 1976 for nearshore, short duration activities in the Bight.

The press of Project field studies occasionally requires ship time in addition to that which can be provided by the Kelez and Johnson. In such cases, supplementary vessel time is furnished by other NOAA ships (e.g., Albatross IV, Delaware II, and Researcher), or by private vessel charter. A complete list of MESA-associated cruises undertaken during FY 1976-76T is presented in Appendix III.

2. RESEARCH RESULTS

Research activities sponsored by the New York Bight Project during FY 1976-76T centered about 50 work units. These are listed in Appendix II. For planning purposes, research activities are classified both by discipline (i.e., geological oceanography, physical oceanography, chemical oceanography, biological oceanography, and health-related investigations), and by interdisciplinary categories. Divided into disciplines, the 50 studies represent 8 geological, 13 physical, 9 chemical, 16 biological, and 3 health-related efforts.

The five interdisciplinary categories follow:

(1) Inventory studies characterize various ecosystem components and are the most basic research activities funded by the New York Bight Project.

(2) Dynamics studies utilize information generated by Inventory work units and describe interactions among ecosystem components.

(3) Effects studies address the relationships between specific ecosystem components and various pollutants.

(4) Synthesis studies integrate multidisciplinary information on the Bight; products provide responses to specific Project objectives.

(5) Monitoring studies utilize information from the above investigations to design a monitoring program that will assess the impact of future human and natural perturbations on the Bight.

The Project funded 22 inventory efforts, 21 dynamics studies, 6 effects projects, and 1 synthesis unit. Work on monitoring is scheduled to begin in FY 1977. Another interdisciplinary unit funded was the MESA Monograph Series.

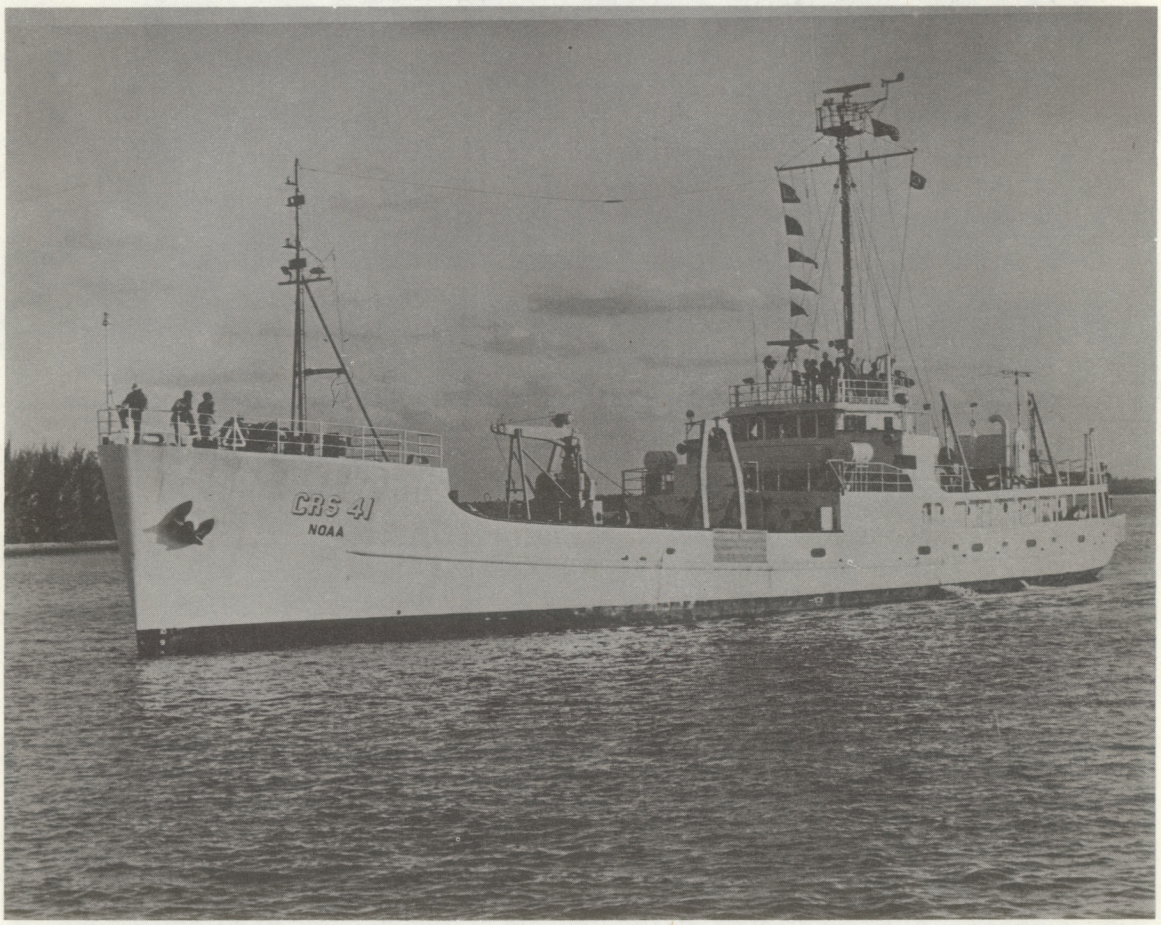

Figure 1.4. The R/V George B. Kelez.

Figure 1.5. The R/V Johnson.

2.1 Inventory Studies

2.1.1 Geological Oceanography

By the beginning of fiscal year 1976, the bulk of inventory programs devoted to geological problems had been completed or were being phased down. In May 1976 a draft report was received detailing net bathymetric changes in the Bight apex between 1936 and 1973. Although no significant changes were observed at the sewage sludge and acid waste dumpsites, considerable change was observed at the dredged materials dumpsite and at the now abandoned dumpsites near Ambrose and Sandy Hook Channels. At the dredged material dumpsite, dumping activities produced a 30-foot shoaling of bottom topography. Approximately 86 percent of the dredged materials dumped between 1936 and 1973 were found still to be in place on the bottom. The accumulated sediments represented primarily the heavier fractions of materials disposed of at the site. Finer-grained, predominantly organic fractions, containing proportionately large amounts of contaminants, were dispersed over the years by various physical and biological processes.

Inventory studies in geological oceanography have been completed. MESA-sponsored investigations in this discipline have led to the publication of a variety of maps and descriptions of Bight sediment distributions and have provided background information for a number of other New York Bight Project initiatives.

2.1.2 Physical Oceanography

The principal purposes of the inventory program in physical oceanography have been the characterization of water circulation, water column structure (temperature, salinity, and density), bottom pressure, and tidal and atmospheric forcing. Understanding these features is essential for defining the physical state of the water column and for describing the transport and dispersion of materials such as contaminants, sediments, and plankton.

The field program for FY 1976 initiated a long-term study of circulation and transport processes on the Bight shelf. For a full year, time series observations (currents, water temperatures, salinities, bottom pressures, and meteorological forcing) were obtained to define better the low-frequency features and to characterize the effects of transient phenomena such as shelf waves, hurricanes, and storms (i.e., extratropical cyclones). Approximately 500 meter-months of serial current observations were obtained and processed. Bottom pressure records were obtained at five stations during the spring and summer months. Data from the coastal meteorological network were supplemented with much needed offshore data from two NDBO meteorological buoys moored on the Bight shelf. Seven expanded water column characterization (XWCC) surveys were conducted during the year to establish the seasonal cycle for water structure and physical/chemical parameters. The resultant combined data set was of exceptional quality and completeness.

A number of preliminary findings indicated that the period was not typical from a physical oceanographic point of view. Sea surface and air temperatures were unseasonably high during the winter of 1975 and spring of 1976. Together with an earlier-than-usual spring freshwater runoff, they brought about the early establishment of stratified conditions in the Bight.

The passage of storm centers through the Bight during spring and summer was significantly reduced. Only six storms (40% of the normal number) occurred during this interval. Simultaneously, the spring/summer pattern of southwesterly winds became established earlier than usual and was stronger and more persistent than normal.

The dynamic relationship between the above conditions and Bight circulation is still being explored; however, direct examination of current patterns indicated that near-bottom shelf flow was much more variable than normal, alternating to the northeast and southwest over

periods of approximately one week. In addition, mean current speeds were approximately one-quarter those observed in 1975, although overall near-bottom water movement appeared to be more energetic.

These anomalous physical conditions were instrumental in bringing about two phenomena of concern to the Project: the appearance of large quantities of floatable debris on metropolitan area beaches, and an anoxic event that severely damaged Bight shellfish resources. These incidents are discussed in greater detail in section 3.

Data obtained by inventory activities in physical oceanography proved to be an invaluable resource for investigations of the floatables incident and low dissolved oxygen conditions. Routine water column surveys provided a long-term data base against which to compare conditions observed during the spring and summer of 1976. These data were also used in efforts to model New York Bight circulation and water mass movements (see section 2.2.2: Dynamics, Physical Oceanography, for a more extensive discussion). Routine measurements of water column conditions will continue through the life of the Project to provide input for diagnostic modeling studies and to furnish data for a Bight-wide monitoring effort to begin in FY 1977.

2.1.3 Chemical Oceanography

The New York Bight receives a multitude of contaminant inputs from a variety of sources. Inventory activities in chemistry during the reporting period were aimed at characterizing these inputs. One important class of contaminants reaching the Bight is trace metals. Studies have indicated that estuarine discharge and the dumping of dredged materials are major loading sources of most metals investigated. Atmospheric input, sewage sludge, and acid waste dumping are relatively minor contributors to the total metals budget. For example, rough estimates of atmospheric input to a 10,000 km^2 area of the Bight indicated that of the total input of pollutant material (from barge dumping, runoff, sewage, rivers, and atmospheric disposition), only 13 percent of the lead, 8 percent of the zinc, 5 percent of the iron, and 1 to 2 percent of the cadmium entered by way of the atmosphere. Concentrations of dissolved metals in the apex were found to be higher than on the open shelf, and higher in the summer than in the spring and fall. Budget calculations revealed that contaminant metals exemplified by copper and zinc do not accumulate in the apex and are rapidly transported and dispersed from it, presumably seaward to surrounding shelf waters and possibly back to the estuaries by tidal flushing. The mean residence times of contaminant metals in apex waters were estimated to be as low as six months or less.

A second contaminant-related study undertaken during the reporting period investigated the distribution of anthropogenic organic materials in Bight sediments. Sediment samples from selected portions of the Bight were analyzed for total carbohydrate (TCH) and total

organic carbon (TOC) contents. The TCH:TOC ratio was determined to be an indicator of sewage-derived organic matter in sediment deposits. Observed TCH:TOC ratios suggested that considerable amounts of the organic material deposited in the Christiaensen Basin were of sewage origin, while only minor components of mud patches near Long Island were sewage-derived. Seaward of the apex, sedimentary organic matter was less influenced by sewage-related material, and organic matter of oceanic origin became more prevalent.

A comprehensive analysis of pollutants entering the Bight was prepared by workers at Manhattan College. The study estimated the magnitude and relative importance of contaminant inputs from sources such as dredge spoils, sewage sludge, acid wastes, chemical wastes, rubble, atmospheric fallout, gaged stream flow, urban runoff, groundwater outflow, and municipal and industrial waste water. In addition to flow or volume for each source, 23 separate contaminants were examined to estimate the inputs of heavy metals, nutrients, organic matter, solids, and microbes. Data provided by this study already have been of assistance to scientists, regulatory officials, and managers working on Bight-associated problems. Increased use of this report is projected as physical processes in the Bight are better understood and modeling efforts become more intense.

The activities described above represent the first portion of a continuing effort in chemical oceanography. Adequate data still are lacking for most metal inputs and for the distributions of most trace elements in the New York Bight ecosystem. The availability of heavy metals from input sources such as dredged materials also needs to be examined in greater detail, as do the distribution and cycling of toxic organic substances.

Future New York Bight Project research will look into many of the still outstanding questions. Additional investigations of the sources and environmental concentrations of heavy metals and toxic organics will be funded, as will examinations of the fate of dredge spoils dumped into the apex. Two items of particular note expected during 1977 are a report on the 25 most serious contaminants affecting the Bight and a study documenting the contaminant inputs provided by urban runoff.

2.1.4 Biological Oceanography

Biological activities associated with inventory studies centered around investigations of the benthic environment. Three examinations of benthic macrofauna were conducted.

Work by the NMFS Sandy Hook Laboratory provided input to the MESA Atlas Monograph on benthic invertebrates and indicated that on the basis of distribution, three broad categories of benthic species occur in the Bight: (1) species that occur regularly at many stations, often

in great abundance, (2) species that occur irregularly but in great numbers, and (3) species that occur irregularly, at few stations, and in low numbers. More species by far belong to category (3), while relatively small numbers belong to category (1). Approximately 26 percent of all species collected in the Bight were found at only one locale. The Sandy Hook effort also confirmed the belief that benthic invertebrate distributions reflect, to some extent, human impact on the benthic environment and thus may represent a useful monitoring tool. Initial cluster analyses revealed that benthic data were capable of identifying variously affected portions of the bottom. Between three and five replicate samples per station were found to be an appropriate balance between sampling precision and cost-effectiveness.

Further studies of the utility of benthic invertebrate distribution data for characterizing Bight environments were undertaken by groups from Fordham University and NOAA's Center for Experiment Design and Data Analysis (CEDDA) working as a team, and by investigators from the University of Rhode Island (URI). The Fordham/CEDDA team utilized a technique known as factor analysis which divides the fauna sampled at various stations into groups, each group or factor containing similar faunal elements. The team found the Bight's benthic environment divisible into five groups: a group of organisms characteristic of the sewage sludge dumpsite, two groups characteristic of sediments with relatively high organic contents (i.e., containing a high proportion of deposit feeders), and two groups characteristic of relatively hard-bottom areas around the dumpsites and around the Hudson Shelf Valley.

The URI group aimed to characterize the abiotic (i.e., physical/ chemical) aspects of the benthic environment by variance techniques and then planned to apply biological data to the physical strata obtained. Although this work was incomplete at the close of the reporting period, the group found that three variables can be used to characterize benthic environments: the total metals content of sediments, the percent organic content of sediments, and sediment grain size characteristics. Future efforts will classify biological samples according to physical strata, and will compare the species composition of samples from similar physical strata. These activities should be completed by early 1977 and will lead to a refined estimate of the number of replicate biological samples required to characterize biological communities at given locations.

Related work utilized the distribution of fecal coliform bacteria in bottom sediments to map the spread of materials disposed of at the sewage sludge dumpsite. The study showed that sewage sludge had contaminated areas extending 11 km north and 37 km south from the dumpsite. Sediment migration patterns implied by the fecal coliform data were in agreement with those determined by independent geological, chemical, and physical studies in the Bight. The investigation also indicated that fecal coliform bacteria may persist in sediments for more than four days during winter and spring when temperatures are low.

These sediments can be resuspended and carried toward Long Island as well as elsewhere by storm-induced turbulence.

Two additional inventory studies were undertaken, an analysis of ciliated protozoan populations and an updated examination of fisheries resources. The former investigation found localized areas of high bactivorous ciliate concentrations in the vicinity of the sewage sludge dumpsite. Bactivorous ciliates occurred in abundance only at specific depths above the dumpsite corresponding to layers of stratification in the water column. Sewage sludge particles and sewage-associated bacteria were concentrated in these strata and provided a substrate for the ciliates. No bactivorous ciliates were found in the sediments of the dumpsite, possibly because of elevated metals concentrations in the sediments. The occurrence of bactivorous ciliates in the New York Bight was noteworthy for they had never been reported from marine environments before. Their presence was found to vary seasonally and was greatest in the summer when stratification was most pronounced.

An examination of finfish resources began during the transitional quarter and centered about investigations of the effects of the anoxic event that occurred in the Bight during the summer of 1976. Although some mortality was observed by sport divers on wrecks off the New Jersey coast and local kills of undetermined size occurred on several occasions when fish were trapped against the shore by intrusions of hypoxic water, no significant finfish mortalities were revealed by eight survey cruises conducted in and near the anoxic water mass. Temporary changes in the distribution and migratory patterns of local fish populations were observed. In general, fishes tended to avoid areas of low dissolved oxygen concentration. Repopulation of the affected areas was observed after the end of the anoxic event. (See section 3 for additional information on the anoxic event.)

Investigations of the anoxic event's effects on the fauna of the Bight will continue into FY 1977, as will efforts to complete the characterization of the Bight's benthic communities. Aside from these studies, however, the aims of the Project's inventory program in biological oceanography have been met and no further initiatives are anticipated.

2.1.5 Health-Related Investigations

The commercial fish and shellfish populations of the New York Bight represent potential reservoirs of heavy metals and toxic organic substances. Investigations in other parts of the country have indicated that commercial species are capable of acquiring pollutant body burdens of sufficient magnitude to pose a threat to the consuming public. An assessment of the heavy metals concentrations in New York Bight fish and shellfish began during the transitional quarter of 1976. Initial efforts were directed at collating already-existing data on the

concentrations of eight metals in various tissues of species obtained from the Bight. A companion study summarizing comparable data from other parts of the country was also undertaken. Future field work and analyses will increase the number of metals under examination to fifteen. Reports due in 1977 and 1978 will explore variations in heavy metal body burdens among different species, among forms with various food and/or habitual preferences, among organisms of different sizes, and among groups from various geographic areas inside and outside the Bight. An analogous study of organic contaminants in fish, shellfish, and plankton will begin in FY 1977 and will continue into 1978.

2.2 Dynamics Studies

2.2.1 Geological Oceanography

A major component of geological studies was concerned with the dynamics of sediment transport. Predictions of sediment transport rates were made at stations occupied during the 1973-1974 current meter field season. Computations indicated an expected state of near-continual sediment movement at the harbor mouth, but also showed anomalous sediment activity in the Hudson Shelf Valley. The results suggested clockwise sediment transport in the apex during the fall and counterclockwise movement in the spring. The fall pattern, however, could be interrupted and occasionally overwhelmed by westward sediment movement.

Also completed were analyses of data generated by an experiment monitoring the movement of sand tagged with the radionuclide ruthenium. These experiments along Long Island clearly demonstrated the seasonality of sediment transport and its governance by storm events. Unusually strong northeasters were found to be capable of dominating sediment transport so that net movement was to the west.

Experiments utilizing naturally occurring radionuclides of thorium, uranium, radium, polonium, and lead examined the rates of sedimentation and sediment perturbation at selected stations in the Bight. Isotopes of lead and thorium (^{210}Pb, ^{228}Th, and ^{234}Th) were particularly useful in this regard. Lead-210 also was found to be useful for distinguishing the origins of organic-rich fine fractions; however, the rapid rates of bioturbation seen in the Bight (turnover of up to 25 cm of sediment in less than five years) reduced the value of this isotope for establishing sediment history.

A preliminary report was received in September 1976 from workers at the University of South Florida investigating the sources, transport, and reactions of suspended particles in the Bight. Results indicated that at least some of the major inputs of particulates to the Bight could be chemically typed and traced. Seasonal changes in the distribution and composition of suspended matter were found to be related to input from the Hudson-Raritan estuarine system, diatom productivity, sediment-water interactions, and the dumping of anthropogenic materials.

Research continued on the origin, extent, and composition of low-density, high carbon mud patches that occur seasonally offshore from Long Island. Evidence indicated that the position of these patches varied seasonally; however, there was no indication that they were steadily moving toward nearby beaches. There also was no compelling evidence that the mud patches were principally derived from sewage sludge dumped in the Bight. Changes in the size and distribution of mud patches were examined by means of techniques such as continuous sidescan sonar recording, grab sampling and analysis of physical and chemical characteristics of patches, bottom photography, and direct measurements utilizing diver-serviced graduated rods.

Research on the organic properties of Bight sediments showed that fecal steroids, such as coprostanol and 24-β-ethyl coprostanol, could be used as tracers of sewage contamination. However, because of the numerous sources of raw and treated sewage to the New York Bight, steroids could not be used to identify the sources of sewage-related material.

Beginning in the transitional quarter, many of the dynamic studies related to sediment transport were combined into a single effort entitled Inner Shelf Sediment Transport Experiment (INSTEP). The goal of this program is to resolve the pattern (i.e., the rates and directions) of fine sediment deposition, transport, and erosion on the inner continental shelf, specifically off Long Island and in the inner Bight. This effort will examine the structure of the coastal turbidity field, the rate of coastwise sediment flux, the rates of onshore/offshore sediment exchange, and the transport and settling patterns of fine particulate matter moving through the water column. Preliminary results will become available during FY 1977.

Perhaps the most ambitious applied geological projects undertaken during the reporting period were the Sewage Tracking Acoustic Experiments (STAX). The initial endeavor (STAX-I) showed that dumped sewage sludge could successfully be tracked over periods of several hours by modified acoustic systems. Sludge dumped at the sewage sludge disposal site by commercial tankers was tracked using 20-kHz and 200-kHz systems. Although portions of the dumped material were observed to sink to the bottom in as little as 20 minutes, other fractions remained suspended near the pycnocline and moved with the water column. Material was tracked for as long as 5 hours after the completion of a dump. During the tracking, point scatterers appeared in the acoustic field. It is still unclear whether these represented particles of sewage sludge that flocculated after the dump or biological targets, such as small fishes, that were attracted to the dump area.

Chemical observations made in association with STAX-I revealed that ammonium, phosphate, and suspended solids contained in the discharged sewage sludge had the greatest impact on water column properties. Factors such as temperature, salinity, pH, and concentrations

of dissolved oxygen and chlorophyll a were not significantly affected by sludge dumping. By 110 minutes after dumping, the water column above the thermocline had nearly returned to background conditions with respect to the variables measured. Below the thermocline, however, concentrations of ammonium, phosphate, and suspended solids remained high for the entire observation period.

A more comprehensive and complex set of acoustical experiments (STAX-II) was undertaken in July 1976. Preliminary results confirmed and extended many of the findings made during STAX-I. Sewage sludge dumping was again observed to affect both the water column and the bottom. Approximately 21 percent of the total load of sewage sludge particles reached the bottom during the first 2 to 3 hours after dumping. However, detectable effects of the dump persisted in the water column for 6 to 8 hours. Highly concentrated horizontal plumes of sewage sludge-derived materials spread from the main vertical plume along the thermocline. These horizontal plumes persisted at least 4 to 6 hours after dumping. Particulate and dissolved fractions of the sewage sludge dispersed under the influence of mixing and advection, but at significantly different rates. A complete report detailing the results of STAX-II will be available late in 1977.

With the end of the 1976-76T funding period, dynamics efforts in geological oceanography will focus on the INSTEP investigations, an examination of the mobility of potential pollutant-carrying fine-grained sediments. Other studies will have been completed, will gradually diminish, or will have been incorporated into the INSTEP effort. Although INSTEP will continue to dominate MESA-sponsored geological studies for the remainder of the life of the Project, plans now call for a STAX-like investigation of dredge spoil dumping to begin during 1978. This study should provide much needed geophysical and chemical data on the fate of substances such as heavy metals and toxic organic compounds contained in the dredged materials.

2.2.2 Physical Oceanography

Considerable progress has been made in characterizing major Bight forcing functions and related dynamic responses. An initial study of meteorological forcing fields was conducted during FY 1976. Extratropical cyclones were shown to be dominant forcing disturbances in the Bight. Examination of historical storms resulted in the characterization of the surface expression and associated air-sea transfers resulting from a typical winter storm. The space-time correlation fields of forcing parameters, such as atmospheric pressure and wind stress, were also developed and were used to produce and verify objective meteorological hindcast extrapolation schemes. These schemes were utilized to generate a limited set of gridded data for various model and analytical studies.

One such set of studies utilized autoregressive and other statistical techniques to determine pressure, sea level, and current responses to meteorolgical and tidal forcing. Examinations of the fluctuations and distribution of currents began to establish close links between components of current response and a manageable number of forcing factors. A significant amount of the low frequency current variance was attributable to tidal and local wind forcing. An understanding of the distributions of component response relationships is expected to lead to the development of a composite model capable of forecasting or hindcasting total current response, given appropriate forcing inputs.

Considerable analytical development and testing of response models were also accomplished. A tidal response model was completed and documented; a one-dimensional current/local wind response model was tested; and work began on the development of a two-dimensional technique for analyzing vector response/forcing relationships. Work on the one-dimensional model indicated that considerations of far-field forcing and stratification may be necessary to achieve the desired variance reduction over a broad range of environmental conditions.

During FY 1976-76T, combined data sets of density, pressure, currents, and wind fields were analyzed as part of a steady-state diagnostic modeling effort. When completed, the diagnostic models will provide a detailed picture of velocity fields (i.e., current patterns) in the Bight. Several case studies were undertaken during the 1976 fiscal year to establish model sensitivity to input factors such as depth or density fields. As a result, boundary conditions were examined and refined. The models were found to be reasonably realistic for non-stratified conditions over averaging periods of approximately one week. Other cases (e.g., stratified conditions) are to be further explored during FY 1977 and models will be applied to conditions observed during the 1976 anoxic event.

In addition to the above modeling efforts, 1976 saw the initiation of the analytical development of a time-dependent diagnostic model. This model will account for the effects of transient forcing events and for the propagation of externally generated current wave forms through the Bight.

The development of physical models of Bight circulation is important to both the applied and pure science aspects of the Project. For example, 1977 will see the start of an effort to model the cycling of carbon, oxygen, and nitrogen in the New York Bight ecosystem. At the heart of this undertaking will be a transport model such as the steady-state diagnostic model mentioned above. Similarly, physical models of the type under development can be of great assistance during a crisis such as an oil spill or a floatables event when it becomes vital to understand how various forcing functions (e.g., wind and tides) affect the movement of parcels of water, in examining the causes

of poorly understood phenomena such as the anoxic event of 1976, and as part of synthesis activities to examine holistically problems such as the fate and distribution of pollutants or to evaluate alternative waste management strategies. During its remaining years, the Project will strive to produce models applicable to the many needs of its users.

2.2.3 Chemical Oceanography

Dynamics efforts in chemistry examined the transport and dispersion of several key compounds and elements in the New York Bight. One such study investigated anthropogenic fluxes of carbon into sediments. Measurements of the relative abundance of two isotopes of carbon, ^{12}C and ^{13}C, revealed that sewage sludge-containing sediments are poor in ^{13}C compared with average organic sediments from the Bight. The ^{13}C technique utilized in this study was judged to be a potential qualitative tracer of anthropogenic components in near-shore sediments.

A second study, conducted by scientists from Florida State University, investigated phosphate fluxes across the sediment-water interface. Results indicated that there was considerable lateral heterogeneity in the distribution of interstitial total dissolved phosphate. The data also suggested that physical processes and organisms associated with the bottom were primarily responsible for the exchange of dissolved phosphate species across sediment-water interfaces in the Bight.

A third study examined fluctuations in the dissolved oxygen levels of the Bight. Dissolved oxygen concentrations generally have been found to be near saturation except in summer when a stable thermocline exists and concentrations in the lower layers of the water column may drop to 10 percent of saturation or less. Localized short-term episodes of oxygen depletion are not uncommon and have been observed during most summers. (These should not be confused with the atypical, large-scale anoxic event that took place during the summer of 1976 and is discussed in section 3.2 of this report.) In order to gain insight into the oxygen situation in the apex, mass balances of oxygen and carbon cycles were examined. Photosynthetically produced carbon was found to account for most of the apex oxygen demand, particularly during the summer. Oxygen demand resulting from sewage sludge and dredged materials was small compared with that from carbon produced in situ. Midsummer primary productivity in the apex was high because of anthropogenic nitrogen input. Most nitrogen supplied to the apex in forms suitable to support photosynthetic production was derived from sewage treatment plant effluent discharged into the Hudson-Raritan estuary. (See also section 2.2.4, Dynamics--Biological Oceanography.) The study concluded that river-borne inputs of nitrogen, rather than ocean dumping, were the primary cause of low summer oxygen concentrations in the apex. Improvement in summer oxygen levels will be achieved only by removing nitrogen from sewage treatment plant effluents.

The Hudson-Raritan estuarine system provides significant inputs of many materials to the New York Bight apex. Exchange takes place across a transect between Sandy Hook, N. J., and Rockaway Point, N. Y. Transport measurements at the transect are difficult to interpret because of the complex hydrography and circulation patterns occurring there. During the reporting period a study was conducted to determine whether contaminants and naturally occurring substances in water masses adjacent to the transect could be used to identify the origin of water passing across the transect. Research indicated that by comparing salinity, ammonium, and chlorophyll-a distributions at the the transect with those characteristic of source waters, such identifications were possible.

With the close of the transitional quarter, the emphasis of dynamics studies in chemical oceanography will shift from biologically labile substances, such as nutrients, carbon, and oxygen, to pollutants. For example, efforts to compile existing information on the chemical effects of dredged material and acid waste dumping will be completed (FY 1977), and a study examining the flux of heavy metals from dredged material deposits will be initiated (FY 1978). FY 1978 will see the beginning of a two-year initiative to summarize contaminant dynamics in the New York Bight ecosystem. This effort will integrate and interpret information on the sources, transfer routes, rates of transfer, and fates of major contaminants.

2.2.4 Biological Oceanography

It is well known that the nutrient loading of the New York Bight apex is dominated by organic inputs from the Hudson-Raritan estuary system (see Mueller et al., 1976). The estuary system, in turn, receives much of its loading from municipal sewer and wastewater outfalls around the metropolitan area. The greater New York area (20 million people) contributes approximately 160 metric tons of nitrogen per day to the estuary. Approximately half comes from New York City alone, and much of this enters the system between the George Washington Bridge and the Narrows. The fate of this input is, to a large extent, determined by responses of phytoplankton assemblages of the Hudson-Raritan estuary and inner Bight. Phytoplankton dynamics in turn significantly affect benthic environments as well as other components of water column communities.

Within the Hudson-Raritan estuary, phytoplankton are capable of utilizing only a small percent of the anthropogenic nitrogen input. Thus nitrogen is never limiting to phytoplankton growth. During periods of high spring runoff, phytoplankton may assimilate as little as 1.6 percent of the available nitrogen, whereas during summer periods of sluggish flow assimilation may be as high as 26.9 percent. In either case, a large proportion of the nitrogen available in the estuary is not used and is flushed into the Bight where it is found in measurable quantities throughout the area required for its uptake.

During the summer this represents an area of 257 km^2 or a fan-shaped section of the Bight having a radius of 20 km. During most of the rest of the year this represents an area of 1370 km^2 or a fan-shaped section of the Bight with a radius of 40 km. Phytoplankton production within the estuary represents a significant contribution to the organic load of the estuary and may be as high as 185 metric tons of carbon per day. This loading contributes significantly to the summer oxygen demand of the estuary and the inner Bight.

A thorough study of productivity was undertaken at one station in lower New York Bay. The results clearly illustrated the effect of nutrient loadings on the estuary. Production at the study site was estimated to be 817 g $C/m^2/yr$. This amount is greater than the highest values previously recorded for marine phytoplanktonic ecosystems. It is 2.2 times the annual particulate production recorded in adjacent marine coastal waters (370 g $C/m^2/yr$), and well above the productivity seen in relatively unpolluted coastal marine systems (100-200 g $C/m^2/yr$). The productivity is comparable only with that observed in highly eutrophic freshwater fish ponds (about 1000 g $C/m^2/yr$). On an annual basis, 18 percent of estuarine primary productivity was found to be attributable to netplankton, 67 percent was attributable to nanoplankton and 15 percent was produced as dissolved organic matter (DOM). In adjacent coastal waters, netplankton represented a larger fraction of the overall productivity.

As previously mentioned, nutrients are not limiting to estuarine primary production. The high concentrations of ammonium and phosphate injected year-round into the Hudson River by sewage treatment plants permit excessive phytoplankton growth. Available light appears to be the limiting parameter, with factors such as the rates of cell importation, growth, dilution, predation, and flushing being important secondary controlling agents. Other work indicates that temperature may also be an important controlling parameter.

In a related study, researchers found that phytoplankton from Raritan, lower New York, and Sandy Hook bays were capable of releasing extremely high quantities of photoassimilated carbon in the form of DOM into the extracellular environment. In the summer, DOM release rates may be greater than 100 mg $C/m^3/hr$. This is two orders of magnitude greater than that found in other estuaries and one order of magnitude greater than that observed in stressed laboratory populations. At times as much as 71 percent of total productivity was released as DOM, although amounts generally averaged between 10 and 15 percent of total productivity.

Research thus far described has been concerned with conditions within the Hudson-Raritan estuary; however, considerable effort also was devoted to conditions in the inner Bight. Work undertaken by the Lamont-Doherty Geological Observatory (L-DGO) examined phytoplankton dynamics in this region. Calculations and field work indicated that annual particulate phytoplankton productivity in the apex

ranged between 430 and 460 g $C/m^2/yr$. Of this, netplankton accounted for 49 percent of annual production, and nanoplankton accounted for the remainder. Approximately 50 percent of netplankton productivity occurred between February and April, while more than half of nanoplankton production occurred between June and August.

Phytoplankton represented a major source of particulate organic carbon (POC) in the apex. However, at no time during the study period did phytoplankton-associated POC account for more than 45 percent of water column POC. Phytoplankton POC values ranged between 15 and 45 percent, with values greater than 35 percent occurring only during bloom periods. Thus at all times during the year, non-phytoplankton-associated POC (e.g., silt or detritus) accounted for the bulk of the water column POC in the apex.

The fate of water column POC was another area examined by L-DGO investigators. Several factors, including grazing by zooplankton and sinking were found to be important mediators of water column POC. With regard to zooplankton, copepods accounted for more than 70 percent of the macrozooplankton during most of the year. Since the absolute abundance of copepods varied with season, the effect of these organisms on the POC pool was variable. Maximum grazing pressure by copepods was observed during late June. During this period, copepod grazing was the major process limiting phytoplankton accumulation, with approximately 22 percent of the standing stock of phytoplankton being grazed daily. Copepods also consumed considerable amounts of detritus and were found to play a major role in turning over the summer water column detrital pool.

With regard to sinking, netplankton (i.e., diatoms) were observed to sink at rates of 2-4 m/day. Nanoplankton, on the other hand, were observed to sink more slowly (0-1 m/day). Since netplankton reach maximum abundance early in the year (February-March), before zooplankton grazing pressure is heavy, sinking was found to be a primary factor controlling the size of netplankton populations. In contrast, nanoplankton populations reach peak abundance during late spring and early summer, when copepod grazing is most intense. Because nanoplankters fall through the water column relatively slowly, grazing rather than sinking was found to be the primary cropping agent of this segment of the phytoplankton.

Studies of benthic processes represented a second area of inquiry during the reporting period. Investigations demonstrated the utility of the ^{14}C-heterotrophic mineralization technique for monitoring benthic microbial activity. No significant diel variations were noted in the rates of microbial activity.

Considerable temporal and spatial variations in total benthic respiration (microbial plus macrobenthos) were noted across the Hudson estuary and Bight apex. In general, the oxygen saturation of bottom

waters varied seasonally and was highest in February and lowest in August. Oxygen utilization during both periods was highest in the lower Hudson River (Spuyten Duyvil to the Narrows) and decreased seaward.

Contrary to common belief, the bulk of the oxygen uptake was observed to occur in the water column rather than on the bottom. In the lower Hudson River, seabed oxygen uptake rates ranged from 12.6 to 41.5 ml $O_2/m^2/hr$. This was sufficient to consume 4.6 percent and 4.8 percent of the organic load in the river in February and August, respectively. In lower New York Bay, seabed oxygen uptake ranged from 3.9 to 31.4 ml $O_2/m^2/hr$. This was sufficient to oxidize 6 percent of the total organic load of the Bay. In the apex, seabed oxygen consumption ranged between 1 and 68 ml $O_2/m^2/hr$. This was sufficient to oxidize 6 percent of the total organic load of the Bay. In the apex, seabed oxygen consumption ranged between 1 and 68 ml $O_2/m^2/hr$. This was sufficient to oxidize only 5 percent of the annual organic loading of the apex.

Seabed oxygen uptake rates obtained for the apex were similar to those obtained by other studies of eutrophied coastal environments. During the winter, highest oxygen uptake rates were observed in the Christaensen Basin, adjacent to the sewage sludge disposal site, and in the dredge spoils disposal area. High values were also observed in the Hudson Shelf Valley seaward of the Christiaensen Basin. During the summer, high rates of benthic oxygen utilization were observed adjacent to the dredge materials dump site and near the site of the Asbury Park, N. J., municipal sewage outfall. Industrial acid wastes produced no noticeable effect on oxygen uptake.

These studies in biological oceanography investigated the relative importance of factors controlling primary productivity and the utilization of phytoplankton biomass. Other investigations examined benthic respiration and its role in utilizing energy sources and dissolved oxygen available to benthic communities. These determinations represent the first steps in developing a fuller understanding of the trophic relationships between components of Bight ecosystems. Future efforts will attempt to quantify these interactions in order to produce a model of carbon, oxygen, and nitrogen cycling in the Bight.

2.2.5 Health-Related Investigations

Previous studies have indicated that pathogenic organisms are capable of surviving at least for short periods of time in the waters and sediments of the New York Bight. A dynamics study was begun to determine if pathogens suspended in the water column could be transmitted to the shore by aerosolization resulting from the bursting of bubbles at the sea surface. Bubble breakage and aerosolization take place wherever there is turbulence. Investigators used a harmless, relatively fragile indicator virus, T_4, in this study. They hypothesized that if T_4 could remain viable during aerosolization, then less fragile pathogens also could be dispersed by this process.

Researchers found that both T_4 and bacteria remained viable in droplets resulting from the bursting of bubbles. The process of droplet formation was found also to concentrate viral and bacterial particles by 30- to 50-fold over that in the bulk suspensions giving rise to the bubbles. The public health significance of these findings is that viruses and bacteria in the sea may be concentrated by adsorption and ejection processes associated with the formation and bursting of bubbles. Particles may be removed from the water by waves (e.g., breakers in the surf zone), white caps, or wakes from passing ships, and wafted into the winds for transmission to humans.

2.3 Effects Studies

Four classes of effects studies were undertaken during the reporting period. These included examinations of the effects of chemical pollutants on phytoplankton populations, an investigation of mutagenesis in ichthyoplankton, studies of fish and shellfish diseases, and an analysis of pollution-mediated antibiotic resistance in benthic bacteria. Results obtained from each of the above are briefly discussed below.

2.3.1 Effects of Chemical Pollutants on Phytoplankton Populations

The effects of chlorinated pesticides such as PCB's on phytoplankton populations were examined by the Marine Sciences Research Center (MSRC) of the State University of New York at Stony Brook. Experiments were conducted under both field and laboratory conditions. For the former, a system using dialysis membrane bags was developed. This system permitted populations of algae to be tested under controlled conditions while still bathed in natural waters.

Work utilizing various species of phytoplankton revealed the following about the effects of PCB's:

(1) A single dose of PCB at 10 ppb substantially but temporarily inhibited a series of phytoplankton functions, whereas a 1-ppb dose produced only limited inhibition of growth and photosynthesis.

(2) Large species of phytoplankters (particularly diatoms) appear to be more susceptible to PCB toxicity than do smaller algae, leading to substantial changes in size class distribution in treated cultures.

(3) In Thalassiosira species, 10 ppb of PCB reduced the growth rate, total particle volume, chlorophyll a and carbon fixation per cell, but did not affect carbon fixation per unit chlorophyll a. Inhibition of photosynthesis appeared to be due to interference with chlorophyll synthesis rather than chlorophyll function.

(4) Repeated doses of PCB's may have a devastating effect on natural phytoplankton communities. Although recovery occurred with time following a single exposure to 5 or 10 ppb PCB, daily doses of 5 ppb inhibited growth and permanently altered species composition. Daily doses of 10 ppb ultimately destroyed all algal cells.

Work with other chlorinated hydrocarbon compounds produced similar results. Single doses of 1, 5, or 10 ppb of DDE were found to inhibit temporarily the growth of the marine dinoflagellate Exuviella baltica. Such inhibition in nature could be sufficient to allow less susceptible phytoplankters to gain a competitive advantage.

Doses of 10 ppb of dieldrin produced even more marked effects on E. baltica. In addition to inhibiting growth, the pesticide caused the rupturing of growing cells and produced successive generations of smaller-than-normal cells, even when daughter cells were grown in dieldrin-free solutions. Since herbivorous zooplankters are frequently size-specific particle feeders, chlorinated pesticides may have an adverse effect on natural food chains by altering the quantities and sizes of phytoplankton available for zooplankton grazing. Such changes will disrupt trophic interactions within a community and may bring about changes in the species composition of a natural system.

2.3.2 Mutagenesis

Research on the incidence of mutagenesis in ichthyoplankton from the New York Bight for the first time revealed possible effects related to waste disposal practices. Mutagenesis refers to abnormalities such as chromosomal aberrations and cleavage anomalies that prevent the successful development of fish eggs and larvae. Although several species were studied, the bulk of the data refer to the Atlantic mackerel, Scomber scombrus. Data from other species show trends similar to those seen for the Atlantic mackerel.

Briefly stated, extremely high incidences of mutagenesis were observed in the apex, particularly in the vicinity of the dumpsites. Extremely high mortalities (26-97 percent) were observed in the latter areas. The incidence of mutagenesis was also high along the New Jersey coast and decreased with distance southeast and east away from the apex. Mortalities of eggs and larvae in the northeast and southern portions of the Bight were relatively low, ranging from 0 to 10 percent.

It should be emphasized that at this time no cause and effect relationship has been determined between the occurrence of mutagenesis and anthropogenic inputs of pollutants. However, the spatial correlation between peaks in these two factors is suggestive. Work to be undertaken in FY 1978 aims to establish more firmly whether a relationship exists between the incidence of pollution and mutagenesis.

2.3.3 Fish and Shellfish Diseases

Data continued to be collected on fish and shellfish disease occurring in the Bight. The incidence and geographic distribution of fin rot disease were identified by NMFS researchers. They found a significantly higher prevalence of fin rot in fish caught in the apex of the New York Bight than in fish from outside of the apex. They also noted a higher incidence of the disease in fish from the Hudson-Raritan estuary (i.e., Raritan and Sandy Hook Bays) than in fish from Great Bay (a relatively unpolluted bay approximately 70 miles south of Sandy Hook). The occurrence of fin rot varied seasonally and annually. Between 1973 and 1975 the incidence of this disease in winter flounder (Pseudopleuronectes americanus) from the apex declined from 12 percent to 3 percent. The reason for the decline is not known.

Cage studies were begun. Healthy winter flounder were held in cages at sites with clean and polluted water, in an attempt to monitor the development of fin rot. Although this experiment was beset by logistical difficulties, initial findings indicated that conditions were unfavorable to the maintenance of healthy fish at the polluted site. Fish held in this area either died or developed caudal fin lesions. The lesions were more severe with longer exposure times. The condition and percentage of fish surviving at the control site were considerably better than at the polluted site.

Work also continued on shellfish gill fouling. The gills of crustacea from the Bight apex frequently were populated by parasites and epibionts, and often were fouled by detrital material, producing a syndrome known as "black-gill" disease. The disease previously had been shown to be induced by dumped material.

A new fouling species of suctorian ciliate, Ephelota sp., was reported for the first time from the gills of four species of crabs and one species of lobster taken from the Bight apex. This epibiont appeared to be present only on bottom-dwelling, relatively sessile organisms that were taken from polluted waters. All of the sites where Ephelota sp. was found either were areas of heavy residential and commercial pollution or were long-term dumping grounds for dredge, sewage, and industrial wastes. The ciliate was not found on crustaceans from Long Island Sound or Montauk Point, suggesting that the epibiont may be a pollution indicator species.

The overall results of investigations of fish and shellfish diseases suggest that organisms inhabiting polluted waters are more likely to exhibit disease symptoms. However, cause and effect relationships generally were not demonstrated.

2.3.4 Antibiotic Resistance in Benthic Bacteria

The final effects study undertaken during the 1976-76T fiscal year involved an examination of the prevalence of antibiotic resistance in bacteria isolated from dumpsites of the New York Bight apex. Workers at Cornell University found varying degrees of resistance to ampicillin, tetracycline, kanamycin, and streptomycin among these bacteria. The same workers also found that forms resistant to the antibiotic ampicillin also tended to be resistant to elevated concentrations of mercury present in the media. Research with both the genus Vibrio and the genus Bacillus led to the conclusion that ampicillin resistance and mercury resistance were genetically linked. Thus, evolutionary selection for bacteria resistant to elevated mercury concentrations present in dumpsite sediments may also have resulted in the evolution of bacterial strains resistant to ampicillin. Work during FY 1977 will investigate this hypothesis.

2.4 Synthesis Studies

Only one synthesis effort (work unit IV.1, MESA Monographs) was funded during FY 1976-76T. The aims of this unit were to summarize and integrate existing information on various aspects of the Bight and to present these data in a manner that is usable by the general public, managers, and scientists. Thirty monographs are projected for the complete series. Nine were published and manuscripts for all remaining monographs were received and reviewed. Additional discussion of the series is presented in section 4.1 (Publications) of this report.

3. SHORT-LIVED EVENTS RESPONSE

During FY 1976-76T the New York Bight Project responded to a number of short-lived phenomena. These ranged in duration and seriousness from an anoxic event, which involved much of the Bight and lasted for several months, to a major spill of toxic chemicals, which posed a 1- to 2-day threat to portions of the apex. Although crisis response is not the primary function of the Project, involvement with selected short-term events may come about for any of the following reasons:

(1) The event may represent a "natural experiment," affording an opportunity to make observations and/or to test hypotheses pertinent to on-going research efforts.

(2) The event may produce environmental consequences of interest to the Project in its role as information center for users of the Bight.

(3) The Project may be requested by federal, state, or local agencies to provide assistance because of its competence and familiarity with the Bight.

(4) The event may disclose previously unappreciated aspects of problems pertinent to the Project's goals.

Four short-lived events are described below: the summer 1976 floatables event, the summer 1976 anoxic episode, Hurricane Belle, and the spring 1976 chemical waste spill. In all, Project staff devoted over one man-year to these events through September 1976. The greatest effort was devoted to the floatables problem (121 man-days). An effort of similar magnitude will have been made by the Project staff for the anoxic episode, by the time all analyses are completed in 1977.

3.1 The Floatables Event

The "summer 1976 floatables event" refers to a period during the second half of June 1976 when beaches along the south shore of Long Island were inundated by a variety of floating litter. Included among the materials washed ashore were tar and grease balls, charred wood, garbage and trash (e.g., watermelon rinds, chicken heads, styrofoam beads, paper, and plastic wrappers), and sewage-related items (e.g., condom rings, diaper liners, and tampon applicators). Although similar occurrences had been recorded in the past, greater sensitivity of citizens to pollution combined with the unprecedented volume of objectionable materials to produce a public outcry. Immediate concern focused on bathing beach water quality and the potential health hazard posed by sewage and waste materials washing ashore. In partial response to these concerns, selected beaches were closed as a precautionary measure beginning on June 15, 1976. By the end of the third week in June, swimming was prohibited at most south shore beaches. Although bathing areas were generally reopened by July 1, the incident caused considerable annoyance and inconvenience to the public and economic loss to local businesses.

The New York Bight Project became involved with the floatables incident primarily because of its research on the effects of sewage sludge dumping and waste disposal in the Bight. Initially, the Project served as a focus for the multi-faceted local, state, and federal response (see section 5: Advisory Services). However, as the effort became better defined, the coordinating role for federal activities shifted to the EPA. The MESA Project concentrated on gathering and analyzing data relative to the causes and possible recurrence of the floatables event. A final report entitled "Long Island Beach Pollution: June 1976" was prepared and published as a MESA Special Report (MESA, 1977a). The report concluded that although no single source or event could be blamed for the variety of floating litter that washed on to the beaches, several natural and man-related factors were contributory.

Among the natural events, it was noted that there was unusually high river runoff in May 1976. This probably flushed more material than usual into the Bight from the Hudson and Raritan River drainage basins. At the same time, strong and unusually persistent winds blew from the

southwest. These events occurred during the end of May and the early part of June and had two effects. First, they shifted the Hudson River plume to the east, away from its normal southerly path parallel to the Jersey coast; and, second, they tended to transport floatables in the Bight to the northeast, towards Long Island beaches. The latter effect was probably enhanced by spring tides, which reached their maximum on June 12.

Human-associated events increased the volume of floating debris available for wind- and tide-driven transport. A series of devastating pier fires early in June dumped tons of wreckage and debris into the water. Prior to that, a ruptured oil storage tank spilled large quantities of oil into the Hackensack River and the wetlands of the Hackensack Meadows. A week later, two sewage sludge storage tanks on Pearsall's Hassock, Hewlett Bay Park, N. Y., exploded, spilling 1 million gallons of sewage sludge into the water and 1.1 million gallons onto the land.

While the above events undoubtedly added to the debris stranded on Long Island beaches, their contribution, like that from the sewage sludge dumpsite, was relatively minor. By far the greatest input of floatables came from the numerous discharges and waste handling operations associated with the Hudson/ Raritan estuary. For example, many discharges (untreated and combined sewer overflows) lacked adequate screening and carried large quantities of floatables into the rivers. The floatables carried into the estuary by all of the above mechanisms were flushed into the Bight by the unusually high flow rates and were then stranded on the beaches of Long Island by the prevailing winds.

Because of the multiplicity of sources contributing to the floatables problem, the MESA summary report on the episode (MESA, 1977a) concluded that "there is no [short term] technological solution to the problem of floatables on New York Metropolitan area beaches [p. 55]." Only through a program directed at (1) improving the metropolitan area's sewer systems, (2) reducing the volume of solid floatables generated by the area's populace, and (3) eliminating discharges of floatable pollutants such as greases and oils can the problem be controlled and its recurrence prevented.

3.2 The Anoxic Event

Shortly after the floatables episode, the New York Bight was beset by another crisis, an anoxic event. The problem first became evident at the end of June and beginning of July 1976. During the weekend of June 27, sport divers observed stressed organisms on a number of wrecks off the Jersey coast. Three days later, a commercial trawler working at 50 m in the apex of the Hudson Shelf Valley reported that up to 75 percent of its catch consisted of dead fishes. The occurrence of unusually large numbers of dead or dying organisms in the northwest portion of the Bight was confirmed during the Fourth of July weekend, when sport divers found dead demersal fishes and invertebrates on and around shipwrecks off the cost of northern New Jersey.

Initial reports of dead organisms were restricted to the area north of Barnegat Inlet, but, as the summer passed, the affected area appeared to spread southward and eastward until it reached its maximum extent in mid-September, when it covered approximately 4,800 km^2 and extended "from just off the west-central Long Island shore to a point approximately 90 km east of the Delaware-Maryland borders and from 2 to 100 km off the N. J. Coast." (Steimle, 1977) The cause of the mortalities was an anoxic mass of water (<2 ml/l dissolved oxygen [DO]) located beneath the thermocline. The spread of the low DO water produced high mortalities in selected benthic and demersal species (e.g., surf clams) and had grave economic effects on New Jersey's sport and commercial fishing industries.

The MESA Project became involved in investigations of the anoxic event for three reasons. First, MESA-sponsored investigators had considerable information relating to the onset of anoxic conditions in the Bight. Second, the anoxic event represented a major perturbation of the Bight ecosystem; understanding the mechanisms by which the anoxic conditions developed would greatly improve the Project's comprehension of the system as a whole. Finally, many people believed that ocean dumping practices were the principal cause of anoxia-related mortalities. Because of the Project's experience with these practices, it was asked to address the problem.

As the result of its investigations, the Project participated in several cooperative efforts to pull together data on the anoxic event. The first was convened by the National Science Foundation (NSF) in mid-October. One paper (Parker, 1976) was presented by the Project office. A second, more comprehensive document was compiled and informally published by a consortium of groups including the New York Bight Project (Oxygen Depletion..., 1977). A final compendium volume is in preparation under the auspices of the MESA New York Bight Project and the NMFS Sandy Hook Laboratory for publication in 1978 as a NOAA Professional Paper.

These reports implicate several factors (both natural and anthropogenic) as contributory causes of the anoxic event. Spring 1976 was atypical in a number of respects. First, the period was milder and less stormy than usual. As a result, the water column underwent less turnover and became stratified earlier than usual. When the water column is fully stratified, there is little exchange of dissolved oxygen across the pycnocline (i.e., from surface to bottom waters).

A second factor centered about Bight circulation. As was mentioned in the description of the floatables event, the Bight was subjected to unusually prolonged periods of southwest winds during the spring and early summer. These winds affected water movement through the Bight, producing less effective circulation and providing a mechanism for concentrating oxygen-demanding components within the affected area.

As the water column became stratified, the Bight experienced a bloom of the dinoflagellate Ceratium tripos. Although C. tripos commonly occurs in the Bight, until 1976 it always had occurred in small numbers (i.e., never in bloom proportions) and at the outer margins of the continental shelf. The species is unusual in that it can respire autotrophically (i.e., plant-like respiration) or heterotrophically (i.e., animal-like respiration).

Evidence on the distribution of C. tripos indicates that late in the spring of 1976, the species was concentrated in the Bight in a layer immediately below the pycnocline. Conditions were such that the dinoflagellates probably respired heterotrophically and thus utilized some of the dissolved oxygen from the bottom layers of the water column. In the early summer, the C. tripos population crashed, adding a considerable organic load to the bottom waters. The resulting biological oxygen demand (BOD) was sufficient to deplete remaining supplies of dissolved oxygen below the pycnocline and thus initiate the anoxic event.

Human activities also may have contributed to the development of the anoxic event. Approximately 2600 metric tons of total organic carbon are flushed into New York harbor and the Bight per day (Mueller et al., 1976: p. 92). Exceptionally high volumes of nitrogen are also introduced as a consequence of human activities. This nitrogen stimulates phytoplankton production in the inner Bight substantially above natural levels. Significant quantities of organic carbon from phytoplankton and other sources eventually reach waters below the pycnocline, adding to the BOD of this stratum. The natural depletion of dissolved oxygen in bottom waters resulting from the annual cycle of organic inputs and BOD loadings produced by anthropogenic inputs and the excess loading associated with the Ceratium bloom were together sufficient to overwhelm the system in 1976.

3.3 Hurricane Belle

During the midst of the anoxic episode in early August, the eastern seaboard of the United States was brushed by Hurricane Belle. The storm passed to the east of the mid-Atlantic states and made landfall on the south shore of Long Island (Long Beach, New York) on the evening of August 9, 1976. Because Belle was the first hurricane to pass through the Bight since the Project's inception, its passage provided the opportunity to examine several questions of practical and scientific interest.

First, the effect of hurricane-generated storm surge was of concern. A historical review of the subject, published as a MESA Atlas Monograph several months earlier, indicated that storm-related events could increase coastal sea levels as much as 10 feet (3.1 m) above normal high tide levels (Pore and Barrientos, 1976, p. 42). Such atypical water heights would present grave threats to life and property. Hurricane Belle was expected to produce serious storm surge conditions because its arrival was predicted to coincide with a spring high tide.

A second area of interest centered about Belle's effects on benthic conditions in the Bight. Previous MESA investigations revealed that coastal storms can affect the distribution of Bight sediments. Belle's passage offered an opportunity to assess the effects of a hurricane on apex dumpsites.

Finally, the effect of the storm's passage on the water column was of interest to the Project. The response of continental shelf waters to storm events is poorly understood; Belle's appearance offered an opportunity to gain a better understanding of this interaction. This included determining whether storm-induced turbulence would be sufficent to reaerate near-shore, near-bottom waters, thus alleviating anoxic conditions in the Bight.

Immediately after the passage of the storm, the Project organized a series of cruises to address the second and third items mentioned above. (Storm surge was not examined because the storm weakened, changed its track, and passed through the Bight quickly on a receding tide, thus minimizing the effects of storm surge). The NOAA ship Kelez was recalled from scheduled shipyard maintenance to retrieve data tapes recorded during the storm by long-term current meter arrays, and to collect sediment samples for geological and chemical analyses. Complementary topographic data were obtained from side-scan sonar profiles made by the NOAA launch Johnson. Although final analyses have not been completed by personnel at AOML, initial results suggest Hurricane Belle had relatively little impact on the benthic environment.

Marine Sciences Research Center (MSRC) personnel aboard the State University of New York's ship R/V Onrust undertook three short cruises to (1) examine the extent of the Hudson River plume, (2) obtain bacterial counts (total and fecal coliform) in various portions of the apex, (3) measure the concentrations of suspended particulate matter and dissolved oxygen, and (4) determine whether the storm had significantly altered water column stability and stratification. Measurements made 4 days after the storm (August 13, 1976) showed no evidence of extensive overturning and no alleviation of the low dissolved oxygen levels prevalent before the onset of the storm. Belle's passage also did not produce active resuspension of bottom sediments in the vicinity of either the sewage sludge or the dredge spoil dumpsites. The Hudson River plume configurations observed on the fourth day after the storm were consistent with those which might be expected from a system perturbed by strong transient winds and high rainfall. By the ninth day after the storm, the plume had returned to a normal southward flow along the New Jersey shore. A complete report on MESA-sponsored MSRC post-hurricane activites is in preparation.

3.4 Chemical Waste Spill

On April 28, 1976, a barge loaded with over a million gallons of toxic waste chemicals was rammed by a freighter 15 miles southeast of Sandy Hook, New Jersey. The 298-foot barge Sparkling Waters was loaded

with 900,000 gallons of sodium hydroxide and 300,000 gallons of organic phosphate pesticides scheduled for disposal at the 106-mile acid waste dumpsite off New Jersey. The entire contents of the barge emptied into the apex as a result of the accident. Because of the potential hazard posed by the spill, the MESA Project became involved in monitoring and survey activities. Through a cooperative effort with the NMFS Sandy Hook Laboratory, samples were obtained by the NOAA ship Delaware II from the area of the mishap. MESA personnel also made overflights of the apex, obtaining photographs and monitoring the extent of the spill. Close communications were maintained between the Project and other federal agencies (e.g., EPA and USCG), and an extended sampling plan was devised. Fortunately, natural processes diluted and dispersed the spill rapidly and precluded the need for additional sampling. No formal MESA report was issued on the incident.

4. INFORMATION TRANSFER

The development and improvement of mechanisms to disseminate the findings of MESA-sponsored research continued to be an important Project activity. Three means were employed to bring about the formal transfer of information: publications, workshops, and the data management system. Each of these is discussed below, as is a MESA reference collection, which was established at the NMFS Sandy Hook Laboratory.

4.1 Publications

Many significant findings of the MESA New York Project were published during FY 1976-76T. A complete list of publications is presented in Appendix I. Results have appeared in a variety of periodicals. The preferred mode of publication is in the open literature so that the data may reach the widest possible audience. However, findings also have been reported in several government series, including NOAA-MESA Data Reports, Technical Memoranda, Technical Reports, and Special Reports. These generally receive limited distribution and primarily are for the publication of data with limited analyses (Data Reports), interim reports and methods papers (Technical Memoranda), or papers that are of professional quality but are unsuitable for publication in the open literature because of their length, specialized content, or need for rapid or unusual publication services (Technical Reports and Special Reports).

The Project has continued to sponsor the MESA New York Bight Atlas Monograph Series, which is produced in cooperation with the New York Sea Grant Institute and will ultimately result in 30 reports. Each report will treat a specific aspect of the New York Bight that is of potential interest to local and regional planners, decision-makers, industry, scientists, conservationists, citizen groups, and the public. In addition to strictly oceanographic information, monographs have been commissioned on subjects such as waste disposal, electricity generation and oil refining, demographic patterns, port facilities and commerce, artificial fishing reefs, and marine and aquatic birds.

Considerable progress was made on the Monograph Series during FY 1976-76T. Preliminary manuscripts for all unpublished Monographs were submitted by July 1, 1976, and by the close of FY 1976T ten had been published. Work on the Series will continue throughout FY 1977. Present plans call for the last of the Monographs to be published during 1978.

4.1.1 Availability of MESA Publications

MESA publications listed in Appendix I may be obtained by the general public, at a nominal cost, from the National Technical Information Service, U. S. Department of Commerce, 5285 Port Royal Road, Springfield, VA 22161. Requests for copies of the Atlas Monograph Series should be addressed to the New York Sea Grant Institute, State University of New York, 99 Washington Avenue, Albany, NY 12246. The cost of each Monograph is $4.00.

4.1.2 Distribution of MESA Publications

The MESA Program Office (Boulder, Colo.) distributed copies of the publications in Appendix I to organizations and institutions involved with studies of the New York Bight by pre-arranged mailing list. In addition, a limited number of copies of these publications were made available to the New York Bight Project Office for discretionary distribution. An analysis of the users requesting MESA publications from the Project Office is presented in Figure 4.1. Statistics are based on requests received between April 25, 1976, and April 21, 1977. It is estimated an equal number of telephone requests were filled during the same period but were not recorded. Thus, over 400 requests for MESA publications were processed by the Project Office during one calendar year. Demand will undoubtedly increase in the future as more interpretive documents become available.

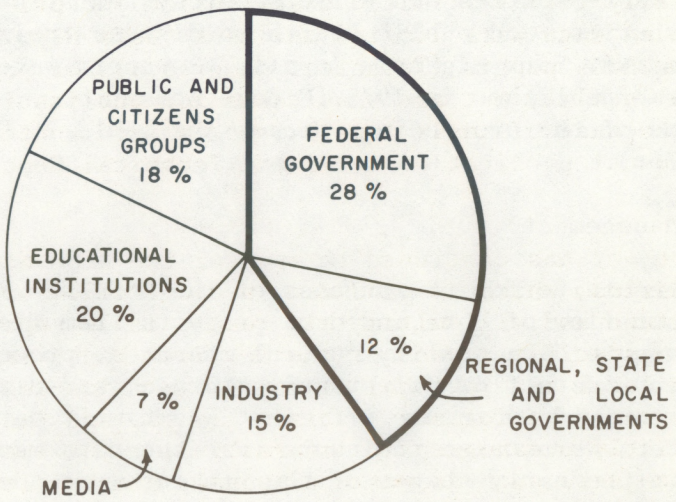

Figure 4.1. Publication requests serviced by the Project Office.

Figure 4.1 shows that 40 percent of all requests for MESA documents come from government entities. Of these, 16 percent originated with NOAA groups, 12 percent were from non-NOAA federal agencies, and 12 percent originated with state, regional, or local governments. These figures do not reflect the total distribution of MESA materials to governing or regulatory groups; most officials directly concerned with the New York Bight and the greater New York-New Jersey metropolitan area are on the Program mailing list and receive pertinent publications automatically. The remaining 60 percent of requests were received from academic institutions (20 percent), industry (15 percent), the media (7 percent), and the public (18 percent). The latter category includes both requests from individuals and citizens' groups (5 percent).

4.2 Workshops

In order to encourage the transfer of information among scientists working on the New York Bight, a series of workshops was sponsored. These are listed and briefly described in Table 4.1. The workshops ranged in size and scope from the Modeling Workshop, which included a limited number of participants and was restricted in the subjects discussed, to the ASLO Symposium, which will be described in greater detail below. Workshops were generally interdisciplinary and provided a forum for the presentation and discussion of the most up-to-date information on physical, chemical, geological, and biological processes in the Bight. Suggestions arising from the workshops frequently were incorporated into MESA Project research plans.

The ASLO Symposium, held November 3-5, 1975, at the American Museum of Natural History, was by far the largest and most integrated workshop organized by the Project to date. Co-sponsored by the American Society of Limnology and Oceanography (ASLO), the Chesapeake Bay Institute, the New York Sea Grant Institute, and the MESA Program, the workshop brought together leading workers in fields such as physical and geological processes, waste sources and effects, ecosystem structure and productivity, fisheries, and public health to discuss their work in the Middle Atlantic and New York Bights. In all, 43 papers were read. A volume of abstracts was published in 1975 (Middle Atlantic..., 1975), and a complete volume of the proceedings became available in December 1976 (Gross, 1976a).

4.3 Data Management

A prerequisite for the success of the MESA New York Bight Project is the smooth flow of data and data products from field collection to users. Adequate data quality control measures, processing procedures, documentation, data flow milestones, storage, and dissemination practices are required to insure efficient and timely data flow. During FY 1976-76T steps were taken to insure that the data management plans developed in the early stages of the Project were adequately followed or were revised to reflect realistically the capabilities of data processors and the needs of the user community.

Table 4.1. Workshops Sponsored by the MESA New York Bight Project During Fiscal Year 1976-76T

Date	Title	Location	Purpose(s)	Organizations Attending
November 3-5, 1975	Middle Atlantic Continental Shelf and the New York Bight	American Museum of Natural History, New York, N.Y.	ASLO symposium to summarize knowledge of the Middle Atlantic continental shelf and the New York Bight.	Multidisciplinary; 650 individual attendees
November 20-21, 1975	Physical Oceanography Workshop	SUNY, Stony Brook, N.Y.	Review past, present and future MESA efforts in physical oceanography; review numerous non-MESA-sponsored efforts in physical oceanography in the Bight and attempt to effect better coordination between future independent efforts and MESA work.	NOS AOML WHOI USGS BNL L-DGO CBI CU RBMAS
January 13-14, 1976	Modeling Workshop	AOML, Miami, Fla.	Review modeling efforts associated with and planned for MESA activities.	AOML MESA Program Office
January 20, 1976	Workshop/Planning Session for Sludge Dump Study	SUNY, Stony Brook, N.Y.	Present papers by principal investigators on sewage sludge tracking work and define scope and responsibilities during planned sludge disposal research efforts.	MESA MSRC BNL MACFC ORSL MG&GL L-DGO CUNY
March 25-26, 1976	Carbon, Oxygen, Nitrogen Cycling in New York Bight	SUNY, Stony Brook, N.Y.	Define an integrated program to investigate C/O/N cycling through FY 1980.	Approximately 50 investigators from all marine disciplines

The major components of the data management system include the following:

(1) A data catalog which is used to inventory and track data collected by MESA-sponsored investigators.

(2) The MESA data bank at the National Oceanographic Data Center (NODC), which contains complete, fully processed and documented data sets obtained by MESA-sponsored investigations.

Data stored at NODC are available to users in either the same format as originally submitted or as associatively retrieved files created by NODC's generalized information reporting system.

Among the major advances were the development and implementation of the MESA data catalog. An initial print-out of the catalog was forwarded to Project participants for comments. Work is continuing to bring the catalog up to date with Project activities.

Magnetic tape formats were developed for data on sea bed oxygen consumption, primary productivity, fin rot, and current meter measurements. Twenty-nine magnetic tape formats, amenable to the NODC retrieval system, were developed and made available for use by September 30, 1976.

As of the close of the fiscal year the MESA data bank included 24 tapes of data, 2 sets of punch cards, and 4 sets of analog strip charts. Requests for data services should contain a definition of the data required, including geographic limits and other pertinent information. Requests should also specify output format (e.g., magnetic tape, punched cards) and may be sent directly to EDS/MESA Data Coordinator, NODC, Page Building No. 1, 2001 Wisconsin Avenue N.W., Washington, D. C. 20235.

Data retrieval costs vary with factors such as the quantity of material requested, the nature of the analysis to be performed, and the computer time required. Estimates will be provided upon request. Limited amounts of data may be supplied to the user at no cost.

4.4 MESA Reference Collection

A MESA reference collection of preserved biological specimens became available on April 1, 1976. The collection is housed at the NMFS Sandy Hook Laboratory and includes sorted and identified specimens of fish and invertebrates obtained during MESA-funded benthic studies in the New York Bight. Also available are temporary storage space for bottom cores and frozen materials and working space for visiting investigators. Individuals interested in using the reference collection should contact the Project office.

5. ADVISORY SERVICES AND COOPERATIVE ACTIVITIES

5.1 Advisory Services

One of the primary charges of the MESA New York Bight Project is to provide data and information on the Bight to Congress, regulatory officials, government and industry decision makers, environmental groups, news media, educational institutions, private citizen organizations, and the public. The previous chapter dealt with information transfer to these groups by means of printed documents and data management system output. Many requests are handled by telephone, but a large number require personal meetings with one or more MESA staff members. From June 1, 1975, to September 30, 1976, the Project staff provided information and advice at 108 meetings with user groups. Appendix IV describes each meeting. Figure 5.1 indicates the distribution of effort among these groups. By far the greatest portion of formal MESA advisory activities (66 percent) involved other governmental entities, i.e., the U. S. Congress (11 percent), federal agencies (25 percent), interstate, state, and local agencies (23 percent), and interagency coordination (7 percent). Advisory services provided to the Congress included briefing members of Congress and their staffs, attending Congressional hearings, and providing testimony. Interactions with federal, regional, state, and local governmental entities consisted, to a large extent, of furnishing comments and advice on the preparation of plans and environmental impact statements (EIS) relating to ocean dumping and waste management. A prime example of this is MESA's continuing participation on the New York City Environmental Protection Administration's (NYCEPA) Technical Advisory Committee (TAC) for the development of an area-wide waste treatment management plan.

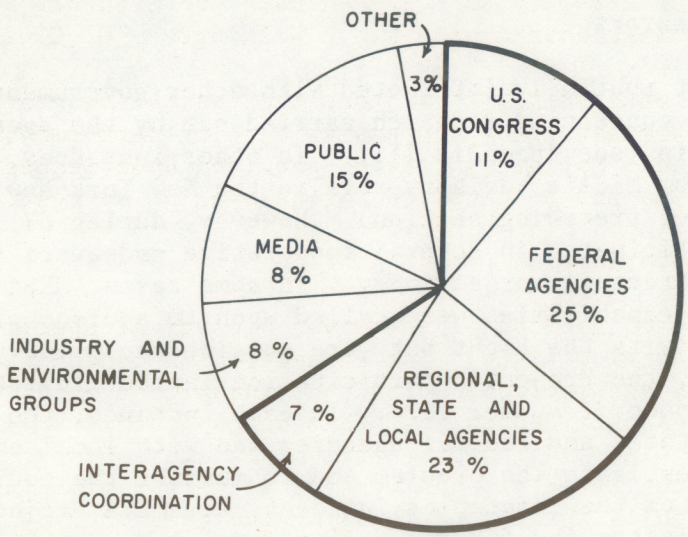

Figure 5.1. Advisory services provided by the Project Office.

Interagency coordination encompasses advisory services, such as those undertaken by the Project during the floatables crisis. During this event (June 1976), the Project coordinated investigative efforts of concerned federal, state, and local agencies, served as a data collection center, and organized a comprehensive analysis of information obtained (see section 3).

The other advisory activities were divided among industry and environmental groups (8 percent), the news media (8 percent), the public - including educational institutions (15 percent), and other groups (3 percent). As might be expected, the Project's involvement with industry and environmental groups centered about the provision of data for management decisions and environmental quality. The office staff also helped potential users to locate and tap non-MESA data sources.

MESA's interest in broad, regional environmental issues has frequently made it the target for queries from the press. In addition to providing interviews and information for news stories, the Project was the subject of several radio and televison programs during FY 1976-76T. Among these were a five-part series on ocean dumping filmed by the National Broadcasting Company New York affiliate (WNBC-TV) and a portion of a Public Broadcasting System/Cousteau Society special on water pollution.

The Project's direct involvement with the public and educational groups spanned a variety of activities such as speaking to local interest groups and high school and college classes, and participating in the design and operation of Gateway National Park's bicentennial exhibition. In all instances, the Project's aim was to inform the public about environmental issues associated with the Bight.

5.2 Cooperative Endeavors

The MESA Project routinely interacted with other governmental agencies, frequently concerning research carried out by the agencies under MESA sponsorship (see Appendix III). In other instances, interaction stemmed from MESA's advisory role in the New York-New Jersey metropolitan area (see preceding section). However, during FY 1976-76T the MESA Project participated in several cooperative endeavors that were neither strictly contractual nor advisory. In some cases, MESA expertise and research capabilities were called upon to address problems that were associated with the Bight but were outside the primary mission of the Project, e.g., the Project's participation in the floatables event and anoxic episode of summer 1976. In each instance, the Project worked with local, state, and federal agencies and with local environmental groups to investigate the problem and to monitor the course of events. In the case of the floatables incident, the MESA Project acted as the initial coordinator for federal activities. A description of the Project's involvement in the floatables and anoxic events is presented in section 3.

On May 7, 1975, the MESA New York Bight Project and the U. S. Envirnomental Protection Agency, Region II (EPA-RII), signed a Letter of Understanding committing the Project to assist EPA-RII in preparing an environmental impact statement (EIS) on the designation of new interim sewage sludge disposal sites. In response to this agreement, the Project augmented research relating to alternative dump sites and provided advice and assistance to EPA contractors (Raytheon, Inc. and Dames & Moore) working on the problem. A Draft EIS on the Ocean Dumping of Sewage Sludge in the New York Bight was issued by EPA-RII in February 1976. In the same month, a MESA Technical Memorandum (MESA, 1976a) was published that summarized MESA New York Bight Project studies of the environment and biota of two proposed alternative sewage sludge dumpsite areas and their surrounding regions. The report also made predictions about the effects of dumping sewage sludge at the proposed interim dumpsites and presented specific recommendations relative to dumping operations and monitoring activities. Information in the report was made available to the EPA for inclusion in its EIS on sewage sludge dumping.

A number of smaller cooperative efforts between the New York Bight Project and other federal agencies were also conducted. For example, field work was completed on a NASA investigation of bottom flow in and about existing alternative sewage sludge dumpsites. The study was funded by EPA pass-through funds and utilized sonar tracking devices to follow acoustic pinging capsules attached to seabed drifters. Analysis of data obtained should be completed during FY 1977.

A combined NASA/NESS/MESA study of Bight waters utilizing remote sensing devices was also continued. Two remote sensing experiments had been conducted in the Bight in April 1973 and April 1975; these were conducted with NASA support but no MESA funds. MESA participated in the planning of the 1975 experiment and provided logistics and field support. In FY 1976-76T, the MESA New York Bight Project began support of analyses of select data sets from these experiments, augmenting analysis being conducted independently by NASA. Emphasis was on surface circulation and the determination of chlorophyll-a and suspended particulate distributions. Various sensing systems and interpretive techniques comparing data obtained with "sea truth" data taken during experiments were also evaluated. Complete descriptions of the two experiments, an evaluation of the utility of remote sensing methods, and data sets for the areas investigated will be available by 1977.

Another area of interagency cooperation centered about collaborative efforts to gather mutually useful but routine data sets. Considerable interaction of this sort occurred with the National Weather Service (NWS) and the National Ocean Survey (NOS). Beginning in FY 1974 and continuing through 1976T, the MESA Project directly contributed to the support of NWS activities in the Bight. The purpose of this collaboration was to establish and improve marine forecasting services for the Bight, up-grade and expand coastal and marine data networks, establish

real-time verification and updating of forecasts by NOAA vessel feedback, and provide general meteorological support data, analysis, and interpretation for other physical oceanographic parameters.

NOS-MESA collaboration included support for three meteorological data buoys deployed in the Bight. This effort was cosponsored with the Bureau of Land Management (BLM) and began in FY 1976. Work is expected to extend through the end of the Project. The aims of this program are to obtain meteorological data offshore in the Middle Atlantic Bight and to supplement Coast Guard and NWS data networks. The NOS (NDBO) operates, maintains, and provides preliminary data services for the three buoys. Data obtained will be used in several MESA work units, including those on meteorological forcing fields, response analysis, and diagnostic modeling. Data also are included in the real-time NWS network and thus are available to a broad range of users not associated with MESA.

In addition to the above cooperative ventures with American agencies, the MESA Project participated in the International Decade of Ocean Exploration (IDOE) during FY 1976-76T. Working with the Atlantic Oceanographic and Meteorological Laboratory (AOML), the Oak Ridge National Laboratory, the Centre d'Etudes Nucléaires de Saclay (CENS), and the Centre National pour l'Exploration des Océans (CNEXO), the MESA Project developed and funded a study to evaluate the feasibility of using radioactive tracers for monitoring the dispersal of sewage sludge dumped in the New York Bight apex. An alternative method of sludge tracking using acoustical methods was simultaneously explored by AOML.

Franco-American field and laboratory cooperation included inspections of New York City's Wards Island Treatment Facility and New York City sludge dumping vessels, and test tracer studies on Paris and New York City sewage sludge. The latter were conducted by CENS in France. Although the decision ultimately was to use acoustical rather than radioactive tracer technology, a French (CNEXO) observer participated in the July 10-17, 1976, sewage sludge tracking experiment (STAX II). In addition, French scientists from CNEXO have been invited to participate in the MESA/ERDA Inner Shelf Sediment Transport Program (INSTEP). Field work for this program will begin early in fiscal year 1977. Under the cooperative arrangement, French and American investigators will meet during a Shelf Dynamics Workshop to be held at Vail, Colorado, November 3-6, 1976, and will discuss the French role in INSTEP and the possible reciprocal participation of American investigators in French projects.

6. SYNOPSIS AND PROJECTIONS

This section considers the Project's progress, its changing emphasis of activities, and its future direction.

6.1 Project Progress

Project progress is evaluated in terms of the objectives listed in section 1.2 (Table 1.1). Because of the complex relationship between

work units and objectives, progress must be judged not only in terms of work unit milestones and final products, but also in terms of interim products.

The objectives may be considered in four groups, according to state of completion. Objectives 1, 2, and 3 are either complete or nearly so. They have received all or most of their funding. Objectives 4 and 7 are in intermediate stages of completion. They have received 62% and 40% of their funding, respectively. Objectives 5, 6, 8, and 11 are still in initial stages, having received no more than 35% of allotted funds. Objectives 9 and 10 have not been formally pursued, although information relating to them has been obtained through other objectives. These final objectives have not yet received funding.

Accomplishments are discussed below in order of expected objective completion.

Objective 1, to identify the characteristics and distribution of Bight sediments, is essentially complete. Geological investigations carried out over the first four years of the Project have led to the publication of maps and descriptions of substrate distributions and have provided basic data to other Project objectives.

Objective 2, to identify major factors influencing primary productivity and food chain dynamics, is completed, as initially established. However, its scope will be expanded through additional work associated with objective 5.

Sampling and laboratory processing have been completed and data analysis is nearly complete for objective 3, characterizing the fauna of the Bight. A summary interpretive report defining the major faunal assemblages is expected during 1977, and an analysis defining the adequacy of existing benthic invertebrate data for characteriziang regions of stress within the Bight is scheduled for 1978.

Objective 4, to characterize the driving forces and responses of tides, major currents, and water masses, is approximately half complete. Major efforts thus far have dealt with Bight water circulation; additional data collection and other work will be directed toward the development of mathematical circulation models.

Objective 7, which is also approximately half complete, addresses the partitioning of contaminants among components of the Bight ecosystem. Studies underway or completed have (1) examined contaminant inputs, (2) designated the most serious contaminants, and (3) investigated heavy metal and abiotic components of the ecosystem. Further activities will augment existing heavy metal data and will explore the distribution of toxic organic substances (e.g., chlorinated hydrocarbons and petroleum hydrocarbons).

Research associated with objective 5, to determine the ecological effects of organic enrichment and nutrient loading, has investigated benthic respiration rates and fluxes of various materials to and from sediments. Further investigations will examine trophic relationships between major components of the water column food web. These studies will provide better understanding of the dynamics of carbon, oxygen, and nitrogen cycling in the Bight. The objective is about 20% complete.

Research on objective 6, to identify the cumulative ecological effects of environmental stress, has examined the relationship between human inputs to the Bight and potential or observed perturbations of the ecosystem. Studies conducted through FY 1976-76T investigated such diverse problems as the effect of chlorinated pesticides on phytoplankton, the causes of fish and shellfish diseases, and pollution-induced mutagenesis in Bight fish eggs and larvae. Work on this objective is approximately 35% complete.

Objective 8, to identify transfer routes and fates of major chemical pollutants, includes activities in physical, geological, and chemical oceanography. Earlier research centered about the physical processes of pollutant transport. During FY 1976-76T emphasis shifted to geochemical and applied aspects of the problem (STAX studies). This emphasis will continue in 1977 as the fate of dredge spoil pollutants and the exchange of pollutants between the Hudson-Raritan estuary and the Bight apex are examined. The objective is about 20% complete.

Work on objective 11, to develop a Bight monitoring plan, began late in FY 1976-76T and is only about 25% complete. A preliminary report submitted in September 1976 provided a rationale for selecting the parameters to be monitored and recommended sampling locations and frequency. The suggested plan will be modified to (1) reflect the data requirements of individual users (e.g., regulatory agencies), (2) insure adequate precision of sampling strategies and methodologies, (3) provide rapid analysis of data obtained, and (4) minimize operational costs.

Objectives 9 and 10 will be accomplished by integrating information obtained from work units carried out under other objectives. Objective 9 will receive its first funding in FY 1977 and will be fully operational in FY 1978. It will examine how the alteration of pollution inputs may affect the distribution, cycling, and fate of contaminants. Included as part of this effort will be an attempt to model carbon, oxygen, and nitrogen cycling. This should provide insight into the implication of alternative organic waste disposal methods.

Objective 10, to be funded in FY 1978, involves the production of a comprehensive assessment of the new York Bight ecosystem. With this tool it will be possible (1) to evaluate the Bight data base available to decision makers and scientists, (2) to define which disciplines will require additional research after the close of the Project in 1981, and (3) to make recommendations on the future use and management of the Bight.

Table 6.1. Distribution, by Percent, of MESA-Sponsored Work Units for Fiscal Years 1975 Through 1977

Work Unit Subjects	FY75	FY76-76T	FY77
Inventory	50	44	30
Dynamics	42	42	50
Effects	4	12	13
Synthesis/Monitoring	4	2	7
Total	100%	100%	100%

6.2 Project emphasis

The emphasis of the Project is changing. Before 1976, virtually all research efforts (92% of work units funded) were devoted to survey-type studies of the Bight. These descriptive efforts are now complete or nearing completion. Therefore, more stress can now be placed on efforts that integrate information and allow its application to solutions of actual problems. Table 6.1 illustrates the changing focus of the project as fewer work units are funded and the number of dynamics and effects studies increases. The broad data base built up through FY 1976-76T is being used more extensively in interdisciplinary studies; this trend will continue in FY 1977 and throughout the remainder of the Project.

6.3 Future direction

The shift in emphasis signals the maturation of the New York Bight Project. In the remaining years of the Project's existence, the results of seemingly disparate studies will be refined and combined to provide answers to key questions on human utilization of the Bight. Thus, in FY 1977, a major report will be produced on the most serious chemical contaminants affecting the Bight, and research will continue on the sources and environmental concentrations of toxic organics and heavy metals.

Considerable effort will also be devoted to examinations of nutrient cycling in the Bight. A multidisciplinary Synoptic Investigation of Nutrient Cycling (SINC) will begin in FY 1977 and will involve scientists from both academic and NOAA facilities. Data from the SINC studies, together with previously obtained biological, chemical, and physical data, and ongoing physical modeling studies will contribute to an effort to model carbon, oxygen, and nitrogen cycling in the Bight. This effort is scheduled to begin during the second half of FY 1977 and ultimately will provide insight for managing nutrient loading of the Bight. It also will contribute to the development of alternative waste management plans and monitoring strategies for the Bight.

The discussion presented above provides only a brief glimpse of Project research activities proposed for FY 1977 and beyond. A more detailed exposition is presented in the New York Bight Project Development Plans and Technical Development Plan (MESA, 1977b). It is our intention that the course chosen for the remainder of the Project be one that will provide (1) useful information to users of the Bight, (2) realistic interpretations and recommendations to managers responsible for the Bight's future, and (3) functional data sets upon which to base future investigations of the Bight.

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Appendix II: Grants and Contracts Funded in FY 1976-76T

The following is a list of the contracts and grants funded by the New York Bight Project during FY 1976-76T. Work unit numbers refer to the designations used in the PDP (MESA 1977b). C = contract funds; G = grant funds; T = intra-NOAA transfer funds.

Work Unit Number	Work Unit Title	Responsible Officer	Institution	Method of Funding	Funding FY 1976	Funding FY 1976T
INVENTORY						
I.A.1	Substrate Inventory	G. Freeland	AOML/MG&GL	T	179K	---
I.B.1	Water Column Characterization	D. Hansen	AOML/PhOL	T	71K	15K
I.B.2	Moored Current Meter Program	D. Hansen	AOML/PhOL	T	57K	14K
I.B.3	Initial Processing of Current Meter Data	C. Fisher	NOS/C-33	T	60K	10K
I.B.4	Meteorological Data Buoy Support	J. Winchester	OOE/NDBO	T	17K	---
I.B.8	OTTS	T. Crane	EDL/NOS	T	15K[1]	---
I.B.9	National Weather Service Support	W. Bonner	NWS/ER	T	35K	9K
I.B.10	Ambrose Meteorological Package	T. Crane	EDL/NOS	T	32K	---
I.B.11	NASA/NESS Remote Sensing	J. Sherman	NESS, NASA	T	130K[2]	---
I.C.1	Contaminant Source Data	J. Mueller	MC	G	52K	---
I.C.2	Designation of Most Serious Contaminants	J. Schmid	JMA	C	34K	---

[1] Additional funds from NOS

[2] NESS support only

Work Unit Number	Work Unit Title	Responsible Officer	Institution	Method of Funding	Funding FY 1976	Funding FY 1976T
I.C.4	TOC, Proteins and Carbhohydrates in Suspended Sediments	D. Atwood	AOML/PhOL	T	40K	---
I.C.5	TOC, Proteins and Carbohydrates in Sediments	D. Atwood	AOML/PhOL	T	40K	---
I.C.6	Geochemistry of Nearshore Sediments	W. Harris	BC	G	30K	---
I.C.7	Sources and Enviromental Concentrations of Organic Compounds	P. Hatcher	AOML/OCL MACFC/ML	T	50K	10K
I.D.1	Benthic Invertebrate Distribution and Abundance	J. Pearce	MACFC/SHL	T	177K	12K
I.D.2	Quantitative Distribution of Middle Atlantic Macrobenthos	R. Wigley	NEFC	T	52K	---
I.D.4	Biology of Ciliated Protozoa	K. Soukup	MACFC/OL	T	---	2K
I.D.5	Statistical Analysis of Benthic Data	S. Saila	URI	T[3]	18K	---
I.D.6	Benthic Ecology -- Data Analysis	R. Rozett	FU, CEDDA	T[3]	35K	---
I.D.8	Data Tape Preparation	A. Pacheco	MACFC/SHL	T	32K	---
I.E.2	Heavy Metal Concentrations in Fish and Shellfish	C. Sindermann	MACFC, SURC	T	---	10K

[3] By transfer of funds through MACFC

Work Unit Number	Work Unit Title	Responsible Officer	Institution	Method of Funding	Funding FY 1976	Funding FY 1976T
DYNAMICS						
II.A.1	Resuspension Characteristics of Bottom Sediments	J. Southard	MIT	T[4]	12K	---
II.A.2	Suspended Sediment Transport	R. Young	AOML/MG&GL	T	59K	---
II.A.3	Sources, Transport and Reactions of Suspended Particles	P. Betzer	USF	T[4]	51K	---
II.A.4	INSTEP	J. Kofoed	AOML/MG&GL	T	---	192K
II.A.5	Use of Isotopes in Determining Coastal Sediment History	K. Turekian	YU	G	26K	---
II.A.6	Sand Transport Program	W. Lavelle	AOML/MG&GL	T	80K	---
II.A.7	STAX	R. Young I. Duedall	AOML/PhOL, MSRC	T C	64K	30K
II.B.1	Tidal Current Analysis	C. Fisher	NOS/C-33	T	52K	---
II.B.2	Bottom Pressure and Tidal Analysis	D. Hansen	AOML/PhOL	T	52K	8K
II.B.4	Analysis of Frictional Boundary Layer	R. Miller	UC	T[4]	15K	---
II.B.5	Meteorological Forcing Fields	C. Mooers	UD	T[4]	51K	25K
II.B.7	Diagnostic Model Study	D. Hansen P. Hsueh	AOML FSU PMEL	T T[4] -[5]	100K	15K

[4]By transfer of funds through AOML
[5]Non-MESA funded

Work Unit Number	Work Unit Title	Responsible Officer	Institution	Method of Funding	Funding FY 1976	Funding FY 1976T
II.C.2	Man-Related Fluxes of Carbon and Heavy Metals into Sediments	O. Schaeffer	DESS	G	28K	---
II.C.3	Transformation of Contaminants Exiting the Hudson/Raritan Estuary	I. Duedall	MSRC	G	56K	---
II.C.5	Chemical Effects of Dredge Spoil and Acid Waste Dumping	D. Segar	EDL/NOS	T	---	5K
II.D.1	Primary Productivity in Raritan Bay	J. Thomas	MACFC/SHL	T	10K	---
II.D.2	Phytoplankton Dynamics and Nutrient Recycling in the Inner Bight	T. Malone C. Garside	L-DGO BLOS	G	2K	17K
II.D.3	Carbon, Oxygen, and Nitrogen Process Rates and Mass Balances	C. Garside	BLOS	G	19K	---
II.D.7	Roles of Bacteria in Carbon, Oxygen, and Nitrogen Cycling	C. Litchfield	RU	G	45K	---
II.D.8	Benthic Respiration	J. Thomas	MACFC/SHL	T	10K	5K
II.E.1	Surf-Induced Transfer of Viruses to the Atmosphere	E. Baylor	MSRC	G	13K[6]	---

[6] Additional funds from New York Sea Grant Institute

Work Unit Number	Work Unit Title	Responsible Officer	Institution	Method of Funding	Funding FY 1976	Funding FY 1976T
EFFECTS						
III.1	Contaminant Effects on Phytoplankton	C. Wurster	MSRC	G	---	29K[7]
III.3	Responses of Benthic Invertebrates to Controlled Stresses	A. Michael	UM	G	74K	---
III.4	Groundfish Distributional Influences by Pollution and Natural Features	T. Azarovitz	MACFC/SHL	T	---	10K
III.5	Environmentally-Induced Mutagenesis in Marine Fishes	A. Longwell	MACFC/ML	T	145K	37K
III.6	Fish and Shellfish Diseases	A. Rosenfield	MACFC/OL	T	95K	24K
III.8	Heavy Metal and Antibiotic Resistance in *Staphylococcus aureus*	J. Timoney	CU	G	20K	43K
SYNTHESIS						
IV.1	MESA Monographs	D. Squires	NYSG	T	54K[7]	---
	MISCELLANEOUS CONTRACTS/GRANTS					
	Study of feasibility of applying a cell sorter in suspended particle research	L. Castiglioni	RFI	C	24K	---
	Assistance in arranging study of 20 most significant Bight contaminants	D. Young	SCCWRP	C	2K	---

[7] Additional funds from New York Sea Grant Institute

Work Unit Number	Work Unit Title	Responsible Officer	Institution	Method of Funding	Funding FY 1976	Funding FY 1976T
	Deep-sea tides research	J. Kuo	USN	C	20K	---
	Processing of drifter data	E. Baylor	MSRC	C	2K	---
	Editing floatables report	O. Terry	MSRC	C	---	2K
	Hurricane Belle research	M. Bowman	MSRC	G	---	22K

Appendix III: MESA-Associated Cruises

July 1, 1975 - September 30, 1976

Dates	Ship	Principal Investigator	Purpose
July 16-23, 1975	Delaware II	M. Fahay	Ichthyoplankton survey
July 28-August 8, 1975	Delaware II	E. Bowman	Gear testing for groundfish surveys
August 7-16, 1975	Albatross IV	C. MacKenzie	Sea scallop survey - provided specimens for metal, pesticide, and histopathological studies
August 12-25, 1975	Delaware II	J. Thomas	Benthic respiration study
September 2-4, 1975	Delaware II	J. Graikoski	Bacteriological survey
September 8-18, 1975	Delaware II	D. Christensen	Fin rot sampling
September 22-25, 1975	Kelez	J. Proni	Long-term current meter deployment and STAX I
September 27-October 3, 1975	Albatross IV	C. MacKenzie	Sea scallop survey - provided specimens for metal, pesticide, and histopathological studies
September 29-October 4, 1975	Kelez	R. Starr	XWCC cruise
October 6-10, 1975	Kelez	R. Young	Boundary layer study
October 15-November 7, 1975	Delaware II	T. Azarovitz	Groundfish survey
October 20-24, 1975	Kelez	G. Freeland	Substrate inventory (box coring)
November 12-14, 1975	Kelez	T. Malone	Phytoplankton productivity experiments
November 13-18, 1975	Delaware II	W. Smith	Ichthyoplankton survey
November 24-26, 1975	Kelez	T. Malone	Phytoplankton productivity experiments

Dates	Ship	Principal Investigator	Purpose
December 3-8, 1975	Kelez	B. Kolitz	XWCC cruise
January 4-15, 1976	Kelez	J. Stachelhaus	Current meter maintenance
January 19-23, 1976	Kelez	J. Stachelhaus	Pressure sensor deployment
January 31-February 11, 1976	Kelez	R. Beardsley	Deployment of current meter arrays
February 15-25, 1976	Kelez	J. Stachelhaus	Deployment of maintenance of current meters Retrieval of OTTS mooring and deep sea tide gauge
February 23-26, 1976	Delaware II	T. Azarovitz	Groundfish survey
February 29-March 4, 1976	Kelez	W. Harris	Bottom sediment geochemistry sampling
March 4-23, 1976	Delaware II	T. Azarovitz	Groundfish survey
March 6-22, 1976	Kelez	J. Stachelhaus	Current meter recovery and maintenance
March 22-26, 1976	Kelez	F. Barvenik	Zooplankton dynamics experiment
April 1-2, 1976	Kelez	T. Malone	Phytoplankton productivity experiments.
April 5-9, 1976	Kelez	G. Freeland	Substrate inventory (box coring)
April 6-19, 1976	Delaware II	J. Ropes	Ocean shellfish of the Mid-Atlantic Bight
April 12-16, 1976	Kelez	R. Starr	XWCC cruise
April 18-23, 1976	Kelez	J. Stachelhaus	Current meter maintenance and deployment
April 19-May 15, 1976	Delaware II	J. Ropes	Ocean shellfish of the Mid-Atlantic Bight
April 25-30, 1976	Kelez	W. Harris	Bottom sediment geochemistry sampling

Dates	Ship	Principal Investigator	Purpose
May 3-15, 1976	Kelez	J. Stachelhaus	Current meter maintenance
May 15-24, 1976	Delaware II	A. Longwell	Mutagenesis studies
May 17-24, 1976	Kelez	J. Hazelworth	XWCC cruise
June 1-4, 1976	Kelez	W. Harris	Bottom sediment geochemistry sampling
June 7-11, 1976	Kelez	J. Stachelhaus	Current meter maintenance and recovery of deep-sea tide sensors
June 9-14, 1976	Delaware II	A. Kendall	Ichthyoplankton survey
June 14-25, 1976	Kelez	H. Bryne, F. Newman	Internal wave and microstructure generation experiment
June 28-July 3, 1976	Kelez	R. Starr	XWCC cruise
July 6-10, 1976	Kelez	J. Stachelhaus	OTTS recovery
July 11-16, 1976	Kelez	R. Young	STAX II
July 12-13, 1976	Johnson	J. Proni	STAX II
July 12-16, 1976	Black Coral	J. Proni	STAX II
July 19-23, 1976	Kelez	J. DeCoste	Current meter maintenance; recovery of pressure sensors
July 26-28, 1976	Kelez	J. DeCoste	Bottom grab sampling and buoy deployment
August 2-4, 1976	Kelez	J. DeCoste	Test of experimental acoustical XBT
August 6-17, 1976	Atlantic Twin	T. Azarovitz	Groundfish resource assessment cruise
August 12-19, 1976	Onrust	M. Bowman	Hurricane Belle effects study

Dates	Ship	Principal Investigator	Purpose
August 12-13, 1976	Johnson	G. Freeland	Hurricane Belle effects study
August 14-15, 1976	Kelez	J. DeCoste	Hurricane Belle effects study and durrent meter maintenance
August 24-27, 1976	Onrust	A. Michael	Benthic sampling
August 24-September 9, 1976	Albatross IV	J. Thomas	Environmental assessment cruise
September 8-27, 1976	Researcher	J. Hazelworth	XWCC cruise and floatables assessment study

Appendix IV

Advisory and consultative services provided by the MESA New York Bight Project, July 1, 1975 - September 30, 1976. (Meetings for the purpose of arranging, monitoring, or reviewing research activities sponsored by MESA are not listed.)

Date	Convening Organization(s)	Location	Purpose	Attendees
July 8, 1975	New York Sea Grant Program (NYSGP)	Stony Brook, N.Y.	Discuss possibility of American Geographical Society (AGS) producing atlas on benthos of Baltimore Canyon; now funded by Texaco, Inc.	MESA: R. L. Swanson J. S. O'Connor NYSGP: J. Ginter AGS: M. Pinter V. Bushnell
July 9, 1975	New York City Environmental Protection Administration	New York, N.Y.	Establish Technical Advisory Committee (TAC) which will coordinate efforts of the Area-Wide Waste Treatment Management Planning Project (P.L. 92-500, Sect. 208) and will guide, coordinate and review land use and water quality work in "208-Areas" of metropolitan New York.	MESA: S. Chanesman
July 25 and July 28, 1975	Marine Sciences Research Center, SUNY, Stony Brook	Stony Brook, N.Y.	Present seminars on ocean dumping to summer school course for high school teachers.	MESA: H. M. Stanford
August 8, 1975	Interstate Sanitation Commission	New York, N.Y.	Discuss water quality standards for oil and grease.	MESA: J. S. O'Connor
August 13, 1975	New Jersey Department of Environmental Protection	New Jersey	Present hearing testimony on the biological effects of oil and grease on the New York Bight ecosystem.	MESA: J. S. O'Connor M. Griben

Date	Convening Organization(s)	Location	Purpose	Attendees
August 19, 1975	New York City Environmental Protection Administration	New York, N.Y.	Attend TAC meeting to evaluate sampling schedule for "208" activities and to discuss land use and the status of "208" projects in Nassau and Suffolk Counties.	MESA: S. Chanesman
August 18, 1975	Biology Department, SUNY Stony Brook	Stony Brook, N.Y.	Discuss MESA direction of Stony Brook Ph.D. candidate in Biology.	MESA: J. S. O'Connor SUNY: R. Koehn
August 22, 1975	Long Island Environmental Council	R/V Spindrift	Participate in Board of Directors meeting; discuss probable suit of Environmental Defense Fund against US EPA regarding planned Suffolk County Southwest Sewer District sewage treatment system.	MESA: J. S. O'Connor
August 27, 1975	Bureau of Land Management Atlantic Outer Continental Shelf Office	New York, N.Y.	Review portions of BLM early DEIS on oil and gas development in Baltimore Canyon.	MESA: J. S. O'Connor
August 29, 1975	NOAA Corps	Kings Point, N.Y.	Give presentation on MESA and EDL activities to officer training class.	MESA: R. L. Swanson EDL: C. Kearse
September 3, 1975	John V. N. Klein, Suffolk County Executive	Suffolk County, N.Y.	Participate in press conference on potential impact of offshore oil and gas development off Long Island's south shore.	MESA: R. L. Swanson R. Roush

Date	Convening Organization(s)	Location	Purpose	Attendees
September 10, 1975	Southern Maine Vocational Technical Institute	South Portland, Maine	Review facilities and programs.	MESA: D. Pasciuti G. Dick
September 15, 1975	U. S. Environmental Protection Agency	Stony Brook, N.Y.	Discuss NOAA data to be used in EIS on proposed alternative sewage sludge dumpsite.	MESA: Staff EPA: P. Anderson Dames and Moore: T. McKinney
September 16, 1975	New York State Department of Environmental Conservation	Stony Brook, N.Y.	Assist in planning of study for Long Island wetlands preservation.	MESA: Staff MSRC: Staff NYDEC: B. Zeisel
September 16-17, 1975	NOAA headquarters	Rockville, Md.	Discuss and edit EPA final report on alternative dumpsite and discuss MESA involvement in future ocean dumping activities.	MESA: R. L. Swanson
September 22, 1975	New York City Department of Water Resources	New York, N.Y.	Discuss monitoring of dumped sewage sludge at present dump site.	MESA: R. L. Swanson H. M. Stanford S. Chanesman N.Y.C. Dept. Water Res: C. Samowitz E. Wagner M. Singer Passaic Valley Sewerage Commissioners: S. Lubetkin Middlesex Co. Sewerage Authority: S. Seid Metcalf and Eddy,Inc.: A. Thomas

Date	Convening Organization(s)	Location	Purpose	Attendees
September 24, 1975	House Subcommittee on the Environment and Atmosphere of the Committee on Science and Technology	Washington, D.C.	Provide information and answer questions required for hearing on ocean dumping. Congressman Brown and Ambro were principal questioners.	MESA: R. L. Swanson NOAA MR: D. Martineau C. Swezey Office of the General Council: J. S. Brookbank
September 24, 1975	New York City Department of Water Resources	New York, N.Y.	Attend TAC meeting and discuss status of work completed for "208" sampling program.	MESA: S. Chanesman
September 26, 1975	Dames and Moore	Services provided by mail	Send ancillary data required for EPA alternative dumpsite EIS.	MESA: Staff
September 30, 1975	Marine Environmental Council of Long Island	Long Island, N.Y.	Make evening presentation on ocean dumping and MESA activities.	MESA: R. L. Swanson
October 2, 1975	Independent Television Producer	Stony Brook, N.Y.	Discuss series of four television programs proposed by producer.	MESA: J. S. O'Connor S. Chanesman TV Producer: J. Snowber
October 4, 1975	Long Island Environmental Council Board of Directors	Fire Island, N.Y.	Participate in field trip and advise on plans for development of National Park seashore areas.	MESA: J. S. O'Connor Environmental Groups National Park Service

Date	Convening Organization(s)	Location	Purpose	Attendees
October 15, 1975	U. S. Environmental Protection Agency	Edison, N.J.	Discuss EPA monitoring requirements and ways that MESA might cooperate with EPA to meet mutual monitoring needs.	MESA: C. Gunnerson R. L. Swanson H. Stanford US EPA representatives NOAA MR and EM representatives
October 17, 1975	The Museums at Stony Brook	Stony Brook, N.Y.	Present antique copper plate engraving on behalf of NOAA and the Director of NOS.	MESA: R. L. Swanson R. Roush
October 20, 1975	Marine Sciences Research Center, SUNY, Stony Brook	Stony Brook, N.Y.	Brief Dr. Schubel on MESA New York Bight activities prior to Dr. Schubel's meeting with Congressman Ambro on ocean dumping.	MESA: R. L. Swanson MSRC: G. Schubel
November 1, 1975	Institute of Storm Research	Stony Brook, N.Y.	Discuss the availability of wave, current, and water column data for use in petroleum firm models of Baltimore Canyon Trough area.	MESA: C. Parker P. Eisen ISR: J. C. Freeman
November 12, 1975	NOAA - EM	Stony Brook, N.Y.	Discuss MESA's monitoring rationale and philosophy for ocean dumping in the Bight.	MESA: R. L. Swanson H. M. Stanford EM: L. Pugh
November 19, 1975	NOAA - MR	Rockville, Md.	Discuss future plans for Deepwater Dumpsite.	MESA: H. M. Stanford MR: F. Hebard

Date	Convening Organization(s)	Location	Purpose	Attendees
November 20, 1975	U. S Environmental Protection Agency	New York, N.Y.	Discuss feasibility of moving the "Wreck Dumpsite".	MESA: S. Chanesman R. Roush US EPA: New York,N.Y. and Edison, N.J. NMFS: Sandy Hook,N.J. Milford, Ct., and Woods Hole, Mass. U.S. Army Corps of Engineers
November 28, 1975	U. S. Environmental Protection Agency	Stony Brook, N.Y.	Review MESA and EPA contractor recommendations relative to relocating sewage sludge dumpsites.	MESA: R. L. Swanson J. S. O'Connor S. Chanesman US EPA: D. Sullivan
December 1, 1975	U. S. Environmental Protection Agency	Edison, N.J.	Examine and reconcile recommendations by Dames and Moore and meeting of November 28, 1975 (see above) relative to relocating existing sewage sludge dumpsite.	MESA: R. L. Swanson J. S. O'Connor
December 4, 1975	Suffolk County Community College	Selden, N.Y.	Inform sociology class studying environmental problems about nature of NOAA and MESA activities and responsibilities in the Bight.	MESA: S. Chanesman
December 9, 1975	New Jersey Congressional delegation	Washington, D.C.	Discuss NOAA's position on moving existing sewage sludge dumpsite; meeting was required to clarify newspaper accounts.	MESA: R. L. Swanson

Date	Convening Organization(s)	Location	Purpose	Attendees
December 10, 1975	Nassau County Department of Public Health (NCDPH)	Stony Brook, N.Y.	Review County draft report on water and sediment quality in Bight waters south of the County.	MESA: J. S. O'Connor T. Maher NCDPH: D. Scanlon
December 17, 1975	American Meteorological Society	Garden City, N.Y.	Inform Society members of MESA New York Bight activities.	MESA: R. L. Swanson
January 7, 1976	National Marine Fisheries Service	Boston, Mass.	Attend NMFS Regional Council Meeting and discuss proposed NMFS research plans for FY77.	MESA: J. S. O'Connor
January 13, 1976	U.S. House of Representatives Subcommittee on Oceanography and Subcommittee on Fisheries and Wildlife Conservation and the Environment	Washington, D.C.	Meet with Subcommittee staff members to prepare for hearings scheduled later in January.	MESA: R. L. Swanson
January 16, 1976	Dames and Moore	Stony Brook, N.Y.	Resolve scientific discrepancies in sewage sludge disposal EIS being prepared by Dames and Moore for the US EPA-RII.	MESA: R. L. Swanson J. S. O'Connor H. M. Stanford Dames and Moore: T. McKinney
January 19, 1976	Marine Resources Council of the Nassau-Suffolk Regional Planning Board	Hauppauge, N.Y.	Give talk on the MESA N.Y. Bight Project and MESA activities in the Bight.	MESA: R. L. Swanson J. S. O'Connor

Date	Convening Organization(s)	Location	Purpose	Attendees
January 20, 1976	Brookhaven National Laboratories	Upton, N.Y.	Review research activities planned by BNL and MESA to insure complementarity.	MESA: R. L. Swanson C. Parker
January 22, 1976	WUSB (SUNY campus radio station)	Stony Brook, N.Y.	Tape radio program on MESA New York Bight Project.	MESA: S. Chanesman WUSB: R. Komitor
January 23, 1976	New York City Environmental Protection Administration	New York, N.Y.	Participate in TAC meeting reviewing "208" research by NYC EPA contractors.	MESA: S. Chanesman
January 24-25, 1976	Southern California Coastal Water Research Project	Los Angeles, Calif.	Participate in Consulting Board Meeting	MESA: J. S. O'Connor
January 27, 1976	Tetra Tech., Inc.	Stony Brook, N.Y.	Provide data required by Tetra Tech for a study of Long Island and onshore water quality.	MESA: J. S. O'Connor P. Eisen Tetra Tech: G. Bingham
February 16, 1976	WUSB (SUNY campus radio station)	Stony Brook, N.Y.	Tape radio program on MESA New York Bight Project Activities (second of a series).	MESA: H. M. Stanford WUSB: R. Komitor
February 19, 1976	U.S. Environmental Protection Agency	New York, N.Y.	Discuss MESA/EPA coordination; discuss status of EPA EIS on sewage sludge dumpsite.	MESA: R. L. Swanson S. Chanesman US EPA: E. Outwater W. Librizzi B. Metzger H. Phillips

Date	Convening Organization(s)	Location	Purpose	Attendees
February 20, 1976	N. L. Industries, Inc.	Stony Brook, N.Y.	Discuss New York Bight data and analyses from Acid Waste Dumpsite.	MESA: R. L. Swanson C. Parker P. Eisen N. L. Industries: H. G. Rodman
February 27, 1976	U.S. House of Representatives Merchant Marine Activities Committee	Washington, D.C.	Attend hearing convened by Committee to provide supporting information for Dr. D. Martineau's testimony.	MESA: R. L. Swanson
March 5, 1976	Hon. John Murphy, Chairman, Subcommittee on Oceanography of the House Committee on Merchant Marine and Fisheries	New York, N.Y.	Present formal testimony on solid waste dumping in the Bight.	MESA: R. L. Swanson
March 24, 1976	U.S. Environmental Protection Agency	New York, N.Y.	Present formal statement at public hearing on EPA's "Draft EIS on the Ocean Dumping of Sewage Sludge in the New York Bight."	MESA: R. L. Swanson S. Chanesman
March 24, 1976	NOAA	Narragansett, R.I.	Discuss future research at Deepwater Dumpsite.	MESA: C. Parker
March 29, 1976	U.S. Environmental Protection Agency	Toms River, N.J.	Deliver statement to public hearing on EPA's DEIS on sewage sludge dumping in the Bight (second in a series).	MESA: R. L. Swanson S. Chanesman

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March 29, 1976	Marine Sciences Research Center, SUNY, Stony Brook	Stony Brook, N.Y.	Give evening presentation on ocean disposal and the MESA New York Bight Project to a class in oceanography.	MESA: R. L. Swanson
March 30, 1976	U.S. Army Corps of Engineers	Stony Brook, N.Y.	Discuss dredge materials research in the Bight.	MESA: R. L. Swanson H. Stanford Corps: L. Pinata R. Engler
April 1, 1976	U.S. Environmental Protection Agency	Hicksville, N.Y.	Deliver statement to public hearing on EPA's DEIS on sewage sludge dumping in the Bight (third in a series).	MESA: R. L. Swanson
April 2, 1976	Marine Sciences Research Center, SUNY, Stony Brook	Stony Brook, N.Y.	Discuss MSRC Long Island bays and estuaries marine data file system proposed for use as part of Nassau and Suffolk Counties' "208" Plans.	MESA: P. Eisen A. Sadler MSRC: A. Robbins
April 2-3, 1976	Long Island Commercial Fisherman	Southampton, N.Y.	Attend forum and exposition at Southampton College.	MESA: J. S. O'Connor S. Chanesman
April 7, 1976	U.S. Environmental Protection Agency	Edison, N.J.	Discuss problems associated with future monitoring requirements being placed on municipal sewage sludge dumpers.	MESA: S. Chanesman C. Parker Representatives of area municipal sludge dumpers

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April 8, 1976	Environmental Science and Technology Magazine, American Chemical Society (ACS)	Stony Brook, N.Y.	Provide information for magazine article on the MESA New York Bight Project.	MESA: R. L. Swanson S. Chanesman ACS: J. Josephson
April 8-9, 1976	Cousteau Society/Public Broadcasting System	Sandy Hook, N.J. sewage sludge dumpsite	Film portion of PBS-TV series on environmental problems. Activities included a roundtable discussion of ocean dumping problems, interviews, and filming of dumping and dumping research activities in the Bight.	MESA, MAFC, and US EPA representatives LIEC: C. Stern NYCDWR: N. Nash C.S.: P. Cousteau
April 12, 1976	U.S. Senate Subcommittee on Oceans and Atmosphere	Washington, D.C.	Attend hearing on ocean dumping.	MESA: R. L. Swanson
April 14, 1976	Clara Barton High School	Brooklyn, N.Y.	Speak on careers in computer sciences and discuss work with the New York Bight Project.	MESA: A. Sadler
April 28, 1976	New York City Environmental Protection Administration	New York, N.Y.	Participate in TAC meeting: hear progress reports on "208" research activities, and discuss "208" modeling efforts.	MESA: S. Chanesman
April 30, 1976	U.S. Environmental Protection Agency	Stony Brook, N.Y.	Discuss NOAA and EPA roles in designing monitoring program for dumping at sewage sludge dumpsite.	MESA: R. L. Swanson H. M. Stanford EPA: W. Librizzi P. Anderson

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May 4, 1976	Nassau County Department of Public Health (NCDPH)	Stony Brook, N.Y.	Discuss MESA's plans for monitoring sewage sludge dumpsite and Nassau County's possible involvement; evaluate Nassau County's plans for monitoring beach and water quality.	MESA: J. S. O'Connor H. M. Stanford C. Parker S. Chanesman NCDPH: T. Maher
May 6, 1976	National Park Service (NPS), Gateway National Recreation Area	Floyd Bennett Field, N.Y.	Explore MESA participation and assistance with Gateway Bicentennial Program.	MESA: J. S. O'Connor NPS: S. Holmes
May 11, 1976	U.S. Environmental Protection Agency	New York, N.Y.	Attend public hearing on Ocean Dumping Permit Program.	MESA: S. Chanesman
May 13, 1976	Centre National pour l'Exploration des Océans	Stony Brook, N.Y.	Exchange information on oceanographic activities	MESA: Staff CNEXO: P. Ozanne
May 13, 1976	New York State Congress of Parents and Teachers, Long Island District	Elwood, N.Y.	Man exhibition MESA activities; display MESA equipment, slides, publications.	MESA: J. S. O'Connor
May 19, 1976	New York City Environmental Protection Administration	New York, N.Y.	Participation in Boundary Condition Subcommittee of New York City TAC for "208" activities.	MESA: P. Eisen

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May 19, 1976	National Park Service (NPS)	------	Determine the MESA materials to be provided to Gateway National Recreation Area for its Bicentennial Program.	MESA: S. Chanesman S. Robbins NPS: G. Konishi
May 21, 1976	Merchant Marine Academy	Kings Point, N.Y.	Deliver presentation on MESA Project.	MESA: D. Pasciuti
May 26, 1976	New York City Environmental Protection Administration	New York, N.Y.	Attend TAC meeting for "208" activities; hear reports on Boundary Condition and Mathematical Modeling Subcommittees; discuss formation of Land Use Subcommittee.	MESA: S. Chanesman
June 15, 1976	MESA Project and Suffolk County Department of Parks, Recreation and Conservation	Fire Island, N.Y.; beaches from Smith Point Park to Davis Park	Assess impact of floatable wastes washing on to beaches; collect preliminary grease ball samples for EPA analysis.	MESA: R. L. Swanson H. M. Stanford S. Chanesman Suffolk Co.: J. Chester S. Corwin
June 16, 1976	MESA Project and U.S. Environmental Protection Agency	Fire Island, N.Y.; beaches from Robert Moses State Park to Davis Park	Continue assessment of floatables problem begun on June 15, 1976.	MESA and EPA RII staff members
June 17, 1976	MESA Project	Stony Brook, N.Y.	Share data and preliminary findings relative to floatables problem; discuss possible sources of flotsam, agency activities and public information dissemination.	Over 20 federal, state, county and local agencies

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June 22, 1976	MESA Project	Nassau County, N.Y. South Shore beaches	Continue assessment of floatables problem begun on June 15, 1976.	MESA Staff and Nassau County officials
June 24, 1976	MESA Project U.S. Environmental Protection Agency - New York State Department of Environmental Conservation	Stony Brook, N.Y.	Share information; plan and coordinate agency activities and information transfer; release information to press (accomplished by three consecutive meetings).	MESA, other NOAA components, EPA, Coast Guard, Interior, NY DEC and various state and local agencies
June 25, 1976	President's Domestic Council and Rep. John W. Wydler	South Shore beaches, Long Island, N.Y.	Assess beach conditions.	MESA: R. L. Swanson H. M. Stanford President's Council: J. M. Cannon G. Humphrys Rep. J. W. Wydler
June 29, 1976	MESA Project and U.S. Environmental Protection Agency	Sewage treatment plants at Bay Park, Cedar Creek, and Pearsalls Hassock, N.Y.	Tour facilities and obtain sludge samples for analysis as part of floatables event investigation.	MESA: S. Chanesman EPA RII: R. Cisbulskis
June 30, 1976	New York State Department of Environmental Conservation	Albany, N.Y.	Brief NYDEC on progress and research plans relative to beach pollution problem.	MESA: R. L. Swanson S. Chanesman NYDEC: P. Berle
July 13, 1976	NOAA and Offices of Congressmen Wydler and Breaux	Stony Brook, N.Y.	Discuss Long Island beach pollution problem relative to sewage sludge dumpsite.	MESA: R. L. Swanson S. Chanesman C. Parker NOAA: R. Paine J. Clotworthy Congressional Offices: R. Wickland J. Townsend

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July 14, 1976	WNBC-TV	New York Bight: Sewage sludge dumpsite (aboard NOAA Ship Kelez	Film portion of news feature on sludge dumping and associated research; interview MESA personnel regarding sludge dumping.	MESA staff Congressional office staff personnel WNBC-TV news personnel
July 19, 1976	Southern California Coastal Waters Research Program	Los Angeles, Calif.	Participate in Consulting Board meeting and review ongoing SCCWRP programs, particularly those related to MESA research.	MESA: R. L. Swanson J. S. O'Connor
July 29, 1976	New York State Environmental Conservation Committee	New York Harbor	Tour harbor to inspect sewage sludge dumpsite, sewage outfalls, and Staten Island landfill operation; become acquainted with waste disposal problems of the New York City Metropolitan area.	MESA: S. Chanesman Environmental Conservation Committee members Sandy Hook Pilots Association Federal and state officials
July 22, 1976	MESA Project	Floyd Bennett Field, Brooklyn, N.Y.	Review status of joint-report on Long Island beach pollution problems; exchange testimonies of upcoming ocean dumping oversite hearings.	MESA: R. L. Swanson S. Chanesman Representatives of USCG-RIII and US EPA RII
July 23, 1976	New York State Department of Environmental Conservation	Stony Brook, N.Y.	Design an experiment to measure surface currents in Hewlett Harbor (site of an earlier sewage sludge storage tank explosion).	MESA: R. L. Swanson S. Chanesman NYDEC: A. Machlin A. Yerman

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July 24, 1976	U. S. House of Representatives Subcommittees on Oceanography, and on Fisheries and Wildlife Conservation and the Environment	Hempstead, N.Y.	Deliver statement at hearing on ocean dumping oversight.	MESA: R. L. Swanson S. Chanesman NOAA: D. Wallace C. Sindermann NYDEC: P. Berle USEPA: G. Hansler Nassau Co.: Officials
July 27, 1976	Marine Sciences Research Center, SUNY, Stony Brook	Stony Brook. N.Y.	Deliver lecture on MESA Project activities to summer school course for high school teachers.	MESA: H. M. Stanford
July 28, 1976	New York City Environmental Protection Authority	New York, N.Y.	Attend monthly meeting of TAC for "208" Waste Water Management; review progress and formulate plans for future.	MESA: S. Chanesman
August 6, 1976	New York City Department of Water Resources	Stony Brook, N.Y.	Review data and analyses pertinent to Long Island beach pollution incident.	MESA: H. M. Stanford NYCDWR: N. Nash W. Pressman
August 16, 1976	Merchant Marine Academy	Kings Point, N.Y.	Give presentation on MESA Project to Merchant Marine Academy class.	MESA: D. Pasciuti

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August 17, 1976	Passaic Valley Sewage Commissioners	Newark, N.J.	Discuss the advisory role to be played by the MESA Project in the implementation of US EPA requirements that permittees dumping sewage sludge in the Bight monitor the impact of the dumping on the environment adjacent to the dumpsite.	MESA: S. Chanesman Representatives of 14 New York metropolitan area permittee involved in ocean dumping
August 17, 1976	WPLJ (Radio Station)	New York, N.Y.	Tape interview on effects of ocean dumping in the Bight.	MESA: R. L. Swanson WPLJ: C. Getzoff
August 20, 1976	Congressman Thomas J. Downey	West Islip, N.Y.	Discuss informally the floatables problem and other issues such as alternatives to ocean dumping.	MESA: R. L. Swanson Congressman T. J. Downey Congressional staff members SUNY: J. Toll MSRC, SUNY: P. Weyl ISC: T. Glenn US EPA RII: R. Olsen BNL: Max Small Striped Bass Assoc.: R. Vandervert
August 23, 1976	Army Corps of Engineers U.S. Environmental Protection Agency	New York, N.Y.	Discuss Corps role relative to (1) dredge spoil dumping and the recently proposed ocean dumping regulations and criteria and (2) preparation of EIS on dredge spoil dumping for continued use of existing site.	MESA: S. Chanesman

Date	Convening Organization(s)	Location	Purpose	Attendees
August 25, 1976	U.S. Environmental Protection Agency	Sandy Hook. N.J.	Establish interagency steering committee to coordinate investigations of anoxic event and fish kill in the Bight during summer 1976; set up an ad hoc committee of federal, state and local agencies to review regional environmental research and events.	MESA: S. Chanesman G. Mayer US EPA RII NMFS, Sandy Hook and Narragansett Labs. NJDEP
August 31, 1976	U.S. Army Corps of Engineers	Corps sea-going dredge Essayons	Observe Corps dredging operations in the Bight	MESA: R. L. Swanson H. M. Stanford
September 10, 1976	U.S. Environmental Protection Agency	Edison, N.J.	Participate in a steering committee meeting on the summer 1976 anoxic event; plan a series of workshops on the event for early in 1977.	MESA: S. Chanesman Members of US EPA RII, NMFS Sandy Hook Lab., NJDEP, American Littoral Society, and L-DGO.
September 16, 1976	regional federal and state agencies	Sandy Hook, N.J.	Establish informal routinely-used communication channels between federal and state agencies. (Such a system will facilitate future crisis response and will enhance interagency cooperation and data flow.)	MESA: S. Chanesman Members of NMFS Sandy Hook Laboratory, EPA RII, US FDA, USCG, Corps of Engineers, National Parks Service, NYDEC and NJDEP
September 21, 1976	U.S. Environmental Protection Agency	New York, N.Y.	Assist in developing discharge permit requirements for Atlantic OCS oil-drilling lessees.	MESA: S. Chanesman Members of EPA RII, BLM, USGS, USFWS

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September 21, 1976	National Science Foundation/International Decade of Oceanographic Exploration	Washington, D.C.	Discuss plans for NSF-sponsored workshop on New York Bight anoxic problem and review future research needs relative to anoxic problem.	MESA: R. L. Swanson
September 22, 1976	New York City Environmental Protection Administration	New York, N.Y.	Attend monthly TAC "208" meeting; review work planned on nutrient inputs.	MESA: S. Chanesman
September 23, 1976	Peter Rosen Productions	Stony Brook, N.Y.	Provide suggestions on content of NOAA-sponsored film on the NOAA Corps.	MESA: R. L. Swanson H. M. Stanford S. Chanesman Peter Rosen Productions: P. Rosen P. Goodman
September 27, 1976	U.S. Environmental Protection Agency	Edison, N.J.	Participate in second meeting of steering committee on the anoxic problem of summer 1976.	MESA: G. Mayer: Members of NMFS Sandy Hook Laboratory, US EPA RII, NJDEP, L-DGO, and American Littoral Society
September 30, 1976	U.S. House of Representatives Subcommittees on Oceanography and on Fisheries and Wildlife Conservation and the Environment	Washington, D.C.	Assist in the presentation of testimony by D. Martineau (NOAA) relative to EPA's "Proposed Revision of Regulations and Criteria on Ocean Dumping."	MESA: H. M. Stanford

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