MONITORING ACTIVITIES IN THE NEW YORK BIGHT

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J.R. Schubel, Director
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INTRODUCTION

With some 20 million people inhabiting the lands adjacent to it, the New York Bight is among the most environmentally stressed bodies of water in the world. It is subject to inputs of industrial wastes, sewage wastes, and contaminated dredged material. These contaminants enter the Bight through point sources such as coastal outfalls, ocean dumping activities, and via the Hudson-Raritan Estuary, as well as non-point sources such as urban and agricultural runoff, and atmospheric fallout.

In spite of the intense amount of human activity in and around the Bight, it's waters still provide important resources for millions of people. Offshore fisheries sustain a substantial regional commercial seafood industry as well as provide the opportunity for excellent recreational fishing. The shorelines of both New Jersey and Long Island offer unsurpassed beaches which contribute to a considerable tourist trade. Mineral resources in the Bight include sand and gravel, and perhaps other heretofore untapped minerals. Also, the Bight is a major sea lane for marine commerce.

In order to preserve and protect this important resource, a number of research and monitoring programs have been undertaken in recent years to assess the effects of human impacts and to better understand the ecosystem of the Bight in general. Monitoring is defined as "the systematic, time-series observations of predetermined pollutants or pertinent components of the marine ecosystem over a length of time that is sufficient to determine the: (a) existing level, (b) trend, (c) natural variations of measured parameters in the water column, sediments, or biota" (Interagency Committee on Ocean Pollution Research, 1979).

Monitoring efforts can be conveniently divided into four basic categories: 1) surveillance of pollutant inputs, or compliance monitoring, 2) environmental monitoring, 3) ecological effects monitoring, and 4) monitoring to protect public health (Swanson and O'Connor, 1987). For instance, monitoring of sewage sludge dumping at the designated 106-mile site (DWD-106) (Figure 2.3) falls into the category of compliance monitoring. The bottom trawl surveys of the National Oceanic and Atmospheric Administration is an example of an ecological effects monitoring program. The mandates of state and local programs are often to certify shellfishing waters or beaches as safe.

It becomes obvious that no single monitoring program can be designed to respond to everyone's needs. Each program must be planned considering specific goals and objectives. Some programs are permanent, long-term endeavors which aim to assess temporal changes in the environment. Others are temporary programs with definite short-term goals. For example, monitoring coastal waterways for floatables presumably will cease once the major sources of floatables are controlled. As a result, a wide variety of monitoring and research programs are ongoing at any one time in the Bight. Periodically, it is useful to inventory these programs in order to offer a means for the establishment of a universal data base for the entire region and perhaps measure the effectiveness of some of the monitoring activities. This was last done in 1980 following a workshop sponsored by the Office of Marine Pollution Assessment of the National Oceanic and Atmospheric Administration (NOAA, 1981).

This report attempts to describe some of the current New York Bight research and monitoring projects in order to facilitate the collection of information to be used in planning and managing this very important resource. In addition, the data from the programs described within will be used in the development of various models of the New York Bight.

Historic Research and Monitoring Programs

Title: National Status and Trends Program (NS&T) and the Northeast Monitoring Program (NEMP)

Sponsor: National Oceanic and Atmospheric Administration

The pilot phase of Northeast Monitoring Program (NEMP) began in 1980, replacing the NOAA Ocean Pulse program and continued until the program was superceded by the National Status and Trends Program in 1984. There were four program components in the original NEMP: 1) water quality, 2) sediments and benthos, 3) trace contaminants in tissues, and 4) biological effects. The current NS&T program is divided into two program phases: 1) the Benthic Surveillance Project, and 2) the Mussel Watch Program.

Northeast Monitoring Program

- Monitoring program objective

The primary objective of the NEMP was to coordinate and focus monitoring and research activities of NOAA studies of the marine environment in coastal and offshore waters of the northeastern United States. In addition, the following specific objectives were listed as part of the original Program Development Plan:

1) Determine or confirm the existing levels, trends, and variations of contaminants in water, sediments, and biota and their effects on living marine organisms.

2) Establish and maintain an interactive data archive resulting from other marine pollution monitoring programs in the northeast and foster cooperation and coordination of estuarine/shelf environmental monitoring and research efforts off the Middle Atlantic and New England states.

3) Summarize, in collaboration with other agencies, information on pollutant inputs to estuarine and coastal waters.

4) Provide data and relevant information to regulatory organizations and the general public, in a timely manner, for planning and management.

5) Determine effects of major activities such as offshore drilling, dumping, and toxic waste disposal on the coastal marine environment and its resources.

6) Detect and provide appropriate and early warning of severe or irreversible changes in the coastal marine ecosystem and its resources.

7) Determine users' needs.

8) Develop and apply standard methodologies for monitoring and evaluate monitoring effectiveness.

9) Determine cost effectiveness of coastal monitoring elements.

10) Determine applicability of marine pollution monitoring methodologies to other United States coastal regions.

• Parameters measured

Water quality:

Dissolved oxygen (DO), organic carbon and nitrogen, inorganic nutrients, chlorophyll a, particulates, and primary productivity.

Sediments:

Trace metals (cadmium, chromium, copper, lead, nickel, silver, and zinc), organic contaminants (PCBs and PAHs), total organic carbon (TOC), total organic nitrogen (TON), grain size, coprostanol, seabed respiration, and bacterial and viral indicators.

Biological effects:

Physiology and biochemistry - the impact of pollutants on animal metabolism and how health, survival, and fecundity may be affected; genetics - frequency of mutational defects; pathology and immunology - incidence of disease and measures of resistance to disease; and behavior - response of selected organisms to a contaminated environment.

Trace contaminants in tissues:

Trace metals (silver, cadmium, chromium, copper, mercury, nickel, lead, and zinc), petroleum hydrocarbons (PAHs in particular), and chlorinated hydrocarbons (especially PCBs).

• Frequency and duration of monitoring

During the program's active period from 1980 to 1984, sampling took place on a weekly basis during April-October, and monthly during November-March. Not all stations were sampled for an analysis of every parameter listed above, but each parameter was measured at least once per year at each station.

• Station locations

The pilot phase of the program consisted of pollution-related monitoring and research for offshore marine waters from the Canadian border to Cape Hatteras. Monitoring of offshore rather than inshore and estuarine waters was emphasized because of the view that inshore waters were relatively well-studied by academia and states, while a general lack of data existed for offshore waters. Figure 1.1 shows the standard sampling locations.

• Funding

The majority of funding for the NEMP came from the habitat conservation appropriations to the Northeast Fisheries Center (NEFC) for the Ocean Pulse program. Other funding support came from the Ocean Assessments Division (OAD) of NOAA. Direct annual funding levels, excluding in-house salaries and contributed ship time, were about $2 million, with $1.3 million from NEFC and $0.7 million from OAD. The OAD portion was reduced to $0.36 million in FY 1984.

• Data storage/availability

A number of annual reports, data reports, cruise reports, published articles, and symposium reports, are available from the NMFS. A bibliography of these reports is given in NOAA, 1987. In addition to these reports, the following databases were developed by NEMP participants:

Data Type	Data Base Custodian
Amphipods species, parasites, pathology	P.T. Johnson, NMFS, Oxford Lab
Fish and scallop physiology, blood data	F. Thurberg, NMFS, Milford Lab
Fish and scallop energy metabolism data	E. Gould, NMFS, Milford Lab
Bacteria in sediments, water, animal tissues	J. Graikoski, NMFS, Milford Lab
Algal assay of water quality for phytoplankton	J. Mahoney, NMFS, Sandy Hook
Surf clam, ocean quahog, sea scallop pathology	F. Kern, NMFS, Oxford Lab
Planktonic crustaceans, pathology	S. MacLean, NMFS, Oxford Lab
Yellowtail EM-blood samples	J. Bodammer, NMFS, Oxford Lab

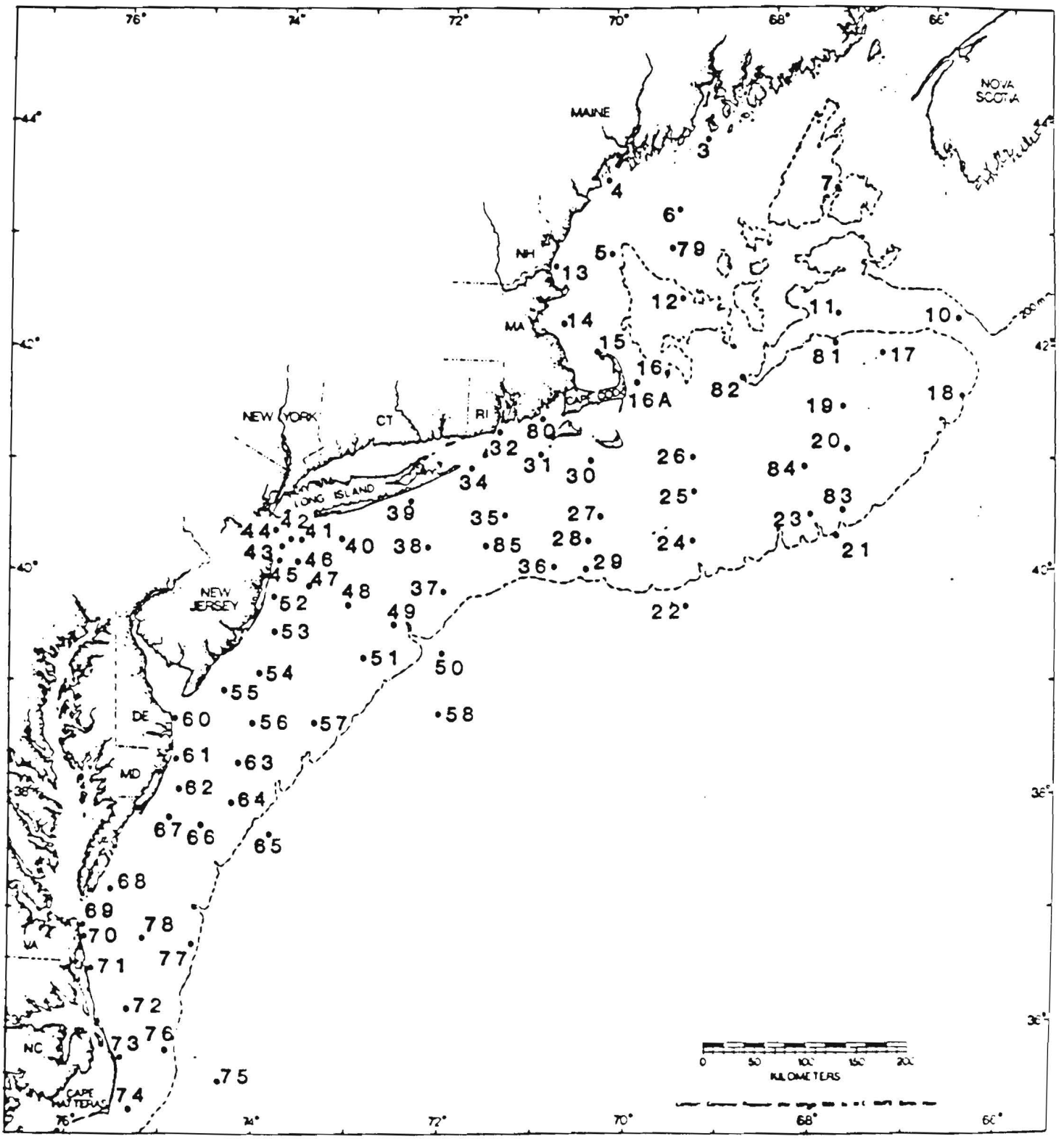


Figure 1.1 Locations of NEMP stations in the Northeast which were occupied in FY 1980 through 1984.

Source: NOAA, 1987

Data Type	Data Base Custodian
Phytoplankton species composition	M. Cohn, NMFS, Sandy Hook Lab
Remote sensing	W. Phoel, NMFS, Sandy Hook Lab
Fish serum antibody profile	J. Stolen, Drew University, Madison, NJ
Primary production, nutrient, chlorophyll, trace metals, hydrography	J. O'Reilly, NMFS, Sandy Hook Lab
Conductivity, salinity, temperature, DO, pH, meteorological observations	C. Warsh, NOS/OAD, Rockville, MD
Chlorophyll a, phytoplankton, nutrients	T. Whitledge, Brookhaven Natl. Lab, Upton, NY H. Marshall, Old Dominion Univ., Norfolk, VA
Sediment grab: phytoplankton identification, C:H:N ratios, chlorophyll a, N_{14}/N_{15} ratios, diatom resting spores	T. Whitledge, Brookhaven Natl. Lab, Upton, NY E. Cosper, SUNY at Stony Brook, Stony Brook, NY

National Status and Trends Program for Marine Environmental Quality

• Monitoring program objectives

The National Status and Trends Program (NS&T) was launched in 1984 to establish and maintain a data base of reliable information concerning spatial and temporal variations in environmental conditions in the oceans. This objective is pursued by quantifying the concentrations of toxic chemicals in marine fish, shellfish, and sediments, measuring biologic parameters that indicate anthropogenic stress. The paramount goal of this program is to not only assess the level of environmental quality of the nation's coastal waters, but to ascertain whether these conditions are improving or deteriorating. This information is used to evaluate environmental quality and recommend Federal actions necessary to maintain or improve it.

• Parameters measured

The NS&T Program is divided into two separate sub-programs, the Benthic Surveillance Project (BSP) and the Mussel Watch Project (MWP).

The BSP supports the measurement of toxic substances in surface sediments and benthic fish species from the same area since both are known to accumulate contaminants and can be used as indicators of local pollution impacts. Tissue samples are measured for 14 metals, PCBs, PAHs, and chlorinated pesticides (Table 1.1). The same parameters are measured in the sediment samples with the addition of two other elements (Si and Al), as well as coprostanol and Clostridium perfringens spores as sewage contamination indicators.

Samples of mussel and other bivalve tissues collected for the MWP are analyzed for a suite of 16 elements, PCBs, PAHs, and pesticides. In addition to these parameters, sediments are analyzed for coprostanol and TOC.

An important similarity between the former NEMP and the current NS&T Program lies in their respective Quality Assurance/Quality Control (QA/QC) procedures. The same QA/QC procedures have been used in each program, thus ensuring the comparability between samples collected from each.

• Frequency and duration of monitoring

The BSP began in 1984 and sampling occurs on a yearly basis. The present MWP, developed from the prototype program administered by the US Environmental Protection Agency (EPA), was initiated in 1986 and also mandates the collection of samples annually. Both programs are ongoing.

• Station locations

Although the NS&T Program evolved from the NEMP to some extent, there are two important differences between the programs. First, the NEMP was a regional monitoring program, whereas the NS&T Program is a national effort. Second, while the NEMP concentrated on sampling in offshore waters, the NS&T Program is primarily concerned with inshore areas. Thus, the NS&T Program is not a New York Bight monitoring program per se, but because of its overall importance as a long-term nationwide monitoring program operating in the Bight region, as well as its relationship with the defunct NEMP, it has been included here. See Figure 1.2 below for NS&T Program stations in the New York Bight region.

• Funding

During FY 1986, the cost of the entire NS&T Program was over $5 million, including expenditures to NOAA laboratories and private contractors totaling nearly $4 million and up to $800,000 for NOAA ship support.

Table 1.1 Chemicals measured in the National Status and Trends Program.

DDT and its metabolites[a]	Polyaromatic Hydrocarbons[d]	Major Elements	
o,p'-DDD	2-ring	Al	Aluminum
p,p'-DDD	Biphenyl	Fe	Iron
o,p'-DDE	Naphthalene	Mn	Manganese
p,p'-DDE	1-Methylnaphthalene	Si	Silicon
o,p'-DDT	2-Methylnaphthalene		
p,p'-DDT	2,6-Dimethylnaphthalene		
	Acenaphthalene	**Trace Elements**	
Chlorinated Pesticides	3-ring	Sb	Antimony
Other Than DDT[b]	Fluorene	As	Arsenic
	Phenanthrene	Cd	Cadmium
Aldrin	1-Methylphenanthrene	Cr	Chromium
Alpha-Chlordane	Anthracene	Cu	Copper
Trans-Nonachlor		Pb	Lead
Dieldrin	4-ring	Hg	Mercury
Heptachlor	Fluoranthene	Ni	Nickel
Heptachlor epoxide	Pyrene	Se	Selenium
Hexachlorobenzene	Benz(a)anthracene	Ag	Silver
Lindane (gamma-BHC)		Sn	Tin
Mirex	5-ring	Zn	Zinc
	Chrysene		
	Benzo(a)pyrene		
	Benzo(e)pyrene		
	Perylene		
	Dibenz(a,h)anthracene		

Polychlorinated Biphenyls[c]	Other Parameters
Dichlorobiphenyls	Total organic carbon
Trichlorobiphenyls	Grain size
Tetrachlorobiphenyls	Coprostanol
Pentachlorobiphenyls	*Clostridium perfringens* spores
Hexachlorobiphenyls	
Heptachlorobiphenyls	
Octachlorobiphenyls	
Nonachlorobiphenyls	

[a] Combined and reported in this paper as total DDT (tDDT). The dominant compounds were generally p,p'DDE and p,p' DDD

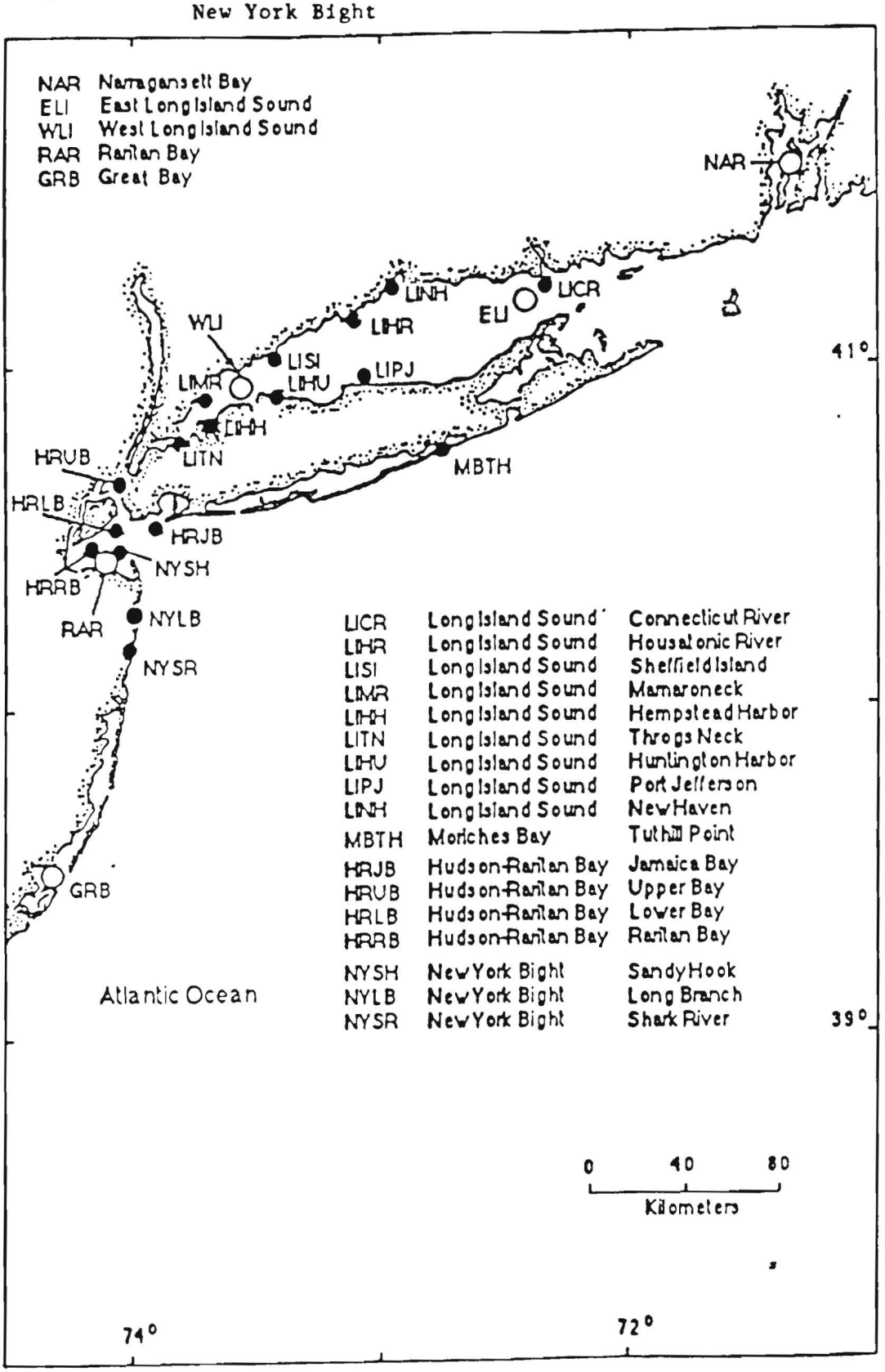
[b] Combined and reported in this paper as total chlorinated pesticides other than DDT (tChlP). Generally this fraction was dominated by dieldnn and the chlordanes.

[c] Combined and reported in this paper as total polychlorinated biphenyls (tPCB).

[d] Combined and reported in this paper as total polyaromatic hydrocarbons (tPAH). In 70% of the samples, more than 75% of the tPAH was comprised of 4-and 5-ring compounds

Source: NOAA, 1988c

Figure 1.2. National Status and Trends Program stations in the New York Bight



Source: NOAA, 1988c

- Data storage/availability

Four major products will come out of the NS&T Program:

1) The NS&T Data Base will house nationally uniform, quality controlled, and statistically reliable data collected during the course of the program, as well as selected data from other programs. The data base is available to environmental management and regulatory agencies, environmental scientists, and other interested parties by contacting the NS&T Program office.

2) The Specimen Bank, containing preserved marine specimens, including fish tissues, bivalves, and sediments, is housed in Gaithersburg, MD, and is available to qualified organizations and researchers.

3) A series of interpretive reports, including an annual summary of accomplishments, will be written using information culled from the Data Base.

4) A periodic newsletter highlights significant program activities.

Title: Marine Ecosystems Analysis New York Bight Project (MESA)

Sponsor: National Oceanic and Atmospheric Administration

Over the course of its operation in the 1970s, the MESA Program consolidated New York Bight research efforts among Federal agencies, state and local governments, universities, industries, and private organizations. Investigations pertaining to regional problems arising from human use of marine and estuarine resources were the focus of the project.

MESA was a research program rather than a monitoring program, but the scope of the research conducted and the results obtained furnished a vast amount of useful environmental data which was and still is used as an information base for subsequent monitoring programs.

• Monitoring program objectives

The MESA mission proceeded in two major directions: the development of baselines and the development of diagnostic models. Toward that end, participants endeavored to meet the following objectives:

1) Determine the fate and effect of pollutants on the New York Bight ecosystem, focusing particular attention on ocean dumping.

2) Quantify the environmental factors involved in major offshore structure design and siting decisions.

3) Provide information on nearshore processes which may influence coastal engineering and coastal zone management decisions.

4) Identify and describe the important subsystems, processes, and mechanisms operating in the Bight, and define their interrelationships and rates of change.

5) Provide data, information, and expertise to support the effective use of Bight resources.

• Parameters measured

Over the course of the project, much of the work was directed toward defining the Bight in terms of the ecosystem it represents, including general distributions of fish and shellfish; existing levels of contaminants in sediments, organisms, and the water column; and water circulation patterns.

Some of the topics studied included a determination of the characteristics of material dumped at individual disposal sites; measurements of the dispersion rates of dumped materials; long- and short-term chemical, biological, and geophysical interactions which govern the effects of dumping; current measurements at various depths and locations; sediment transport rates and processes; and collection of benthic organisms for the study of biological and pathological impacts of man's activities. Han *et al.* (1979) gives an example of a model developed during the MESA Project.

• Frequency and duration of monitoring

The MESA Project, carried out as a seven year study, began in 1973. Various research projects were carried out during that time. Among these projects were the analysis of the hypoxic/anoxic event in 1976 and documentation of the sources and transport of floatable wastes to area beaches. MESA also designed a statistically based monitoring program for the Bight.

• Station locations

The area of study was defined as the entire New York Bight to the edge of the continental shelf and in the apex to the point where the Hudson narrows.

• Funding

A total of $5 million annually was appropriated by US Congress for the MESA Program. Specific projects dealing with impacted or potentially impacted areas were selected and funded over several years.

• Data storage/availability

Findings of the MESA Project were published in two types of reports. One set of reports contains actual Project publications (eg. MESA Series, Atlas Monographs) and the other contains all other published reports that resulted from MESA-supported research (eg. scientific journal articles). The MESA Series publications include Data Reports, Technical Memoranda, and Special reports. The MESA New York Bight Atlas Monograph series was produced in cooperation with the New York Sea Grant Institute, and resulted in thirty essays on specific Bight topics. All data collected is retained by the National Oceanographic Data Center in a special New York Bight file.

Title: Shelf Edge Exchange Processes Phase I (SEEP-I)

Sponsor: US Department of Energy

SEEP-I was the first phase of an ongoing program designed to gather hydrographic and particle flux data along the continental shelf and slope of the eastern United States. Some of the data generated during the course of the SEEP-I program is pertinent to studies of the New York Bight. The current SEEP-II program, however, is operational south of the Bight in waters off the coast of Virginia.

Many of the stations occupied during the SEEP-I program were actually east of the Bight. However, it has been included here both because the overall goal of the project was to ascertain the flux of material originating in the Bight and because the data has been used in subsequent New York Bight monitoring programs such as that connected with sewage sludge dumping activities at 106-mile dumpsite.

• Monitoring program objective

Investigate the flux of suspended material from the continental shelf to the upper slope waters, and possibly into slope sediments.

• Parameters measured

Eight cruises undertaken during the course of the SEEP-I project made regular measurements of water temperature, salinity, pressure, conductivity, dissolved oxygen, fluorescence, and transmission. Expendable bathythermograph data were collected sporadically. In addition, current meters were deployed in both long-term and short-term mooring arrays east of the Bight.

• Frequency and duration of monitoring

The program was active beginning in July, 1983 and terminated in October, 1984.

• Station locations

Station locations for each of the eight SEEP-I cruises are shown in Figures 1.3 through 1.10. A ninth cruise (cruise number 2) has been omitted here because no hydrographic data were collected during that cruise.

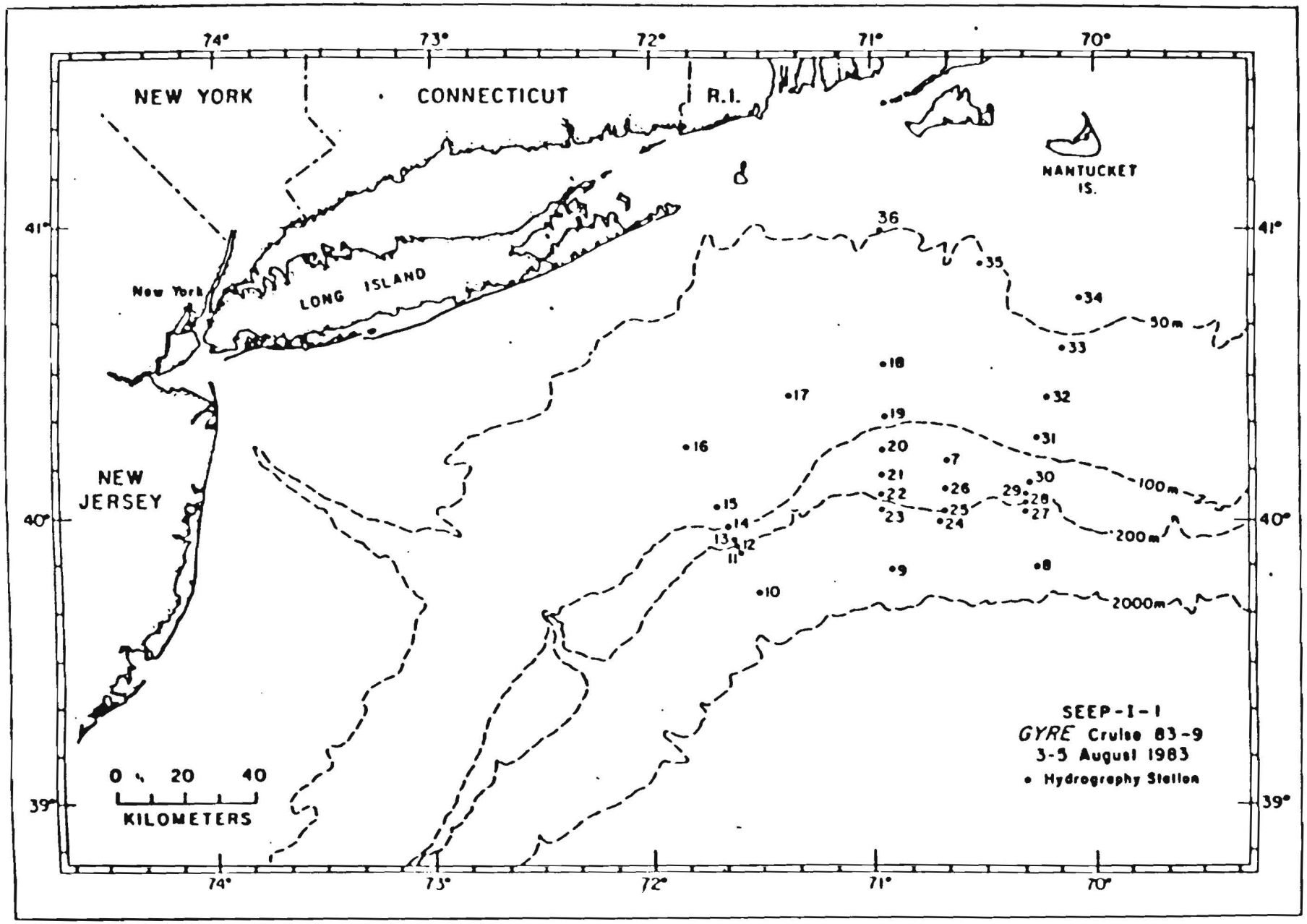


Figure 1.3. Shelf Edge Exchange Processes Phase I stations occupied during cruise I
Source: Behrens and Flagg, 1986

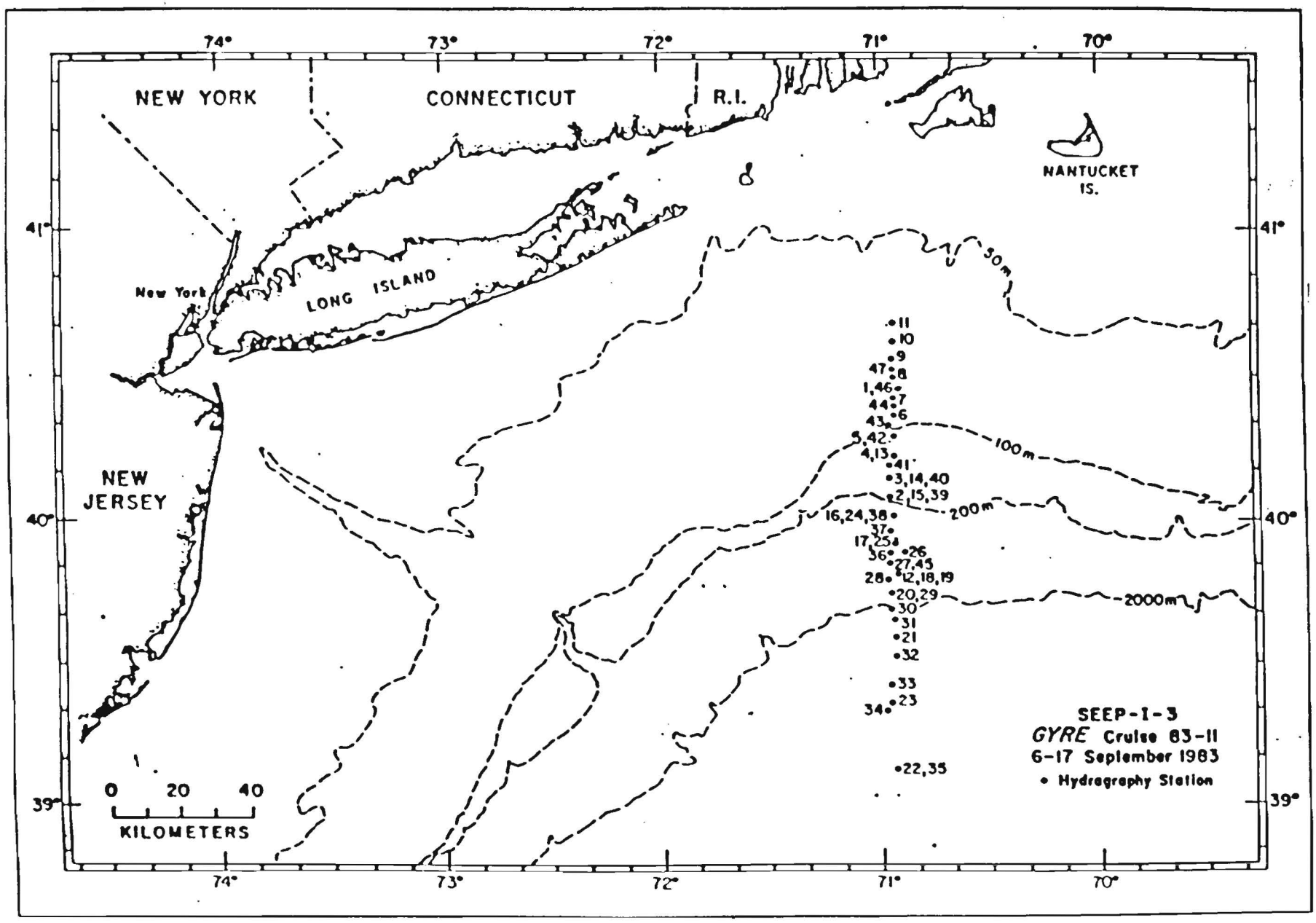


Figure 1.4. Shelf Edge Exchange Processes Phase I stations occupied during cruise 3
Source: Behrens and Flagg, 1986

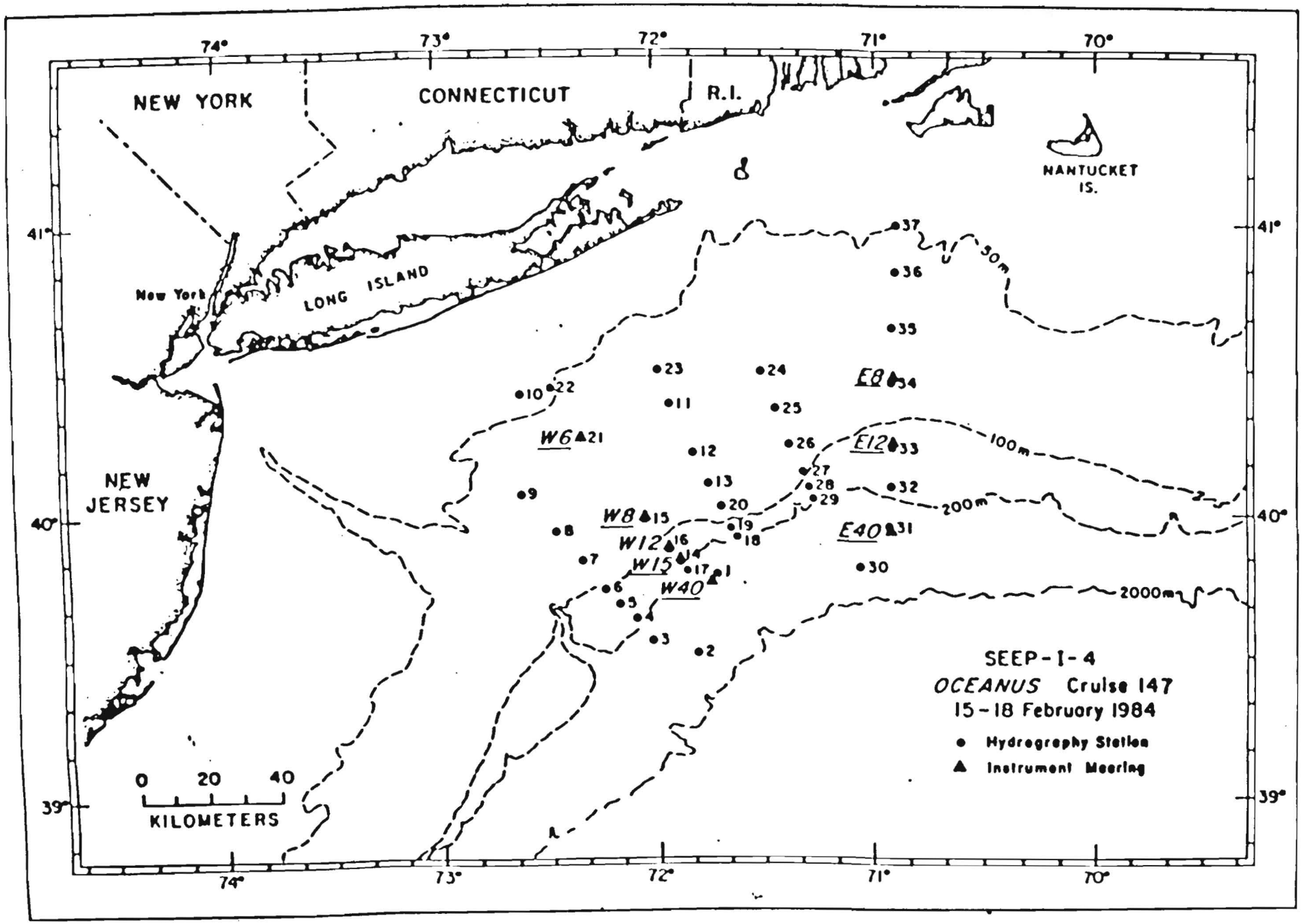


Figure 1.5. Shelf Edge Exchange Processes Phase I stations occupied during cruise 4
Source: Behrens and Flagg, 1986

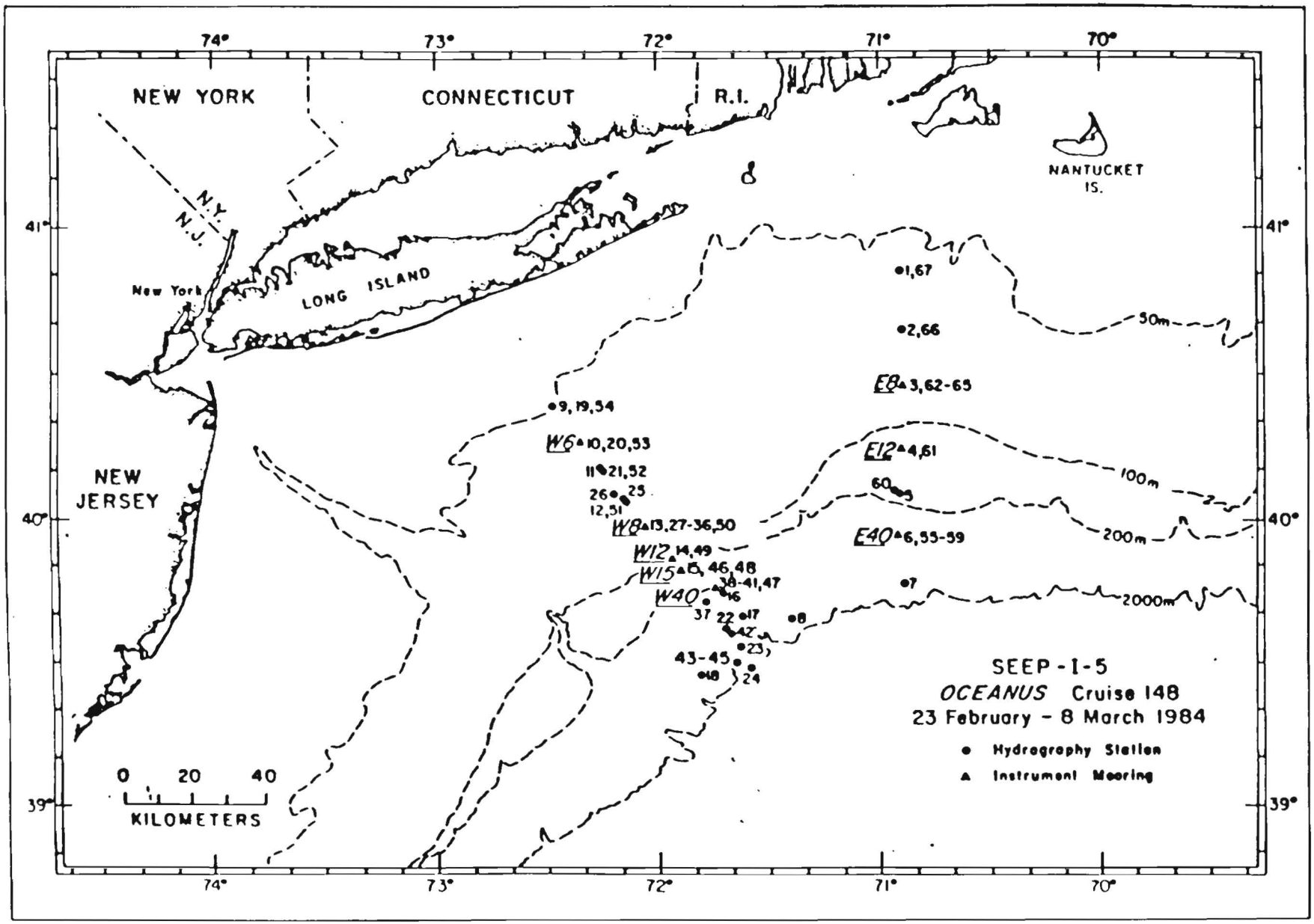


Figure 1.6. Shelf Edge Exchange Processes Phase I stations occupied during cruise 5
Source: Behrens and Flagg, 1986

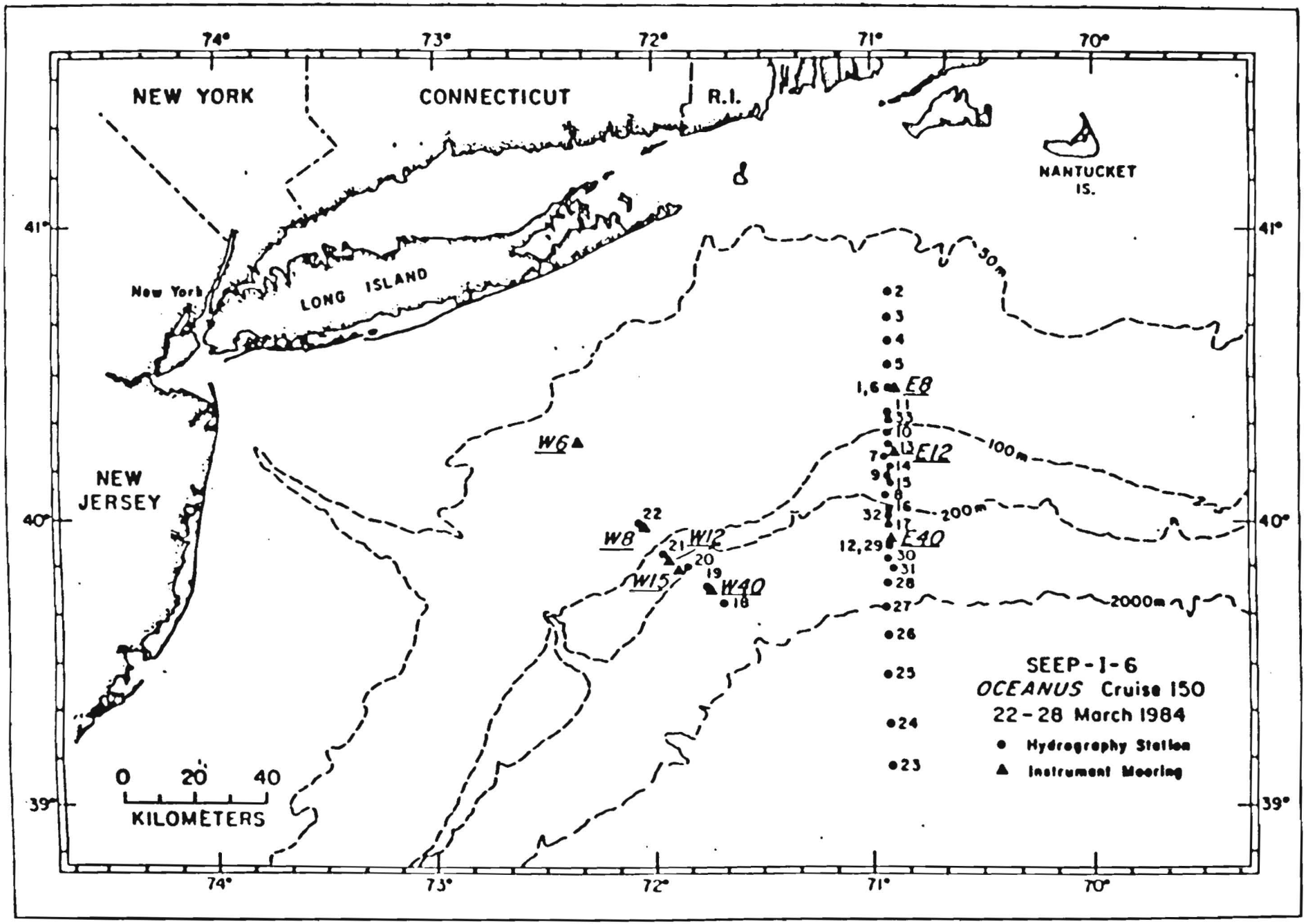


Figure 1.7. Shelf Edge Exchange Processes Phase I stations occupied during cruise 6
Source: Behrens and Flagg, 1986

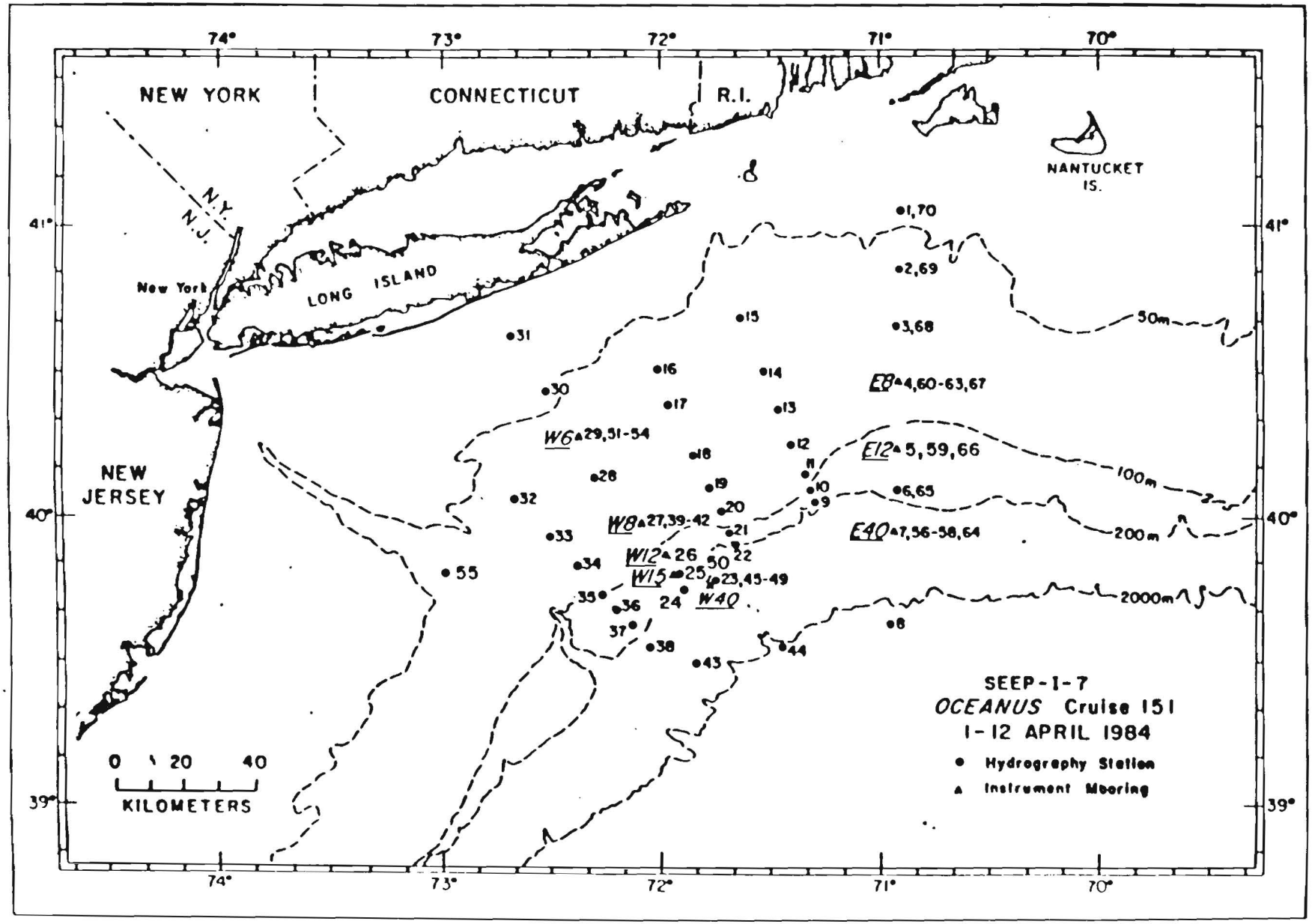


Figure 1.8. Shelf Edge Exchange Processes Phase I stations occupied during cruise 7
Source: Behrens and Flagg, 1986

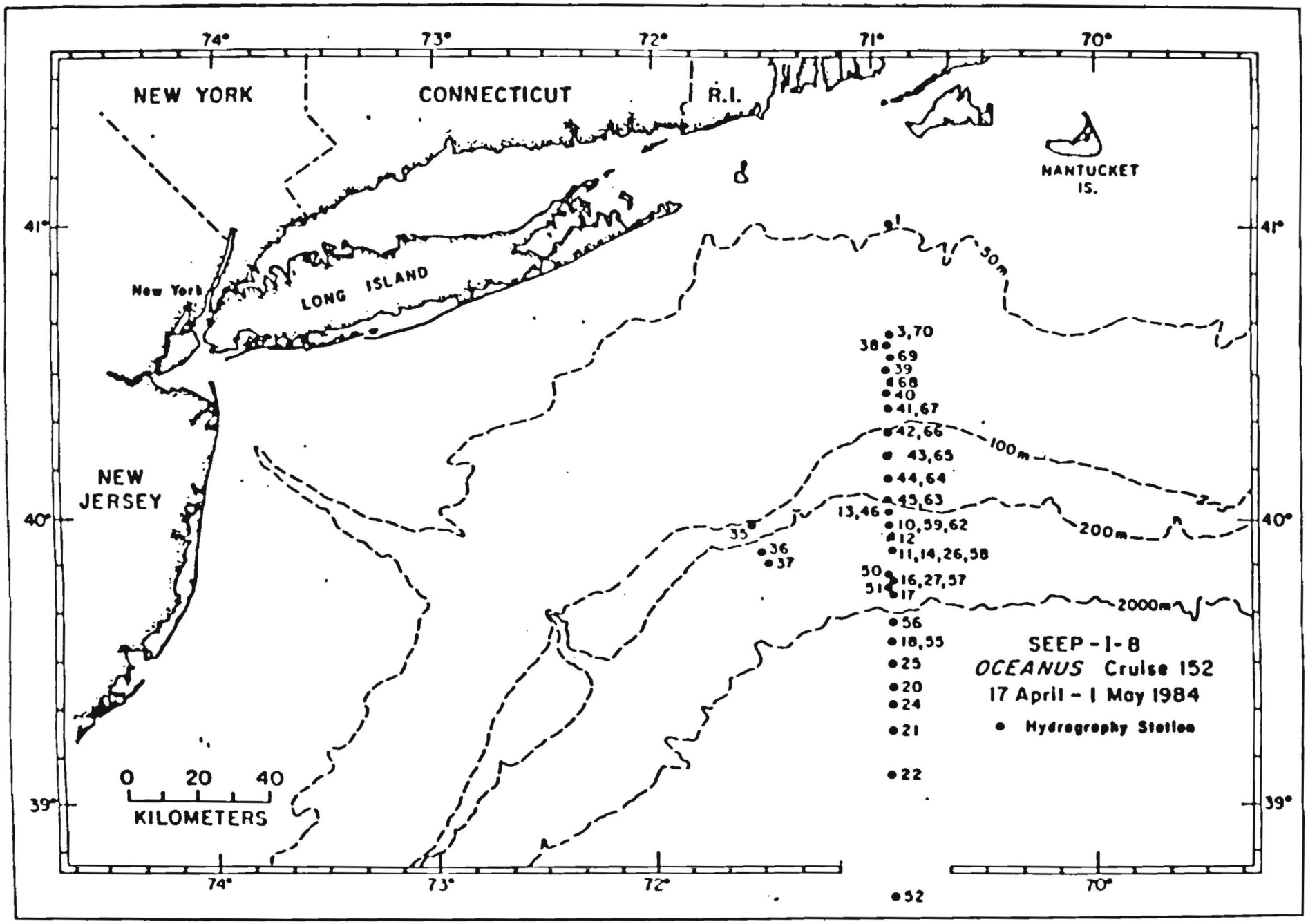


Figure 1.9. Shelf Edge Exchange Processes Phase I stations occupied during cruise 8
Source: Behrens and Flagg, 1986

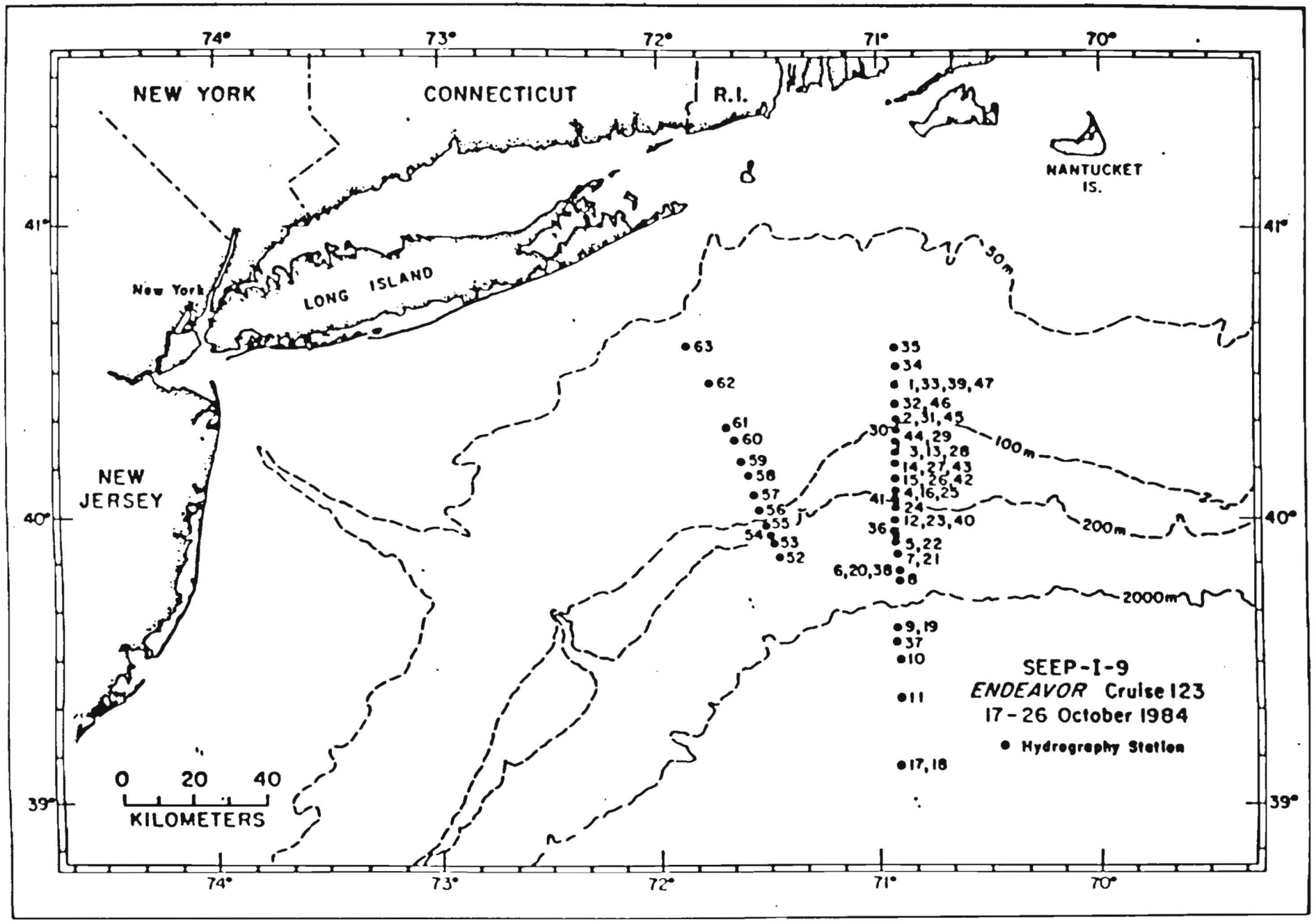


Figure 1.10. Shelf Edge Exchange Processes Phase I stations occupied during cruise 9
Source: Behrens and Flagg, 1986

• Funding

SEEP-I was a multi-institutional effort supported by the US Department of Energy. Participants included Brookhaven National Laboratory (BNL), Lamont-Doherty Geological Observatory, North Carolina State University, and the University of Maryland.

• Data storage/availability

Complete reports including tables of calibrated data for each variable as well as separate cruise reports are available. Also, an interactive data base has been established from which data may be obtained in nearly any format using user-friendly computer programs.

Current Monitoring

Programs

Title: Response of the Habitat and Biota of the Inner New York Bight to Abatement of Sewage Sludge Dumping (12-Mile dumpsite)

Sponsor: National Oceanic and Atmospheric Administration

Sewage sludge dumping began at the 12-Mile Dumpsite in the Bight apex in 1924 and continued until the end of 1987. The abatement of sewage sludge dumping at this site has been viewed as a rare opportunity to study the response of an ecosystem to the discontinuation of a major waste input.

• Monitoring program objective

Observe and document changes in the biota and habitat at the 12-mile sewage sludge dumpsite during and following the period in which sewage sludge dumping is being phased out.

• Parameters measured

An array of variables has been selected that are germane to fishery resources and their habitats or applicable as indicators of environmental quality. Investigations of habitat (ie. water and sediment studies) as well as the biota (ie. resource species, benthos, and bacteria) will be undertaken. An outline of these parameters is given in Table 2.1.

Although replicate measurements of all the variables considered in the study would be the ideal approach, it is not a practical one due to the high cost and labor intensiveness of such a strategy. The plan therefore calls for two separate sampling surveys to be completed within the framework of the program, the replicate survey and the broadscale survey.

Intensive sampling takes place at the replicate survey stations, which have been chosen to represent a gradient of sewage sludge concentrations and effects. The data collected from these sites will be used for specific hypothesis testing.

The broadscale survey incorporates 25 stations throughout the Bight apex. Sampling at these sites, which have been chosen to include all major habitat types, will consist of a single, non-replicated suite of measurements. Data compiled from these stations will be used to display, using contour charts, the geographical distribution of sewage sludge effects. Broadscale survey stations will also be used to study the relationships between variables using correlative analysis.

Table 2.1. Variables measured during the 12-mile dumpsite study.

Habitat		Biota
Water	Sediments	Bottom Communities
• Bottom water Dissolved oxygen (R,B) Temperature (R,B) Salinity (R,B) pH (R,B) Sulfide (R,B) Nutrients (R,B) Turbidity (R,B)	• Chemistry Heavy metals (R,B) Organic contaminants (R,B) Sulfide, pH profiles (R) Redox potential (R,B) Sediment BOD (R) Chlorophyll pigments (R) Total organic carbon (R,B)	• Resource species Distribution/abundance (R,B) Diet (R) winter flounder red hake silver hake lobster Gross pathology (R,B) Tissue organics (R) winter flounder lobster Migration (tagging) (B) winter flounder
• Water column Temperature Salinity Oxygen Current measurements (moored meters)	• Characteristics Grain size (R,B) Erodability	
	• Rates Seabed oxygen consumption Sedimentation	• Benthos Macrofauna abundance/ diversity (R,B) Meiofauna abundance/ diversity (R,B)
		• Bacteria - sediments Fecal and total coliform (R) *C. perfringens* (R) *Vibrio* spp. (R) Total count (R)
R = Replicate Survey B = Broadscale Survey		• Bacteria - shellfish

Source: NOAA, 1988a

• Frequency of monitoring

The monitoring plan calls for bimonthly sampling year-round for both the replicate and the broadscale surveys, with one exception. From July to September each year, when the potential for hypoxia and sulfide accumulation in bottom waters is greatest, replicate sampling is to be done on a monthly basis. Table 2.2 shows the planned sampling schedule for the program.

• Program duration

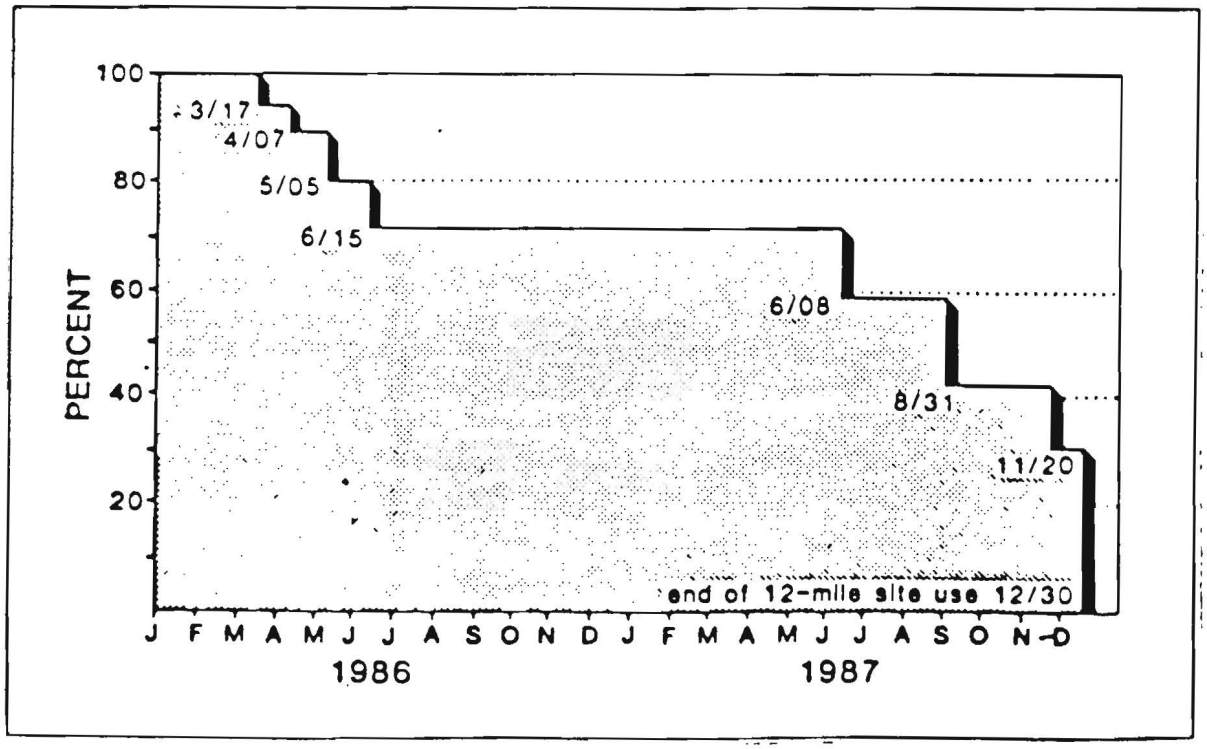
Beginning in 1986, the dumping of sewage sludge at the 12-mile dumpsite was shifted decrementally to the Deepwater (DWD-106) dumpsite, with the last load dumped in December of 1987. The phase-out schedule for dumping at the 12-mile site is shown graphically in Figure 2.1.

Table 2.2 Survey schedule of the 12-mile dumpsite

	1986					1987-1988												1989								
	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S
Replicate	X	X	X		X		X		X		X		X	X	X		X		X		X		X		X	X	X
Broadscale		X		X		X		X		X		X		X		X		X		X		X		X		
Seabed metabolism		X	X		X	X	X	X	X		X	X	X		X	X		X	X	X		X	X		X	X	X
Hydrographic surveys (with USEPA)											X												X			
Seabed and water column rates, hydrographic surveys (with USEPA, NJDEP, and others)															X											X	

Source: NOAA, 1988a

Figure 2.1. Phase-out schedule for sewage sludge dumping at the 12-mile dumpsite



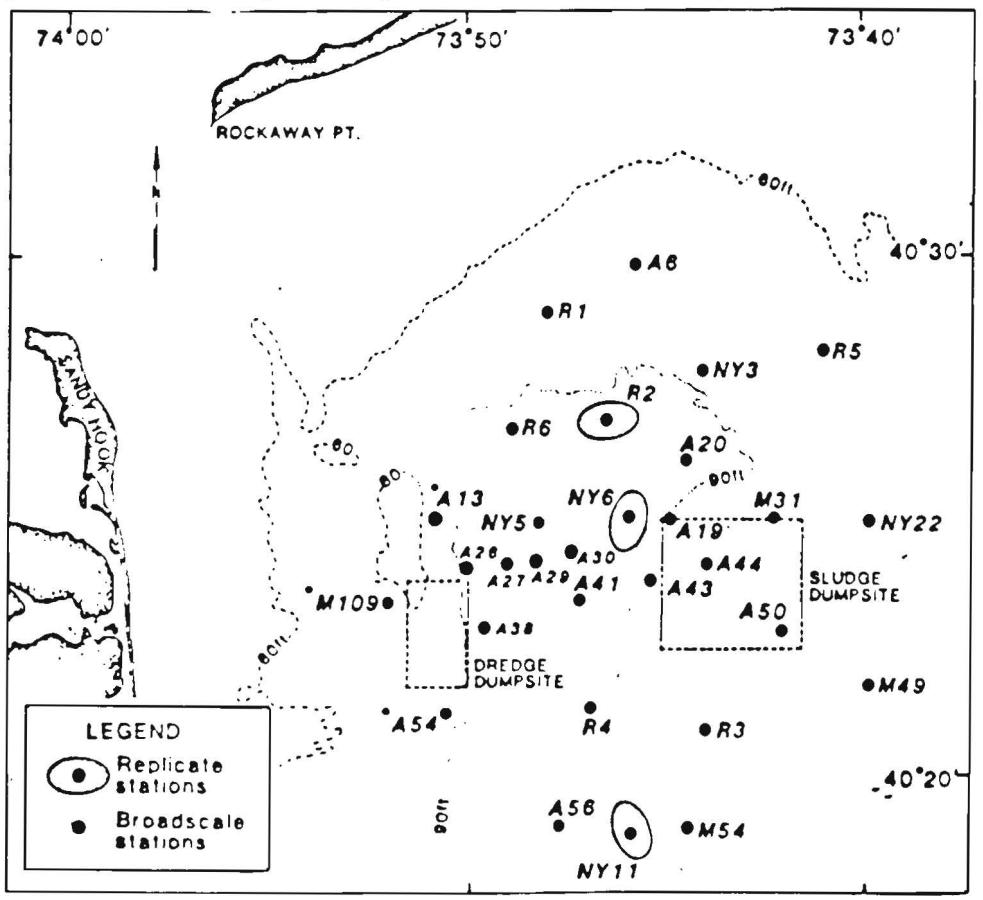
Source: NOAA, 1988a

Full-scale sampling for the program began in July, 1986 and will continue through the summer of 1989. If evidence of sewage sludge or any effects attributable to dumping still exist after that time, a continuation of sampling at reduced frequencies is intended.

• Station locations

The three replicate stations are located to the west of the dumpsite area. These were chosen because they have similar depths and sediment types, and because they are not thought to be affected by dredged material dumping activities. There is, in addition, data from past surveys available for these stations. The replicate stations are symbolized in Figure 2.2 with an ellipse. Three complete sets of measurements are taken at the center of each ellipse, and five more replicates are taken at other points within the ellipses.

Figure 2.2. Locations of stations sampled on the replicate and broadscale surveys during the 12-mile dumpsite recovery study



Source: NOAA, 1988a

Broadscale stations are located both within the perimeter of the dumpsite area and throughout the Bight apex. The stations were chosen according to the following criteria:

1) Provide fairly regular coverage of the study area (area of apparent impact plus immediate environs) to facilitate contouring.

2) Provide coverage of the niche gradients in the study area as completely as is practicable to legitimize correlative analyses.

3) Correspond with historical station locations when possible.

- Data storage/availability

Products anticipated to come out of this effort include:

1) Quarterly reports on status, findings, and problems of the survey.

2) Annual reports for individual tasks within the overall program and for the overall study itself.

3) A final, comprehensive interpretive report.

4) A computerized data base housed at the NMFS Northeast Fisheries Center in Woods Hole, Massachusetts, which will be available for further analysis and comparisons.

5) Manuscripts on study findings.

Title: Deepwater Municipal Sludge Site

Sponsor: US Environmental Protection Agency (USEPA)

The Deepwater Municipal Dumpsite (106-mile site) has been used as a disposal site for waste materials since 1961 when liquid chemical wastes were dumped there (Fig. 2.3). In 1965, the US Fish and Wildlife Service proposed the site as an alternative to inland disposal of other wastes due to the threat they posed to drinking water supplies. Consequently, the 106-mile site has received municipal sewage sludge and municipal sludge digester cleanout residue in addition to chemical wastes since that time.

In 1982, the original site was split into two smaller sites to facilitate compliance monitoring efforts. One site was designated for sewage sludge wastes and the other for industrial wastes. Because no dumping of acid wastes or industrial wastes is currently underway in the New York Bight, the remainder of the disscussion here will focus on compliance monitoring programs pertaining to sewage sludge dumping.

The 106-mile site, located just off the continental shelf break, is bounded by 38°40'00" and 39°00'00" north latitudes and 72°00'00" and 72°05'00" west longitude. Curretntly, nine sewerage authorities in New Jersey and New York dump an estimated 8 million wet tons at the site annually.

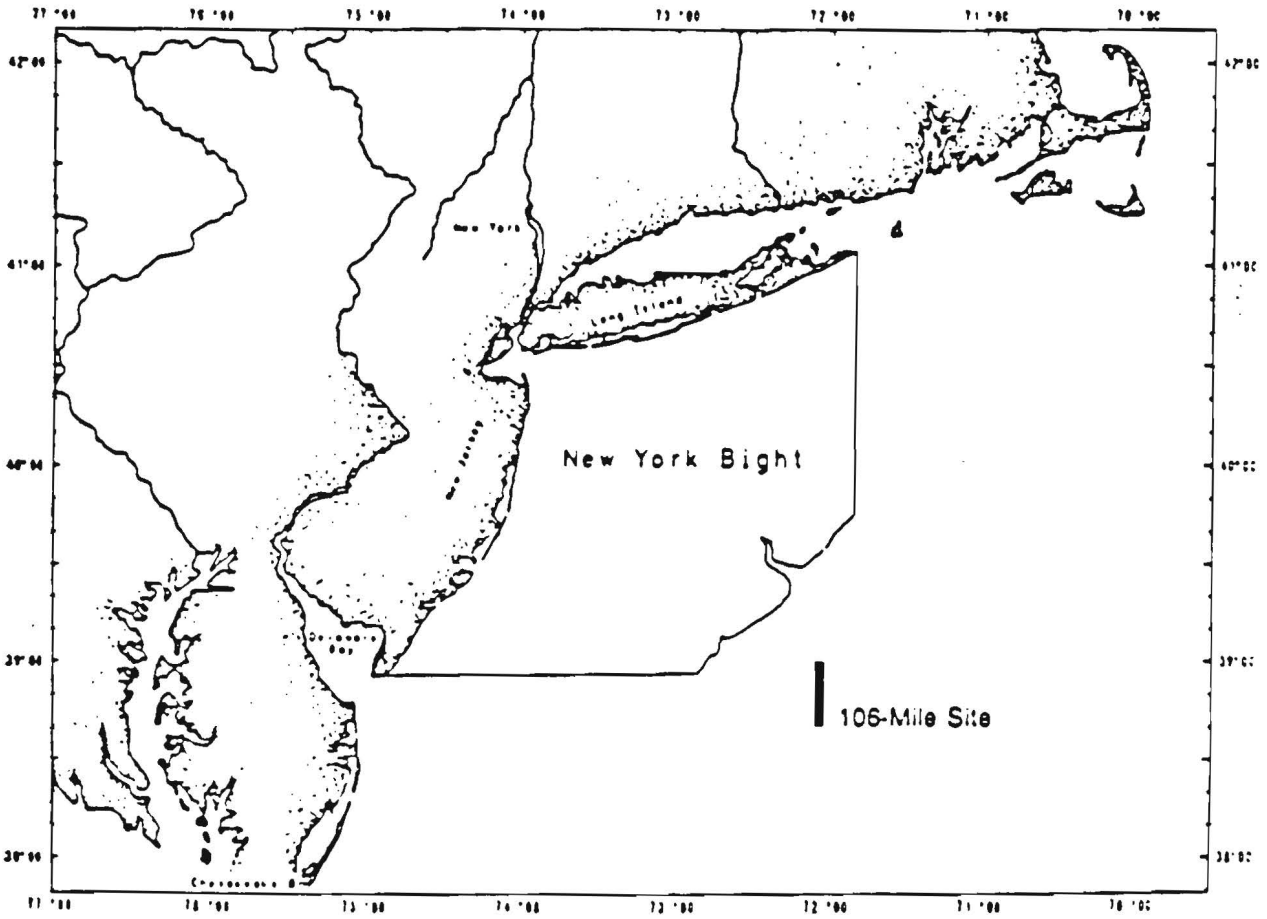
The Marine Protection, Research, and Sanctuaries Act of 1972 (MPRSA, P.L. 92-532), a.k.a. Ocean Dumping Act, regulates all ocean dumping activities. The USEPA has the responsibility to issue permits for dumping and the USEPA and the US Coast Guard have joint responsibility to monitor site and enforce permit conditions. The Ocean Dumping Ban Act of 1988 calls for the end of all sewage sludge and industrial waste dumping by 1991. Users of the site after 1991 will be required to pay substantial penalties.

• Monitoring program objectives

The monitoring program for the 106-site has been organized into a tiered approach: (1) sludge characteristics and disposal operations; (2) nearfield fate and short-term effects; (3) farfield fate; and (4) long-term effects.

Since sewage sludge disposal at the 106-site was initiated under court order, prior to the issuance of permits, monitoring results are being used to set permit conditions in addition to modifying them. Thus, information originating from the various tiers of the program have different objectives:

Figure 2.3. Middle Atlantic Bight area showing location of the 106-mile site



Source: Battelle, 1989

1) Tier 1 and Tier 2 are used to set allowable dumping rates, with these rates being revised on a quarterly basis;

2) Tier 2 is used to determine whether adverse effects result from dumping at site;

3) Tier 3 permits the estimation of the transport direction and areal distribution of sludge constituents;

4) Tier 2 and Tier 3 together will be used to determine whether the site should be redesignated when the current designation expires in 1991;

5) Tier 4 will determine whether adverse effects result from dumping at the site over an extended period of time.

Figure 2.4 summarizes the objectives and issues addressed by the tiered monitoring approach.

• Parameters measured

Characterization of site currents and hydrographic conditions (ie. temperature, salinity, and vertical density structure) mostly rely on data from the SEEP I Program (see page 13) and the Mid-Atlantic Slope and Rise Physical Oceanography Study (MASAR/POS), a research program funded by the Minerals Management Service. Effects of the Gulf Stream and warm-core eddies were also investigated during the MASAR/POS program.

Baseline site information includes water column and sediment chemistry, data on benthic, demersal, and pelagic species biology, and specific information on endangered species in the area. Water chemistry and microbiology analyses included trace metals, organic constituents (PAHs, pesticides), PCBs, β-coprostanol, Clostridium perfringens. Sediment samples were analysed for trace metals, hydrocarbons, pesticides, Clostridium perfringens.

Sewarge authorities report sludge characteristics data to USEPA. Parameters generally reported are BOD, pH, total solids, settleable solids, coliform bacteria, total nitrogen, total petroleum hydrocarbons, and metals.

Tier 2 activities have included nearfield fate studies to determine the dilution rates of the sludge and evauation of short-term effects using toxicity tests, examination of specimens for genetic mutations and other developmental abnormalities, and measurements of phytoplankton biomass (chlorophyll a).

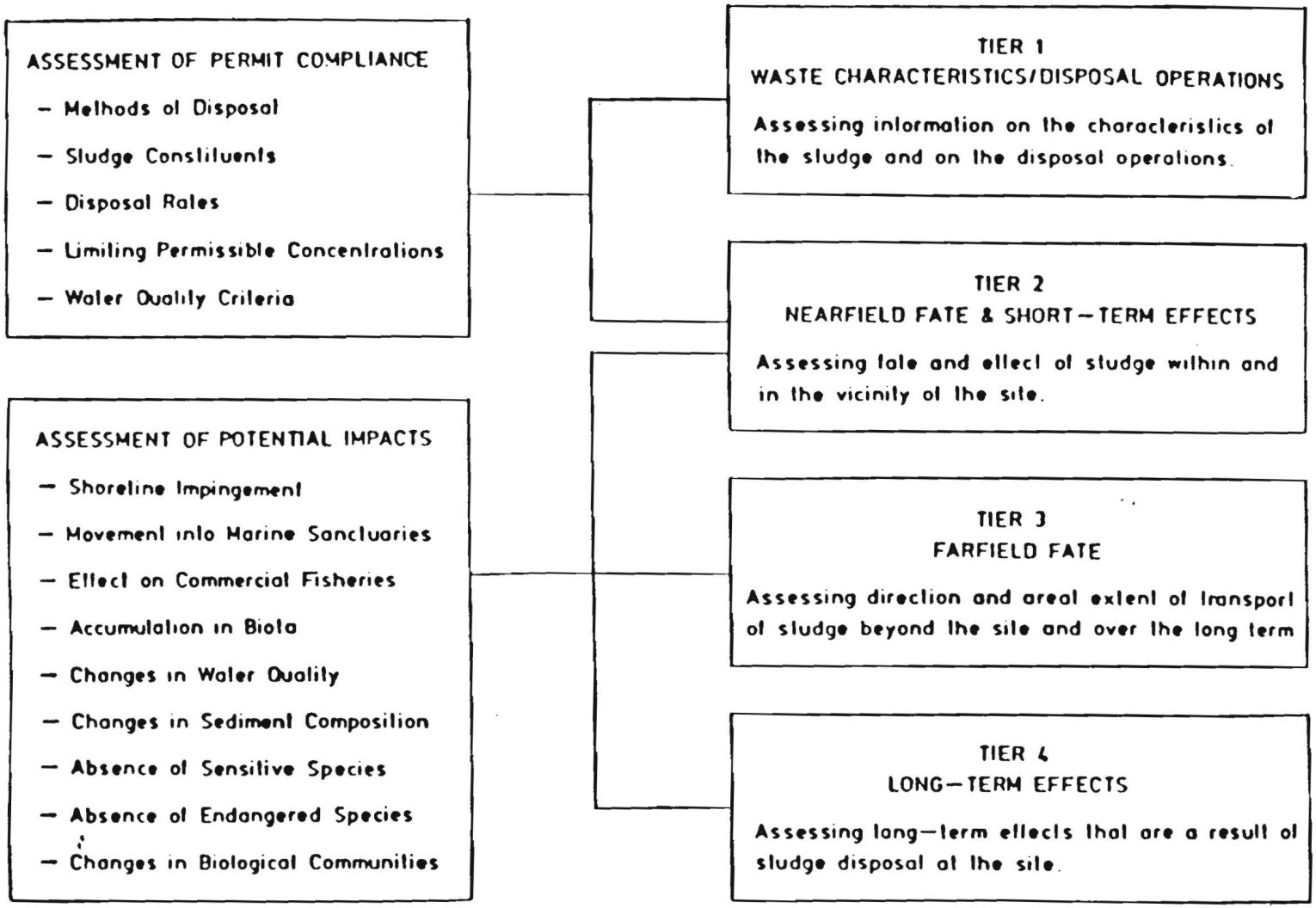


Figure 2.4. Monitoring tier relationships with permit compliance and impact assessment
Source: Battelle, 1989

Tier 3 monitoring activities began with the deployment of current meter moorings near the site. Satellite-tracked drifting buoys have been subsequently released to determine the effects of regional circulation and the probable transport of sludge in near-surface waters.

Surveillance of sludge disposal is carried out through three operations: 1) notification by transport companies of intent to dump, 2) on-site obervations of dumping operations during USEPA monitoring surveys, and 3) use of the Ocean Dumping Surveillance System (ODSS), a "black box" system which remotely tracks and documents dumping operations. The ODSS is maintained by the US Coast Guard.

• Frequency and duration of monitoring

Although the tiered monitoring plan was only formally announced in March 1988, much of the work included in the plan had already been done. Background site data and sludge characterizations have been utilized from other research and monitoring activities. Tier 1 surveys began in 1984, Tier 2 surveys were conducted in 1987 and 1988, and Tier 3 efforts began in 1986 (Table 2.3). No monitoring activities under Tier 4 of the plan have been completed to date pending evaluation of results from the other monitoring tiers.

• Stations locations

USEPA baseline surveys conducted from 1984 to 1986, surveys at the proposed North Atlantic Incineration Site, the 1983-85 MASAR/POS, and NEMP surveys (see page 6) were used to gather baseline environmental data. Water column stations are shown in Figures 2.5 and 2.6. Stations where sediment chemistry and microbiology work was completed are given in Figure 2.7. Benthic infauna studies were conducted at the stations shown in Figure 2.8.

• Data storage/availability

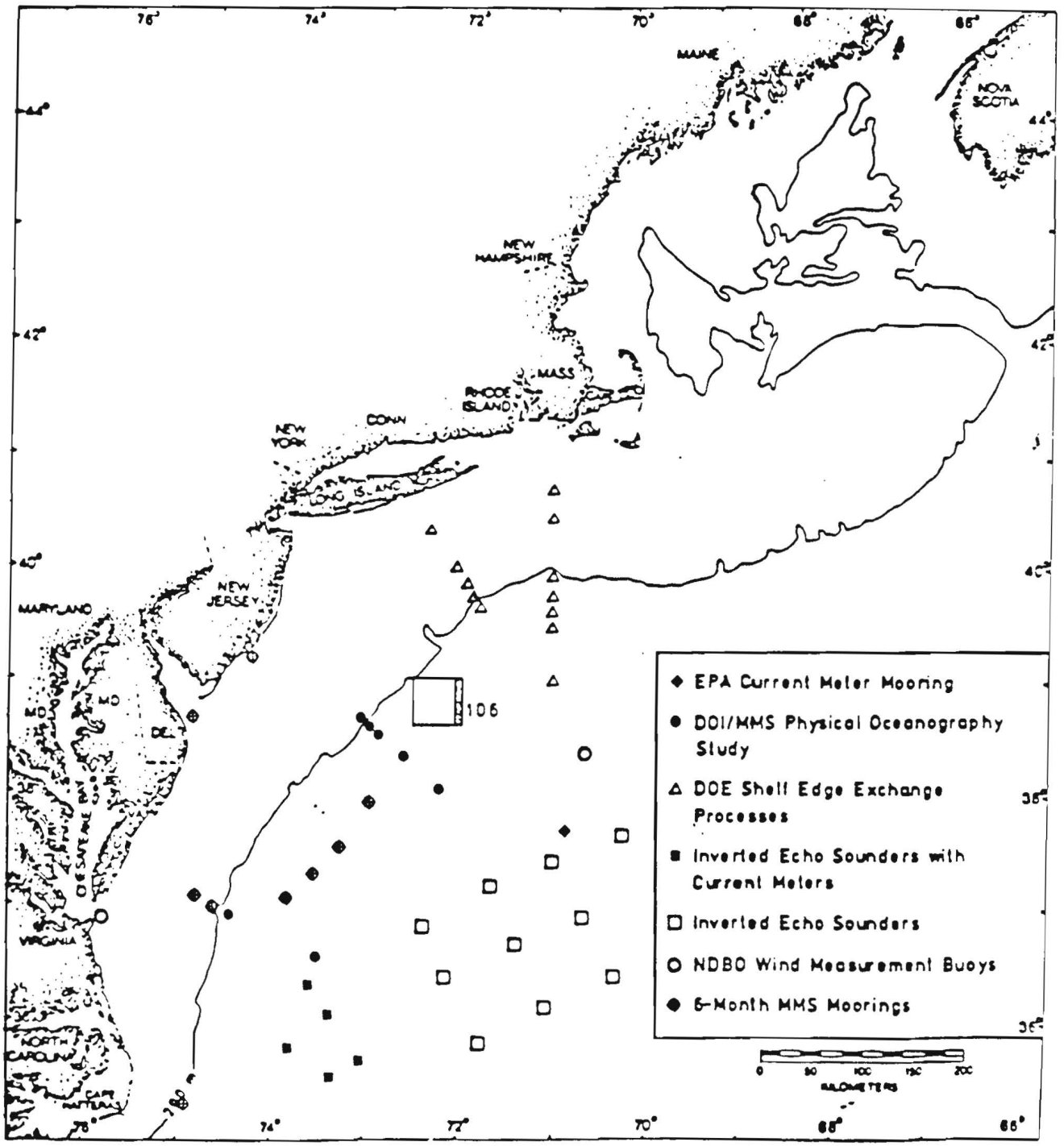
The Final Draft Monitoring Plan and monitoring reports are available from the USEPA Region II office in New York City.

Table 2.3. Summary of USEPA 106-mile site monitoring activities, 1984 to present

Activity/Date Survey/Ship/Date	Framework Within Monitoring Program: Site Baseline Information – Chemical	Site Baseline Information – Biological	Site Baseline Information – Physical	Tier 1 – Sludge Characteristics	Tier 1 – Disposal Operations	Tier 2 – Compliance Issues	Tier 2 – Nearfield Fate	Tier 2 – Short-Term Effects	Tier 3 – Farfield Fate	Tier 4 – Long-Term Effects
Survey										
OSV Anderson, 1984	■									
OSV Oceanus, 1986	■	■								
OSV Cyre, 1986	■	■								
OSV Anderson, 1986	■									
OSV Anderson, 1988	■		■							
Mooring, 1986 to 1987			■							
Survey										
OSV Anderson, 1987			■			■	■			
RV Endeavor, 1988			■			■	■			
OSV Anderson, 1988			■			■	■	■	■	
Mooring, 1989							■		■	
Development of Data Management Systems										
Historical Data, 1987		■	■	■						
Sludge Characteristics, 1988					■					
Disposal Operations, 1988						■				

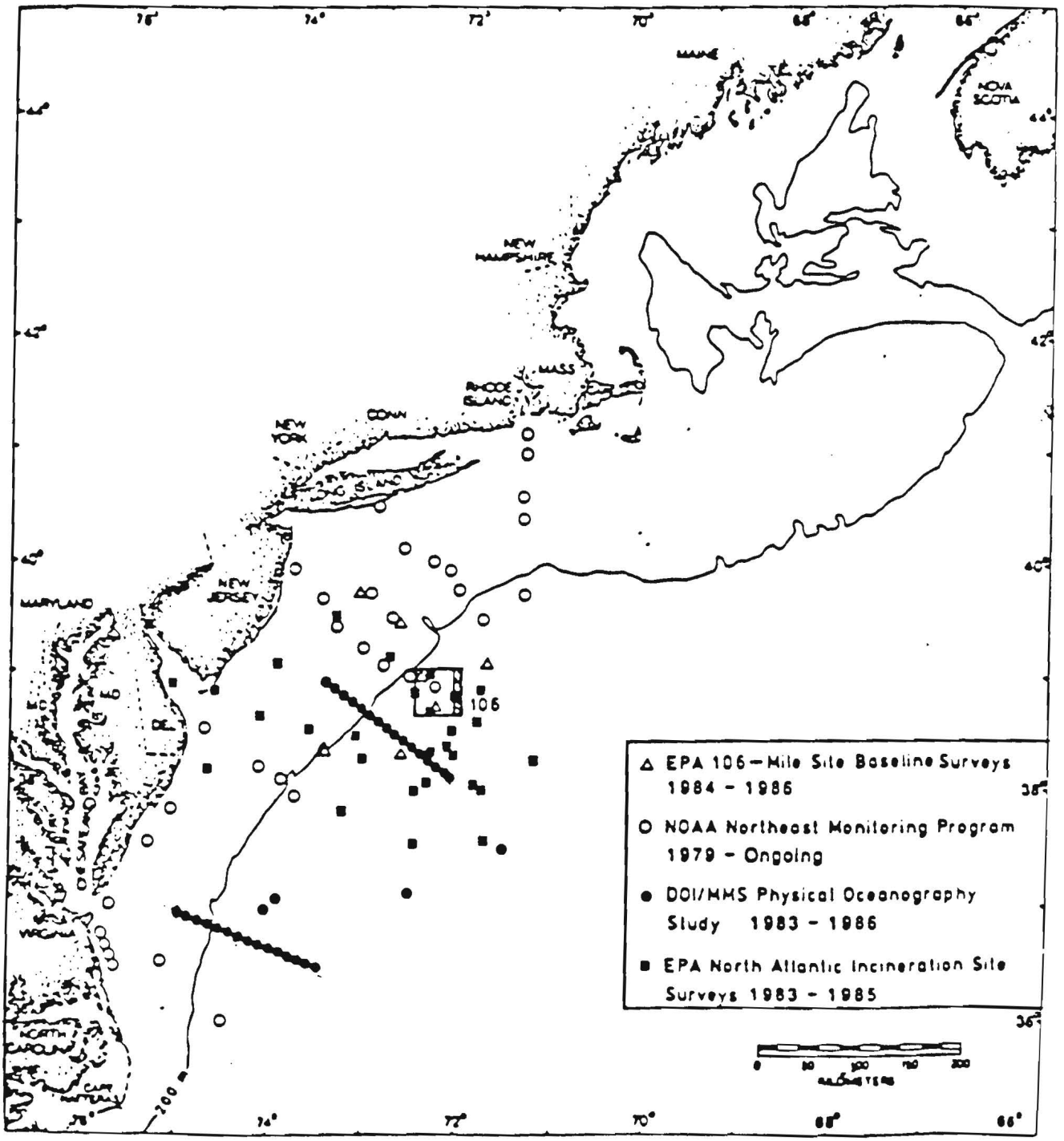
Source: Battelle, 1989

Figure 2.5. Chemical and microbiological constituents in sediments of the New York Bight



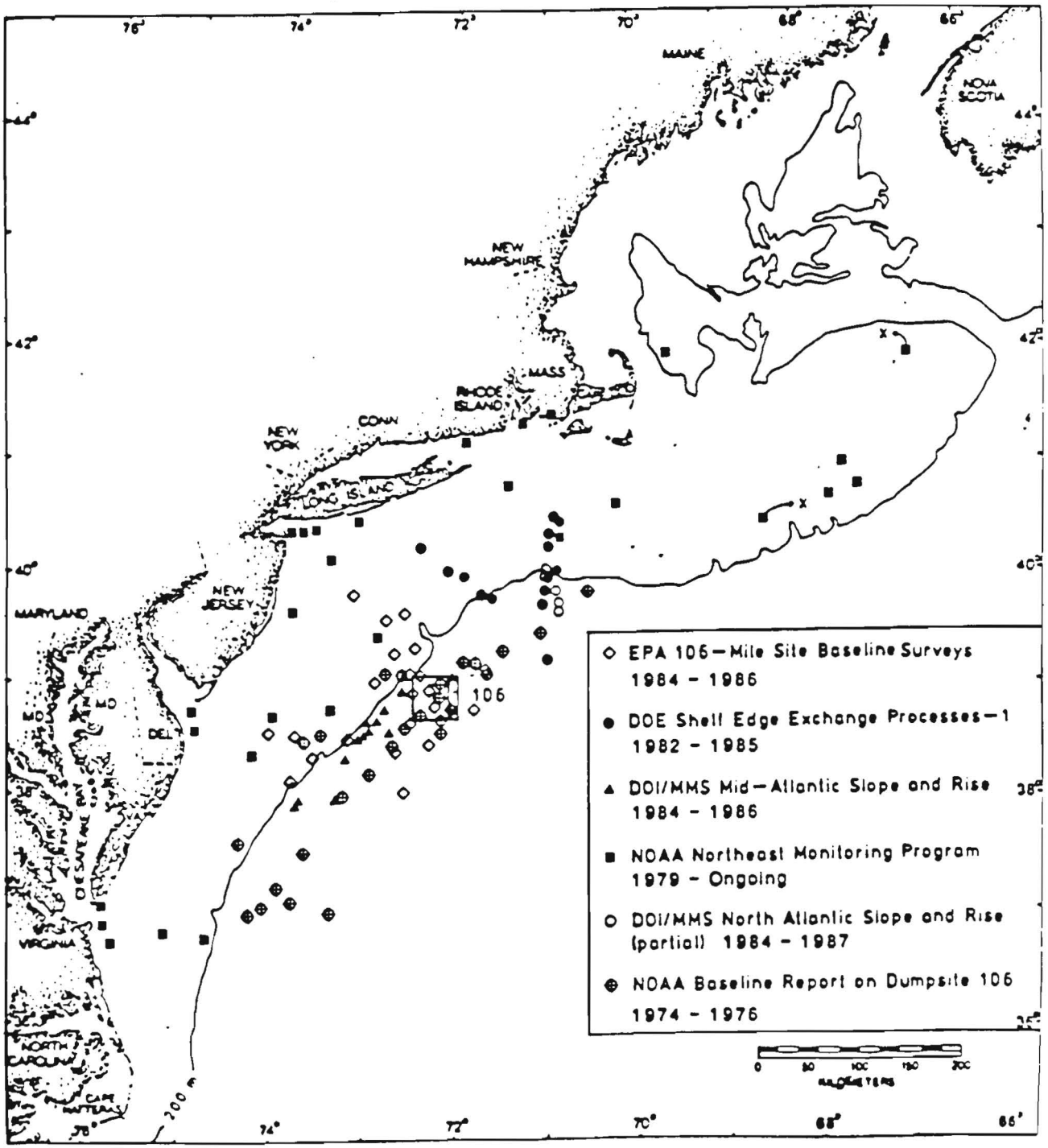
Source: Battelle, 1989

Figure 2.6. Water column studies conducted in the New York Bight



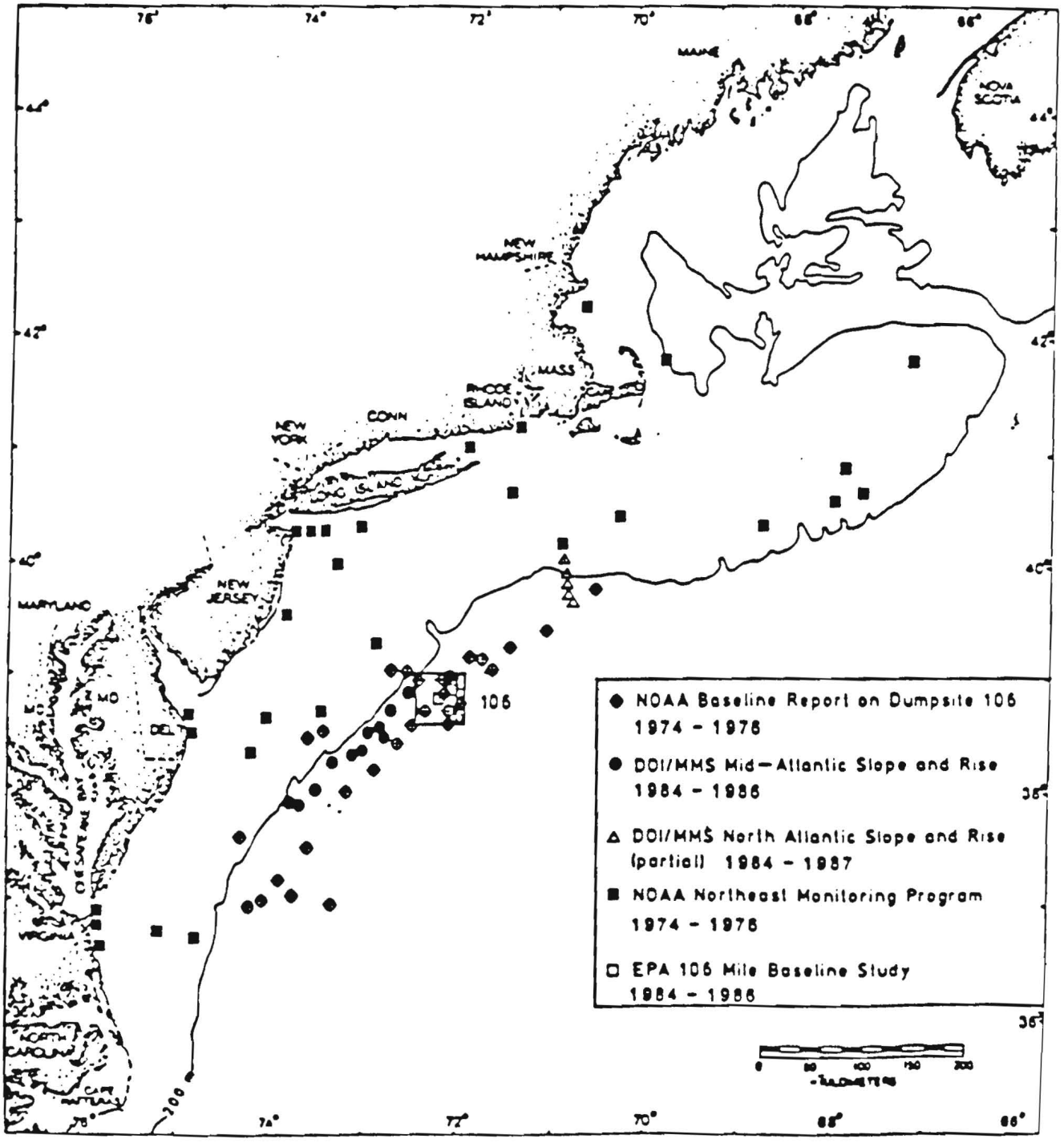
Source: Battelle, 1989

Figure 2.7. Baseline sediment chemistry studies conducted in the New York Bight



Source: Battelle, 1989

Figure 2.8. Benthic infauna studies conducted in the New York Bight



Source: Battelle, 1989

Title: New York Bight Water Quality Monitoring Program

Sponsor: US Environmental Protection Agency

In response to mandates put forth by the Marine Protection, Research and Sanctuaries Act of 1972, the Water Pollution Control Act Amendments of 1972 and 1977, and the Water Quality Act of 1987, the USEPA initiated the monitoring of water quality in waters adjacent to Long Island and New Jersey beaches in 1974.

• Monitoring program objectives

The current intensive summer monitoring program objectives are to enable predictions of environmental crises (eg. beach washups of floatable debris, anoxic conditions, etc.), investigate the origins of these crises, and direct any decisions concerning the protection of the water quality of the Bight.

• Parameters measured

Water samples are collected from surface and bottom waters at stations along the coasts of New Jersey and Long Island using the USEPA Huey helicopter. These samples are analyzed for dissolved oxygen (DO), temperature, salinity, fecal coliform and enterococcus bacteria, and phytoplankton (Table 2.4). In addition, water in the area of the closed 12-mile sewage dumpsite is periodically analyzed for viruses and pathogens.

In recent years, the program has been expanded to include the analyses of sediments for heavy metals and organic compounds, and the collection of benthic organisms for ecological studies. Sediment and benthic organism collections are made from the USEPA ships, the ANDERSON and the CLEAN WATERS.

• Frequency and duration of monitoring

When the New York Bight Water Quality program began in 1974, it was year-round monitoring effort. Due to budget constraints and several reassessments of the objectives of the program, it was modified to its present form of an intensive summer-only monitoring program. In particular, the environmental crises of 1976 (mass mortality of benthic organisms in Bight due to anoxic conditions and wash-up of debris on Long Island beaches), prompted the modification of the program so it would be more responsive to the needs of the general public, the states, the counties, and USEPA.

Sampling takes place five days per week from mid-May through October, and six days per week in July and August. The US Coast

Table 2.4. Parameters evaluated for the New York Bight Water Quality Monitoring Program

Parameters	L.I. & N.J. Beaches[1]	L.I. & N.J. Perpendiculars[2]	N.Y. Bight[2]	Bight Contingency[2]	Phytoplankton[1]
Fecal Coliform	X		X	X	
Enterococcus	X		X	X	
Salinity Chlorinity		X			
Temperature		X	X	X	
Dissolved Oxygen (DO)		X	X	X	
Total Phosphorus (TP)					X
Phosphate Phosphorus (PO_4-P)					X
Ammonia Nitrogen (NH_3-N)					X
Nitrite Nitrogen (NO_2-N)					X
Nitrate Nitrogen (NO_3-N)					X
Silica (SiO_2)					X
Plankton					X
Chlorophyll	X[3]	X[4]			

[1]Sample Depth: 1 meter below the surface
[2]Sample Depth: 1 meter below the surface and 1 meter above the ocean floor
[3]Long Island beaches only
[4]Long Island perpendiculars only

Source: Braun et al., 1988

Guard provides assistance for sampling on weekends. The sampling program for 1987, the last year for which a final report is available, is given in Table 2.5. Sampling in subsequent years remains essentially the same.

- Station locations

Five separate sampling networks are in place:

1) Beach station network - 26 L.I. coast stations and 40 NJ coast stations; bacteriological water quality data (Figs. 2.9, 2.10 and 2.11).

2) New York Bight station network - 20 stations in the inner NY Bight; chemical and bacteriological water quality data (Fig. 2.12).

3) Perpendicular station network - 12 transects extending from the Long Island and New Jersey coasts (3 transects from south of LI with 4 stations in each transect, and 9 transects extending east of NJ with 5 stations in each); DO and temperature (Fig. 2.13 and 2.14).

4) New York Bight Contingency network - 24 stations sampled for DO, temperature, and fecal coliform and enterococcus densities. The stations sampled are:
   NYB 20, 22, 24, 40, 42, and 44;
   LIC 09P, A, B, and C;
   LIC 14P, A, B, and C;
   JC 14E, G, I, K, and M;
   JC 27E, G, I, K, and M.
   Their locations are shown in Figures 2.12 and 2.13.

5) Phytoplankton sampling network - 54 stations sampled for phytoplankton identification and nutrient analysis. All LI coast and LI perpendicular stations and the following NJ stations are sampled:
   JC05, JC11, JC21, JC30, JC49, JC57,
   RB32, RB15, JC65, JC75, JC83, JC93
   JC75I, JC75M, JC85I, and JC85M.

- Data storage/availability

Annual reports describing each years New York Bight Water Quality Monitoring sampling program and the results obtained are available from the USEPA Region II office in New York City.

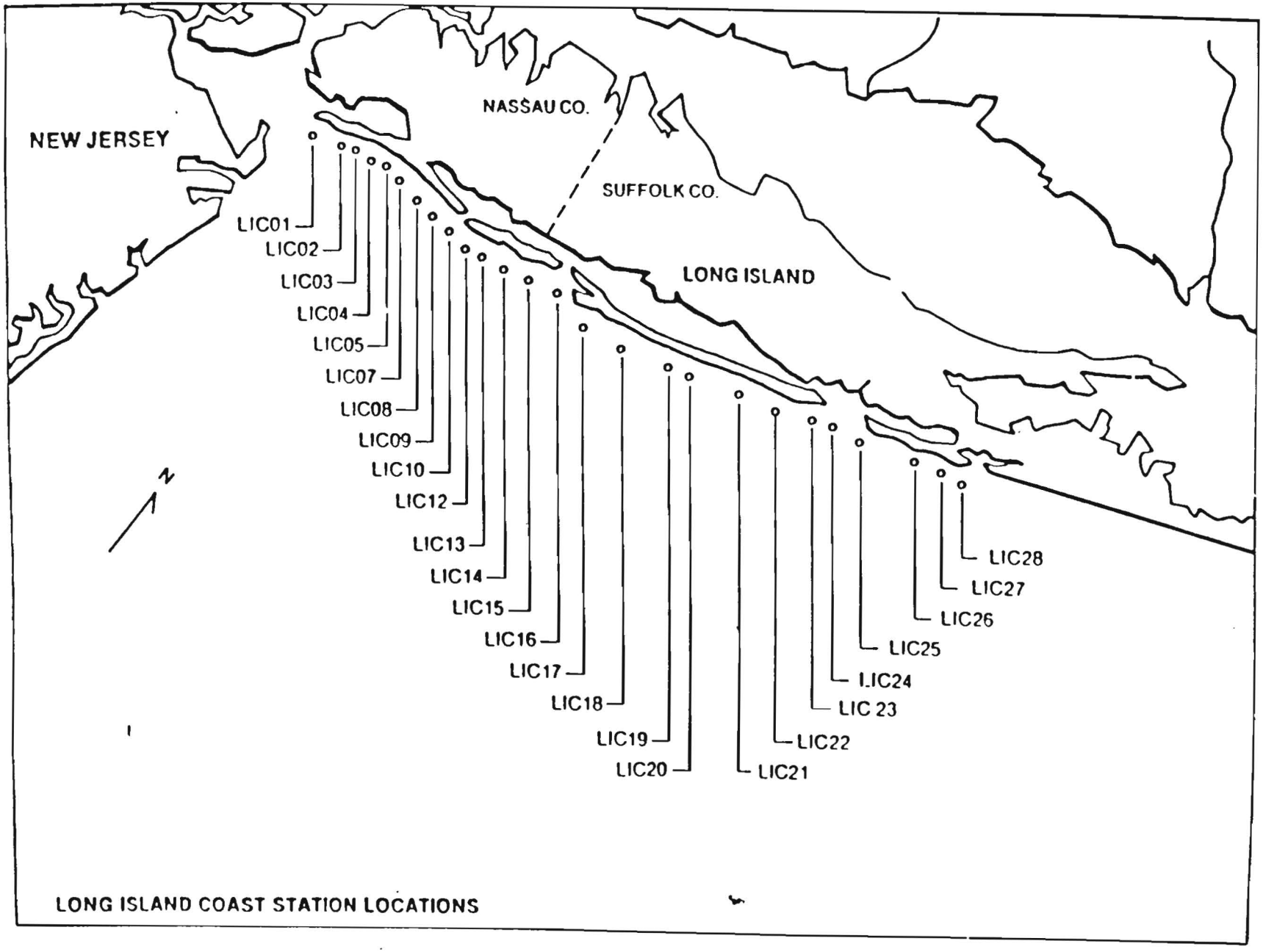
Table 2.5. Outline of 1987 sampling program for the New York Bight Water Quality Monitoring Program

Station Group	Frequency per Week	Parameter	Sample Depth
Long Island Beaches (Rockaway Pt. to Fire Island Inlet)	1	Bacteriological Phytoplankton Chlorophyll	Top[1]
Long Island Beaches (Fire Island Inlet to Shinnecock Inlet)	Bimonthly	Bacteriological Phytoplankton Chlorophyll	Top[1]
New Jersey Beaches (Sandy Hook to Cape May)	1	Bacteriological	Top[1]
Long Island Perpendiculars	1	Dissolved Oxygen Phytoplankton Chlorophyll Temperature	Top[1], Bottom[2]
North Jersey Perpendiculars (Long Branch to Seaside)	1	Dissolved Oxygen Temperature	Top[1], Bottom[2]
South Jersey Perpendiculars (Barnegat to Strathmere)	Bimonthly	Dissolved Oxygen Temperature	Top[1], Bottom[2]
Bight Contingency	2	Dissolved Oxygen Temperature	Top[1], Bottom[2]
Bight Contingency	1	Bacteriological	Top[1], Bottom[2]
Phytoplankton	1	Phytoplankton Chlorophyll[3] Nutrients[4]	Top[1]
Inner New York Bight	1	Bacteriological Dissolved Oxygen Temperature	Top[1], Bottom[2]

[1] One meter below the surface
[2] One meter above the ocean floor
[3] Long Island stations only
[4] New Jersey stations only

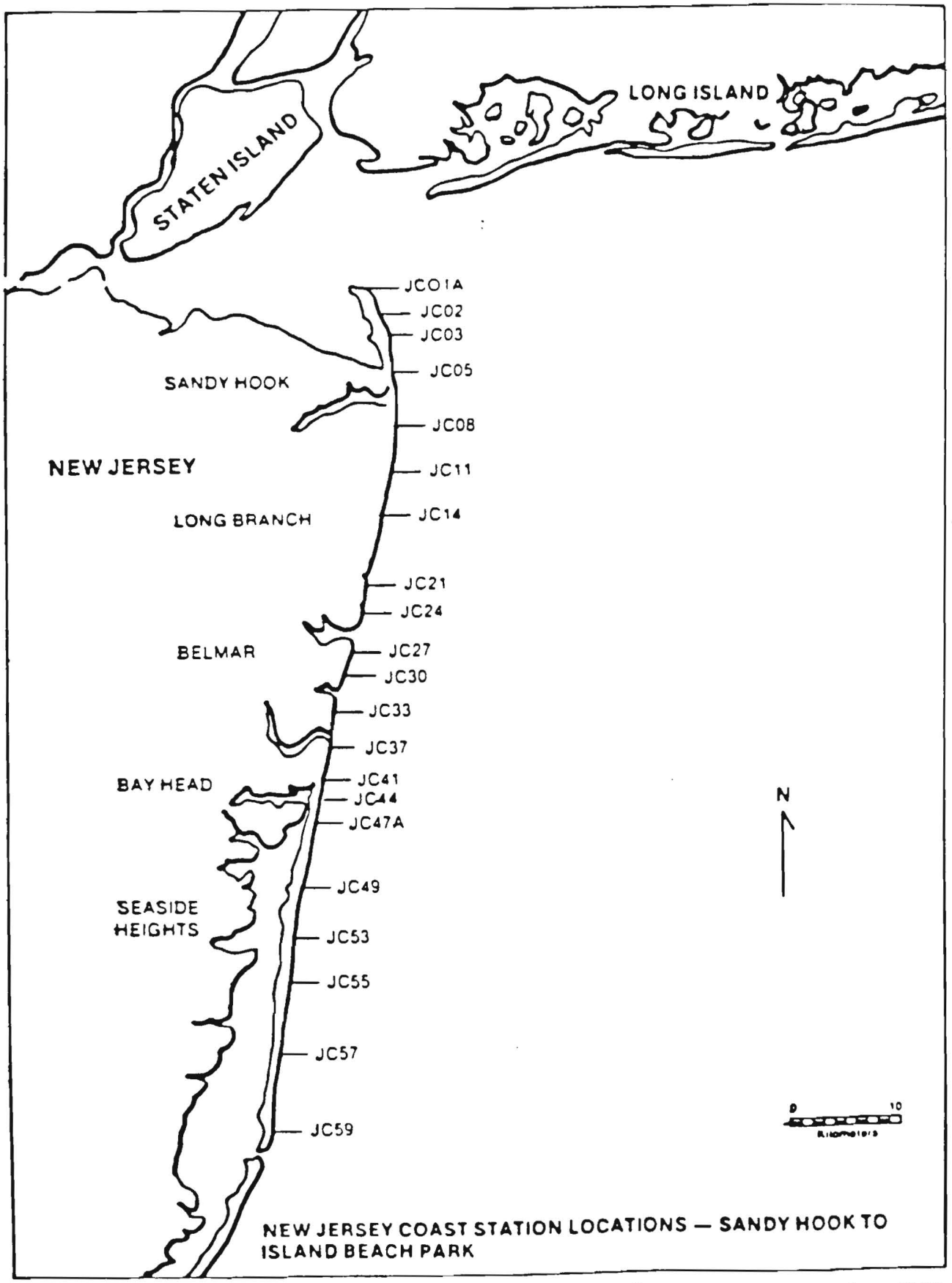
Source: Braun et al., 1988

Figure 2.9. New York Bight Water Quality Program Long Island coast station locations



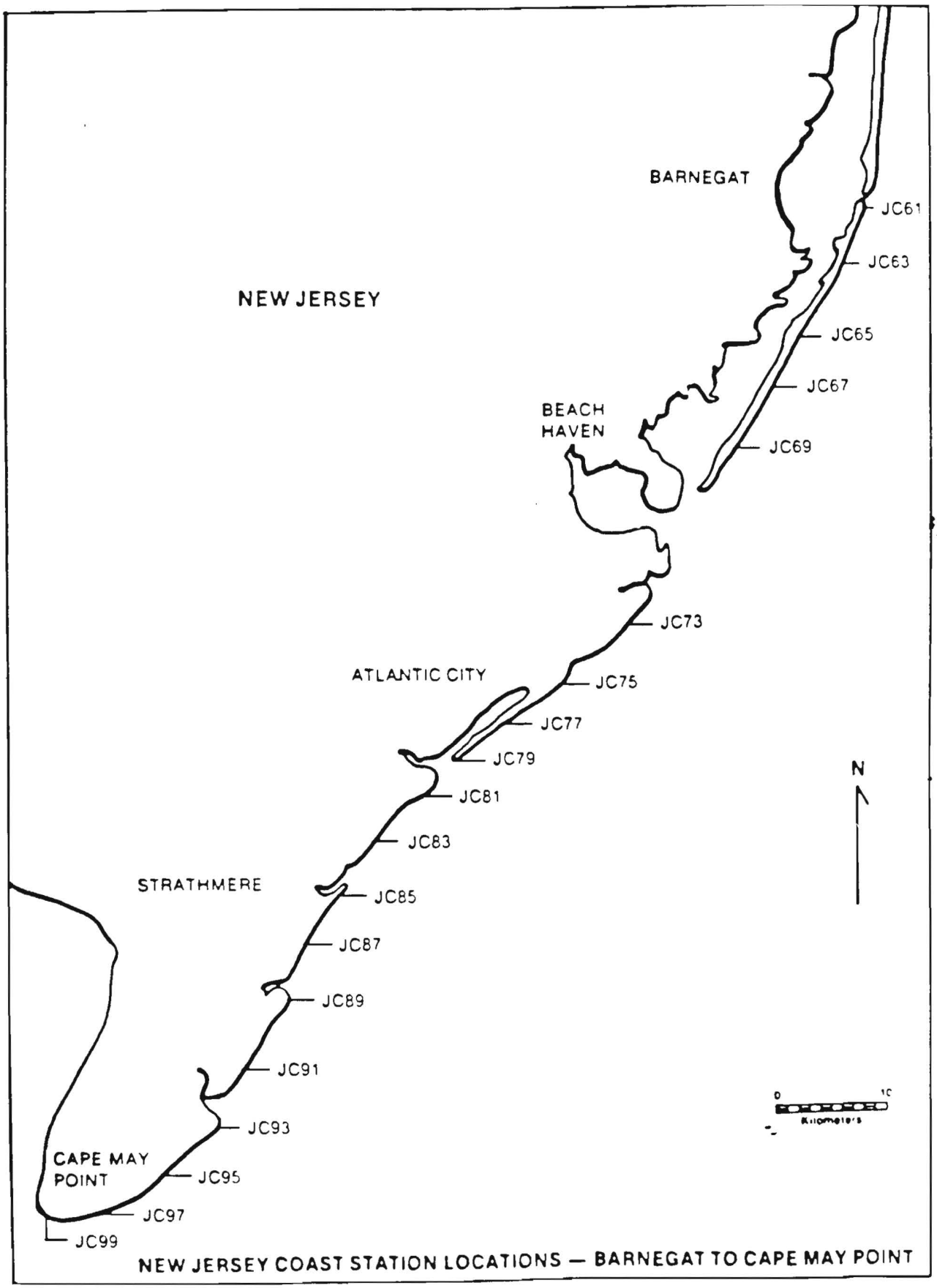
Source: Braun et al., 1988

Figure 2.10. New York Bight Water Quality Program New Jersey coast station locations - Sandy Hook to Island Beach Park



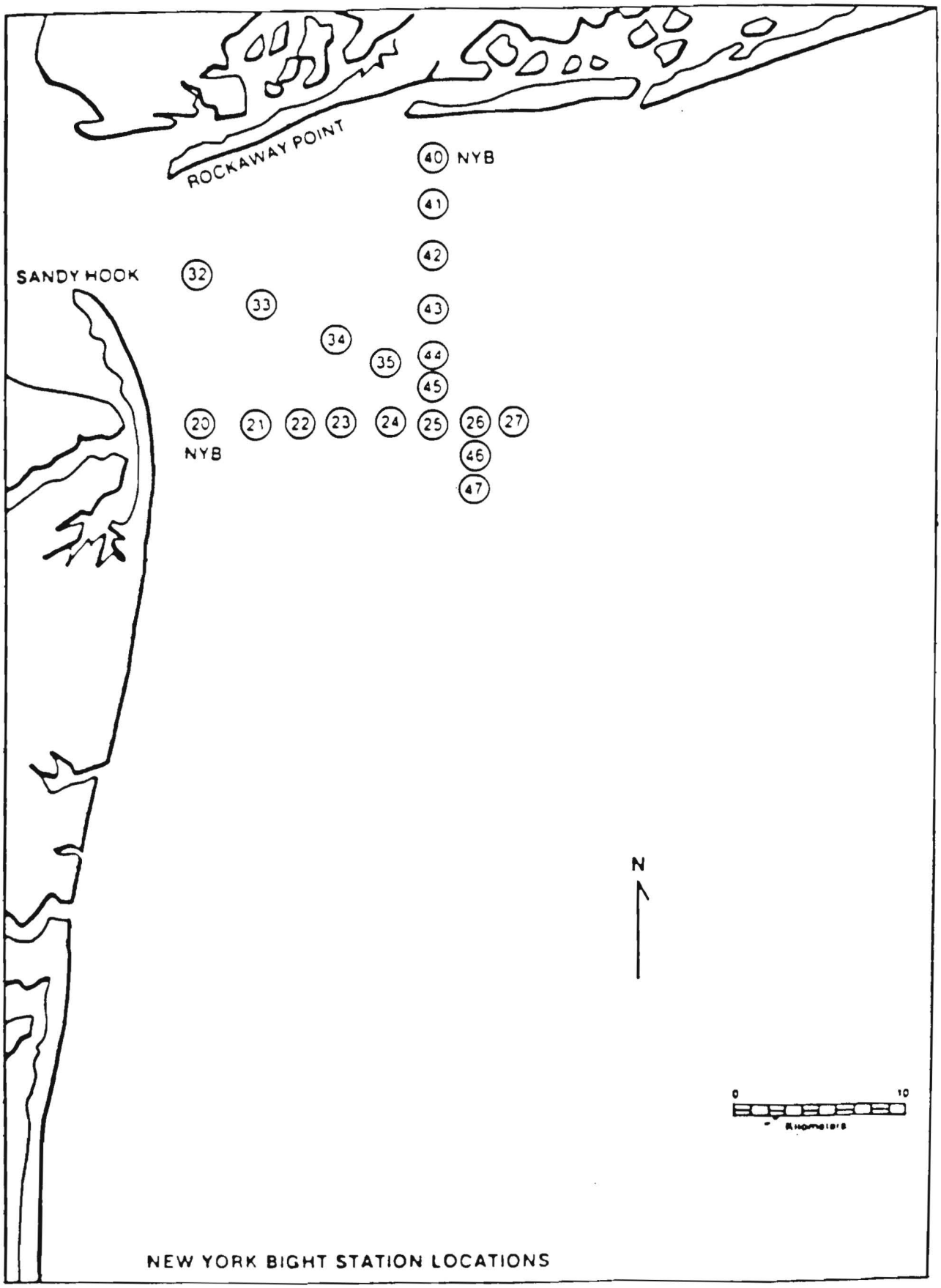
Source: Braun et al., 1988

Figure 2.11. New York Bight Water Quality Program New Jersey coast station locations - Barnegat to Cape May Point



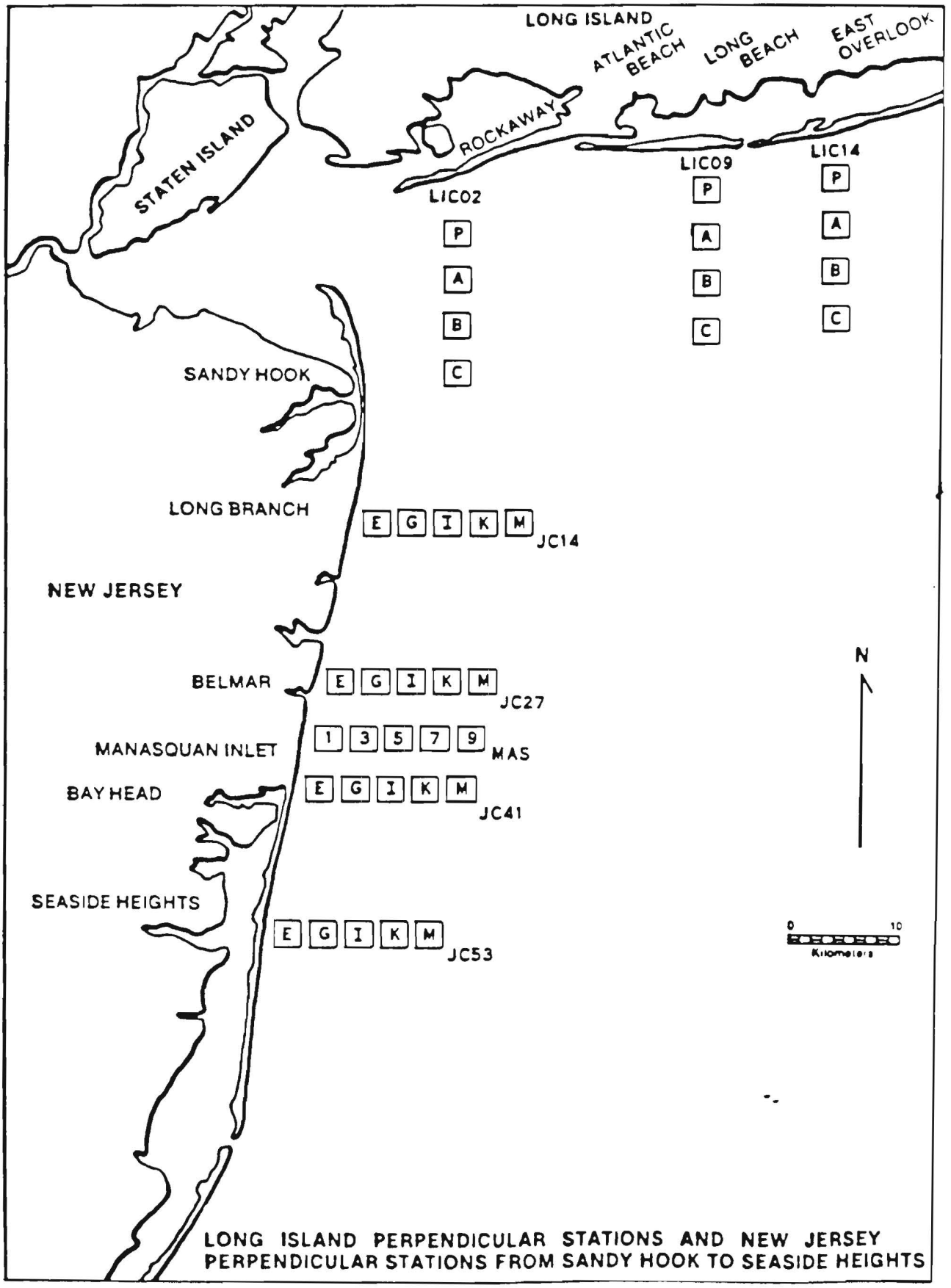
Source: Braun et al., 1988

Figure 2.12. New York Bight Water Quality Program New York Bight station locations



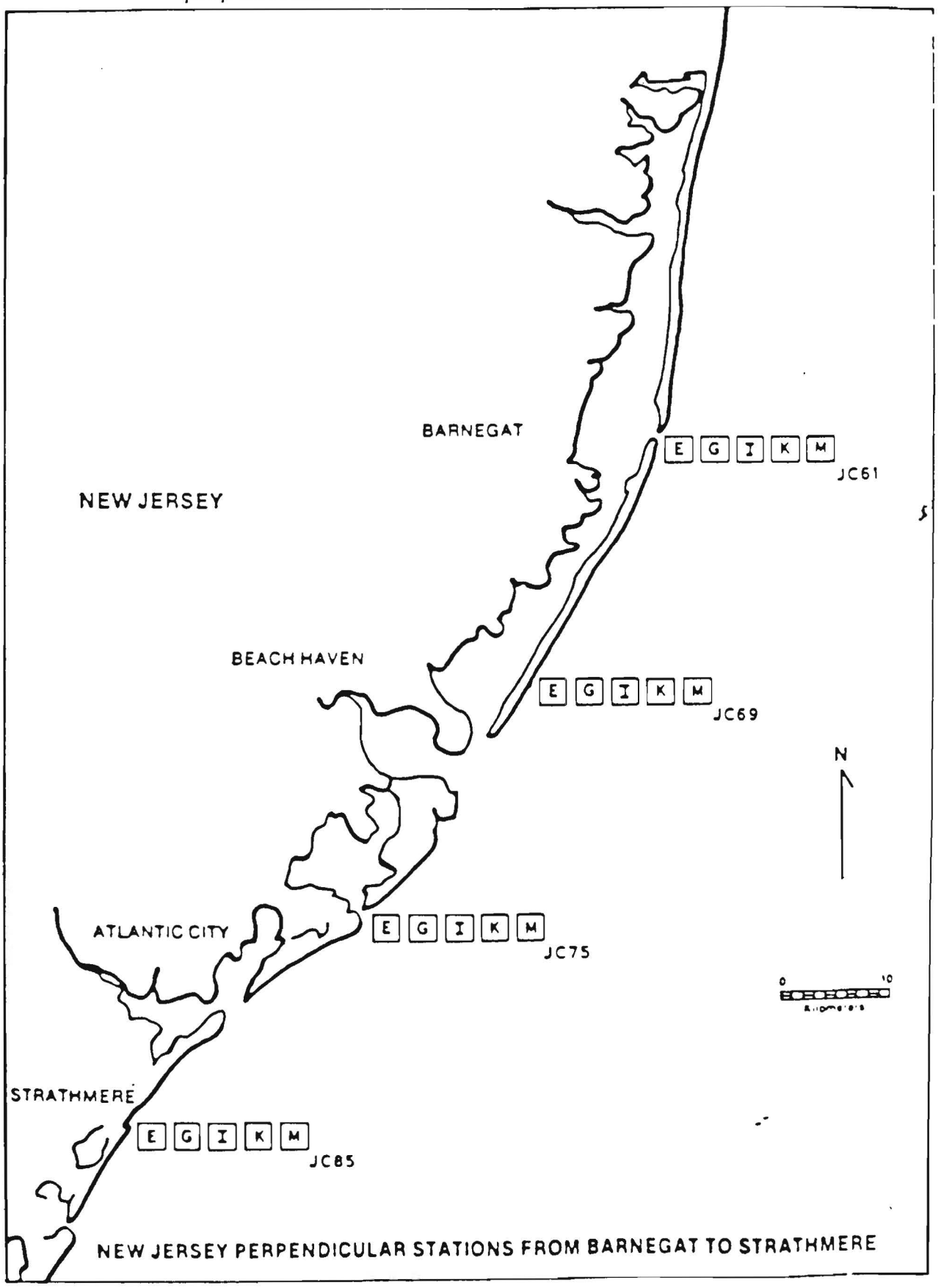
Source: Braun et al., 1988

Figure 2.13. New York Bight Water Quality Monitoring Program Long Island perpendicular stations and New Jersey perpendicular stations from Sandy Hook to Seaside Heights



Source: Braun et al., 1988

Figure 2.14. New York Bight Water Quality Monitoring Program New Jersey perpendicular stations from Barnegat Bay to Strathmere



Source: Braun et al., 1988

Title: New York Dredged Material Disposal Site Monitoring Program

Sponsor: US Army Corps of Engineers

The Dredged Material Disposal Site, or the Mud Dump Site, has been used for the disposal of dredged material from New York Harbor, channel deepening, and maintenance projects since 1914. A disposal limit of 100 million cubic yards has been established since the site was officially designated in June, 1984. Approximately six million cubic yards have been dumped since that time.

The current monitoring efforts at the Dredged Material Disposal Site have their roots in an experimental study undertaken in 1980 which sought to determine the effectiveness of containing contaminated dredged material with a cap of clean sand. Bathymetric surveys, sub-bottom profiles, and REMOTS® sediment-profile imagery developed in 1986 for that program have been subsequently employed in routine compliance monitoring efforts.

Two related monitoring projects are undertaken by the COE in the Bight. The first is a verification of navigation buoys in the dredged material dumpsite. The other is a reporting log of all dumping activity at the dumpsite.

• Monitoring program objectives

Provide accurate bathymetric information on the lineaments of the dredged material dumpsite and describe the physical and biological conditions around its perimeter. Because dredged material is regarded as an acceptable waste using existing criteria, ecological and chemical monitoring are not deemed necessary.

The buoy position establishment and verification program confirms that the three navigation buoys marking the different dumping areas within the dumpsite are in their proper locations to ensure effective site management.

Reporting logs maintain a record of all dumping activity at the dumpsite.

• Parameters measured

Two procedures employed for the experimental study, precision bathymetric surveys and sub-bottom profiling, are currently used in regular monitoring at the dumpsite. The other technique, REMOTS® sediment profiling, is periodically used when needed, and will be briefly described since proposals have been submitted to institute its continuous use.

Survey activities:

1) Precision Bathymetric Surveys - A fathometer measures water depth at an array of stations to provide a contoured depth chart of the area.

2) Sub-bottom Profiling - Permits the characterization of different sediment types by size (eg. sand, silt) and the plotting of both vertical and horizontal distributions of these sediments.

3) REMOTS® Sediment Profile Imagery - Utilizes a camera to obtain in situ profile images of the top 15-20 cm of sediment. The following parameters can be estimated using the REMOTS® system:

   a) grain size
   b) surface boundary roughness
   c) mud clast presence - abundance, distribution, oxidation state, and shape of mud clasts can be used to make inferences about recent seafloor disturbances.
   d) apparent redox potential discontinuity depth - an indicator of biological mixing depth, infaunal succession status, and within-station patchiness.
   e) presence of sedimentary methane
   f) presence of epifauna
   g) organism-sediment index - characterizes habitat quality in terms of disturbance frequency

Buoy position establishment and verification program:

1) LORAN position of three buoys in the dumpsite

Reporting log:

1) Users of the dumpsite are required to telephone the COE Water Quality Compliance Branch daily with the following information:

   a) permit or contract number
   b) name
   c) volume of dredged material dumped
   d) description of material
   e) time of arrival at dumpsite
   f) time of departure from dumpsite
   g) tugboat name
   h) scow number
   i) buoy destination

2) Written logs describing monthly dumping activities are also required of dumpsite users.

• Frequency and duration of monitoring

The Water Quality Compliance Branch of the US Army Corps of Engineers (COE) oversees monitoring at the dumpsite. A final monitoring plan, calling for annual monitoring cruises, was submitted to the USEPA in January, 1989.

The buoy position verification program confirms the position of the three buoys on a weekly basis, subject to change.

Reporting logs of dumping activity are available on a computerized data base dating to 1976. However, the current telephone reporting system has been in place only since November of 1988.

• Station locations

The survey lanes used in the 1986 survey are shown in Figure 2.15. The REMOTS® stations for the same survey are presented in Figures 2.16 and 2.17. Stations are determined as needed for the surveys.

• Funding

Federal funds of $150,000 per year are usually allocated for this project, subject to change.

• Data storage/availability

A computer data base has been established containing site data. Also, written interpretive reports are available from the COE. Data originating from different contractors are currently stored in various formats. Attempts are currently underway to standardize methods used by contractors to assure the compatibility of future data.

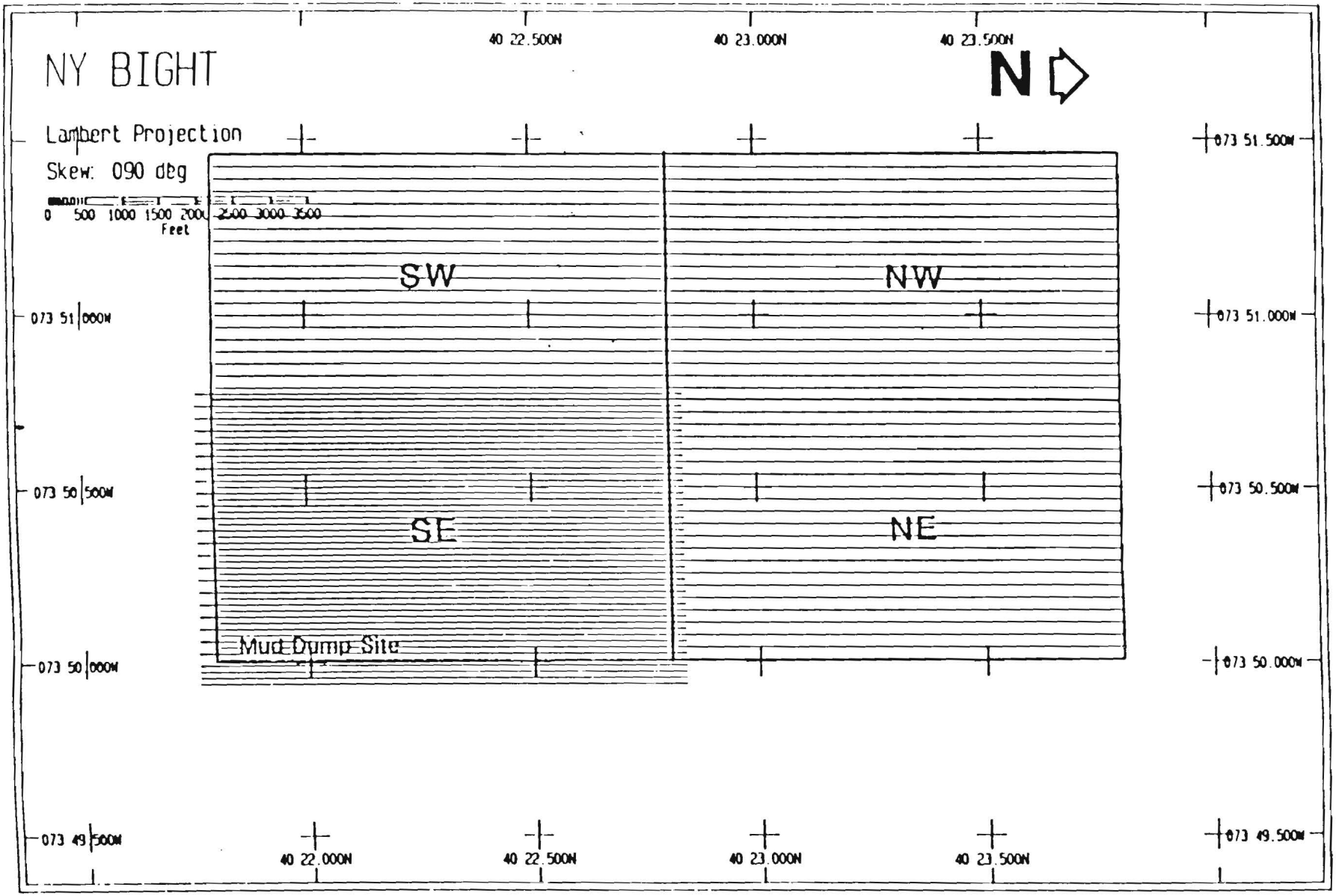


Figure 2.15 Survey lanes used for the precision bathymetric survey.

Source: Parker and Valente, 1988

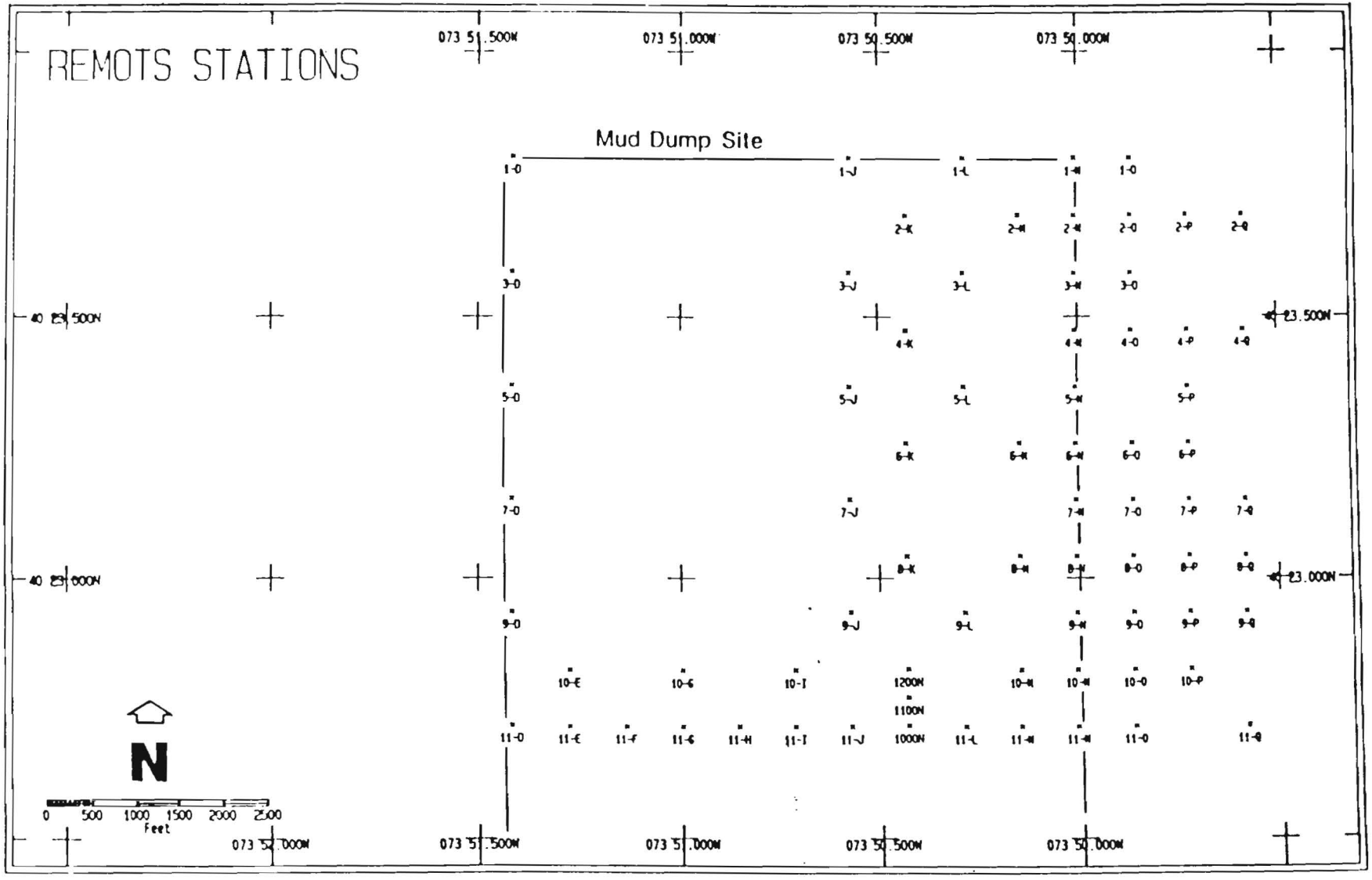


Figure 2.16. Locations and designations of REMOTS® stations in the northern half of the New York Mud Dump site.

Source: Parker and Valente, 1988

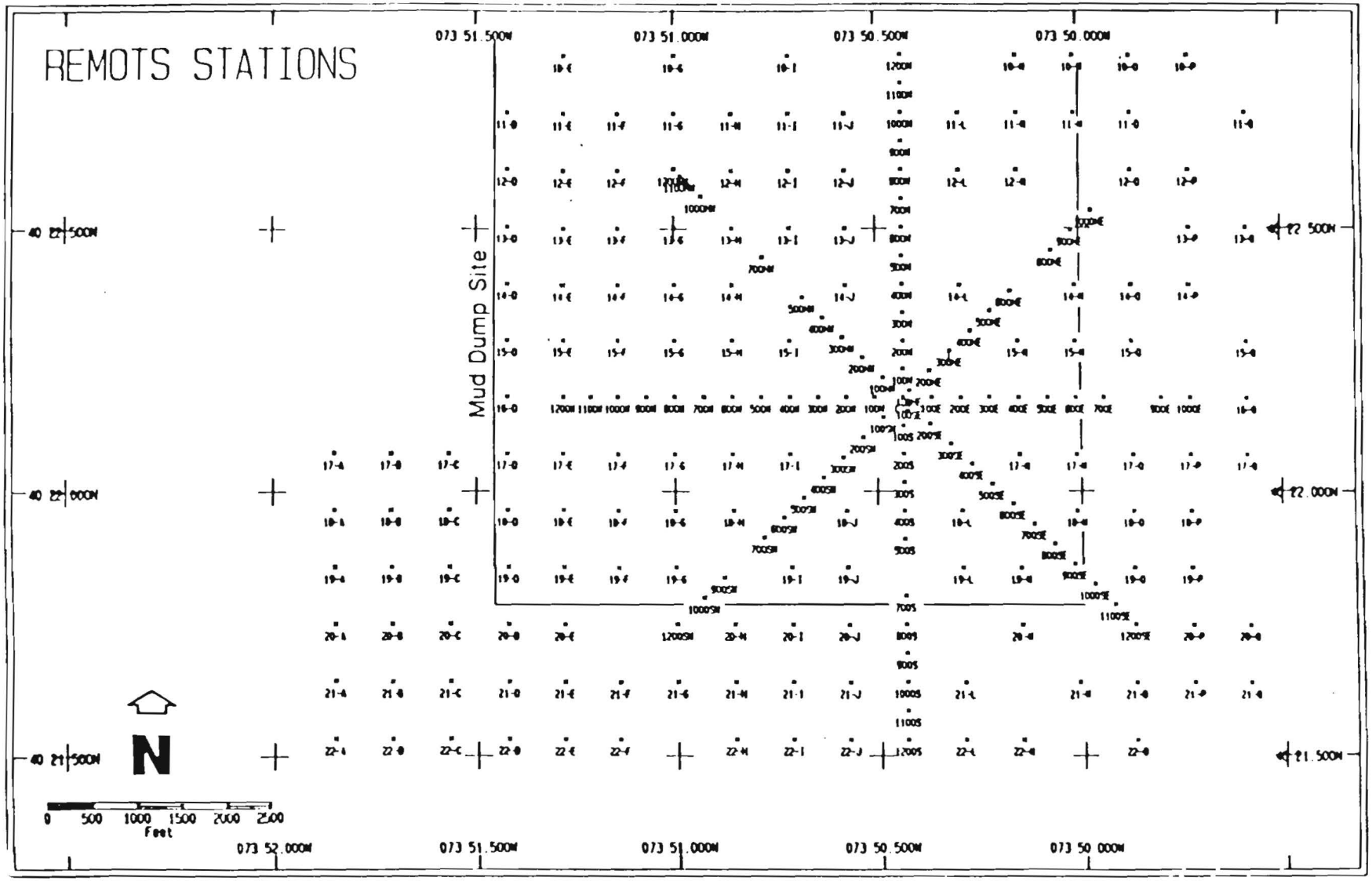


Figure 2.17. Locations and designations of REMOTS® stations in the southern half of the New York Mud Dump site.

Source: Parker and Valente, 1988

Title: Cellar Dirt Site

Sponsor: US Environmental Protection Agency

The Cellar Dirt Disposal Site (Fig. 2.18) has been used for the disposal of excavation dirt, rubble, rock, concrete, and construction debris since 1940. The USEPA began issuing disposal permits in 1973 and formally designated the site as a permanent dumpsite in 1983.

The site has been used infrequently since 1980, and currently only one permittee is actively dumping. Port Liberte Partners from New Jersey have disposed of approximately 17,450 cubic yards of material since 1986.

The USEPA has proposed that the site be de-designated upon the expiration of Port Liberte's permit because viable land-based disposal alternatives for this type of material are available. The USEPA anticipates the site de-designation process to be complete by the end of 1990.

• Monitoring program objectives

Assure that environmental impacts resulting from the disposal of cellar dirt material will be minimal and that the dumping operations will be conducted in a safe and controlled manner.

• Parameters measured

The volume of material dumped daily must be reported to the USEPA by both the waste generator and the transporter. Quarterly waste characterization data must also be submitted. Other analyses may be requested at the discretion of the USEPA.

• Frequency of monitoring

A monitoring program consisting of four parts must be implemented by the waste generator:

1) Baseline survey before commencement of dumping operations to assess site conditions;

2) Within 30 days of the end of dumping at the site, a second survey must be conducted to assess short-term impacts of the activity.

3) A third survey, conducted within six to twelve months of the final dumping event, must be

completed to assess long-term environmental impacts.

4) Compliance surveys are required each summer to monitor the effects of a typical ocean dumping event.

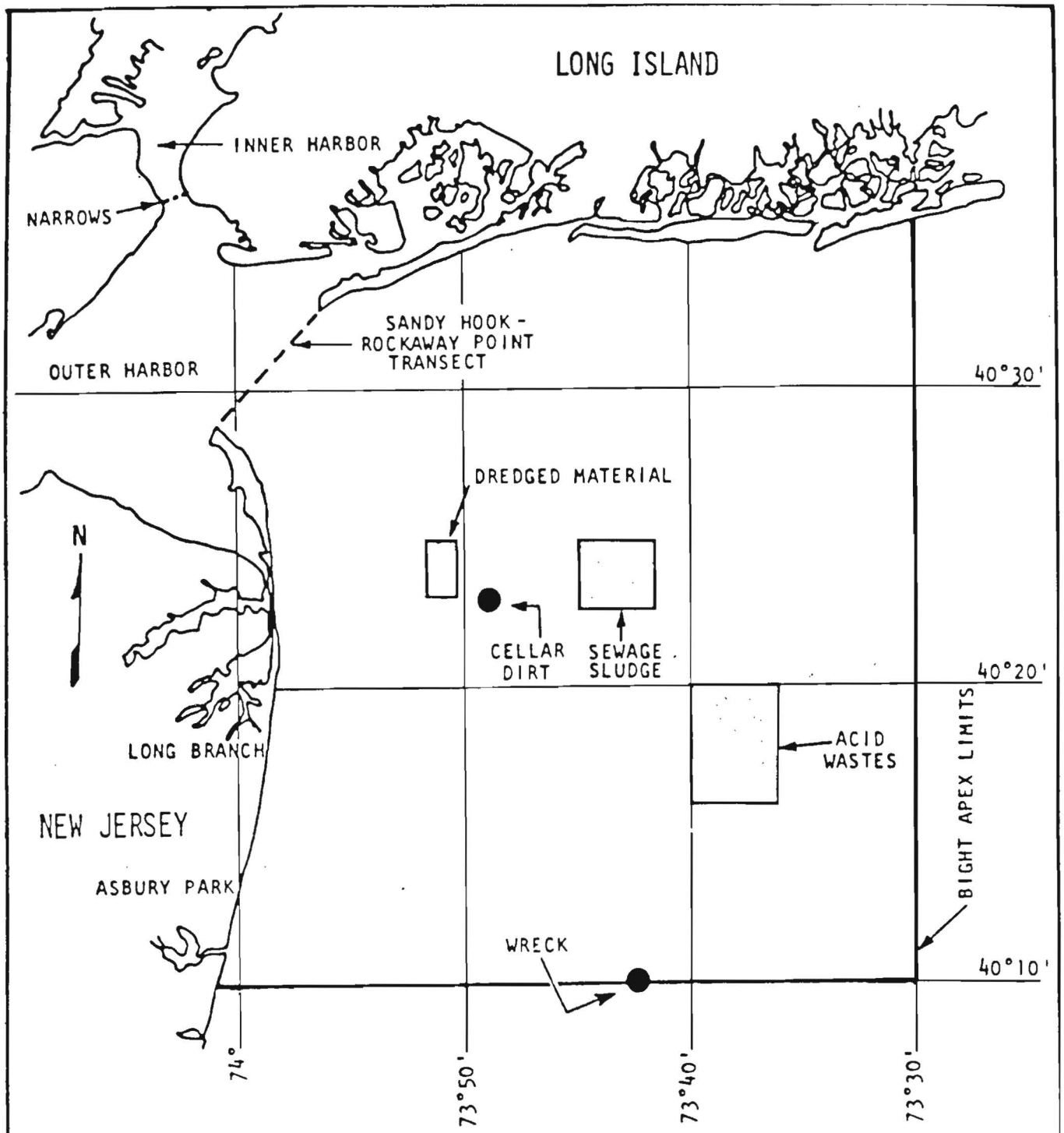
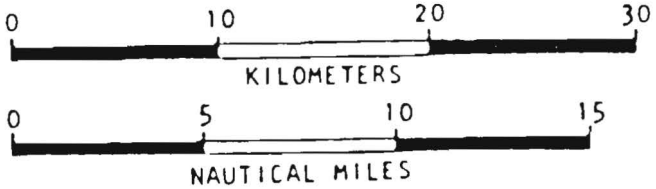


Figure 2.18

BIGHT APEX AND EXISTING DUMP SITES

Source: Braun et al., 1988



Title: New York Bight Woodburning Site

Sponsor: US Environmental Protection Agency

Floating wood debris collected from the port of New York and New Jersey, as well as wood salvaged from deteriorating waterfront structures, has been burned at a site 17 nautical miles east of Point Pleasant, New Jersey, since the mid-1960s.

Because the site is currently designated only on an interim basis, the USEPA issued a notice of intent in 1983 to prepare an Environmental Impact Statement (EIS) to formally designate a woodburning site. The current site and three alternative sites are under consideration. Release of the final EIS, expected in 1989, was postponed pending the results of air and water quality impact studies.

Approximately 340,000 tons of wood have been burned between 1973 and 1987, with the US Army Corps of Engineers accounting for about 70% of the total. New York City and the Weeks Stevedoring Company are the only other parties with permits to use the site.

• Monitoring program objectives

Assure that environmental impacts resulting from burning of wood debris will be minimal and that the burning operations will be conducted in a safe and controlled manner.

• Parameters measured

For the recently completed air and water quality impact studies, a waste characterization was performed to determine the concentrations of various metals, organohalogens, PCBs, and creosote. The same parameters were measured in air and water samples collected during a burning operation.

Permittees are required to perform a waste characterization for each specific project and to report to the US Coast Guard and the USEPA before any woodburning operation. The Coast Guard, which has primary surveillance responsibility, conducts pre-departure inspections of the barges. An independent USEPA-approved shiprider must be present for 24-hour a day surveillance of the burning operation. The shiprider is required to submit a written report upon returning to port.

In addition, USEPA provides aerial surveillance support when a helicopter is available and New Jersey Department of Environmental Protection (NJDEP) provides occasional surveillance support from marine police boats.

- Frequency and duration of monitoring

Surveillance and compliance monitoring activities are operative for the entire burning season. (A moratorium on woodburning is in effect between Memorial and Labor Days.) Records documenting activities at the woodburning site were first compiled in 1973.

Title: Marine Resources Monitoring, Assessment and Prediction (MARMAP)

Sponsor: National Oceanic and Atmospheric Administration

The Marine Resources Monitoring, Assessment and Prediction (MARMAP) Program is a comprehensive fishery ecosystem monitoring program utilizing a series of mesoscale plankton surveys. Tar and other marine debris are also collected and subsequently archived during surface water sampling.

• Monitoring program objective

The main objective of MARMAP is to pictorially summarize survey results pertaining to the principal fish larvae found in the coastal waters of the northeast United States. A secondary goal is to catalog and archive marine tar and debris that is collected during routine sampling runs as part of the MARMAP Pelagic Tar Survey.

• Parameters measured

Estimations of the spatial patterns of distribution, abundance, production, and mortality of fish eggs and larvae are made in addition to measurements and/or collections of neuston (surface organisms), zooplankton, phytoplankton, chlorophyll a, temperature, and salinity. Ichthyoplankton data are also used to derive fishery-independent estimates of adult spawning biomass.

Floatable debris, such as tar balls and plastic, are separated from the biological samples collected in the neuston net. However, no analyses of these materials has been completed due to a lack of funding.

• Frequency and duration of monitoring

The MARMAP survey fisheries data are tabulated and charted for the period from winter, 1977 to spring, 1984. Surveys are conducted at monthly to bimonthly intervals.

Collection of floatable debris through MARMAP began in 1972. Samples from two cruises each year are available for at least 10 years.

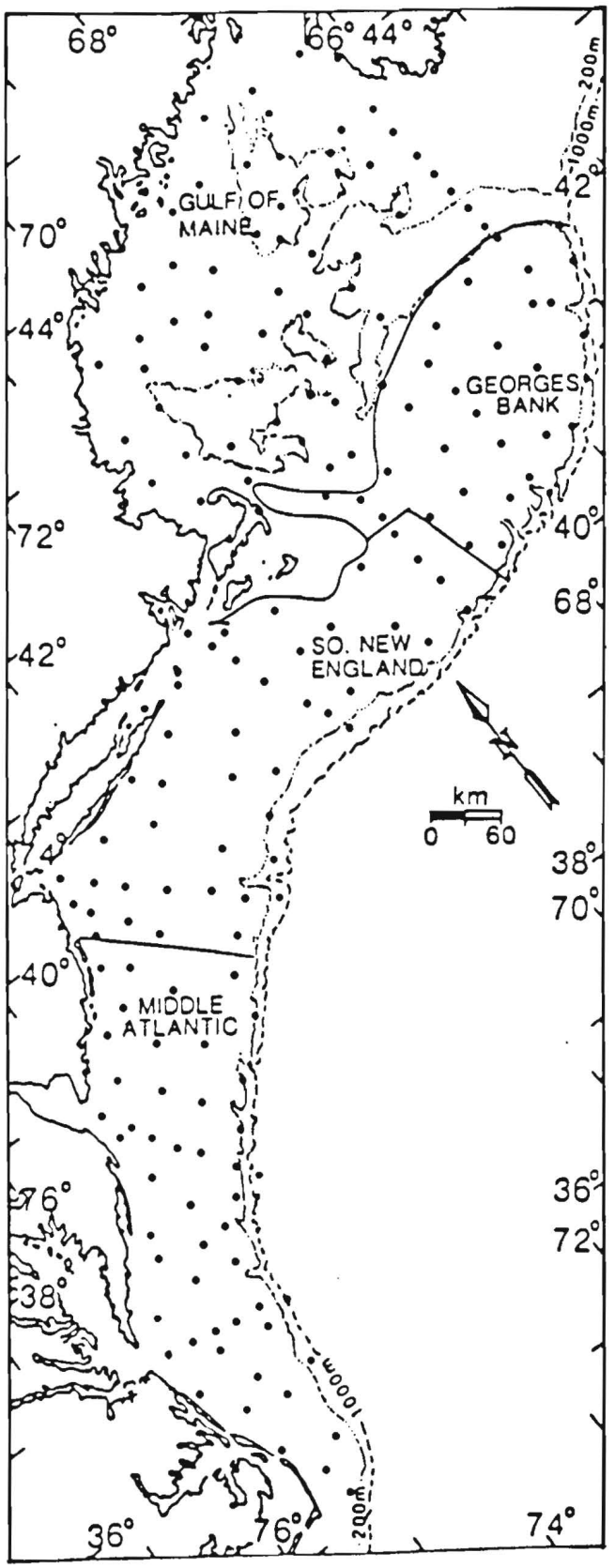
• Station locations

The MARMAP Program covers an area from Cape Hatteras, NC to Cape Sable, Nova Scotia, including the New York Bight (Fig. 2.19).

• Data storage/availability

Fisheries data are published in a set of NOAA Technical Memoranda available from the National Marine Fisheries Service (NMFS). Pelagic debris samples are stored in the Northeast Fisheries Center of the NMFS in Woods Hole, MA.

Figure 2.19. Standard station plan and four subareas for MARMAP, NEFC ichthyoplankton surveys



Source: Morse et al., 1987

Title: Bottom Trawl Survey Program

Sponsor: National Oceanic and Atmospheric Administration,
National Marine Fisheries Service

The Northeast Fisheries Center of the National Marine Fisheries Service in Woods Hole, Massachusetts, conducts regular fisheries assessment surveys of the northeastern United States.

• Monitoring program objectives

Monitor trends in abundance and distribution of finfish and invertebrate resource species, determine age and size composition of populations of those species, and learn more about their biology and ecology to facilitate sound fisheries management decisions.

• Parameters measured

After the bottom trawl is hauled back, the catch is sorted by species and each is weighed to the nearest 0.1 kg. In addition, the following measurements are made:

finfish	length (fork length for most species)
rays	wing width
lobsters	carapace length
crabs	carapace width
scallops	shell height
squids	mantle length
shrimp	weight only

Ageing samples (ie. scales and/or otoliths) are also taken for approximately 26 species. Sex and maturity information is recorded and observations of disease are noted. Stomach contents of some species are examined for predator/prey studies. Specimens may also be preserved for later studies by researchers in other agencies and academic institutions.

At one-third to one-half of the stations, a temperature profile of the water column is taken using an expendable bathythermograph (XBT).

• Frequency and duration of monitoring

Autumn surveys have been conducted since the program began in 1963. Spring surveys were instituted in 1968. Surveys during the summer and winter have been conducted sporadically.

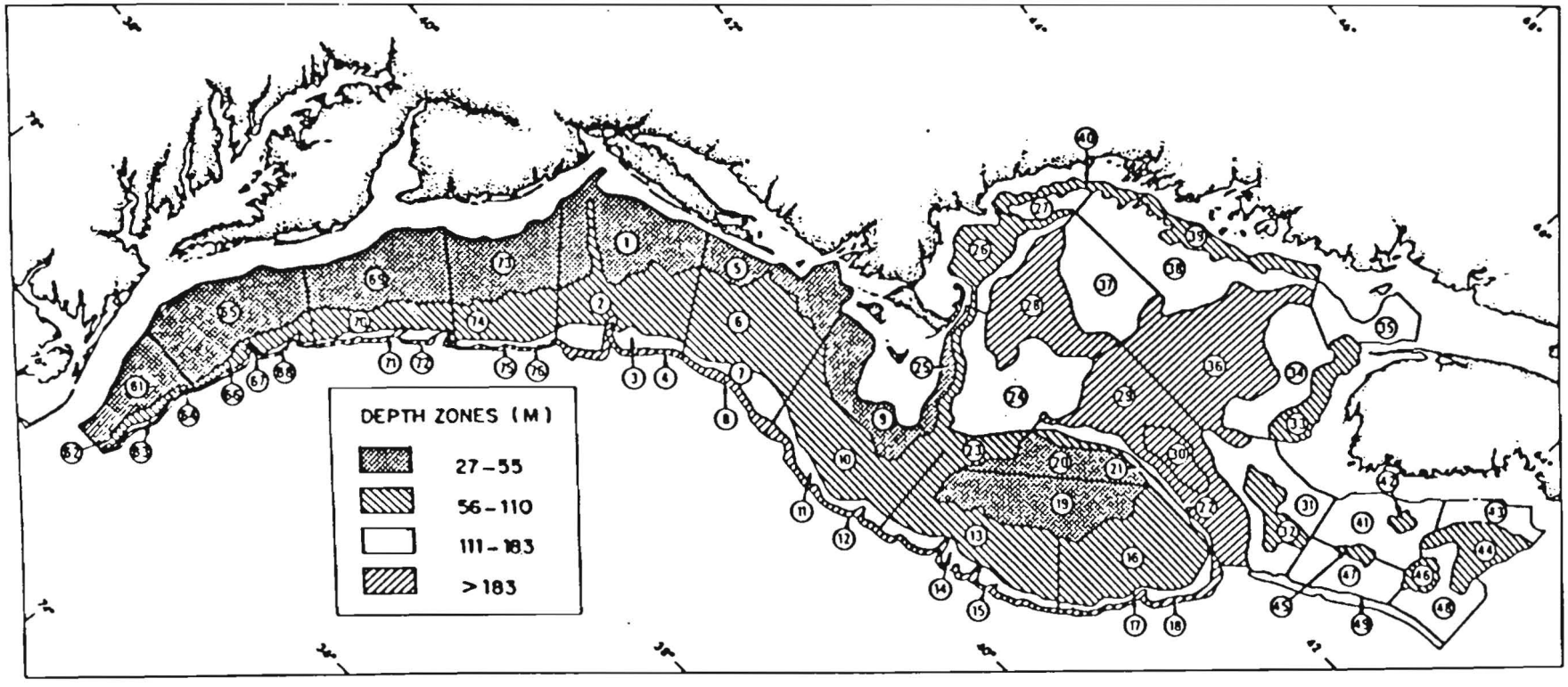
• Station locations

The survey covers the waters of the northeastern United States from Maine to North Carolina. The sampling areas are divided into two strata: inshore and offshore. Each stratum is subdivided into smaller rectangular units and a random number generator is employed to choose the exact location of each station within the strata. Figure 2.20 shows that group of inshore strata sampled in which the New York Bight is included. Figure 2.21 shows the strata sampled on offshore bottom trawl surveys. Typically, between 350 and 400 stations are occupied during each survey.

• Data storage/availability

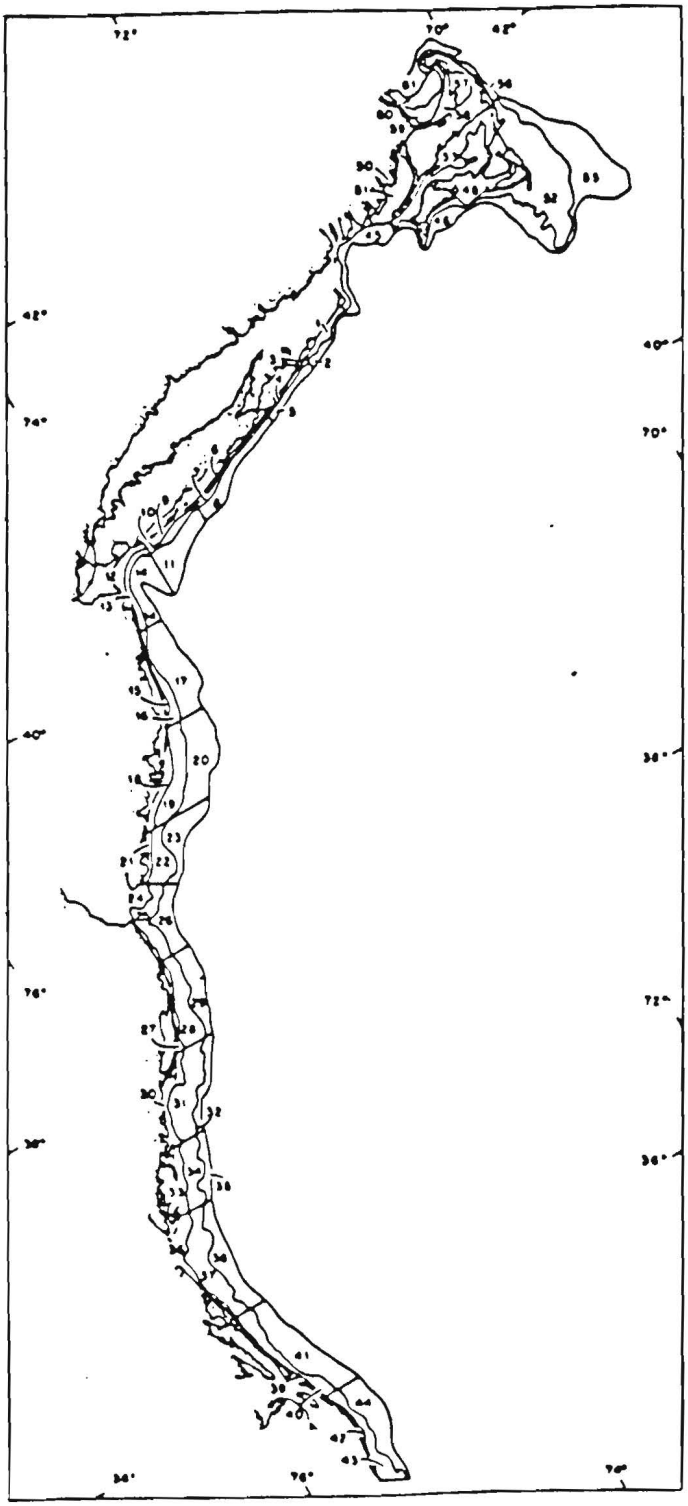
Bottom trawl survey data are published in a set of NOAA Technical Memoranda available from the National Marine Fisheries Service (NMFS).

Figure 2.20. Strata sampled on NEFC offshore bottom trawl surveys



Source: NOAA, 1988b

Figure 2.21. Strata sampled on NEFC inshore bottom trawl surveys from Cape Cod Bay, Massachusetts to Cape Hatteras, North Carolina



Source: NOAA, 1988b

Title: National Data Buoy Center (NDBC) Coastal-Marine Automated Network

Sponsor: National Oceanic and Atmospheric Administration

• Monitoring program objective

The Coastal-Marine Automated Network (C-MAN) is a collection of 51 automated meteorological stations in coastal areas of the United States. The sites are selected primarily for use by the National Weather Service for coastal and marine forecasts, watches, and warnings, although the data is also useful for general oceanographic studies. Nine of the C-MAN stations are located on U.S. Coast Guard buoys. The remaining 42, called "fixed" sites, are located in coastal areas or on offshore rigid structures. There are one of each type station in the New York Bight.

• Parameters measured

Data collected includes wind speed and direction, wind gust magnitude, air temperature, and barometric pressure. Buoy stations include sea surface temperature, significant wave height, average and dominant wave period, and wave spectra as additional measurements. At selected fixed sites, dew point, precipitation, and visibility are also recorded.

• Frequency of monitoring

A microprocessor-based, modular component system continuously monitors the above parameters. At regular intervals, data are taken, formatted into an ASCII message, and transmitted to the GOES satellite. Accumulated data are transmitted every 15 minutes at fixed sites and every hour from buoys. The data flow is shown schematically in Figure 2.22. Because of restrictions on satellite transmission times, C-MAN observations are not all taken at the same time. Because of this, the choices of observation times are necessarily a compromise between having synchronous data and having the most recent data.

• Program duration

The first stations of the C-MAN system became operational in 1983. In addition to the 51 currently operational stations, the National Weather Service has designated 108 more stations to be added to the system when funding becomes available.

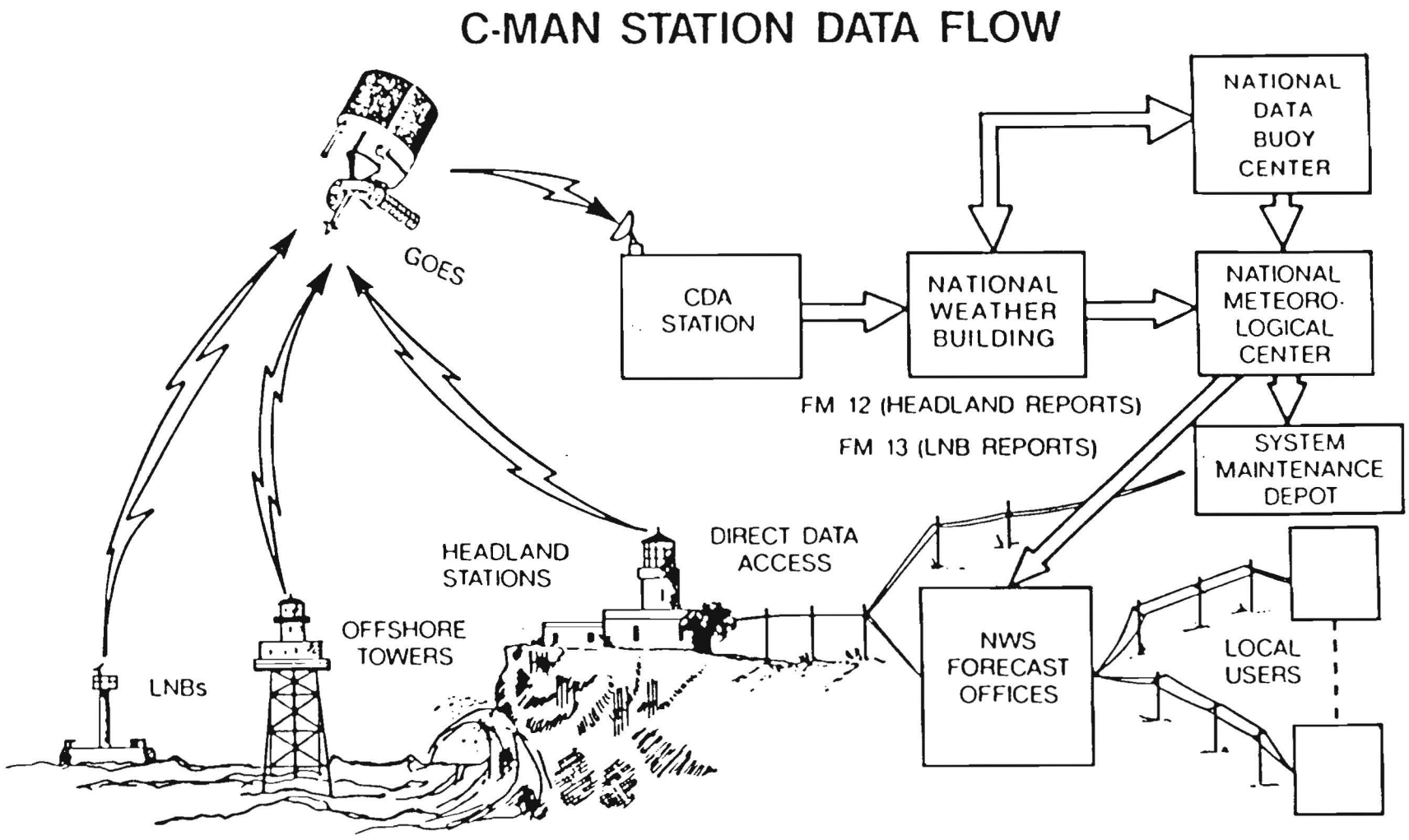


Figure 2.22. C-MAN station data flow

Source: NOAA, 1988d

• Station locations

There are two C-MAN stations in the New York Bight. One is a moored buoy, the other a fixed site.

A Large Navigational Buoy (LNB), a 12-meter discus hull buoy with a 100-ton displacement, equipped with a Data Acquisition, Control, and Telemetry (DACT) payload, is located at the Five Fathom Bank off southern New Jersey at 38.8°N, 74.6°W.

The fixed station at the Ambrose Light Station, also equipped with a DACT payload, is located in the apex of the New York Bight at 40.5°N, 73.8°W.

• Data storage/availability

NDBC Data Availability Summary updated approximately every six months. Archived NDBC data is available on magnetic tape, microfiche, or in printed form from the archive centers listed below:

National Climatic Data Center (NCDC)
Federal Building
Asheville, NC 28801
(704) 259-0682 or (704) CLIMATE
FTS 672-0682

National Oceanographic Data Center (NODC)
Universal South
1825 Connecticut Avenue, NW
Washington, DC 20235
(202) 673-5549 or FTS 673-5549

Title: National Tidal Data Program

Sponsor: National Oceanic and Atmospheric Administration

• Monitoring program objectives

Forecast both long- and short-term fluctuations in sea level in coastal waters of the United States.

• Parameters measured

Tide gages continuously measure sea level heights relative to the land adjacent to the station. Data collected at these stations are used to calculate times of high and low tides, sea level, and tidal range at each station. Monthly and yearly mean sea level is also calculated for analysis of long-term trends.

• Frequency of monitoring

Sea level is measured continuously at each station. Mean sea level values are calculated using hourly heights.

• Program duration and station locations

The first tide gage in the New York Bight was placed in New York City in 1856. Additional permanent gages in the Bight were subsequently incorporated into the program as shown in Table 2.6. Other tide gages are periodically placed in various locations around the Bight for specific short-term studies.

Table 2.6. New York Bight tide station locations

Station Name	Station Number	Date of First Full Year of Series	Latitude	Longitude
Montauk, NY	851 0560	1948	41°02.9'N	71°57.6'W
New York, NY	851 8750	1856	40°42.0'N	74°00.9'W
Sandy Hook, NJ	853 1680	1933	40°28.0'N	74°00.6'W
Atlantic City, NJ	853 4720	1912	39°21.3'N	74°25.1'W
Lewes, DE	855 7380	1921	38°46.9'N	75°07.2'W

Source: Lyles et al., 1988

• Data storage/availability

Short-term sea level forecasts are presented in the form of tide tables. Long-term trends are reported in periodic data set reviews published by NOAA.

New York State Shellfish Safety Monitoring

Interstate Sanitation Commission has provided some sampling support in the Rockaways area.

Stations from about Jones Beach inlet to the Fire Island Inlet are sampled approximately five times per year. Stations farther east are sampled less frequently. Goal is to sample all stations at least five times per year.

- Program duration

Monitoring programs of shellfishing grounds have been in place nationally since the 1940s and in New York State since the 1920s. The present program is expected to continue indefinitely.

- Funding

The NYSDEC New York Bight water quality monitoring program, under the review of the Food and Drug Administration, is part of a larger statewide monitoring program.

- Data storage/availability

Data from each station are tabulated and presented in written reports which are available from the NYSDEC. Efforts are currently underway to store past and present results into computer data bases.

Title: New Jersey Water Quality Monitoring

Sponsor: New Jersey Department of Environmental Protection (NJDEP)

The New Jersey Department of Environmental Protection sponsors three monitoring programs in the New York Bight, the Cooperative Coastal Monitoring Program (CCMP), the Marine and Estuarine Water Quality Monitoring Network, and the Marine Water Classification and Analysis for Shellfish Growing Areas Program.

- Monitoring program objectives

The CCMP, authorized by the County Environmental Health Act, is directed at providing consistent procedures for field monitoring and water analysis for application to coastal zone management strategies and response to public health concerns. Responses include closure of public beaches when water quality falls below predetermined criteria.

The Marine and Estuarine Water Quality Monitoring Network is designed to collect background data that can be used to assess trends in environmental quality over time.

The Marine Water Classification and Analysis for Shellfish Growing Areas Program tracks bacterial water quality trends applicable to the shellfishing industry.

- Parameters measured

1) CCMP

fecal coliform
enterococcus

2) Marine and Estuarine Water Quality Monitoring Network

a) water column
nutrients
metals
PCBs
pesticides
acid extractables
base neutrals
purgeables

b) sediments
metals
PCBs
pesticides

3) Marine Water Classification and Analysis for Shellfish Growing Areas Program

total coliform
fecal coliform

- Frequency of monitoring

1) CCMP

Minimum of every Monday from 1 May to 15 September

2) Marine and Estuarine Water Quality Monitoring Network

a) water column nutrients and metals -- 4 times per year

b) other water column parameters -- 2 times per year

c) sediment parameters -- once per year

3) Marine Water Classification and Analysis for Shellfish Growing Areas Program

once per month

- Station locations

1) CCMP

a) fecal coliform -- 170 ocean stations in surf zone and 170 bay and estuary stations

b) enterococcus -- 51 stations

2) Marine and Estuarine Water Quality Monitoring Network

29 monitoring stations

Location	Station Number
Atlantic Ocean near Bayshore Regional SA	A7E
Atlantic Ocean near Northeast Monmouth Regional SA	A11E
Atlantic Ocean near Long Branch SA	A13A
Atlantic Ocean near Ocean Township STP	A17A2
Atlantic Ocean near Asbury Park STP	A18A2
Atlantic Ocean off Ocean Grove	A19A
Atlantic Ocean near Neptune SA and off Lake Sylvan	A20B

Location	Station Number
Atlantic Ocean near Shark River	A21A
Atlantic Ocean near South Monmouth Regional SA	A22B
Atlantic Ocean off Wreck Pond	A24A
Atlantic Ocean off Manasquan River	A26A
Atlantic Ocean near Ocean County UA Northern	A30B
Atlantic Ocean near CIBA-GEIGY	A34A
	A35A
Atlantic Ocean near Ocean County UA Central	A38B
Atlantic Ocean off Barnegat Inlet	A47B
Atlantic Ocean near Ocean County UA Southern	A54B
Atlantic Ocean off Little Egg Harbor Inlet	A65A
Atlantic Ocean off Absecon Inlet	A74A
Atlantic Ocean near Atlantic County UA	A77B
Atlantic Ocean off Great Egg Harbor Inlet	A65A
Atlantic Ocean near CMCMUA Ocean City	A85C
Atlantic Ocean off Corsons Inlet	A87A
Atlantic Ocean off Townsends Inlet	A93A
Atlantic Ocean near CMCMUA Avalon	A94C
Atlantic Ocean off Hereford Inlet	A100A
Atlantic Ocean near CMCMUA Wildwood	A105A2
Atlantic Ocean off Cape May Inlet	106A1
Delaware Bay near CMCMUA Cape May	A112B

3) Marine Water Classification and Analysis for Shellfish Growing Areas Program

174 stations from Sandy Hook to Cape May located a minimum of 0.25 miles and a maximum of 2 miles offshore.

- Data storage/availability

Data from all three monitoring programs are stored in the STORET computer data base system.

Title: Nassau County Water Quality Program

Sponsor: Nassau County Department of Health,
Nassau County Office of Marine Ecology

• Monitoring program objectives

Establish and maintain a baseline database of environmental quality in Nassau County marine, estuarine, and fresh waters; predict disturbances in the marine environment such as phytoplankton blooms and fishkills; diagnose the cause of such disturbances when they do occur.

Beyond routine monitoring activities, first priority of Nassau County Department of Health officials is to respond to complaints made by other agencies or a resident of the county (eg. discolored water, whale or turtle stranding, oil spill, etc.).

• Parameters measured

Water samples:

1) Phytoplankton and zooplankton presence and abundance
2) Nutrient (N and P) analysis of surface waters
3) Surface water salinity and temperature
4) Secchi disc depth
5) Chlorophyll-a; dry weight

Sediment samples:

1) Identify and count, down to larger meiofauna species

Lifeguard surveys:

Nassau County lifeguards have been trained to spot and record marine disturbances for 12 years. Lifeguards daily record biological, chemical, and physical parameters such as presence of phytoplankton blooms, water color, animal and debris washups, air and water temperature, visibility, wind direction and speed, wave height and wavelength, water salinity, and longshore current movement.

Special studies:

Often special studies are initiated in response to a complaint or an acute environmental problem. For example, when worm-castings washing ashore were mistaken for a sludge washup, a follow-up ecological study of the worm species was undertaken. In another

case, a green tide bloom event led to the gathering of additional phytoplankton data.

Sediment samples:

Sediment samples are taken routinely at the Cedar Creek outfall stations, but only intermittently at other stations.

- Frequency of monitoring

    1) Regular water sampling stations: quarterly sampling - February, May, August, November

    2) Cedar Creek outfall stations: yearly - usually in spring or fall

- Program duration

    1) Regular water sampling stations: original monitoring program covering bays and harbors has been underway since 1971; program was expanded about four years ago to include current oceanic stations in the New York Bight.

    2) Cedar Creek outfall stations: baseline data at site first gathered in 1973 before operation of outfall began.

- Station locations - two separate programs

    1) Regular water sampling stations:
    6 nearshore stations -- ½-mile offshore
    2 stations near inlets - Jones inlet and East Rockaway inlet; 4 stations along barrier beach.

    2) Cedar Creek outfall stations:
    29 stations around the outfall arranged in a rosette pattern. Not every station is sampled each time out.

- Funding

Primary support for programs come from Nassau County general fund; additional funds are obtained periodically to support particular activities (eg. computerization of data bank, development of rapid sludge indicator technique).

• Data storage/availability

All current, as well as past data, are categorized and stored in a computerized data bank. The data can be accessed through any of the following categories (computer files):

1) Alphabetic
2) Plankton
    a) phytoplankton
    b) zooplankton
3) Benthic
4) Taxonomic identification
5) Early-warning lifeguard network reports
6) Geographic
7) Complaints
    a) environmental (eg. oil spill)
    b) illness-related (eg. bad clam)
8) Chronology
9) Garbage and trash (floatables)

Data originating from the scheduled water sampling stations, as well as any special monitoring studies, are tabulated and presented in written annual assessment reports which are submitted to the NYSDEC.

Title: Nassau County Surface Water Surveillance Program (SWSP) and Wastewater Surveillance Program (WSP)

Sponsor: Nassau County Department of Health, Bureau of Water Pollution Control

- Monitoring program objectives

    1) SWSP: Determine compliance with state surface and bathing water quality standards.

    2) WSP: Provide early warning to citizens who use receiving waters of any possible public health threat originating from a sewage treatment plant.

- Parameters measured

    1) SWSP: The primary parameters measured are total coliform, fecal coliform, and dissolved oxygen (DO).

    2) WSP: The sampling parameters measured at sewage treatment plants include treatment plant flow, pH, chlorine residual, biological and chemical oxygen demand, settleable and suspended solids, and total and fecal coliform levels. Total and fecal coliform levels are measured in water and sediment samples from around the Cedar Creek outfall.

- Frequency of monitoring

    1) SWSP: Sampling is performed on a monthly basis with the exception of January and February.

    2) WSP: Sampling at sewage treatment plants occurs on a quarterly basis. A biennial survey is conducted of water and sediment samples from the Cedar Creek outfall stations.

- Station locations

    1) SWSP: Ocean waters in Nassau County are sampled at 22 stations. Eleven stations are located ¼-mile offshore or in the inlets, and 13 are located at bathing beaches from East Rockaway to Tobay Beach.

2) WSP: The Cedar Creek outfall is located about 2.5 miles south of Wantaugh, Long Island.

• Funding

Primary support for programs come from Nassau County general fund.

• Data storage/availability

Annual Water Quality Assessment Reports are available from the Nassau County Department of Health.

Title: Bergen Point Sewage Treatment Outfall Monitoring Program

Sponsor: Suffolk County Department of Public Works

• Monitoring program objectives

Certify that water quality in the vicinity of the Bergen Point, Long Island, sewer outfall is within the standards mandated by the discharge permit for the outfall.

• Parameters measured

Total and fecal coliform counts are taken routinely. In addition, the following measurements are made intermittently:

1) biological oxygen demand (BOD)
2) total suspended solids
3) total ammonia
4) total Kjeldahl nitrogen (TKN)
5) nitrate
6) temperature
7) salinity
8) plume tracking (dye marker)

The program coordinators hope to also include fluorometric and sediment studies in future investigations.

• Frequency and duration of monitoring

The monitoring plan for the outfall calls for sampling on a monthly basis. However, due to budget limitations and the fact that Suffolk County does not have unrestricted use of a boat for sampling, sampling actually occurs only seasonally. The exception to this rule is that dye testing to track the outfall plume in the bay takes place annually. Sampling at the Bergen Point outfall began in 1988.

• Station locations

There is a grid of fifteen stations around the outfall, each of which is sampled at three depths: surface, mid-water, and bottom.

• Funding

Funding for the program is provided by the Suffolk County general fund. Allocations for monitoring efforts must be divided

among Long Island Sound, Great South Bay, and Atlantic Ocean projects. Recently, Long Island Sound monitoring programs, primarily in Port Jefferson Harbor, have received the bulk of the available monies.

• Data storage/availability

The data from the first three sampling runs have been tabulated, but not published. They are considered preliminary data at this time.

CONCLUSIONS

There are several monitoring programs in place in the New York Bight covering a range of issues including public health, compliance with effluent guidelines, and environmental effects. These existing programs combined with those of the past, the bulk of which spanned the 1970s, comprise a marine environmental data base that is extraordinary.

In some cases there is a sufficient data base to have established a reasonable understanding of oceanographic processes - such as the physical processes. In others there is a basis for developing trends - i.e. bottom dissolved oxygen. Clearly some measures of environmental health are not well documented at all. Dissolved metal data perhaps is a case in point. As a result of developing analytical procedures and inadequate quality assurance, the compatibility of data among programs and over time is poor.

Despite the fact that monitoring programs have contributed to a rich data base, the individual data sets are not readily comparable because of the varying temporal and spatial sampling protocols, and the differing means storing, cataloging, and accessing it.

However, the real test of a monitoring program is perhaps related to the decisions that the programs have influenced. This is perhaps the area where most of the monitoring programs have, and still do, come up short. Generally marine pollution monitoring programs are inadequate in this regard because they have poorly defined goals and objectives, insufficient oversight and review, no associated criteria by which decisions can be made, and no clear means of relating observed impacts with polluting activities.

If a monitoring endeavor is to emerge from this task, the above notions should be considered in its design. Further, management of such an activity should be assigned to an agency that has no function in conducting or operating a polluting activity.

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