MESA-NYB-FUNDED BIOLOGICAL RESEARCH
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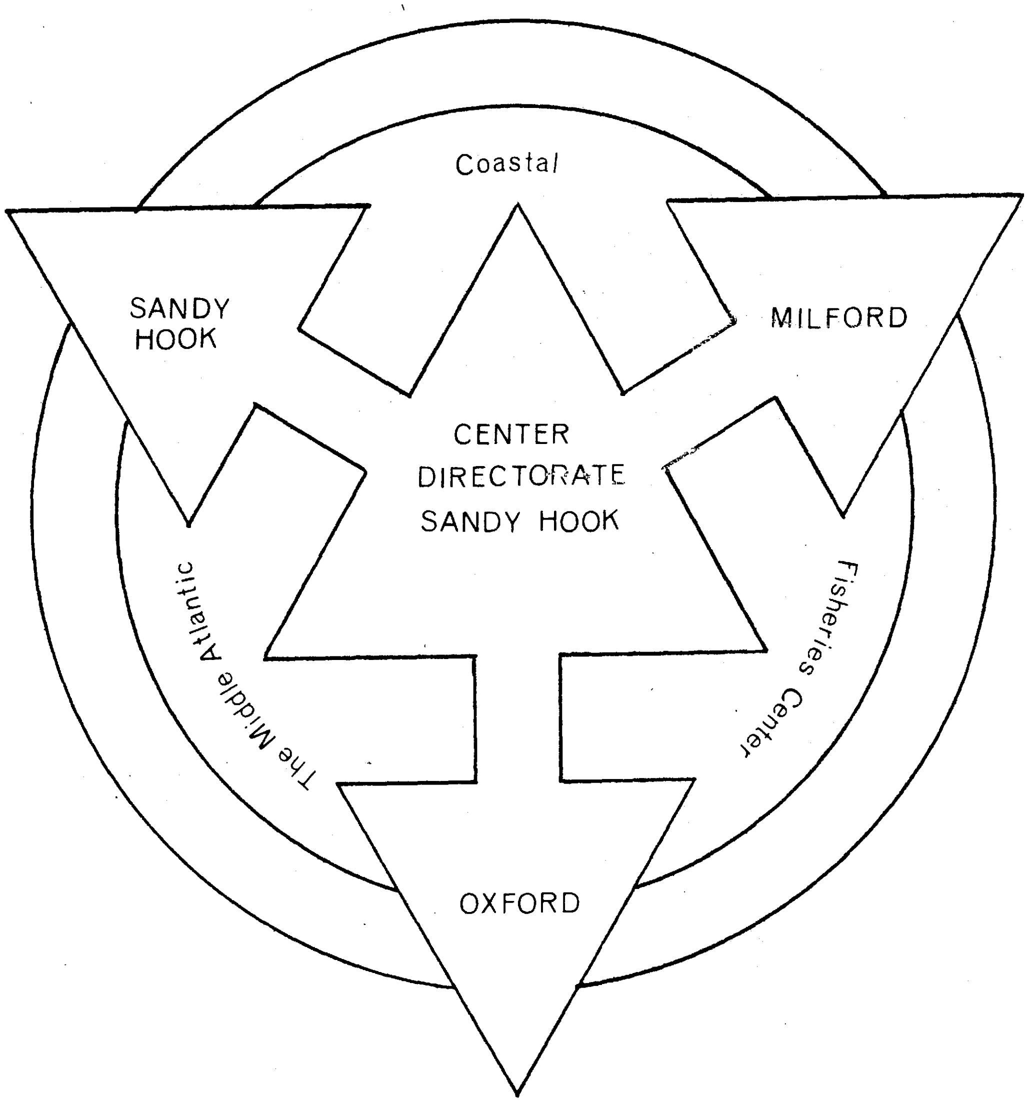
July 1974 - February 1975
Volume 3

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

MIDDLE ATLANTIC COASTAL FISHERIES CENTER



Informal Report No. 52

March 31, 1975

VI. (continued) APPENDICES (Volume III)

10. Cruise Report -- Delaware II, August 26 - September 6, 1974.

11. Cruise Report -- Albatross IV and Delaware II -- September 23 - October 4, 1974.

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16. Data report -- suspended particulates and phytoplankton -- T. C. Malone. (Contract Report).

17. Annual report -- Foraminifera of the New York Bight -- J. Lee. (Contract Report).

18. Quarterly report -- Ciliate Protozoan of the NYB -- E. Small. (Contract Report).

19. Heavy metals data -- R. Greig (Milford Laboratory, MACFC).

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CRUISE REPORT

NOAA Ship Delaware II

26 August - 6 September 1974

Cruise D-74-9

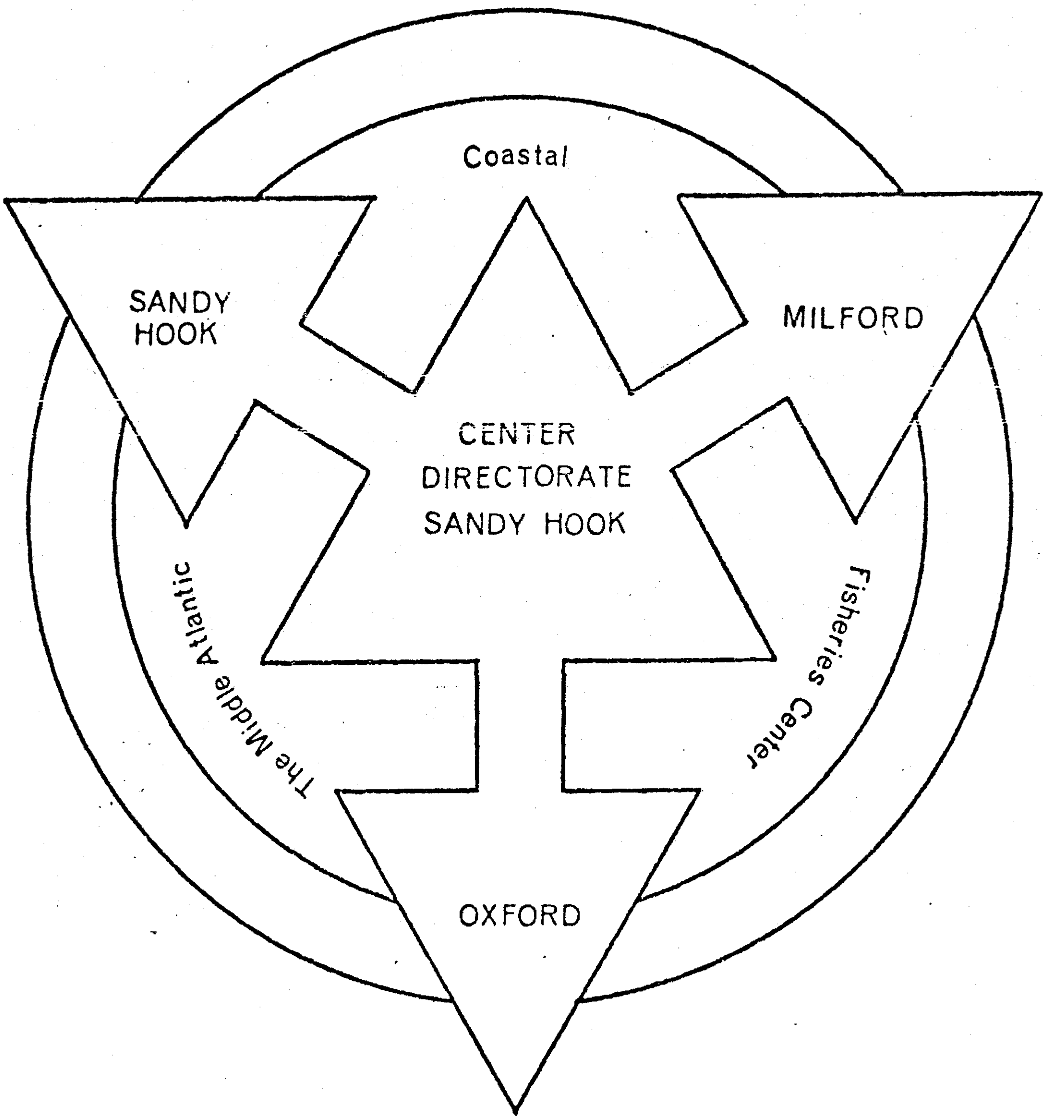
U.S. DEPARTMENT OF COMMERCE

National Oceanic and Atmospheric Administration

National Marine Fisheries Service

Northeast Region

MIDDLE ATLANTIC COASTAL FISHERIES CENTER



Ecosystems Investigations, Sandy Hook Laboratory, Highlands, New Jersey

(Funded by NOAA-MESA Appropriations)

Cruise R.port NOAA Ship Delaware II, Cruise # D-74-9

INTRODUCTION:

The NOAA Ship Delaware II departed Sandy Hook (SH) at 1230 hrs on 26 August 1974 bound for the New York Bight Apex. RAYDIST was calibrated at buoy 1 in the Sandy Hook Channel at 1312 hrs. Due to the presence of a grounded fully-loaded oil tanker located approximately 2.5 nautical miles NW of Ambrose Light Tower the usual order for sampling stations was modified. Standard MESA grid stations around the tanker were sampled first. Station 1 commenced at 1425 hrs. Sampling with Smith-McIntyre bottom grab and multiple corer proceeded uneventfully.

On 28 August at 1030 hrs R/V Rorqual rendezvoused with Delaware II to transfer personnel and equipment. A second calibration of RAYDIST was also accomplished that dayat 1500 hrs at Ambrose Light Tower. That evening at 2000 hrs a violent thunderstorm forced us to briefly suspend operations. Following the thunderstorm activity RAYDIST was recalibrated at 2150 hrs at Ambrose Light Tower.

RAYDIST was again calibrated 29 August at 2000 hrs at Ambrose Light Tower.

On 30 August at 1535 hrs we were again forced to briefly suspend operations due to violent thunderstorm which caused the RAYDIST to lose calibration. RAYDIST was recalibrated at 1615 hrs off Long Branch using shore based points.

At 0537 hrs on 31 August suspended sampling to head for Floyd Bennett Field arriving there at 0345 hrs to receive water and scientific gear crucial to the program. Departed Floyd Bennett at 1207 hrs. Proceeded to position off Monmouth Beach at 1325 hrs for RAYDIST calibration. Following calibration sampling was resumed.

On 2 September at 2000 hrs again a thunderstorm passed over the ship. However, RAYDIST did not have to be recalibrated. A RAYDIST calibration check occurred at 1610 hrs off Elberon using land points.

On 3 September suspended sampling operations at 1500 hrs due to rough seas and headed for SH arriving at 1742 hrs.

On 4 September departed SH at 0920 hrs to resume sampling. Two stations were accomplished at this time, when due to sick crew member, sampling operations had to be suspended and the vessel returned to SH arriving at 1620 hrs. Vessel immediately departed SH. RAYDIST appeared to be off calibration. Thus RAYDIST calibrated at Ambrose Light Tower at 1725 hrs. RAYDIST had been off calibration and the last two stations had been sampled outside of a circle around each station with a one-quarter mile radius. These stations were resampled later in the cruise to meet our above standards. Sampling resumed at 1830 hrs.

On 6 September all required sampling was completed by 1040 hrs and the vessel headed for SH arriving at 1305 hrs. Off loading commenced immediately and was completed by 1800 with the exception of RAYDIST. RAYDIST equipment was later removed under the direction of Cdr. Austin.

SCIENTIFIC PERSONNEL:

Smith-McIntyre grab (bottom) sampling and multiple core operations.

James Thomas - Party Chief
Frank Steimle
Clyde MacKenzie
Leslie Rogers
Bob Dennis
Cady Soukup - 26 - 31 August
Gene Small - 26 - 31 August
Gary Albertson
Ken Holden
Bill Davidson
David Timpy

CRUISE OBJECTIVES:

Smith-McIntyre grab (bottom sampling and multiple core operations).

Objective of this cruise was to provide baseline data necessary to the accomplishment of MESA Task No. 4: Benthic Macrofauna and No. 5: Benthic Meiofauna (MACFC, Informal Report No. 13). Samples were collected for examination and analyses for macrofauna, meiofauna, ciliated protozoa, nematodes and foraminifera, heavy metal burdens in sediments, and mechanical properties in sediments (grain size distribution, etc.). Multiple coring operations for benthic respiration were continued during this cruise (Task No. 3 in MACFC, Informal Report No. 13).

OPERATIONS:

Stations were selected on a grid (1 min. latitude x 1 min. longitude) overlying the apex of the New York Bight (see Fig. 1 and Table 1). Five Smith-McIntyre bottom grab samples were taken at each station.

Each grab sample was brought aboard and three cores were removed from near the center of the sample. Two of the cores were taken with 38 mm (1.5 inch) diameter plastic core liners. These cores were labeled and frozen for future analyses for heavy metals and the mechanical properties of sediment. The third core was taken with a 25 mm (1.0 inch) diameter plastic tube to a depth of approximately 5 cm. The samples was placed in a labeled jar containing buffered formalin, rose bengal, and clam shell chips as additional buffer and stored for meiofaunal (nematodes and foraminifera) examination. The remainder of the Smith-McIntyre grab sample was removed from the grab and washed through standard geological screens (4 mm, 2 mm, 1 mm). The material trapped on screens (larger than 1 mm) was placed in labeled jars, buffered formalin was added, and the samples were stored for macrofaunal examination.

At each station samples were taken using a Niskin water bottle with reversing thermometer for bottom dissolved oxygen, salinity and temperature. The oxygen samples were titrated on board using a sample volume of 203 ml and titrating with 0.025 N PAO with thyodene as the indicator. The salinity samples were stored for later analysis at Sandy Hook using an RS7-B salinometer.

Multiple core casts to obtain undisturbed bottom sediment with overlying bottom water were made at 65 different stations (Fig. 1) to measure seabed oxygen consumption. Seven stations were repeated. Two stations could not be sampled with the multiple corer due to the coarseness of the bottom. These stations were abandoned after five unsuccessful multiple core casts. Ideally, a minimum of four cores per station were used to measure oxygen consumption by the seabed according to the methods of Pamatmat (1971). The cores were equilibrated for 1 hour in a water bath regulated to within two degrees of in situ temperature. Following equilibration, the oxygen consumption was monitored for approximately 6 hours. Initial and final dissolved oxygen samples were taken and processed according to the azide modification of the idometric method using 0.025 N PAO instead of sodium thiosulfate. Reagents were added to the sample with a 1 ml insulin syringe. A 2 ml gilmont microburet with needle was used in the titration of the 26 ml samples. Concentrated formalin was added to several of the samples at each station and the oxygen decrease was again monitored for 6 hours. One of the cores was stored frozen for later carbon analysis. Usually, at stations where the multiple corer was used, a Niskin bottle with reversing thermometer was attached to the multiple corer to collect bottom water for salinity and dissolved oxygen determinations and to record bottom temperature.

RESULTS:

Each of 103 standard stations in the New York Bight Apex are now represented by five Smith-McIntyre samples and associated cores collected during the subject cruise. (Table 1 and Fig. 1). In all, a total of 515 bottom grab samples were taken. Additional samples (P1 - P10) were taken as cores from single Smith-McIntyre grabs taken at one mile intervals from the center of the sewage toward Atlantic Beach, Long Island. These cores were labeled and stored frozen. They are awaiting shipment to Dr. Foehrenbach, SUNY, Stony Brook, Long Island, New York.

Five hundred fifteen frozen core samples for heavy metal analyses are awaiting distribution. Five hundred fifteen core samples for geological analyses and five hundred fifteen samples for meiofaunal (nematodes and foraminifera) examination are awaiting distribution. Macrofaunal samples have been transferred to alchohol and glycerin and will be sorted, counted, identified and recorded on standard forms by contract personnel (Trenton State College).

Sixty-five stations (300 cores) (Fig. 1) were sampled to measure total oxygen consumption by the seabed. The data from these samples are now being processed.

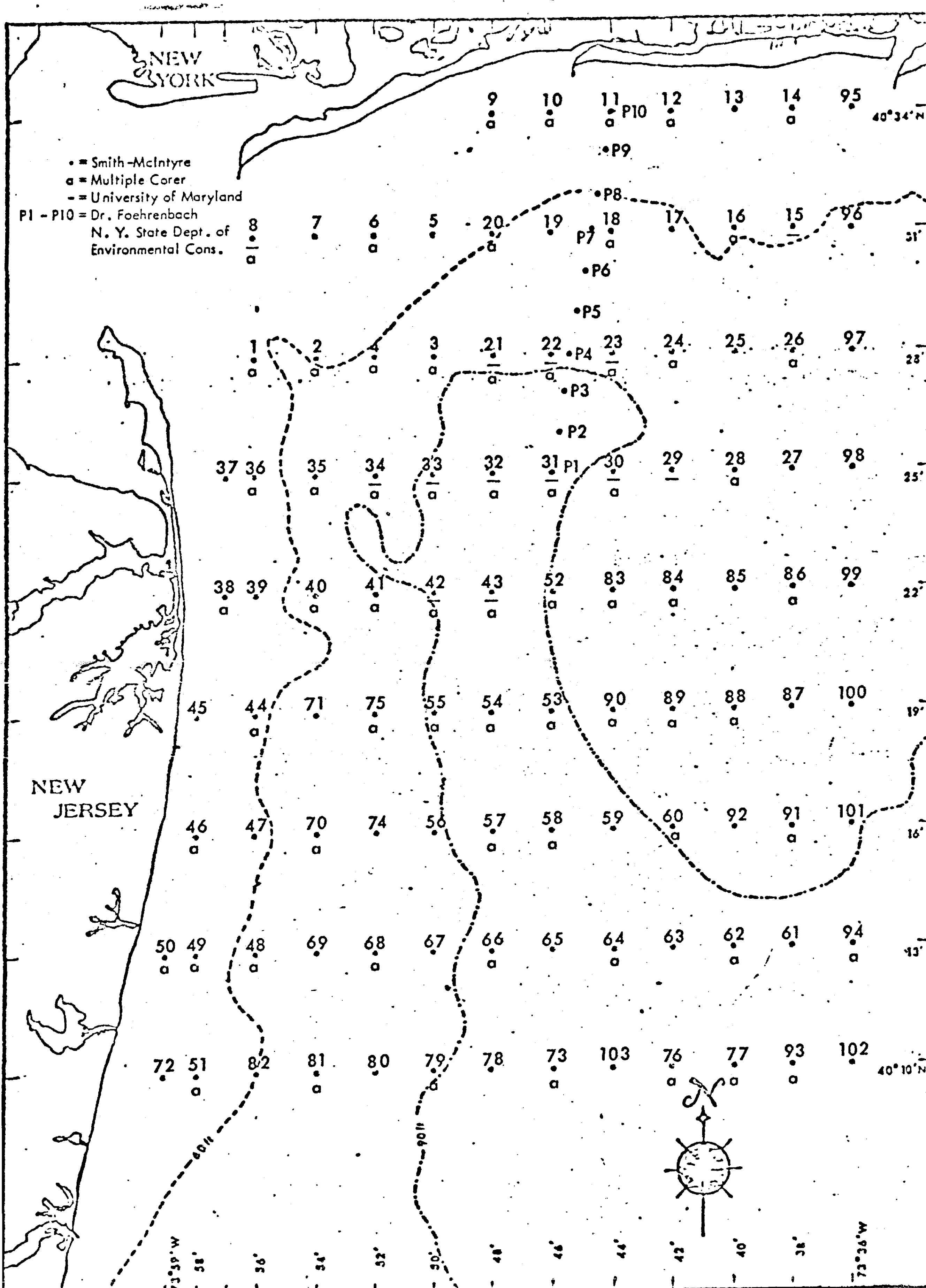

NEW YORK
NEW JERSEY
• = Smith-McIntyre
a = Multiple Corer
- = University of Maryland
P1 - P10 = Dr. Foehrenbach
N. Y. State Dept. of
Environmental Cons.
P1
P2
P3
P4
P5
P6
P7
P8
P9
P10
40°34'N
31'
28'
25'
22'
19'
16'
13'
40°10'N
73°59'W
58'
56'
54'
52'
50'
48'
46'
44'
42'
40'
38'
73°36'W
60ft
90ft

Figure 1.

Table 1.

East

40°34'N, 73°43'W
40°34'N, 73°46'W
40°34'N, 73°44'W
40°34'N, 73°42'W
40°34'N, 73°40'W
40°34'N, 73°38'W

South & then west

40°31'N, 73°33'W
40°31'N, 73°40'W
40°31'N, 73°42'W
40°31'N, 73°44'W
40°31'N, 73°46'W
40°31'N, 73°43'W
40°31'N, 73°50'W
40°31'N, 73°52'W
40°31'N, 73°54'W
40°31'N, 73°56'W

South & then east

40°28'N, 73°56'W
40°28'N, 73°54'W
40°28'N, 73°52'W
40°28'N, 73°50'W
40°28'N, 73°48'W
40°28'N, 73°46'W
40°28'N, 73°44'W
40°28'N, 73°42'W
40°28'N, 73°40'W
40°28'N, 73°38'W

South & then west

40°25'N, 73°38'W
40°25'N, 73°40'W
40°25'N, 73°42'W
40°25'N, 73°44'W
40°25'N, 73°46'W
40°25'N, 73°43'W
40°25'N, 73°50'W
40°25'N, 73°52'W
40°25'N, 73°54'W
40°25'N, 73°56'W
40°25'N, 73°57'W

Table 1 (continued)

South & then east
40°22'N, 73°57'W
40°22'N, 73°56'W
40°22'N, 73°54'W
40°22'N, 73°52'W
40°22'N, 73°50'W
40°22'N, 73°48'W
40°22'N, 73°46'W
40°22'N, 73°44'W
40°22'N, 73°42'W
40°22'N, 73°40'W
40°22'N, 73°38'W

South & then west
40°19'N, 73°38'W
40°19'N, 73°40'W
40°19'N, 73°42'W
40°19'N, 73°44'W
40°19'N, 73°46'W
40°19'N, 73°48'W
40°19'N, 73°50'W
40°19'N, 73°52'W
40°19'N, 73°54'W
40°19'N, 73°56'W
40°19'N, 73°58'W

South & then east
40°16'N, 73°58'W
40°16'N, 73°56'W
40°16'N, 73°54'W
40°16'N, 73°52'W
40°16'N, 73°50'W
40°16'N, 73°48'W
40°16'N, 73°46'W
40°16'N, 73°44'W
40°16'N, 73°42'W
40°16'N, 73°40'W
40°16'N, 73°38'W

South & west
40°13'N, 73°38'W
40°13'N, 73°40'W
40°13'N, 73°42'W
40°13'N, 73°44'W
40°13'N, 73°46'W
40°13'N, 73°48'W
40°13'N, 73°50'W
40°13'N, 73°52'W
40°13'N, 73°54'W
40°13'N, 73°56'W
40°13'N, 73°58'W
[illegible]

Table 1 (continued)

South & then east

40°10'N, 73°59'W
40°10'N, 73°58'W
40°10'N, 73°56'W
40°10'N, 73°54'W
40°10'N, 73°52'W
40°10'N, 73°50'W
40°10'N, 73°48'W
40°10'N, 73°46'W
40°10'N, 73°44'W
40°10'N, 73°42'W
40°10'N, 73°40'W
40°10'N, 73°38'W

And north

40°10'N, 73°36'W
40°13'N, 73°36'W
40°16'N, 73°36'W
40°19'N, 73°36'W
40°22'N, 73°36'W
40°25'N, 73°36'W
40°23'N, 73°36'W
40°31'N, 73°36'W
40°34'N, 73°36'W

Additional Stations for J. Foehrenbach

P1	40°25.00'N, 73°46.00'W
P2	40°25.98'N, 73°45.80'W
P3	40°26.93'N, 73°45.60'W
P4	40°27.91'N, 73°45.37'W
P5	40°28.91'N, 73°45.12'W
P6	40°29.85'N, 73°44.91'W
P7	40°30.85'N, 73°44.70'W
P8	40°31.80'N, 73°44.40'W
P9	40°32.80'N, 73°44.20'W
P10	40°33.80'N, 73°44.02'W

Samples for examining ciliated protozoa were collected by Dr. Eugene Small (University of Maryland) and Cady Soukup at 12 selected stations (Fig. 1). Sediments only were sampled at stations 21, 22, 23, 31, 32, 34, 42 and 43. Sediments and water were sampled at stations 8, 15, 30 and 33.

Their Cruise Report follows:

Stations 8, 15, 21, 22, 23, 30, 31, 32, 33, 34, 42 and 43 were investigated using the methods previously described. A peristaltic pump and a plankton net were tested as new equipment. Four stations (8, 13, 30, 33) were sampled using Lackey jars (L.+0., 1961) and the Nisken-Cascade of filters methods. Additional sediment and planktonic sampling was done respectively by means of simple sterile plastic tags for the sediment and a peristaltic pump, vertical plankton net tow (through the euphotic zone) was accomplished for the latter. Nisken casts were taken at several of these stations. These stations have been sampled during the past year. Eight stations (21, 22, 23, 31, 32, 34, 42, 43) were chosen on the basis of their proximity to the sewage disposal site. These stations were sampled using the Lackey jar method in order to determine the predominant protozoan fauna present in sediment and sediment water interface.

One interesting observation was the presence, at station 30, of a surface layer of very cloudy and presumably sewage rich water. In this layer unusually high numbers of both ciliates and other types of small planktonic fauna were noted. Three hours later, upon passing the station again, the layer was not present on the surface, nor did we find evidence that it had sunk. This would seem to be an indication of the mobility of such patches.

SUBMITTED BY:

James P. Thomas Date 11/12/74
James P. Thomas, Chief
Biological Oceanography Investigations

John B. Pearce Date 14 XI 74
John B. Pearce, Director
Ecosystems Investigations

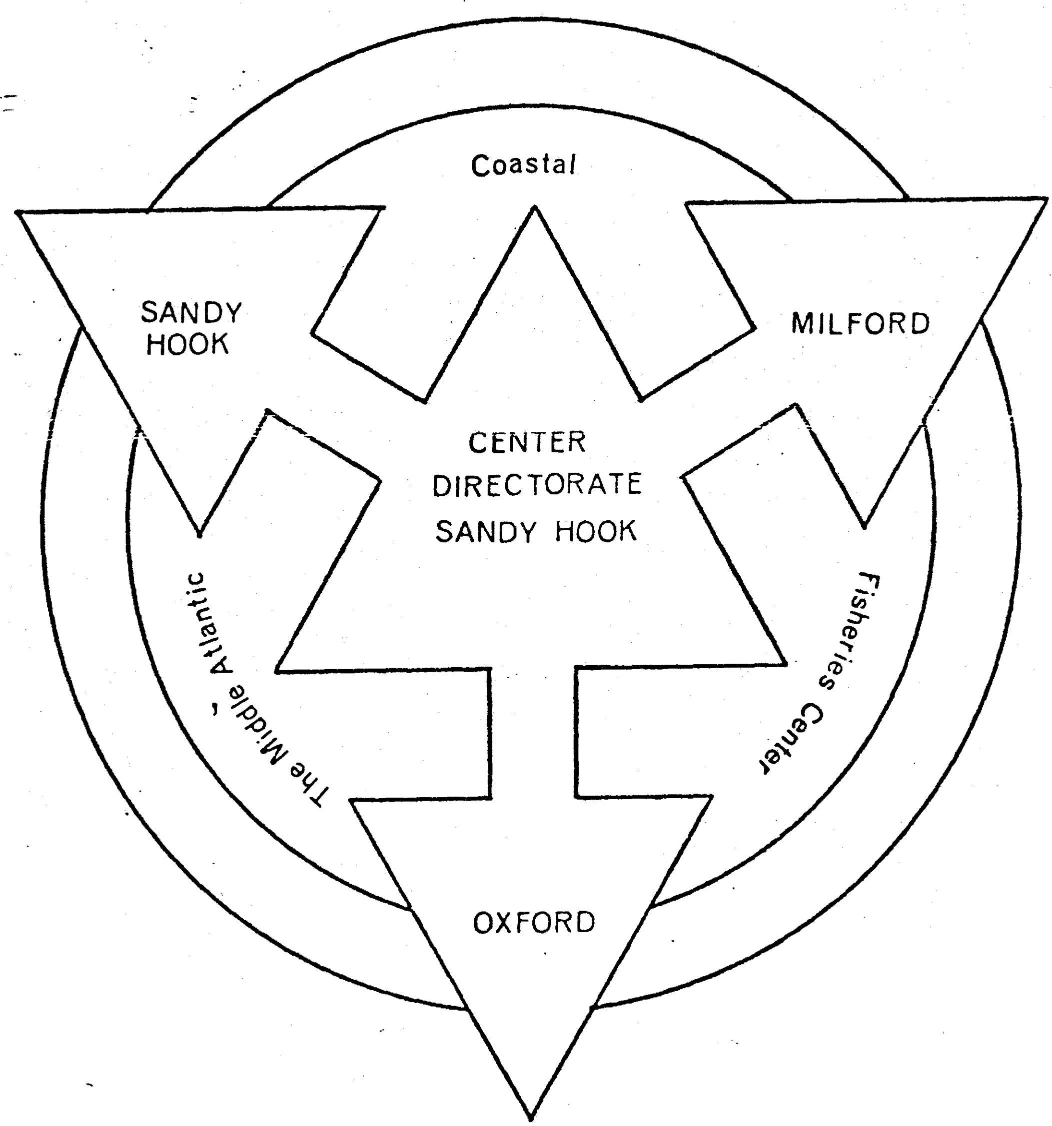
Carl J. Sindermann Date Nov 14 1974
Carl J. Sindermann, Center Director
Middle Atlantic Coastal Fisheries Center

CRUISE REPORT
NOAA SHIP ALBATROSS IV AND DELAWARE II

September 23 - October 4, 1974
1974 FALL GROUNDFISH SURVEY

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

MIDDLE ATLANTIC COASTAL FISHERIES CENTER



PART I - MIDDLE ATLANTIC BIGHT

CRUISE REPORT

1974 Fall Groundfish Survey

Part I - Middle Atlantic Bight

R/V Albatross IV 74-8 and R/V Delaware II 74-12(462)

Albatross IV sailed from Woods Hole, Mass., on September 23, 1974 and returned October 4, 1974.

Delaware II sailed from Sandy Hook, New Jersey on September 28, 1974 and returned October 4, 1974.

The purpose of the joint cruise survey was to conduct the fall groundfish and ichthyoplankton survey in southern New England and Mid-Atlantic Bight waters.

The Middle Atlantic Coastal Fisheries Center, headquartered at Sandy Hook, New Jersey now has the responsibility to conduct the Middle Atlantic portion of the groundfish survey. Close cooperation and a common data bank are maintained between this Center and the Northeast Fisheries Center at Woods Hole, Mass.

CRUISE OBJECTIVES

1. Investigate the distribution, weights and abundance of finfish and invertebrates collected in a standard otter trawl from Block Island to Cape Hatteras.

2. Investigate the distribution and abundance of larval and juvenile fishes collected by 60 cm bongo nets and neuston nets in the survey area.

3. Sample benthic finfish and their larval and juvenile stages intensively within the apex of the New York Bight, to measure variations in the fish population and determine differences in characteristics within areas of man-induced stress.

4. Make extensive sample collections for colleagues at both participating Centers as well as State and Federal facilities and universities. These samples are generally for life-history studies including age and growth, food habits, maturation and fecundity.

5. During the cruise obtain surface and bottom salinities and temperature profiles at all stations. On special stations take standard hydrographic measurements.

OPERATIONS - METHODS

The locations of trawling stations were established prior to the cruise on the basis of random selection of starting points in areas called strata. Strata limits are based on depth, proximity to major estuaries, bottom type and known fishing grounds.

A standard trawl station consisted of a 1/2 hour tow at 3-1/2 knots with a roller rigged #36 Yankee trawl, with 1200 lb oval doors and 10 fathom bridle. Scope varied according to depth. Surface and bottom salinity samples were collected and an XBT profile made on each station. During the tow a fathometer trace was kept for subsequent analysis of bottom contours and fish echoes. Catch processing was based on standard groundfish survey procedures.

Samples taken included preserved whole fish, and scales, otoliths, stomachs and gonads.

Plankton tows at preselected stations were made with 60 cm bongo nets according to standard MARMAP procedures.

A 15 min neuston tow was made with a one-meter Haedrich sampler while the trawl was fishing.

At some trawl stations and on some special stations profiles of salinity, temperature, depth and oxygen were taken. A rosette Niskin sampler was used in conjunction with the STDO probe.

RESULTS

The 166 stations made during the two vessel survey are shown in Figure 1. Included in the total either as combined or separate stations were 161 trawl hauls, 57 plankton and 6 hydrographic stations. Neuston collections were made on all trawl stations and 13 STDO profiles were made.

A list of species caught with the average weight per tow are shown in Table 1. The catch is summarized by 6 areas shown in Figure 1. The total catch weighed 22,621 lbs including 12,872 lbs of bony fishes, 8,376 lbs of elasmobranchs, 1,156 lbs of invertebrates and 215 lbs of turtles.

The Sciaenids as a group represented 50% of the bony fishes catch weight, spot and croaker alone accounted for 43%. The timing of the survey enabled us to sample spot and croaker as they began to move out of Chesapeake and Delaware Bays. This is clearly shown in the catch plot of these two species in Figure 2.

Samples collected during the cruise for life history or other special biological studies are listed in Table 2.

1974 Fall Groundfish Survey

Delaware II

Scientific Personnel:

T. Azarovitz, Chief Scientist
W. Morse, Watch Chief
V. Anderson
S. Roberts
S. Steimle
W. Smith
M. Fahay
W. Meredith (Univ. of Del.)

Albatross IV

Scientific Personnel:

A. Pacheco, Chief Scientist
Mal. Silverman, Watch Chief
A. Thoms
D. Christensen
J. Sibunka
P. Berrien
R. Bowman (Woods Hole) Watch Chief
J. Nicholas (Woods Hole)
J. Medeiros (L.E. & M.M.P. - Gloucester)
G. Clayton (Univ. of Mass.)
M. Belevich (USSR)
B. Motuzenko (USSR)
V. Tsitsyurskiy (USSR)
A. Romanchenko (USSR)

Thomas R. Azarovitz, Chief
Coastal Survey Invesitgation

Dr. Carl J. Sindermann, Center Directc
Middle Atlantic Coastal Fisheries Center

Dr. Arthur S. Merrill, Director
Resource Assessment Investigations

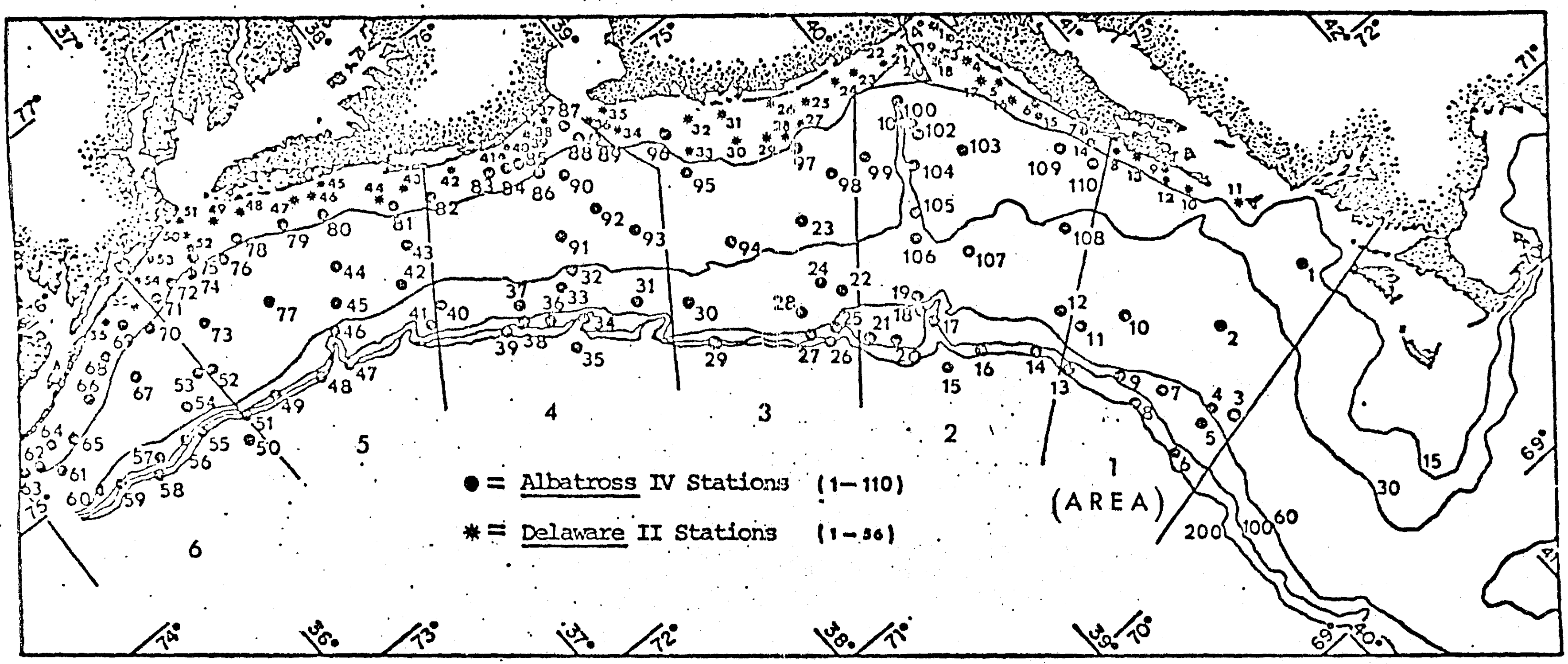
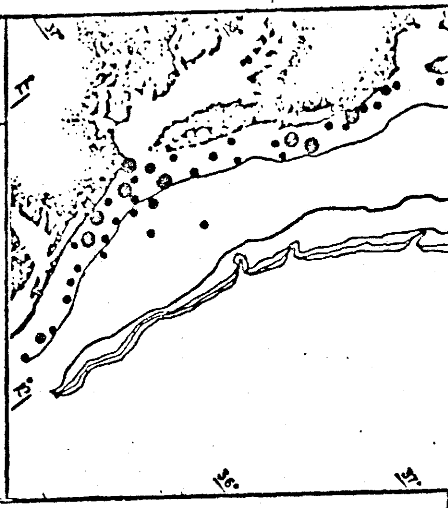


Figure 1. Plot of stations completed during the fall groundfish survey, Albatross IV and Delaware II, September 23 - October 4, 1974, covering the mid Atlantic shelf. Catch areas 1 through 6.

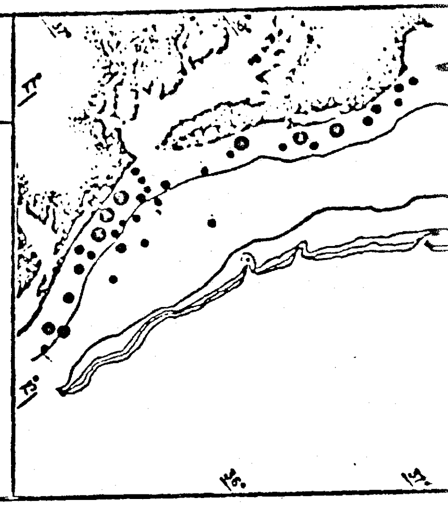
Species:
Spot

- • = less than 20 lbs
- • = 21 to 50 lbs
- ● = 51 to 100 lbs
- O = greater than 100 lbs



Species:
Croaker

- • = less than 20 lbs
- • = 21 to 50 lbs
- ● = 51 to 100 lbs
- ◉ = greater than 100 lbs



Species: spot

Stn No.	POSITION latitude	POSITION longitude	Tow Direct.	Depth (fms)	Day Nite	Wgt in lbs Total	Wgt in lbs Avg
62	35°28'	75°15'	225	14	D	1	1.00
64	35°38'	75°21'	060	14	D	73	.17
65	35°43'	75°16'	350	16	N	20	.20
66	35°59'	75°23'	045	12	N	13	.30
68	36°09'	75°32'	330	13	N	6	.20
69	36°20'	75°39'	350	12	N	5	.22
70	36°24'	75°36'	000	14	N	9	.25
71	36°33'	75°41'	190	12	D	27	.19
72	36°39'	75°40'	000	8	D	8	.22
73	36°68'	75°20'	040	13	D	3	.27
74	36°44'	75°37'	050	11	D	1	.16
75	36°52'	75°40'	020	12	D	39	.20
76	36°56'	75°35'	040	12	N	51	.18
77	36°56'	75°11'	090	20	N	1	.50
78	37°04'	75°37'	025	8	N	141	.17
79	37°18'	75°29'	025	12	N	41	.12
80	37°28'	75°23'	200	11	N	7	.21
81	37°44'	75°10'	050	12	D	1	.50
82	37°56'	75°04'	035	13	D	221	.20
83	38°11'	74°54'	025	12	D	1	.50
D35	38°59'	74°46'	000	5	D	1	.20
D37	38°41'	74°58'	220	8	N	12	.17
D38	38°39'	75°03'	150	6	N	70	.19
D39	38°36'	74°58'	150	9	N	4	.21
D40	38°27'	75°01'	180	8	N	47	.73
D41	38°25'	74°58'	190	8	N	111	1.40
D42	38°11'	75°05'	210	7	N	22	.20
D43	37°56'	75°10'	220	8	N	135	.17
D44	37°47'	75°15'	235	11	D	1	.16
D45	37°37'	75°32'	140	7	D	8	.18
D47	37°27'	75°35'	200	6	D	40	.19
D48	37°11'	75°44'	200	6	D	13	.17
D49	37°01'	75°48'	200	6	D	94	.16
D50	36°56'	75°51'	215	6	D	31	.20
D51	36°53'	75°58'	120	4	N	123	.12
D52	36°54'	75°45'	140	9	N	127	.17
D53	36°39'	75°53'	000	6	N	49	.89
D54	36°33'	75°47'	180	9	N	267	.25
D55	36°24'	75°46'	160	6	N	119	.24
D56	36°14'	75°43'	000	10	D	7	.24

Species: Croaker

Stn No.	POSITION latitude	POSITION longitude	Tow Direct.	Depth (fms)	Day Nite	Wgt in lbs Total	Wgt in lbs Avg
62	35°28'	75°15'	225	14	D	1	1.00
64	35°38'	75°21'	060	14	D	94	.29
65	35°43'	75°16'	350	16	N	99	.34
66	35°59'	75°23'	045	12	N	37	.36
67	36 10'	75°20'	009	18	N	1	.33
68	36°09'	75°32'	330	13	N	63	.42
69	36°20'	75°39'	350	12	N	27	.42
70	36°24'	75°36'	000	14	N	84	.53
71	36°33'	75°41'	190	12	D	21	.42
72	36°39'	75°40'	000	8	D	2	.50
73	36°68'	75°20'	040	13	D	12	.57
74	36°44'	75°37'	050	11	D	5	.50
75	36°52'	75°40'	020	12	D	23	.50
76	36°56'	75°35'	040	12	N	12	.48
77	36°56'	75°11'	090	20	N	1	1.00
78	37°04'	75°37'	025	8	N	21	.53
79	37°18'	75°29'	025	12	N	6	.66
82	37°56'	75°04'	035	13	D	28	.96
D37	38°41'	74°58'	220	8	N	1	.50
D38	38°39'	75°03'	150	6	N	27	.56
D39	38°36'	74°58'	150	9	N	2	2.00
D40	38°27'	75°01'	180	8	N	66	.54
D41	38°25'	74°58'	190	8	N	54	.72
D42	38°11'	75°05'	210	7	N	339	.58
D43	37°56'	75°10'	220	8	N	213	.61
D44	37°47'	75°15'	235	11	D	4	.80
D45	37°37'	75°32'	140	7	D	103	.40
D46	37°31'	75°31'	210	7	D	1	.50
D50	36°56'	75°51'	215	6	D	1	1.00
D51	36°53'	75°58'	120	4	N	29	.21
D52	36°54'	75°45'	140	9	N	2	.50
D53	36°39'	75°53'	000	6	N	246	.33
D54	36°33'	75°47'	180	9	N	261	.44
D55	36°24'	75°46'	160	6	N	762	.90
D56	36°14'	75°43'	000	10	D	71	.56

Figure 2.

Table 1. Species and weight of Fall 1974 Middle Atlantic Groundfish Survey.

	Weight/Tow						
Area	Area 1	Area 2	Area 3	Area 4	Area 5	Area 6	Total Wt.
No. of Tows	18	32	31	25	34	20	(lbs)
Hagfish	.6	<.1	--	--	<.1	--	14.5
Sand tiger	--	--	--	6.8	--	3.5	240.0
Chain dogfish	--	--	--	--	--	<.1	.5
Sandbar shark	--	--	.9	3.4	1.2	--	188.9
Smooth dogfish	8.6	2.1	23.0	29.3	1.2	--	1752.2
Dusky shark	--	--	--	--	3.0	--	102.0
Black dogfish	--	--	--	--	<.1	--	.4
Spiny dogfish	<.1	--	--	--	<.1	--	.7
Atlantic angel shark	--	--	--	1.5	4.3	<.1	185.2
Shark uncl.	--	--	--	--	4.3	11.9	416.2
Atlantic torpedo	6.3	--	--	--	--	--	113.4
Clearnose skate	--	--	.2	.6	1.1	<.1	59.6
Little skate	<.1	1.7	.5	<.1	--	--	70.9
Rossette skate	--	<.1	<.1	--	--	.4	8.3
Winter skate	<.1	.2	--	--	--	--	7.6
Skate uncl.	--	<.1	--	--	--	--	1.0
Roughtail stingray	--	--	.8	4.9	10.2	67.7	1848.1
Atlantic stingray	--	--	--	--	--	7.9	158.0
Bluntnose stingray	--	--	--	23.6	14.0	.7	1080.0
Spiny butterfly ray	--	--	--	1.5	26.7	--	945.3
Smooth butterfly ray	--	--	--	2.7	<.1	--	68.0
Bullnose ray	--	--	.2	25.8	8.2	1.5	960.0
Cownose ray	--	--	--	4.2	.2	2.9	169.8
Eel uncl.	<.1	--	--	--	--	--	.5
Conger eel	<.1	<.1	--	<.1	<.1	<.1	2.9
Snake eel	<.1	<.1	--	--	--	--	.9
Snipe eel	--	<.1	--	--	--	--	.5
Blueback herring	--	--	--	--	<.1	--	1.0
Alewife	--	--	--	<.1	--	--	.5
Atlantic menhaden	--	--	--	.1	--	--	2.5
Round herring	<.1	.3	0.2	<.1	--	--	1.0
Atlantic threadherring	--	--	--	--	<.1	--	1.0
Spanish sardine	--	<.1	--	--	<.1	<.1	5.0

Table 1. Continued

Area No. of Tows	Weight/Tow Area 1 18	 Area 2 32	 Area 3 31	 Area 4 25	 Area 5 34	 Area 6 20	Total Wt. (lbs)
Striped anchovy	<.1	<.1	<.1	<.1	4.0	.1	141.8
Bay anchovy	<.1	.4	<.1	<.1	--	--	14.0
Silver anchovy	--	<.1	--	--	--	--	1.0
Anchovy uncl.	<.1	<.1	--	--	--	--	1.0
Atlantic argentine	<.1	--	--	--	--	--	.5
Gonostomatidae	<.1	<.1	--	--	--	--	1.0
Inshore lizardfish	--	--	<.1	.1	.2	.2	12.5
Snakefish	--	--	--	--	<.1	--	.6
Pearlsides	<.1	<.1	--	--	--	--	1.0
Greeneyes	<.1	<.1	<.1	<.1	<.1	<.1	5.8
Myctophidae	<.1	<.1	--	<.1	<.1	<.1	4.0
Hatchetfish	<.1	--	--	--	--	<.1	1.0
Goosefish	4.2	1.6	1.1	.1	<.1	--	181.3
Atlantic batfish	--	<.1	--	--	--	--	.5
Hakeling	<.1	--	--	--	--	--	.5
Blue hake	--	<.1	--	--	--	--	.5
Fourbeard rockling	<.1	--	<.1	--	--	--	3.7
Atlantic cod	.5	--	--	--	--	--	8.5
Silver hake	2.6	1.0	<.1	<.1	<.1	.3	8.5
Longfin hake	<.1	<.1	<.1	<.1	--	--	2.0
Red hake	.6	<.1	--	--	<.1	<.1	14.1
Spotted hake	.7	.4	.4	1.1	1.7	2.5	162.4
Offshore hake	.5	.2	<.1	--	--	--	14.9
Fawn cusk-eel	.4	<.1	<.1	<.1	<.1	<.1	11.5
Striped cusk-eel	--	--	--	.5	<.1	<.1	12.5
Grenadier uncl.	<.1	.1	--	<.1	<.1	--	4.3
Halfbeak	--	--	--	<.1	--	<.1	1.2
Northern pipefish	--	--	--	--	<.1	--	5.9
Black sea bass	--	<.1	.1	.2	.8	<.1	36.0
Bluefish	.8	1.1	.6	<.1	3.0	.3	178.1
Cobia	--	--	--	--	--	7.0	140.0
Shark sucker	--	--	--	--	--	<.1	.5

Table 1. Continued

Area No. of Tows	Area 1 18	Area 2 32	Area 3 31	Area 4 25	Area 5 34	Area 6 20	Total Wt. (lbs)
Blue runner	--	<.1	<.1	<.1	.2	.9	24.8
Crevalle jack	--	--	<.1	--	--	--	1.3
Mackerel scad	--	<.1	<.1	--	--	--	2.0
Round scad	<.1	<.1	<.1	--	<.1	--	4.0
Bigeye scad	<.1	<.1	<.1	<.1	.1	.6	19.6
Lookdown	--	--	--	--	<.1	<.1	1.4
Greater amberjack	--	--	--	--	.1	<.1	5.0
Banded rudderfish	--	<.1	--	--	<.1	<.1	1.2
Florida pompano	--	--	--	--	.1	--	.6
Rough scad	--	--	<.1	4.0	<.1	.6	115.2
Atlantic moonfish	--	--	<.1	--	<.1	<.1	2.0
Carrangidae uncl.	--	.2	--	--	--	<.1	6.4
Dolphin	--	<.1	--	--	--	--	.5
Silk snapper	--	--	--	--	<.1	--	.5
White grunt	--	--	--	--	--	<.1	.5
Pigfish	--	--	--	--	<.1	<.1	1.0
Pinfish	--	--	--	--	<.1	.4	8.5
Longspine porgy	--	--	--	--	18.8	2.8	695.2
Scup	.4	2.2	.3	<.1	9.1	17.0	736.4
Silver seatrout	--	--	--	--	--	<.1	.5
Weakfish	<.1	.3	.6	11.1	7.0	.5	554.5
Banded drum	--	--	--	--	<.1	.2	4.2
Spot	--	--	7.2	21.2	37.2	12.6	2270.5
Southern kingfish	--	--	--	<.1	2.2	.5	86.1
Northern kingfish	--	<.1	--	.1	<.1	<.1	8.0
Atlantic croaker	--	--	.8	39.1	28.3	61.9	3287.3
Red goatfish	--	<.1	--	--	--	--	.5
Cunner	--	--	.1	--	--	--	3.1
Striped mullet	--	--	<.1	--	--	--	1.0
Northern sennet	--	<.1	<.1	--	<.1	<.1	3.5
Rock gunnel	<.1	--	--	--	--	--	.5
Wrymouth	--	<.1	--	--	--	--	1.0
Sand lance	--	<.1	<.1	<.1	.2	--	8.5
Atlantic cutlassfish	--	<.1	--	--	<.1	.3	6.7
Atlantic mackerel	<.1	<.1	<.1	<.1	--	--	1.5
King mackerel	--	--	--	--	--	<.1	.5
Spanish mackerel	--	--	--	.4	.4	3.7	97.6

Table 1. Continued

Area	Area 1	Area 2	Area 3	Area 4	Area 5	Area 6	Total Wt.
	Weight/Tow						
No. of Tows	18	32	31	25	34	20	(lbs)
Harvestfish	--	--	--	--	<.1	--	1.7
Butterfish	5.7	4.6	4.5	22.0	27.6	3.7	1981.6
Blackbelly rosefish	--	--	.2	<.1	.3	<.1	18.9
Ocean perch	.2	.1	--	--	--	--	6.6
Armored searobin	<.1	--	--	--	<.1	.1	3.5
Northern searobin	<.1	.2	.3	7.1	5.9	.2	398.2
Striped searobin	--	2.9	<.1	3.4	1.6	.3	238.2
Longhorned sculpin	--	<.1	--	--	--	--	2.0
Gulf Stream flounder	--	<.1	<.1	.2	--	--	7.1
Summer flounder	3.7	4.0	11.0	9.1	4.8	.4	932.1
Fourspot flounder	<.1	.4	.4	.4	--	--	35.2
Windowpane	.4	.2	.6	.6	2.0	.3	120.8
Etropus sp.	.2	<.1	--	--	<.1	--	5.1
Bothidae sp.	--	--	<.1	--	--	--	1.2
Witch flounder	--	<.1	--	<.1	--	--	1.0
Yellowtail flounder	--	.5	<.1	--	--	--	17.5
Winter flounder	<.1	<.1	<.1	--	--	--	7.0
Hogchoker	--	--	--	.6	--	--	15.0
Cynoglossidae	--	--	--	<.1	<.1	--	1.6
Orange filefish	--	--	--	--	.2	--	6.8
Gray triggerfish	--	--	--	--	<.1	--	2.0
Planehead filefish	<.1	.1	.1	.2	.4	<.1	26.0
Smooth puffer	--	--	--	--	<.1	--	.5
Northern puffer	<.1	<.1	<.1	<.1	<.1	--	4.7
Striped burrfish	--	--	--	--	<.1	--	.6
Mussels	7.6	--	--	--	--	--	129.2
Scallops	<.1	--	1.2	.5	--	--	50.9
Loligo	3.3	4.5	6.3	6.6	4.4	--	710.0
Illex	.7	1.2	1.6	.2	1.3	--	149.1
Cancer crabs	--	<.1	<.1	--	<.1	--	3.0
Shrimps	--	--	--	.2	--	--	5.0
Lobsters	.6	.6	1.3	--	1.2	--	110.5
Turtles	--	--	--	--	3.1	5.5	215.4

TABLE 2.--Station and sampling inforamtion for 1974 fall groundfish survey

I. Station information

(1)

Station type	No. of Stations
Trawl	161
Bongo	57
Neuston	161
STDO	13
XBT	117

II. Sampling information

(1) Age and growth sampling

Species	Otoliths
Cod	1
Red hake	23
Silver hake	93

(2) Feeding habits

Species	Adults	Juveniles
Little skate	17	--
Silver hake	90	185
Spotted hake	65	22
Red hake	19	--
Fourspot flounder	57	--
Yellowtail flounder	11	--
Scup	37	79
Butterfish	103	62

(3) Maturity samples

Species	Sampled
Butterfish	36
Summer flounder	41
Spanish mackerel	2
Silver hake	29
Red hake	4
Scup	16
Offshore hake	11
Winter flounder	5
Fourspot flounder	7
Spotted hake	12
Windowpane	7

(4) Linda Mercer (VIMS)

Species	Samples
Black sea bass	178

TABLE 2. Continued

(5) Dr. Clement Market (Yale)

Species	Samples
Conger eel	1
Snake eels	4
Grenadiers	4

(6) Dr. Richard Wallace (Univ. of Idaho)

Species	Samples
Bluefish	1

(7) Gordon Waring (NEFC)

Species	Samples
Little skate	10

(8) Dr. John Stegeman (WHOI)

Species	Samples
Silver hake	2
Longfin hake	1
Fourbeard rockling	1
Offshore hake	1
Spotted hake	2
Red hake	2
Grenadiers	2

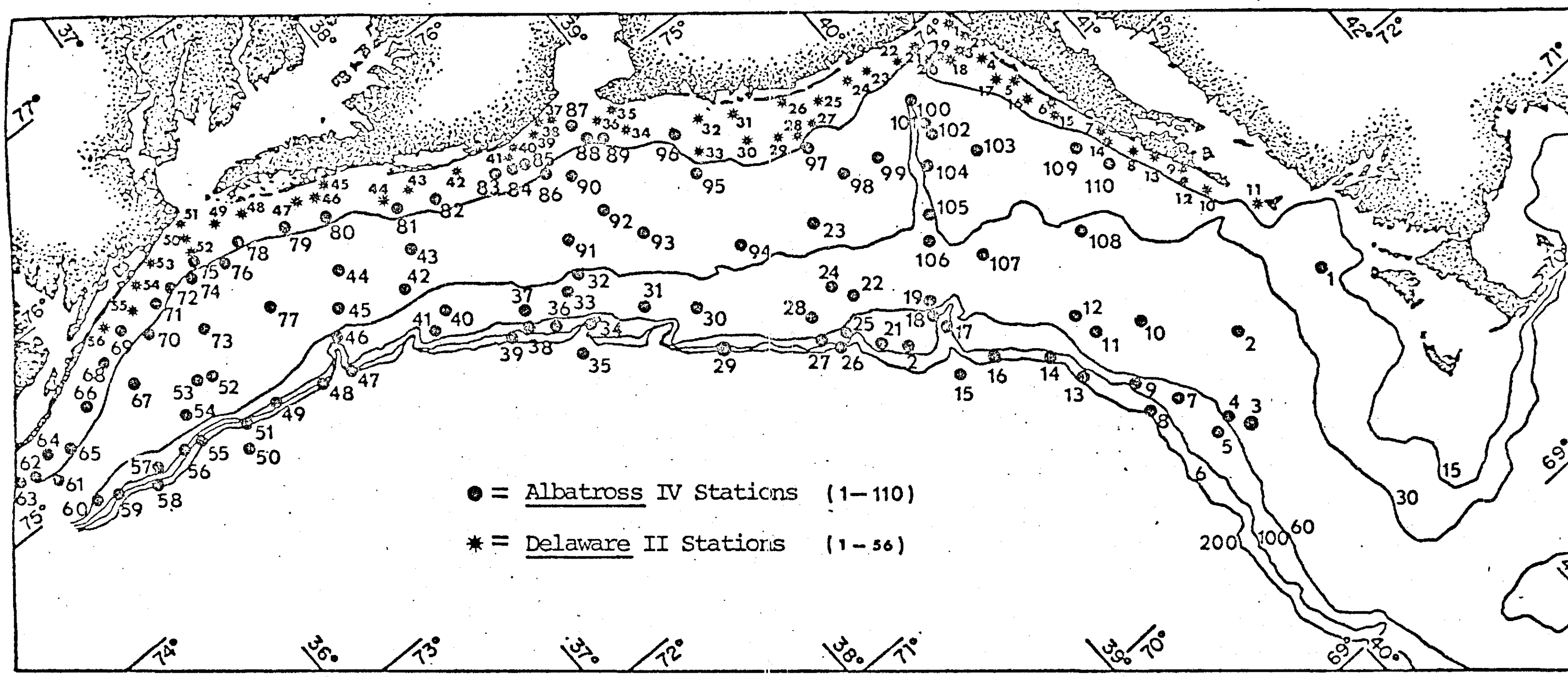
(9) Stuart Wilk (Sandy Hook)

Species	Samples
Sciaenids	3800

CATCH OF *ALBATROSS* IV AND *DELAWARE* II ON GROUNDFISH SURVEY, SEPTEMBER 23 - OCTOBER 4, 1974

(PART I, COVERING MID-ATLANTIC SHELF)

The included charts and station data are designed to show where commercially and recreationally important species were found in some quantity during the Fall Groundfish Survey. The tows were made with a #36 trawl with rollers, standard 5-fathom legs, and standard 1200-lb oval doors. The cod end and upper belly were lined with ½-inch mesh netting to retain the smaller fish. Because of the short tow time (one-half hour), the catches listed are low when compared to standard dragger tows. The bias caused by the day-night catchability of some fish, and the fact that randomly selected stations won't necessarily fall on fish concentrations, will have to be appreciated. These data should give fishermen some useful information as to relative amounts of fish in the areas surveyed. For further information, please call or write to NATIONAL MARINE FISHERIES SERVICE, SANDY HOOK LABORATORY, HIGHLANDS, NEW JERSEY 07732, Resource Assessment Investigations.



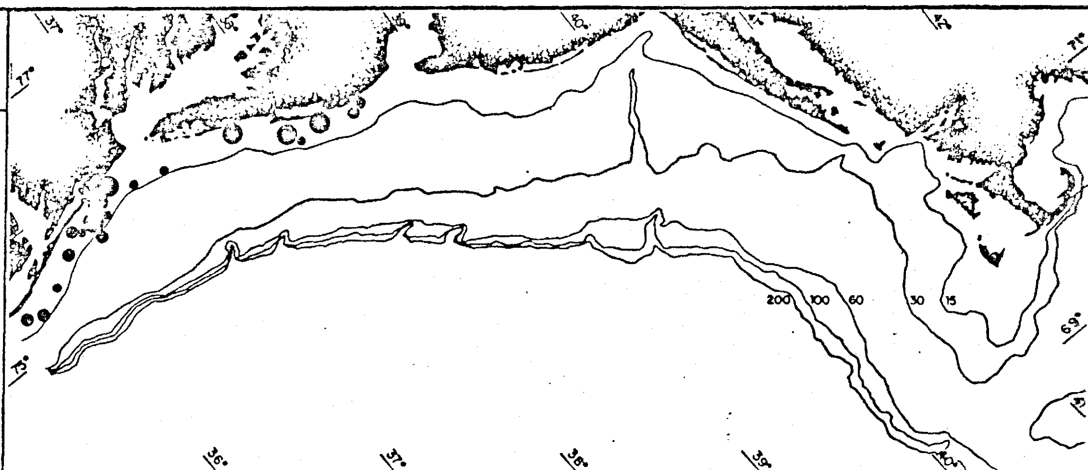
Plot of stations completed during the fall groundfish survey, Albatross IV and Delaware II, September 23 - October 4, 1974, covering the mid Atlantic shelf.

Species: CROAKER

• = between 20 and 50 lbs

● = between 50 and 100 lbs

⊛ = greater than 100 lbs

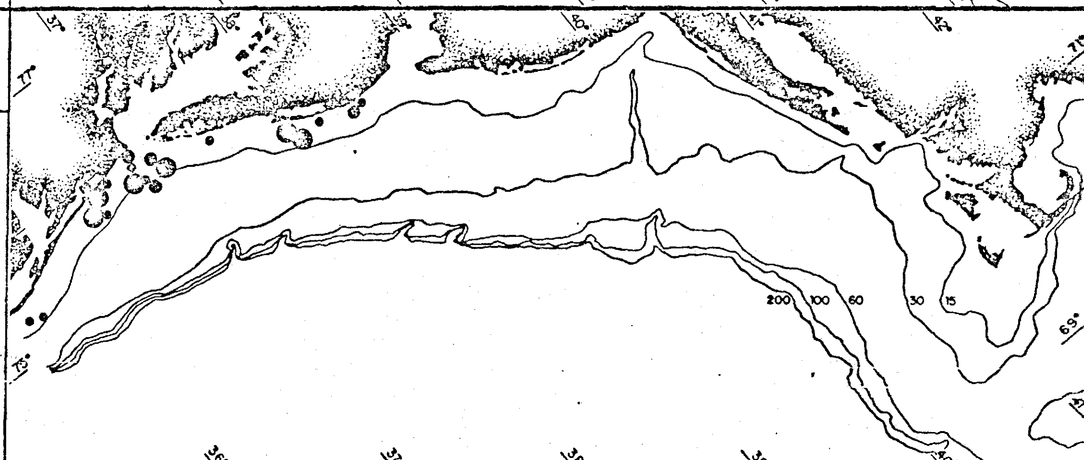


Species: SPOT

• = between 20 and 50 lbs

● = between 50 and 100 lbs

⊛ = greater than 100 lbs



Species: CROAKER

Stn No.	POSITION latitude	POSITION longitude	Tow Direct.	Depth (fms)	Day Nite	Wgt in lbs Total	Wgt in lbs Avg
64	35°38'	75°21'	060	14	D	75	.32
65	35°43'	75°15'	350	16	N	99	.34
66	35°59'	75°23'	045	10	N	37	.37
68	38°09'	75°32'	330	13	N	63	.42
69	36°20'	75°39'	350	11	N	27	.42
70	36°34'	75°36'	000	14	N	84	.56
71	36°33'	75°41'	190	11	D	21	.42
75	36°52'	75°40'	020	11	D	23	.51
78	37°04'	75°38'	025	8	N	20	.51
82	37°56'	75°04'	035	13	D	26	.90
D40	38°27'	75°01'	180	6	D	66	.59
D41	38°25'	74°58'	190	7	N	54	.72
D42	38°11'	75°05'	210	7	N	339	.58
D43	37°56'	75°10'	220	7	N	213	.65
D45	37°37'	75°32'	140	7	D	103	.38
D53	36°39'	75°53'	360	5	N	246	.38
D54	36°33'	75°47'	180	8	N	261	.47
D55	36°24'	75°50'	160	5	N	762	.58
D56	36°14'	75°43'	360	9	D	71	.56

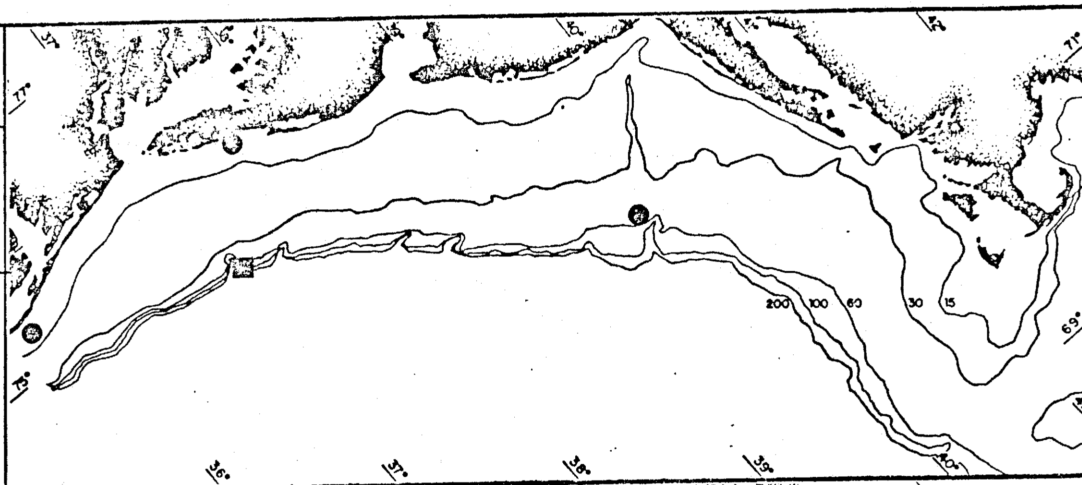
Species: SPOT

Stn No.	POSITION latitude	POSITION longitude	Tow Direct.	Depth (fms)	Day Nite	Wgt in lbs Total	Wgt in lbs Avg
64	35°38'	75°21'	060	14	D	44	.14
65	35°43'	75°15'	350	16	N	20	.20
71	36°33'	75°41'	190	11	D	27	.20
75	36°52'	75°40'	020	11	D	39	.20
76	36°56'	75°35'	040	12	N	51	.18
78	37°04'	75°38'	025	8	N	141	.18
82	37°56'	75°04'	035	13	D	221	.19
D40	38°27'	75°01'	180	6	N	47	.16
D41	38°25'	74°58'	190	7	N	74	.14
D42	38°11'	75°05'	210	7	N	22	.21
D43	37°56'	75°10'	220	7	N	135	.18
D47	37°27'	75°35'	200	6	D	40	.20
D49	37°01'	75°48'	200	6	D	94	.16
D50	36°56'	75°51'	215	5	D	31	.16
D51	36°53'	75°58'	120	3	N	92	.12
D52	36°53'	75°45'	140	7	N	127	.17
D53	36°39'	75°53'	360	5	N	49	.15
D54	36°33'	75°47'	180	8	N	267	.25
D55	36°24'	75°43'	360	9	D	119	.24

Species: BUTTERFISH

● = between 20 and 50 lbs

SPOTTED HAKE ■

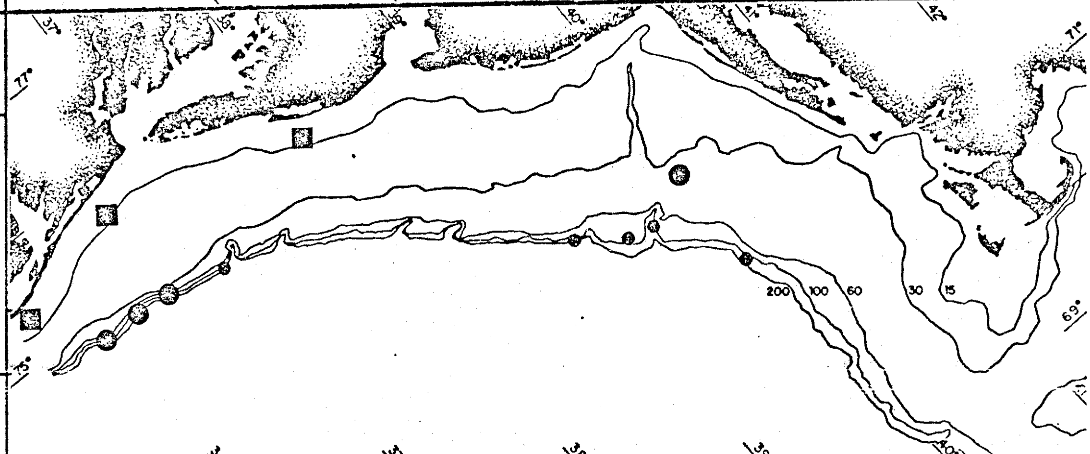


Species: LOBSTER

• = between 5 and 20 lbs

● = greater than 20 lbs

BLUEFISH ■ = between 20 and 50 lbs



Species: BUTTERFISH, SPOTTED HAKE

Stn No.	POSITION latitude	POSITION longitude	Tow Direct.	Depth (fms)	Day Nite	Wgt in lbs Total	Wgt in lbs Avg
			BUTTERFISH				
19	39°30'	72°32'	220	55	D	27	.32
64	35°38'	75°21'	060	14	D	38	.15
D45	37°37'	75°32'	140	7	D	40	.23
			SPOTTED HAKE				
47	37°07'	74°34'	015	100	N	28	.15

Species: LOBSTER, BLUEFISH

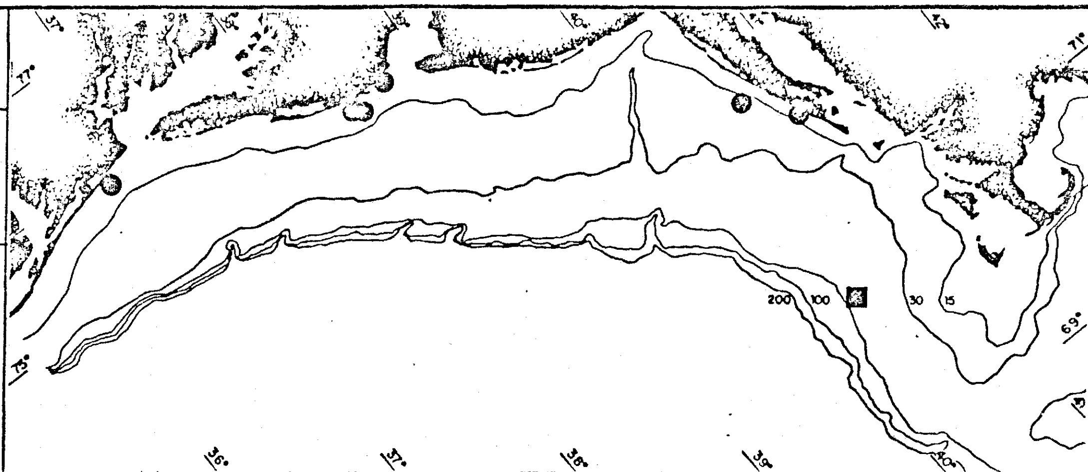
Stn No.	POSITION latitude	POSITION longitude	Tow Direct.	Depth (fms)	Day Nite	Wgt in lbs Total	Wgt in lbs Avg
			LOBSTER				
13	39°53'	71°40'	070	142	N	7	.58
17	39°32'	72°22'	120	280	D	5	.71
20	39°19'	72°24'	225	80	N	8	8.00
26	38°59'	72°48'	220	170	D	7	2.33
48	36°56'	74°37'	180	135	D	6	6.00
51	36°37'	74°42'	010	145	D	33	3.67
55	36°17'	74°48'	180	127	N	31	3.44
58	36°00'	74°46'	180	110	N	17	1.55
107	39°54'	72°31'	225	38	D	42	14.00
			BLUEFISH				
64	35°38'	75°21'	060	14	D	30	.28
71	36°33'	75°41'	190	11	D	28	.30
82	37°56'	75°04'	035	13	D	40	.39

Species: SUMMER FLOUNDER

● = greater than 20 lbs

SILVER HAKE

■ = greater than 20 lbs



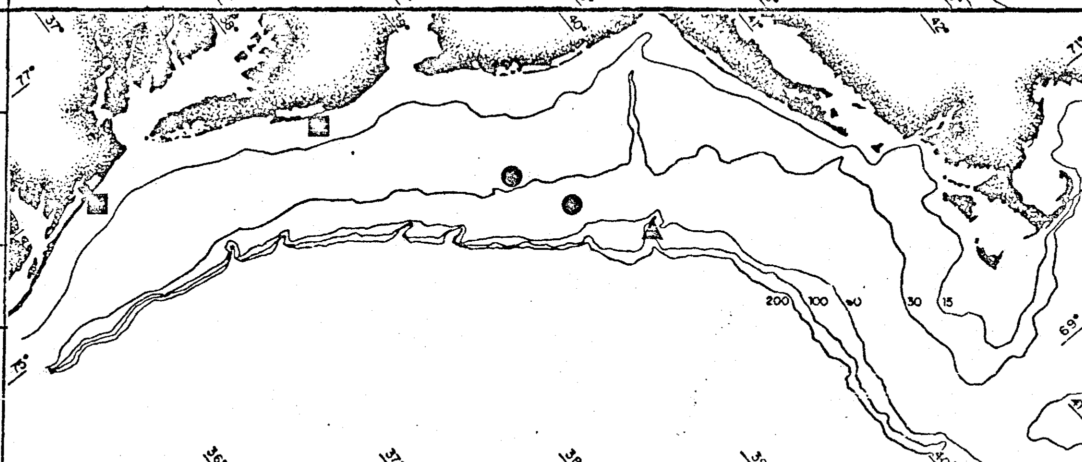
Species: SCALLOPS

● = between 20 and 50 lbs

RED CRAB ▲

WEAKFISH

■ = between 20 and 50 lbs



Species: SUMMER FLOUNDER, SILVER HAKE

Stn No.	POSITION latitude	POSITION longitude	Tow Direct.	Depth (fms)	Day Nite	Wgt in lbs Total	Wgt in lbs Avg
		SUMMER FLOUNDER					
85	38°27'	74°51'	015	9	D	31	1.63
109	40°35'	72°44'	055	20	N	27	3.00
D13	40°54'	72°14'	215	9	N	39	6.50
D37	38°41'	74°58'	220	7	D	43	1.65
D41	38°25'	74°58'	190	7	N	24	1.50
D53	36°39'	75°53'	360	5	N	26	2.36
		SILVER HAKE					
3	40°22'	70°46'	105	56	N	20	.20

Species: SCALLOPS, RED CRAB, WEAKFISH

Stn No.	POSITION latitude	POSITION longitude	Tow Direct.	Depth (fms)	Day Nite	Wgt in lbs Total	Wgt in lbs Avg
		SCALLOPS					
24	39°11'	73°04'	130	42	N	27	.18
94	38°58'	73°39'	045	30	D	22	.23
		RED CRAB					
17	39°32'	72°22'	120	280	D	50	1.32
		WEAKFISH					
D42	38°11'	75°05'	210	7	N	50	1.09
D54	36°33'	75°47'	180	8	N	24	.75

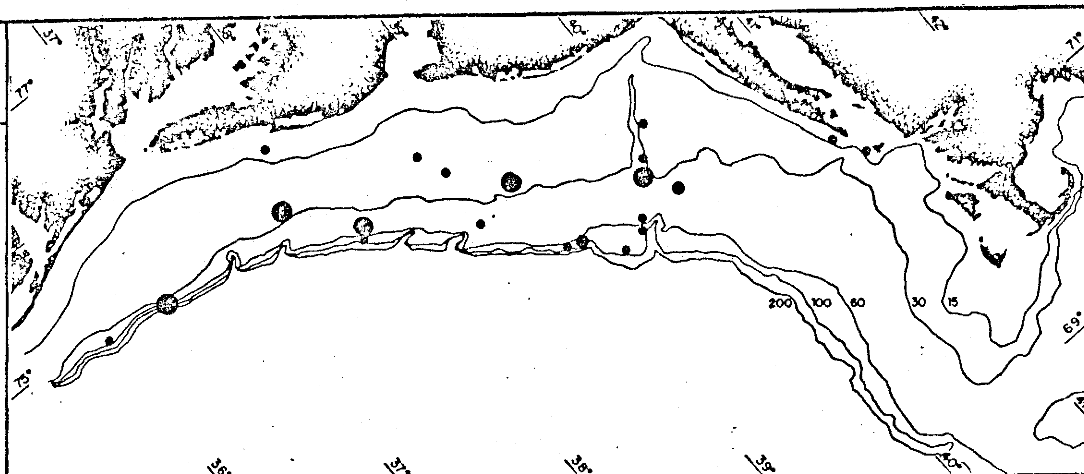
Species:

LOLIGO

• = between 20 and 50 lbs

● = between 50 and 100 lbs

◉ = greater than 100 lbs



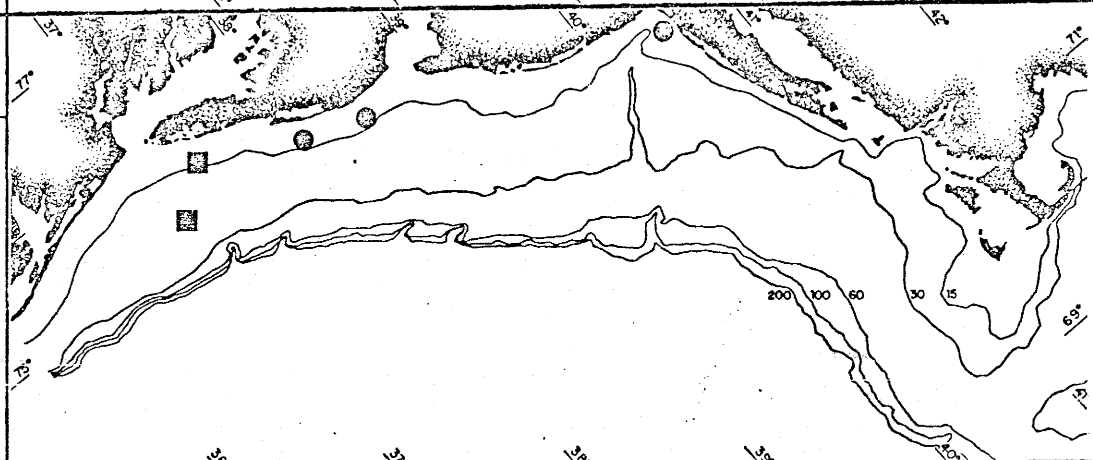
Species:

SCUP

◉ = between 20 and 35 lbs

SEA BASS

▣ = between 50 and 75 lbs



Species: LOLIGO

Stn No.	POSITION latitude	longitude	Tow Direct.	Depth (fms)	Day Nite	Wgt in lbs Total	Avg
18	39°29'	72°26'	210	62	D	35	.20
19	39°30'	72°32'	220	55	D	40	.19
20	39°19'	72°24'	225	80	N	20	.23
25	39°05'	72°49'	200	62	D	67	.13
27	38°56'	72°53'	220	68	D	45	.16
30	38°36'	73°26'	240	45	D	32	.13
37	37°56'	74°01'	220	75	D	38	.16
38	37°60'	74°07'	220	55	D	101	.16
42	37°33'	74°42'	270	30	D	142	.16
51	36°37'	74°42'	010	145	D	104	.15
57	36°03'	74°49'	225	51	N	26	.16
92	38°34'	74°22'	075	23	N	48	.18
93	38°37'	74°03'	040	28	D	34	.19
94	38°58'	73°39'	045	30	D	112	.22
104	39°57'	73°13'	270	35	D	38	.20
105	39°50'	73°00'	100	40	D	40	.17
106	39°44'	72°51'	120	41	D	141	.14
107	39°54'	72°31'	225	38	D	94	.22
D10	40°59'	71°55'	075	12	D	35	.10
D11	41°06'	71°26'	090	11	D	23	.10
D44	37°47'	75°16'	235	10	D	26	.15

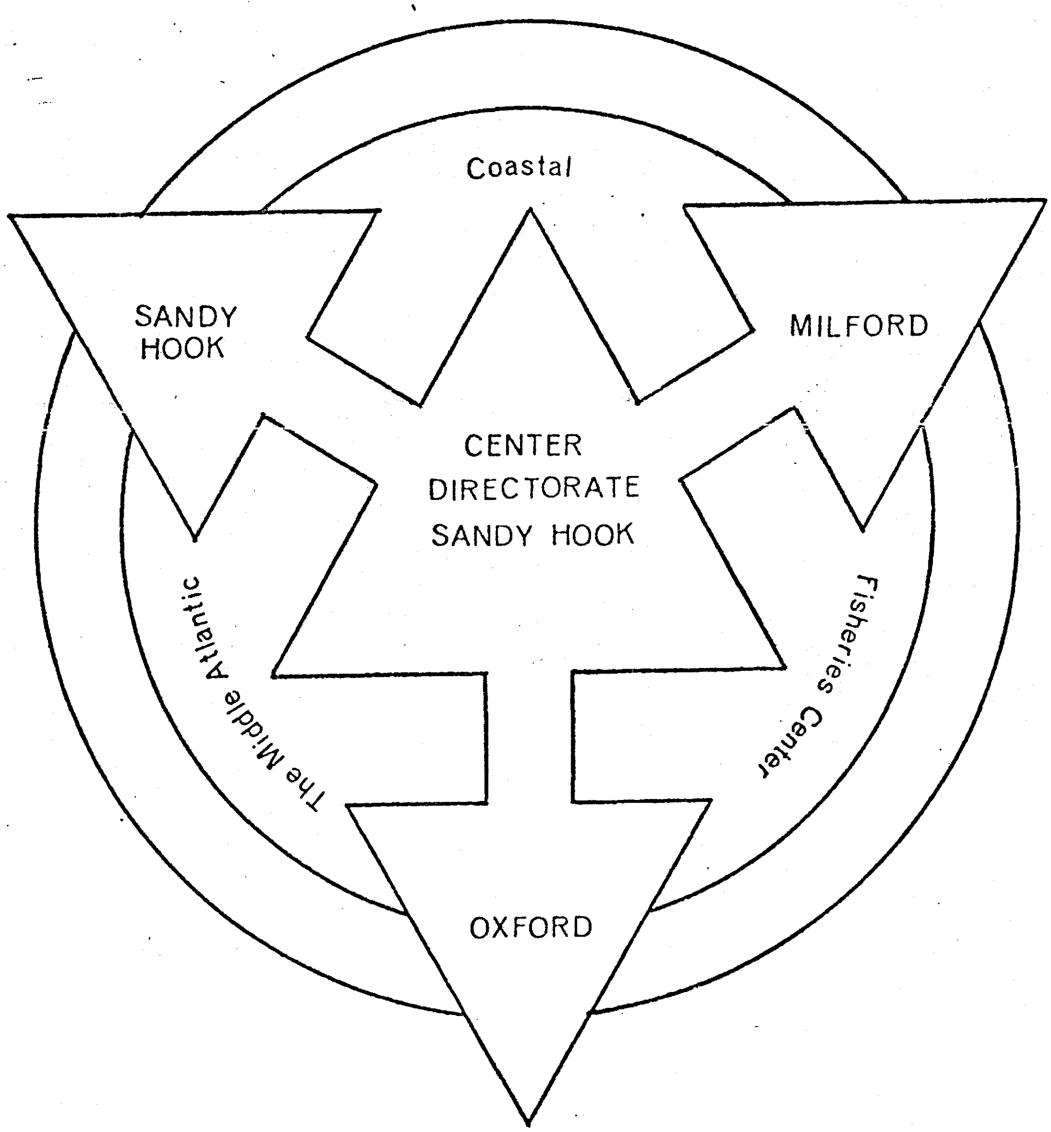
Species: SCUP AND SEA BASS

Stn No.	POSITION latitude	longitude	Tow Direct.	Depth (fms)	Day Nite	Wgt in lbs Total	Avg
			SCUP				
82	37°56'	75°04'	035	13	D	31	.18
85	38°27'	74°51;	015	9	D	22	.21
D 3	40°29'	73°38'	060	9	D	31	.17
			SEA BASS				
77	36°56'	75°11'	090	20	N	60	.43
79	37°18'	75°29'	025	11	N	55	.73

CRUISE REPORT
NOAA Ship Delaware II
2 December - 15 December 1974

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

MIDDLE ATLANTIC COASTAL FISHERIES CENTER



Ecosystems Investigations, Sandy Hook Laboratory
Highlands, New Jersey

(Funded by NOAA-MESA Appropriations)

Cruise Report NOAA Ship Delaware II, Cruise D-74-16

INTRODUCTION:
FRS Delaware II departed Sandy Hook (SH) dock at 0915 hrs on 6 December 74, four days late due to major storm system during which winds up to 80 mph were reported by a local radio station and much damage was evidenced along the New Jersey coast.

Following departure the vessel proceeded to Ambrose Light Tower to calibrate RAYDIST at 1025 hrs. Multiple core sampling at the first station commenced at 1135 hrs using both drop buoy and RAYDIST to maintain position for sampling (within a circle with a radius of ¼ nautical mile and the center at the station point). Sampling operations proceeded uneventfully.

Following station 13 on 7 December, RAYDIST was calibrated at Ambrose Light Tower at 1435 hrs. Sampling continued at station 14 at 1600 hrs.

On 8 December sampling suspended at 1500 hrs at station 19 after unsuccessful attempt at coring due to weather (winds SE at 30 knots). Vessel proceeded to SH dock arriving at 1615 hrs.

On 9 December departed SH at 1215 hrs bound for station 19. Commenced sampling 1402 hrs.

On 10 December suspended sampling at 0710 hrs at station 27 to return to SH to pick up RAYDIST operator. Personnel on board, departed SH at 0855 bound for Ambrose Light Tower. RAYDIST calibrated at 1015 hrs. Sampling commenced at station 28 at 1055 hrs. Sampling uneventful. Last station marker buoy 2300 hrs at station 31. Rest of cruise accomplished without buoy to mark station. RAYDIST control exercised to maintain positioning within ¼ nautical mile of station for sampling.

On 11 December sampling suspended at 0950 hrs after completing station 36. Vessel proceeded to SH arriving at 1105 hrs to transfer scientific personnel. Dr. Thomas departed vessel 1600 hrs for MESA meeting in Washington, D. C.

On 12 December vessel departed SH at 0805 hrs to commence sampling 0955 hrs at station 37. Sampling suspended at 1605 hrs after station 43. Vessel proceeded to SH arriving 1730.

On 13 December depart SH 0850 with Dr. Thomas back on board. Calibrate RAYDIST at Ambrose Light Tower at 0945 hrs. Commence sampling 1100 hrs at station 44.

On 14 December suspended sampling 1210 hrs after completing station 57 to calibrate RAYDIST at Ambrose Light Tower. Calibration complete 1320 hrs. Commence sampling 1424 hrs at station 58. Sampling continued uneventfully.

On 15 December sampling terminated 0400 hrs after completing station 63. Vessel proceeded to SH arriving 0450 hrs. Off-loading commenced 1400 hrs but was not completed until 17 December due to high winds and rain on 16 December.

Cruise Report NOAA Ship Delaware II, Cruise D-74-16

SCIENTIFIC PERSONNEL:
Smith-McIntyre grab (bottom) sampling and multiple core operations.

James Thomas - Party Chief	Frank Saunders
William Phoel	Mike Rossi, 12 - 15 Dec.
Bob Dennis, 6 - 11 Dec.	James Young, 12 - 15 Dec.
Greg Kornutik	Margaret Dawson, 12 - 15 Dec.
Thomas Jackson	Brenda Morton, 12 - 15 Dec.

CRUISE OBJECTIVES:
Objective of this cruise was to provide baseline data necessary to the accomplishment of MESA Task No. 3 in MACFC, Informal Report No. 13, benthic respiration.

OPERATIONS:
Stations were selected on a grid (1 min. latitude x 1 min. longitude) overlying the apex of the New York Bight (see Fig. 1 and Table 1).

Multiple core casts to obtain undisturbed bottom sediment with overlying bottom water were made at 63 different stations (Fig. 1) to measure seabed oxygen consumption. Two stations could not be sampled with the multiple corer due to the coarseness of the bottom. These stations were abandoned after five unsuccessful multiple core casts. Ideally, a minimum of four cores per station were used to measure oxygen consumption by the seabed according to the methods of Pamatmat (1971). The cores were equilibrated for 1 hour in a water bath regulated to within two degress of *in situ* temperature. Following equilibration, the oxygen consumption was monitored for approximately 12 hours. Initial and final dissolved oxygen samples were taken and processed according to the azide modification of the idometric method using 0.025 N PAO instead of sodium thiosulfate. Reagents were added to the sample with a 1 ml insulin syringe. A 2 ml gilmont microburet with needle was used in the titration of the 26 ml samples. Concentrated formalin was added to several of the samples at each station and the oxygen decrease was again monitored for 12 hours. One of the cores was stored frozen for later carbon analysis. A Niskin bottle with reversing thermometer was attached to the frame of the multiple corer to collect bottom water for salinity and dissolved oxygen determinations and to record bottom temperature at each station. The oxygen samples were titrated on board using a sample volume of 203 ml and titrating with 0.025 N PAO with thyodene as the indicator. The salinity samples were stored for later analysis at Sandy Hook using an RS7-B salinometer.

RESULTS:

Sixty-three stations (241 cores) (Fig. 1) were sampled to measure total oxygen consumption by the seabed. The data from these samples are now being processed.

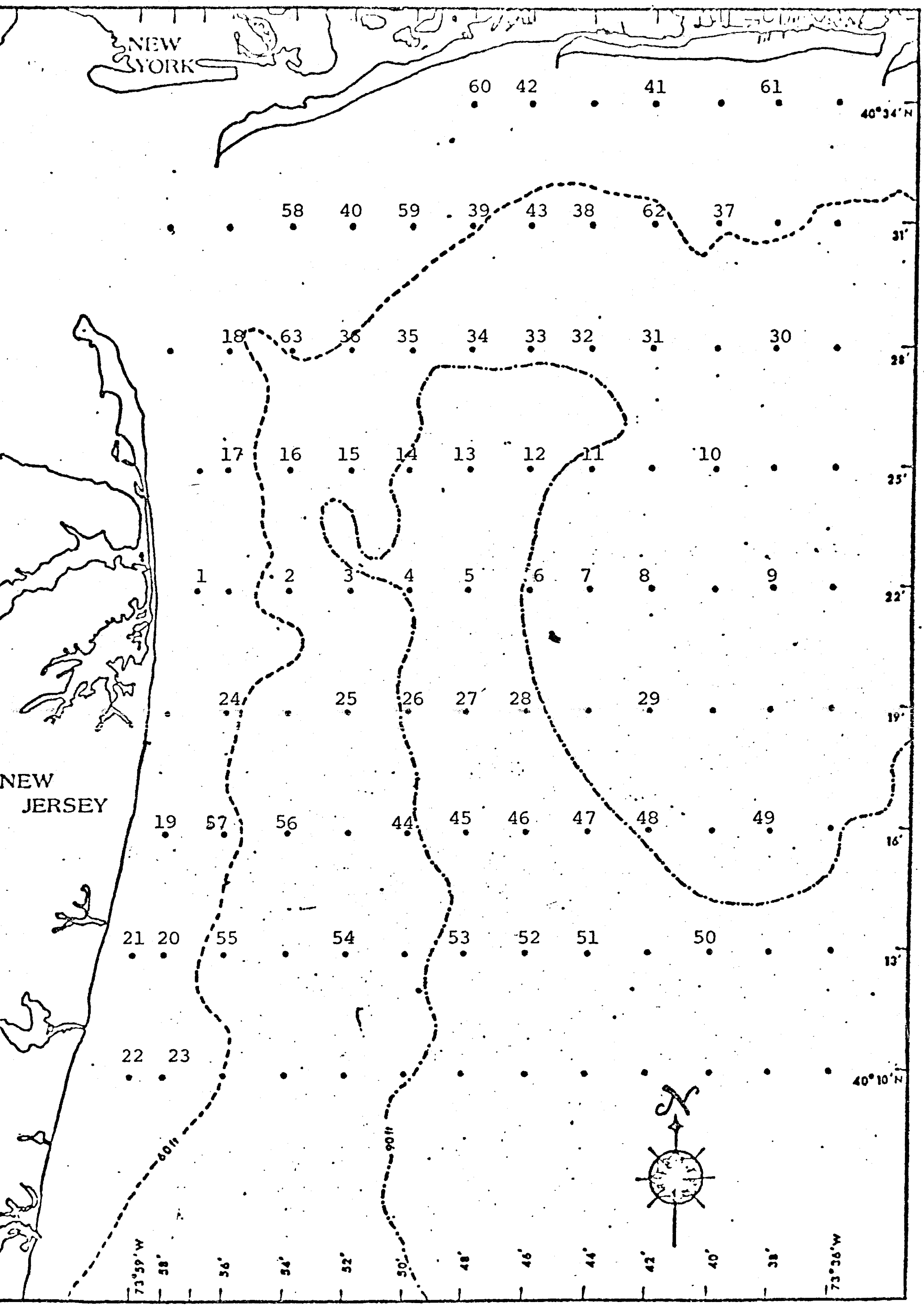


Figure 1. Locations of multiple coring stations for seabed oxygen consumption studies.

40°22'N,	73°57'W
40°22'N,	73°54'W
40°22'N,	73°52'W
40°22'N	73°50'W
40°22'N	73°48'W
40°22'N	73°46'W
40°22'N	73°44'W
40°22'N	73°42'W
40°22'N	73°38'W
40°25'N	73°40'W
40°25'N	73°44'W
40°25'N	73°46'W
40°25'N	73°48'W
40°25'N	73°50'W
40°25'N	73°52'W
40°25'N	73°54'W
40°25'N	73°56'W
40°28'N	73°56'W
40°16'N	73°58'W
40°13'N	73°58'W
40°13'N	73°59'W
40°10'N	73°59'W
40°10'N	73°58'W
40°19'N	73°56'W
40°19'N	73°52'W
40°19'N	73°50'W
40°19'N	73°48'W
40°19'N	73°46'W
40°19'N	73°42'W
40°28'N	73°38'W
40°28'N	73°42'W
40°28'N	73°44'W
40°28'N	73°46'W
40°28'N	73°48'W
40°28'N	73°50'W
40°28'N	73°52'W

Table 1 (continued)

40°31'N	73°40'W
40°31'N	73°44'W
40°31'N	73°48'W
40°31'N	73°52'W

40°34'N	73°42'W
40°34'N	73°46'W
40°31'N	73°46'W

40°16'N	73°50'W
40°16'N	73°48'W
40°16'N	73°46'W
40°16'N	73°44'W
40°16'N	73°42'W
40°16'N	73°38'W

40°13'N	73°40'W
40°13'N	73°44'W
40°13'N	73°46'W
40°13'N	73°48'W
40°13'N	73°52'W
40°13'N	73°56'W

40°16'N	73°52'W
40°16'N	73°56'W

40°31'N	73°54'W
40°31'N	73°50'W

40°34'N	73°48'W
40°34'N	73°38'W

40°31'N	73°42'W
40°28'N	73°54'W

SUBMITTED BY:

James P. Thomas Date February 28, 1975

James P. Thomas, Chief, Biological Oceanography Investigations

Date

John B. Pearce, Director, Ecosystems Investigations

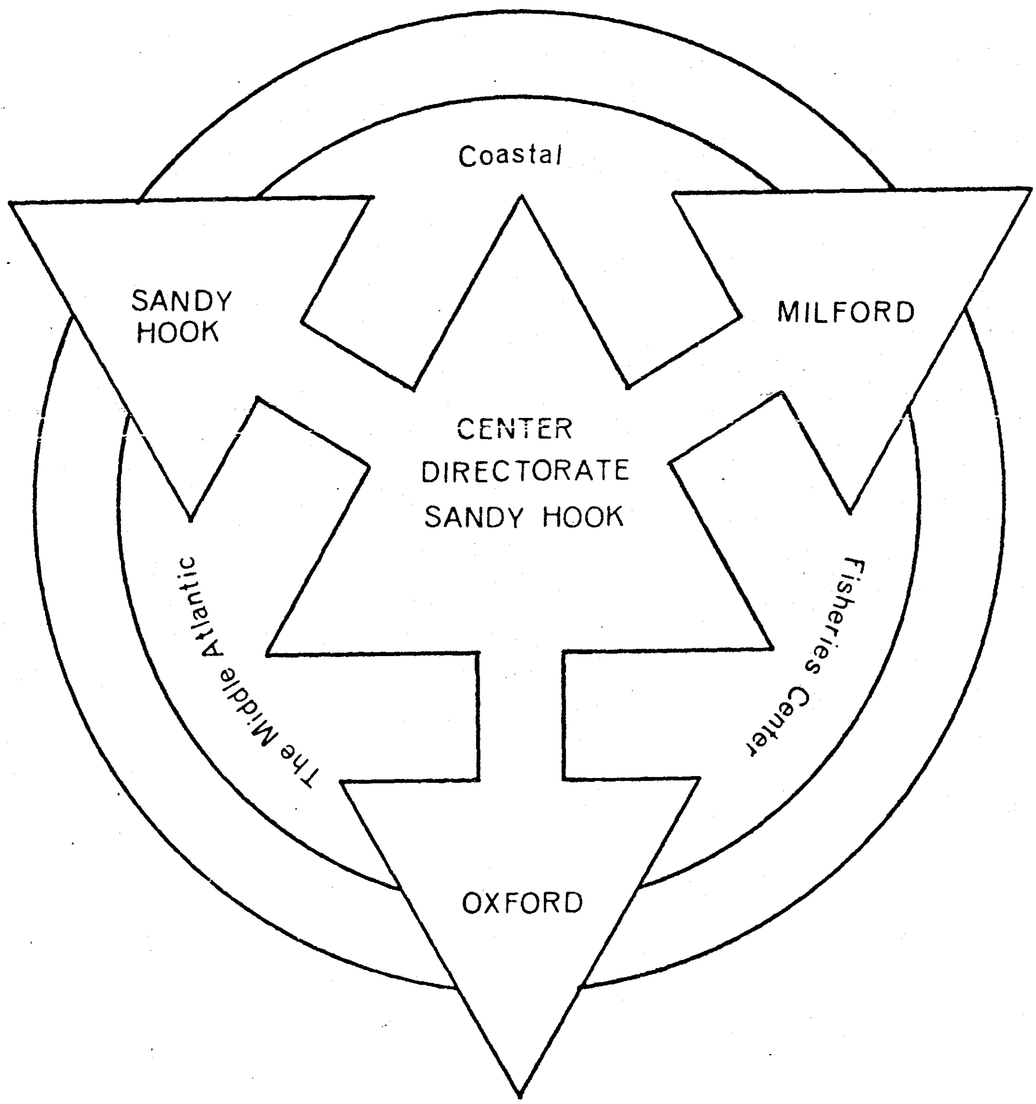
Date

Carl J. Sindermann, Center Director
Middle Atlantic Coastal Fisheries Center

CRUISE REPORT
NOAA SHIP DELAWARE II
August 16-21, 1974
MONTHLY ASSESSMENT SURVEY

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

MIDDLE ATLANTIC COASTAL FISHERIES CENTER



CRUISE REPORT 874

NOAA SHIP DELAWARE II

AUGUST 16-21, 1974

MONTHLY ASSESSMENT SURVEY

U. S. DEPARTMENT OF COMMERCE

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

NATIONAL MARINE FISHERIES SERVICE

MIDDLE ATLANTIC COASTAL FISHERIES CENTER

RESOURCE ASSESSMENT INVESTIGATIONS

SANDY HOOK LABORATORY

HIGHLANDS, NEW JERSEY 07732

MONTHLY ASSESSMENT SURVEY

CRUISE REPORT 874 R. V. DELAWARE II

INTRODUCTION: The R. V. Delaware II sailed August 16 from Sandy Hook, New Jersey and returned August 21 after conducting a groundfish-ichthyoplankton survey in the New York Bight.

This was the third in a series of monthly trawl surveys designed to monitor both juvenile and adult fish populations in a 6300 sq. mi. study area (outlined in Figure 1) between Raritan Bay and the 200-fathom curve near Hudson Canyon. Additional trawl stations made in the MESA apex (dashed lines, Figure 1) provided intensive coverage in this special area. Collections of finfish from trawl catches were saved for species studies of age, growth and fecundity.

An AEC-supported study designed to show seasonal variations in distribution and abundance of ichthyoplankton was conducted with this cruise.

Although the groundfish-ichthyoplankton surveys are separate studies piggybacked on the same cruise, the synopticity of the data will permit a merged application in population models.

SAMPLING PROCEDURES: Trawl stations -- Random stations were selected in sampling strata prior to the cruise. The standard collecting gear for these surveys is a #36 Yankee trawl equipped with 80 ft chain sweep with 5-inch rubber discs, 10-fathom bridles and 1200 lb oval steel doors. The codend and upper belly are lined with 1/2-inch mesh netting to retain small specimens. Tows are for 1/2-hour at 3-1/2 knots, direction toward the next stations and with scope varied according to depth. Fish data were collected simultaneously on 16 stations from shallow areas of the Raritan Bay complex. A 30 ft trawl was used from a small boat, the R. V. Xiphias.

All fish and commercially significant invertebrates were identified, sorted and weighed by species and measured. During the measuring process the fish were examined for fin rot. A sample of all bony fishes was frozen for life history studies at the laboratory. Surface and bottom temperatures and salinities are taken on all trawl stations.

Ichthyoplankton stations -- Stations are set in a grid pattern 21 nautical miles apart (Figure 1); 60 cm bongo nets with .333 and .505 mesh netting were used in a standard MARMAP smooth oblique tow from surface to bottom. Discrete depth tows were made using 20 cm bongo nets on a transect off Shinnecock Inlet, N. Y. Standard hydrocasts were made at each ichthyoplankton station and a neuston collection using a Haedrich net was also taken.

RESULTS: Forty-five trawl hauls were made on the Delaware II (Figure 1). The catch totalled 7,616 lbs including 2,401 lbs of bony fishes, 2,371 lbs of sharks and skates and 2,844 lbs of invertebrates. Catch weights and station data are summarized in Table 1.

Approximately 3,245 fish representing over 49 species were frozen for life history investigations.

Seventeen smooth oblique and four series of discrete depth bongo net tows were made. Seventeen neuston collections were made.

SCIENTIFIC PERSONNEL:

W. Morse, Chief Scientist
V. Anderson
A. Thoms
L. Williams
A. Kendall
M. Fahay
D. Ralph
F. Barvenik (AEC)
E. Bouchard (NOS)
B. Wolfe (NOS)

Submitted by:

Thomas R. Azarovitz, Chief
Coastal Survey Investigation

Approved by:

Arthur S. Merrill, Director
Resource Assessment Investigations

Carl J. Sindermann, Center Director
Middle Atlantic Coastal Fisheries Center

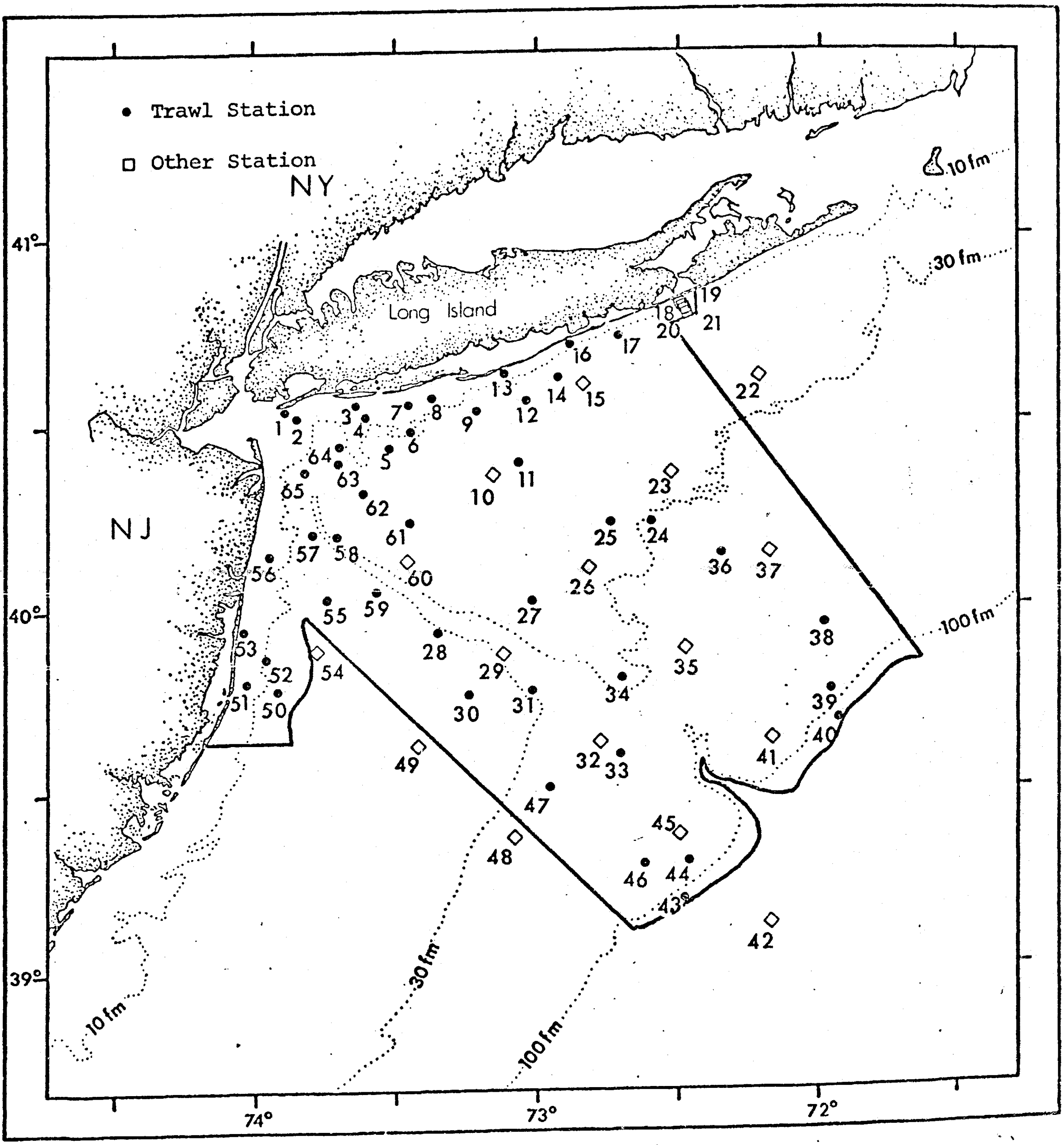


Figure 1. Location of offshore trawl and other offshore stations sampled.

Table 1.--Station data - Cruise 874.

ation		Tot. Wt. Per Sta.	Fin Fish Wt.	Elasmo-branch Wt.	Inverte-brate Tot. Wt.	Lat.	Long.	Depth (m)	Temperature Surf.	Temperature Bottom
1		803	140	662	1	40°32'	73°55'	12	22.2	22.3
2		191	42	148	1	40°31'	73°53'	11	22.7	22.0
3		83.5	82.5	0	1	40°33'	73°39'	16	22.5	21.1
4		94	74	5	15	40°32'	73°36'	20	22.5	19.1
5		120.5	30.5	40	50	40°26'	73°33'	27	22.7	17.1
6		110	32	50	28	40°28'	73°26'	24	21.4	17.1
7		41	26	12	3	40°33'	73°28'	16	22.2	20.1
8		89	37	48	4	40°34'	73°23'	18	22.3	19.8
9		108.5	11.5	68	29	40°31'	73°13'	24	21.9	17.2
10	C-2	Ichthyoplankton Station				40°22'	73°10'	35	21.5	
11		111.5	5.5	42	64	40°24'	73°05'	40	21.2	10.9
12		135	82	22	31	40°34'	73°03'	29	21.8	13.8
13		130	4	78	48	40°37'	73°08'	19	20.5	18.5
14		77	13	28	36	40°36'	72°55'	30	—	13.9
15	D-1	Ichthyoplankton Station				40°37'	72°50'	37	21.5	22.0
16		110	84	22	4	40°42'	72°54'	15	21.4	17.8
17		253	2	188	63	40°43'	72°43'	23	21.5	17.7
18		Ichthyoplankton Station - Shin. I				40°49'	72°32'	15	21.0	15.0
19		Ichthyoplankton Station - Shin. II				40°47'	72°31'	30	21.4	16.4
20		Ichthyoplankton Station - Shin. III				40°45'	72°29'	36	—	—
21		Ichthyoplankton Station - Shin. IV				40°43'	72°28'	38	—	—
22	F-1	Ichthyoplankton Station				40°37'	72°11'	46	20.9	09.4
23	E-2	Ichthyoplankton Station				40°22'	72°31'	48	20.5	09.5
24		367	154	105	108	40°13'	72°36'	54	21.8	08.4
25		405	123	168	114	40°14'	72°44'	52	21.3	08.7
26	D-3	Ichthyoplankton Station				40°18'	72°50'	50	21.7	08.7
27		37	9	10	18	40°01'	73°01'	49	21.7	08.5
28	C-4	Ichthyoplankton Station				39°52'	73°10'	55	22.5	10.0
29		197	48	112	37	39°55'	73°20'	49	22.2	08.5
30		104	44	24	36	39°45'	73°15'	45	22.3	10.7
31		186	43	42	101	39°46'	73°00'	67	22.6	08.4
32	D-5	Ichthyoplankton Station				39°37'	72°50'	65	22.2	08.4
33		289	13	14	262	39°36'	72°43'	72	22.5	08.9
34		76	4	3	69	39°48'	72°43'	56	22.9	08.4
35	E-4	Ichthyoplankton Station				39°52'	72°31'	68	22.5	08.7
36		339.5	123.5	194	22	40°09'	72°20'	68	22.6	09.6
37	F-3	Ichthyoplankton Station				40°07'	72°11'	73	22.8	09.8
38		177	159	13	5	39°55'	72°00'	89	22.4	18.3
39		80	53	1	26	39°45'	71°58'	146	23.3	13.5
0		90	39	0	51	39°41'	71°56'	267	23.0	09.0
1	F-5	Ichthyoplankton Station				39°37'	72°10'	120	23.1	14.3
2	F-7	Ichthyoplankton Station				39°07'	72°12'	1325	25.0	—
3		463	47	0	416	39°11'	72°27'	330	23.9	07.8
4		283	8	2	273	39°18'	72°28'	139	23.6	13.2
5	E-6	Ichthyoplankton Station				39°23'	72°21'	126	23.2	12.0
6		283	243	0	40	39°17'	72°37'	127	23.4	13.4
7	C-6	Ichthyoplankton Station				39°22'	73°10'	59	22.8	09.7
8		221	62	28	131	39°30'	73°03'	66	22.2	08.1
9	B-5	Ichthyoplankton Station				39°36'	73°29'	35	23.2	12.7
0		78.5	7.5	8	63	39°46'	73°55'	25	23.4	14.0

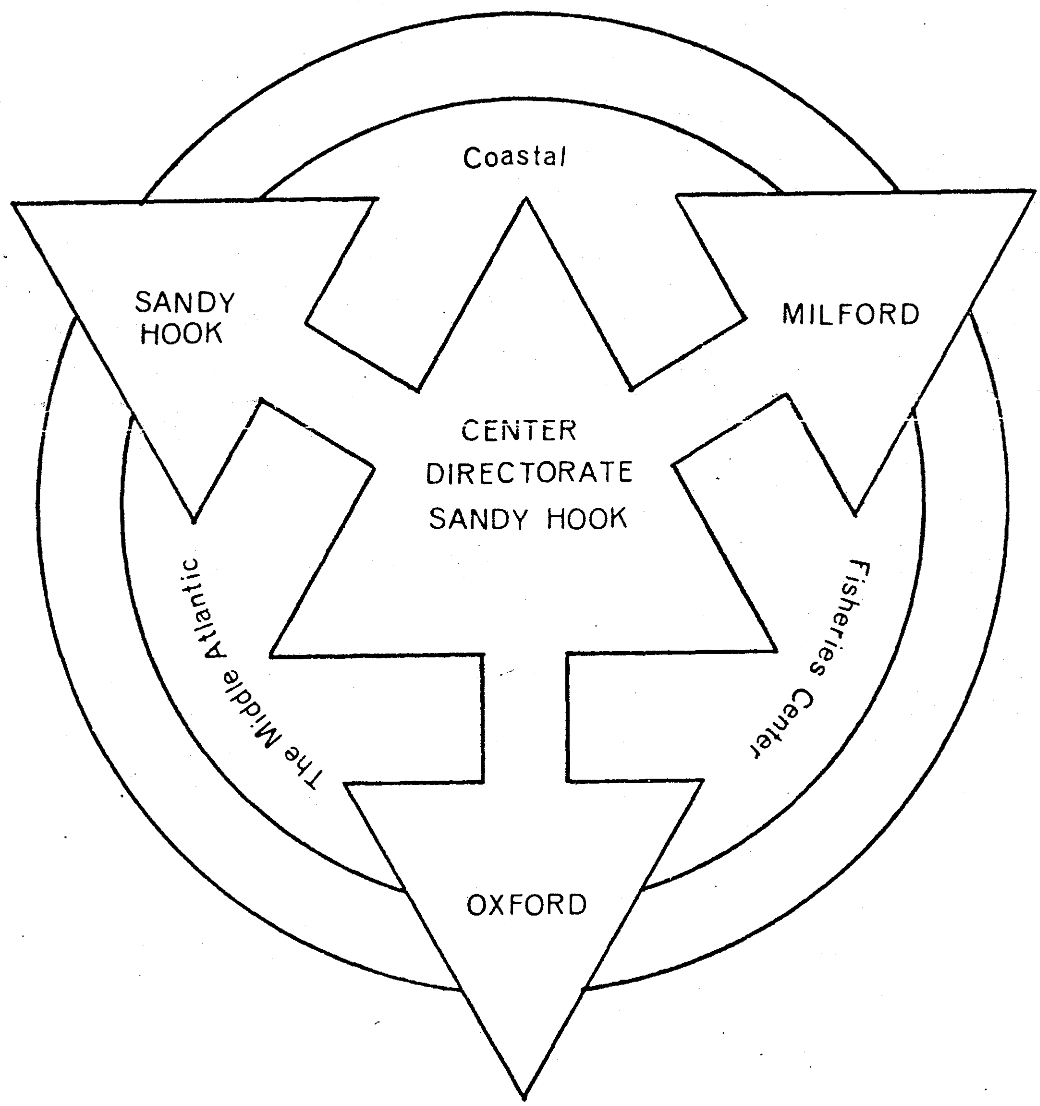
Table 1.--Continued

ation		Tot. Wt. Per. Sta.	Fin Fish Wt.	Elasmo-branch Wt.	Inverte-brate Tot. Wt.	Lat.	Long.	Depth (m)	Temperature Surf.	Temperature Bottom
51		27	15	0	12	39°49'	74°01'	17	21.4	16.2
52		3	2	0.5	0.5	39°56'	74°03'	18	21.0	17.0
53		22	5	1	16	39°51'	73°57'	21	23.0	14.4
54	A-4	Ichthyoplankton Station				39°52'	73°49'	26	22.9	14.0
55		80	4	12	64	40°01'	73°45'	33	23.2	13.3
56		44	3	1	40	40°09'	73°57'	17	23.2	16.3
57		388	143	23	222	40°10'	73°47'	33	23.9	13.1
58		267	151	94	22	40°10'	73°41'	49	23.7	09.2
59		390	138	13	239	40°03'	73°35'	42	23.2	10.8
60	B-3	Ichthyoplankton Station				40°07'	73°29'	40	23.6	--
61		122.5	17.5	83	22	40°14'	73°27'	38	23.6	12.5
62		74	21	3	50	40°19'	73°36'	26	23.4	15.4
63		32	24	3	5	40°23'	73°41'	27	23.8	15.9
64		19.5	19.5	0	0	40°25'	73°41'	28	23.9	15.3
65	A-2	Ichthyoplankton Station				40°22'	73°49'	36	22.5	13.4
66		14	12	0	2	40°23'	73°51'	25	22.6	15.3

CRUISE REPORT
NOAA SHIP DELAWARE II
September 23-28, 1974
MONTHLY ASSESSMENT SURVEY

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

MIDDLE ATLANTIC COASTAL FISHERIES CENTER



CRUISE REPORT 974

NOAA SHIP DELAWARE II

SEPTEMBER 23-28, 1974

MONTHLY ASSESSMENT SURVEY

U. S. DEPARTMENT OF COMMERCE

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

NATIONAL MARINE FISHERIES SERVICE

MIDDLE ATLANTIC COASTAL FISHERIES CENTER

RESOURCE ASSESSMENT INVESTIGATIONS

SANDY HOOK LABORATORY

HIGHLANDS, NEW JERSEY 07732

MONTHLY ASSESSMENT SURVEY

CRUISE REPORT 974 R. V. DELAWARE II

INTRODUCTION: The R. V. Delaware II sailed September 23, from Sandy Hook, New Jersey and returned September 28 after conducting a groundfish-ichthyoplankton survey in the New York Bight.

This was the fourth in a series of monthly trawl surveys designed to monitor both juveniles and adult fish populations in a 6300 sq. mi. study area (outlined in Figure 1) between Raritan Bay and the 200-fathom curve near Hudson Caynon. Additional trawl stations made in the MESA apex (dashed lines, Figure 1) provided intensive coverage in this special area. Collections of finfish from trawl catches were saved for species studies of age, growth and fecundity.

An AEC-supported study designed to show seasonal variations in distribution and abundance of ichthyoplankton was conducted with this cruise.

Although the groundfish-ichthyoplankton surveys are separate studies piggybacked on the same cruise, the synopticity of the data will permit a merged application in population models.

SAMPLING PROCEDURES: Trawl stations -- Random stations were selected in sampling strata prior to the cruise. The standard collecting gear for these surveys is a #36 Yankee trawl equipped with 80 ft chain sweep with 5-inch rubber discs, 10-fathom bridles and 1200 lb oval steel doors. The codend and upper belly are lined with 1/2-inch mesh netting to retain small specimens. Tows are for 1/2-hour at 3-1/2 knots, direction toward the next station and with scope varied according to depth. Fish data were collected simultaneously on 15 stations from shallow areas of the Raritan Bay complex. A 30 ft trawl was used from a small boat, the R. V. Xiphias. Some paired tows were made in the Bay by the R. V. Delaware and Xiphias to evaluate net bias.

All fish and commercially significant invertebrates were identified, sorted and weighed by species and measured. During the measuring process the fish were examined for fin rot. A sample of all bony fishes was frozen for life history studies at the laboratory. Surface and bottom temperatures and salinities are taken on all trawl stations.

Ichthyoplankton stations -- Stations are set in a grid pattern 21 nautical miles apart (Figure 1); 60 cm bongo nets with .333 and .505 mesh netting were used in a standard MARMAP smooth oblique tow from surface to bottom. Discrete depth tows were made using 20 cm bongo nets on a transect off Shinnecock Inlet, N. Y. Standard hydrocasts were made at each ichthyoplankton station and a neuston collection using a Haedrich net was also taken.

RESULTS: Forty-three trawl hauls including three paired tows were made on the Delaware II (Figure 1). The catch totalled 12,174 lbs including 4,468 lbs of bony fishes, 4,817 lbs of sharks and skates and 2,889 lbs of invertebrates. Catch weights and station data are summarized in Table 1.

Approximately 4,256 fish representing over 53 species were frozen for life history investigations.

Seventeen smooth oblique and four series of discrete depth bongo net tows were made. Seventeen neuston collections were made.

SCIENTIFIC PERSONNEL:

W. Morse, Chief Scientist
V. Anderson
E. Steady
J. Ziskowski
W. Smith
M. Fahay
F. Barvenik (AEC)
B. Malowsky (AEC)

Submitted by:

Thomas R. Azarovitz, Chief
Coastal Survey Investigation

Approved by:

Arthur S. Merrill, Director
Resource Assessment Investigations

Carl J. Sindermann, Center Director
Middle Atlantic Coastal Fisheries Center

Table 1.--Station data - Cruise 974.

tion		Tot. Wt. Per Sta.	Fin Fish Wt.	Elasmo-branch Wt.	Inverte-brate Tot. Wt.	Lat.	Long.	Depth (m)	Temperature Surf.	Temperature Bottom
1		33	26	0	7	40°29'	74°06'	7	19.8	19.5
2		40	38	0	2	40°29'	74°07'	8	—	—
3		967.5	123.5	0	844	40°30'	74°06'	7	19.0	19.5
4		296	104	188	4	40°30'	73°53'	12	18.9	16.5
5		206.5	86.5	119	1	40°32'	73°49'	10	18.8	16.4
6		161	127.8	33	.2	40°34'	73°42'	12	18.2	16.7
7		326.5	45.5	281	0	40°29'	73°40'	18	18.2	12.9
8		109.5	8.5	100	1	40°17'	73°42'	26	19.1	14.6
9		152.5	45.5	102	5	40°18'	73°38'	25	—	—
0		330.5	2.5	318	10	40°15'	73°37'	26	18.5	19.4
1		131	18	110	3	40°16'	73°35'	25	18.2	16.9
2		650.5	13.5	636	1	40°20'	73°33'	25	18.5	18.9
3		135	56	71	8	40°25'	73°31'	26	18.4	18.4
4		250	39.5	210	.5	40°29'	73°27'	20	—	—
5		137.5	89.5	40	8	40°31'	73°29'	16	17.6	17.1
6		224	155	49	20	40°33'	73°25'	16	17.6	17.5
7		187	159	5	23	40°37'	73°11'	14	17.5	17.1
8	C-2	Ichthyoplankton Station				40°22'	73°10'	40	19.2	14.2
9		286.5	32.5	192	62	40°32'	73°08'	29	—	—
0		119	107	10	2	40°38'	73°05'	13	17.5	17.3
1		356	41	309	6	40°38'	72°55'	25	17.5	17.1
2	D-1	Ichthyoplankton Station				40°37'	72°50'	29	—	—
3		220.5	63.5	153	4	40°41'	72°52'	21	17.6	17.9
4		377	261	97	19	40°46'	72°40'	14	17.0	16.8
5		Ichthyoplankton Station				40°49'	72°31'	13	18.0	19.5
6		Ichthyoplankton Station				40°47'	72°30'	30	—	—
7		Ichthyoplankton Station				40°45'	72°29'	29	18.0	18.0
8		Ichthyoplankton Station				40°43'	72°28'	31	18.0	18.1
9		199	10	44	145	40°32'	72°31'	43	17.5	14.2
0	E-2	Ichthyoplankton Station				40°22'	72°31'	49	17.6	10.8
1	F-1	Ichthyoplankton Station				40°37'	72°11'	52	16.6	11.8
2	G-2	Ichthyoplankton Station				40°22'	71°51'	71	19.2	10.0
3	F-3	Ichthyoplankton Station				40°07'	72°11'	70	18.9	10.2
4		110	107	1	2	39°59'	71°58'	86	19.3	11.0
5	G-4	Ichthyoplankton Station				39°52'	71°51'	141	19.8	13.3
6		73	30	0	43	39°48'	71°50'	217	19.3	11.3
7		24	13	1	10	39°39'	72°18'	115	20.1	15.5
8		292	14	0	278	39°23'	72°22'	141	20.4	12.6
9	F-7	Ichthyoplankton Station				39°07'	72°11'	146	21.5	07.9
0		148	53	0	95	39°13'	72°26'	297	21.4	—
1		157	21	0	136	39°22'	72°29'	131	—	—
2	E-6	Ichthyoplankton Station				39°22'	72°31'	130	21.1	14.3
3	D-5	Ichthyoplankton Station				39°37'	72°50'	67	19.2	11.0
4		339	116	51	172	39°44'	72°40'	69	19.3	11.0
5	E-4	Ichthyoplankton Station				39°52'	72°31'	68	18.8	10.7

Table 1.--Continued

ation		Tot. Wt. Per Sta.	Fin Fish Wt.	Elasmobranch Wt.	Invertebrate Tot. Wt.	Lat.	Long.	Depth (m)	Temperature Surf.	Temperature Bottom
46		357	94	79	184	39°57'	72°35'	59	18.7	10.8
47		209	82	64	63	40°06'	72°31'	59	18.7	10.8
48		490	109	280	101	40°04'	72°39'	60	18.6	10.4
49	D-3	Ichthyoplankton Station				40°07'	72°50'	52	13.6	10.3
50		355	37	99	219	40°09'	73°06'	46	18.5	14.5
51		673	432	72	169	39°59'	73°19'	65	18.8	11.0
52		188	18	84	86	39°54'	73°19'	49	19.0	10.4
53	C-4	Ichthyoplankton Station				39°52'	73°11'	49	18.8	10.0
54		121	13	32	76	39°46'	73°11'	38	19.3	10.3
55		1244	1210	22	12	39°48'	73°22'	39	20.0	10.3
6	B-5	Ichthyoplankton Station				39°37'	73°29'	38	19.4	12.7
7		355	57	290	8	39°45'	74°03'	13	19.9	19.1
8		415	176	236	3	39°48'	73°58'	20	19.9	19.1
9	A-4	Ichthyoplankton Station				39°52'	73°48'	27	—	—
0		217	83	133	1	40°05'	74°00'	18	20.0	20.0
1		213	68	139	6	40°04'	73°56'	19	—	—
2		298	82	167	49	40°07'	73°48'	34	—	—
3	B-3	Ichthyoplankton Station				40°07'	73°29'	45	19.7	12.6
4	A-2	Ichthyoplankton Station				40°23'	73°48'	38	19.7	14.0

THE CITY COLLEGE
OF
THE CITY UNIVERSITY OF NEW YORK
NEW YORK, N. Y. 10031

TMENT OF BIOLOGY

25 September 1974

Dr. J. Kneeland McNulty
Middle Atlantic Coastal Fisheries Center
National Marine Fisheries Service
Highlands, New Jersey 07732

Dear Dr. McNulty:

The enclosed preliminary final report presents the data we have collected during the first year of our contract (No. 03-4-043-310). Our final report will be forthcoming in November.

On the basis of the data we have collected to date, I strongly feel that it would be a mistake for MESA to abandon work in the Bight Apex. In terms of plankton dynamics, it would be much wiser to continue our present effort in the Apex for at least another year (with additional observations at select stations during key periods of the year) while expanding further into the Bight. This should be done regardless of the decision to move the dump site. If the acronym "MESA" has any meaning, it is essential that we have the information on year-to-year variations in so-called seasonal patterns. It is my impression that the MESA Program is at the crossroads of becomming a fatality of politically based decisions or of making a truly significant contribution to our knowledge of coastal zone processes. The latter, in my opinion, is a prerequisite for intelligent coastal zone management.

Sincerely,

Thomas C. Malone

Thomas C. Malone

Received
SEP 30 1974
Knee Mc Nulty
cc: Dr. Sindermann/Holston
Dr. Pearce
Dr. Thomas

CRUISE NO. VII DATE 10-11 April 74

SUSPENDED PARTICULATE MATTER ($VOLUME^{-1}$)
TABLE II.

STA	Z	TURB.	TMS	% OMS	POC	CHL	% PHYTO-C	PHAEO
A3	0	-	13.29	16.5	1.05	1.19	2.8	1.45
	3	-	13.60	18.9	1.08	1.54		1.98
	12	-	18.07	19.7	1.10	2.59		2.41
P1	0	-	5.40	20.8	0.57	1.85	8.1	1.39
	3	-	7.48	21.3	0.43	1.96		1.19
	12	-	8.47	19.1	0.54	2.19		1.37
B4	0	-	4.36	25.7	0.51	0.64	3.1	0.64
	4	-	4.72	21.4	0.31	0.73		0.74
	10	-	4.45	21.4	0.29	0.84		0.72
	19	-	4.66	21.2	0.38	1.15		0.84
C3	0	1.6	3.72	28.4	0.47	1.57	8.4	0.91
	4	2.4	3.42	28.8	0.37	1.52		0.88
	8	2.1	3.06	29.1	0.33	1.53		0.58
	21	1.9	4.12	28.4	0.39	1.68		1.27
	23	1.9	5.92	28.2	0.47	1.88		2.02
C5	0	2.4	2.45	29.8	0.38	0.89	5.8	0.63
	4	1.6	3.79	26.6	0.31	0.91		0.71
	9	2.1	3.09	28.5	0.26	0.79		0.39
	15	1.9	2.81	29.6	0.29	0.78		0.43
	23	2.0	6.14	21.3	0.36	1.06		1.21
D3	0	1.9	3.05	26.4	0.51	1.63	11.2	0.66
	3	1.6	4.14	22.8	0.38	1.61		0.85
	6	1.6	3.78	25.2	0.32	1.30		1.19
	15	1.6	3.23	28.3	0.41	1.61		0.68
	21	1.5	4.38	27.0	0.48	1.94		0.89
D5	0	2.4	3.51	31.1	0.66	1.81	9.6	0.59
	3	1.5	4.11	28.4	0.39	1.88		0.51
	6	2.0	3.37	28.1	0.45	1.54		0.61
	15	2.6	3.21	33.4	0.45	1.79		0.74
	23	1.6	3.99	26.8	0.39	2.06		1.01

CRUISE NO. VIII DATE 27-2[illegible] April 74

SUSPENDED PARTICULATE MATTER (VOLUME^{-1})
TABLE II.

STA	Z	TURB.	TMS	% OMS	POC	CHL	% PHYTO-C	PHAEO
A1	0	16.0	26.49	13.2	1.25	0.64	1.3	1.50
	2	30.0				1.33		3.29
	6	47.0	122.80	11.4	4.74	1.85		5.08
A2	0	34.0	73.46	10.9	2.76	1.16	1.0	3.02
	2	50.0				1.50		4.69
	6	69.0	197.28	10.7	7.58	2.54		9.74
A3	0	9.9	18.47	19.1	1.15	3.74	8.1	1.34
	5	7.6	16.61	19.6	1.29	4.28		1.37
	9	7.7	21.36	14.7	1.41	3.87		2.27
A4	0	5.4	15.69	14.9	0.89	4.28	12.0	0.64
	5	5.1				7.74		1.30
	9	5.3	11.83	24.2	0.99	7.17		1.28
P1	0	2.9	5.40	31.0	0.73	3.41	11.7	0.82
	3	2.4	4.37	34.3	0.60	3.04		0.94
	13	3.4	4.19	30.7	0.40	2.41		1.55
B2	0	3.2	5.01	33.4	0.58	3.35	14.4	0.78
	3	3.6				3.41		0.77
	14	3.4				1.27		1.19
	25	3.4	5.33	26.4	0.42	1.56		1.24
B3	0	5.1	4.91	33.8	0.46	2.49	13.5	1.45
	3	4.9				2.72		1.31
	13	4.9				0.84		1.15
	17	5.8	5.16	28.3	0.38	1.15		1.25
B4	0	6.8	3.73	36.6	0.60	3.33	13.9	0.72
	3	4.1	4.10	37.6	0.52	3.64		1.08
	15	5.1	4.87	25.4	0.38	1.17		1.76
	17	4.6	4.57	26.5	0.37	1.08		1.56
C2	0	4.1	5.31	32.3	0.60	3.18	18.6	0.85
	3	3.5				3.76		0.67
	6	2.6				3.58		0.54
	14	2.1				1.52		0.71
	30	2.0	5.07	24.8	0.28	0.62		0.62
C3	0	2.6	4.44	29.2	0.80	2.96	13.0	0.38
	3	2.5	2.51	55.8	0.59	2.89		0.52
	6	2.1	4.67	29.5	0.52	2.93		0.50
	10	3.1	5.00	23.3	0.41	2.10		0.92
	13	3.1	5.44	23.6	0.43	1.43		0.84
C4	0	3.8	4.64	37.1	0.62	2.89	16.3	0.55
	3	3.2				3.01		0.48
	6	3.3				2.60		0.45
	14	2.7				0.93		1.02
	21	3.8	4.86	27.2	0.38	0.87		1.59

CRUISE NO. VIII DATE 27-29 April 74

SUSPENDED PARTICULATE MATTER (VOLUME^{-1})
TABLE II cont'd.

STA	Z	TURB.	TMS	% OMS	POC	CHL	% PHYTO-C	PHAEO
C5	0	2.3	3.78	30.3	0.58	2.18	13.2	0.19
	3	2.0	4.15	36.1	0.50	1.99		0.22
	9	1.8	2.57	32.9	0.37	1.08		0.29
	21	2.0	3.94	21.7	0.34	-		-
	28	1.9	4.41	19.5	0.28	0.53		0.68
D2	0	3.3	3.91	32.2	0.56	3.01	13.4	1.12
	3	2.7				2.77		1.16
	6	3.0				2.83		1.10
	14	3.0				1.79		0.86
	23	4.2	8.61	20.2	0.57	5.66		2.30
D3	0	3.6	4.36	29.0	0.68	3.45	12.7	1.33
	3	3.5	5.41	30.1	0.48	3.41		1.31
	6	2.9	4.12	29.5	0.46	2.15		1.53
	14	2.5	3.92	23.3	0.30	1.39		1.01
	23	4.3	10.62	17.9	0.55	2.84		1.42
D4	0	2.3	4.81	27.5	0.52	3.12	15.0	0.76
	3	2.4				3.58		0.54
	6	2.5				4.51		0.90
	15	2.6				1.32		0.63
	17	4.6	5.13	23.6	0.36	1.50		1.10
D5	0	2.0	4.17	35.3	0.70	2.01	10.0	0.30
	3	2.1	5.06	38.1	0.70	2.32		0.37
	8	2.0	4.45	30.1	0.46	1.85		0.10
	18	2.1	3.77	24.3	0.37	1.02		0.41
	25	2.3	3.02	21.4	0.30	0.57		0.50

CRUISE NO. IX DATE 25-27 May 74

SUSPENDED PARTICULATE MATTER (VOLUME^{-1})
TABLE II.

STA	Z	TURB.	TMS	% OMS	POC	CHL	% PHYTO-C	PHAEO
A1	0	20.0	42.06	12.1	1.79	13.62	19.0	4.68
	2	21.1				11.42		4.64
	5	25.0	58.90	12.2	2.29	6.15		6.55
A2	0	20.0	39.91	12.6	1.60	3.93	6.1	2.99
	2	25.0				5.27		4.44
	6	24.0	50.17	14.1	2.05	2.67		4.50
A3	0	8.1	21.51	23.1	0.96	2.16	5.6	1.56
	4	7.2	19.08	24.1	1.18	2.01		2.24
	10	10.0	34.94	15.5	2.05	2.19		5.45
A4	0	5.2	10.30	26.9	1.03	3.11	7.5	1.88
	4	5.2				2.30		3.08
	8	7.4	15.02	19.1	0.97	2.19		3.78
P1	0	3.7	5.39	56.6	1.19	2.88	6.0	0.42
	5	3.7	7.12	54.6	1.26	4.96		0.62
	12	4.3	5.50	31.5	0.38	0.61		0.77
B2	0	4.5	4.63	43.4	0.58	1.67	7.2	0.12
	4	4.6				3.57		0.35
	15	4.6				0.75		0.30
	22	4.6	4.69	29.7	0.40	0.57		0.62
B3	0	1.4	4.98	41.0	0.59	1.84	7.8	0.12
	4	1.4				1.84		0.12
	10	1.7				2.07		0.00
	17	1.8	5.02	45.2	0.65	1.19		0.31
B4	0	4.1	3.98	53.1	0.41	2.07	12.6	0.40
	5	3.1	4.12	49.0	0.67	1.89		0.43
	10	3.1	5.48	44.2	0.61	1.89		0.46
	17	2.8	5.74	31.6	0.35	0.71		0.97
C2	0	5.6	4.71	43.8	0.58	2.19	13.2	0.16
	5	5.5				5.41		0.00
	12	4.4				1.54		0.22
	18	4.4				1.27		0.33
	28	4.4	4.82	29.2	0.33	0.44		0.49
C3	0	3.6	3.68	39.9	0.51	1.41	9.7	0.13
	2	3.1	4.35	38.3	0.37	1.32		0.18
	5	2.1	6.89	38.4	0.59	1.63		0.24
	8	1.8	4.30	44.1	0.60	1.41		0.20
	21	2.5	5.42	40.8	0.55	1.19		0.38
C4	0	6.2	4.65	47.6	0.67	1.67	8.7	0.01
	3	6.2				1.85		0.13
	7	7.0				2.07		0.08
	16	5.4				1.96		0.00
	21	6.1	6.11	32.9	0.39	0.75		0.93

CRUISE NO. IX DATE 25-27 May 74

SUSPENDED PARTICULATE MATTER (VOLUME^{-1})
TABLE II cont'd.

STA	Z	TURB.	TMS	% OMS	POC	CHL	% PHYTO-C	PHAEO
C5	0	2.4	6.93	31.9	0.56	0.61	2.7	0.20
	2	2.6	4.28	40.7	0.53	1.76		0.30
	6	2.5	3.20	41.9	0.43	1.45		0.20
	9	4.	4.59	33.6	0.39	0.88		0.21
	24	3.6	5.50	31.6	0.30	0.22		0.21
D2	0	2.6	7.77	40.7	0.76	2.65	8.7	0.58
	2	3.1				2.53		0.31
	6	3.5				2.53		0.60
	12	3.1				0.92		0.76
	20	3.1	5.89	28.9	0.34	0.66		1.06
D3	0	4.4	8.08	42.5	1.04	3.13	7.5	0.86
	2	3.6	4.19	55.1	0.84	3.13		0.76
	4	3.5	4.77	44.3	0.60	1.93		1.32
	10	2.6	4.66	33.9	0.38	1.01		0.71
	20	3.0	5.49	27.5	0.36	0.27		1.26
D4	0	3.2	4.59	43.9	0.71	2.07	7.3	0.47
	2	3.5				2.53		0.40
	5	2.7				2.99		0.82
	10	3.8				1.38		1.16
	20	4.6	4.91	29.4	0.36	0.70		1.02
D5	0	3.1	4.14	26.9	0.35	0.24	1.7	0.13
	3	2.5	2.95	32.4	0.27	0.59		0.12
	7	2.5	4.08	45.4	0.65	1.33		0.22
	11	3.1	4.20	37.4	0.41	0.44		1.02
	24	4.4	4.99	28.6	0.30	0.18		0.67

CRUISE NO. X DATE 22-24 June 74

SUSPENDED PARTICULATE MATTER (VOLUME^{-1})
TABLE II.

STA	Z	TURB.	TMS	% OMS	POC	CHL	% PHYTO-C	PHAEO
A1	0	14.0	29.39	12.9	1.21	3.22	6.6	2.94
	2	15.1				3.46		2.81
	5	15.1	41.39	15.3	1.53	3.11		2.47
A2	0	9.3	17.50	17.3	0.92	2.65	7.2	1.56
	2	9.9				2.53		1.68
	6	14.0	30.26	13.6	1.47	2.07		2.14
A3	0	5.6	10.0	29.3	1.06	2.69	6.3	1.11
	5	6.3	13.78	32.5	1.05	2.41		0.99
	10	8.0	19.13	24.3	1.30	2.26		1.59
A4	0	7.5	9.07	30.7	0.72	4.49	15.6	1.48
	7	5.7				4.72		1.64
	17	5.0	11.80	24.1	0.84	3.92		2.45
P1	0	5.2	8.57	40.0	1.02	12.19	29.9	1.23
	6	4.6	9.76	35.5	0.92	11.71		0.70
	12	3.5	8.86	28.8	0.56	1.36		0.69
B2	0	4.3	4.78	57.3	0.97	14.50	37.4	2.68
	5	4.5				14.94		2.24
	12	5.1				1.23		0.64
	25	5.4	4.57	31.6	0.25	0.35		0.47
B3	0	3.5	4.60	58.3	0.86	7.03	20.4	1.19
	4	3.3				7.03		0.81
	10	4.9				0.88		0.80
	19	4.9	4.16	33.9	0.27	0.53		0.52
B4	0	3.5	4.70	57.0	0.97	4.66	12.0	0.89
	4	3.4	4.13	62.0	0.85	4.98		0.57
	10	3.6	4.70	44.9	0.60	2.50		0.75
	15	3.8	3.15	34.3	0.32	0.78		0.66
C2	0	5.1	5.48	45.9	0.76	14.06	46.2	1.25
	2	4.8				14.94		1.49
	4	5.1				15.38		1.43
	8	4.6				9.23		1.60
	29	4.5	5.13	25.9	0.27	0.44		0.53
C3	0	3.0	7.66	47.5	1.20	14.50	30.2	2.31
	2	2.2	8.39	46.0	0.86	10.79		2.76
	6	2.5	4.80	45.9	0.55	2.97		1.20
	12	1.9	5.40	43.0	0.52	2.62		0.64
	22	3.2	4.55	39.5	0.42	1.41		0.84
C4	0	3.4	4.02	52.4	0.83	4.38	13.2	0.23
	2	4.4				4.38		0.52
	4	3.6				4.38		0.32
	10	3.4				2.19		0.16
	21	5.6	4.85	33.5	0.42	1.01		0.67

CRUISE NO. X　　　　DATE 22-24 June 74

SUSPENDED PARTICULATE MATTER (VOLUME^{-1})
TABLE II cont'd.

STA	Z	TURB.	TMS	% OMS	POC	CHL	% PHYTO-C	PHAEO
C5	0	2.8	3.42	56.1	0.82	2.79	8.5	0.60
	3	2.5	3.29	60.2	0.66	2.85		0.52
	9	2.4	4.10	46.2	0.45	1.54		0.48
	15	-	4.23	37.4	0.33	0.73		0.23
	28	3.1	4.06	33.5	0.27	0.37		0.24
D2	0	3.4	6.04	58.0	1.18	15.82	33.5	3.60
	4	3.0				19.58		0.98
	9	2.1				2.99		0.73
	15	2.5				1.41		0.65
	21	4.5	11.08		0.49	0.62		0.92
D3	0	5.0	5.02	65.8	1.54	6.10	9.9	2.12
	3	3.6	4.66	57.4	0.91	4.38		1.20
	8	3.3	4.43	43.1	0.56	2.29		0.52
	14	3.7	3.49	40.6	0.49	2.05		0.67
	21	4.6	7.26	26.4	0.36	0.49		0.58
D4	0	2.6	3.93	44.7	0.56	1.84	8.2	0.90
	3	2.8				3.22		0.50
	6	3.0				2.07		0.47
	15	2.9				1.23		0.71
	20	3.5	4.56	28.1	0.29	0.44		0.83
D5	0	2.4	3.09	31.9	0.41	1.19	7.2	0.14
	5	2.4	16.67	37.1	0.82	2.78		0.34
	10	2.6	5.30	48.3	0 94	2.75		0.39
	18	3.6	5.49	66.4	1.33	7.21		0.21
	23	2.6	5.53	31.6	0.28	0.59		0.33

CRUISE NO. XI DATE 15-17 July 74

SUSPENDED PARTICULATE MATTER (VOLUME^{-1})
TABLE II.

STA	Z	TURB.	TMS	% OMS	POC	CHL	% PHYTO-C	PHAEO
A1	0		14.36	26.9	1.49	16.70		2.72
	2					13.62		3.19
	5		22.20	17.2	1.44	6.15		2.44
A2	0		15.08	24.7	1.36	16.26		3.54
	3					16.26		2.42
	6		26.04	15.1	1.31	3.93		2.16
A3	0		15.94	24.7	1.10	9.08		1.94
	4		14.35	22.8	0.99	3.69		3.43
	8		13.43	25.4	1.13	4.15		3.79
A4	0		8.14	31.1	0.96	8.35		4.35
	5					5.71		5.12
	10		11.04	25.2	1.04	5.27		6.31
P1	0		8.47	42.9	1.23	12.04		6.64
	5		7.49	30.7	0.75	4.02		3.32
	13		9.46	28.4	0.55	0.63		0.62
B2	0		6.62	53.2	1.39	10.98		8.81
	2					5.71		7.73
	8					1.41		0.84
	22		4.79	29.8	0.38	0.53		0.59
B3	0		3.48	42.8	0.57	3.69		0.52
	4					2.76		0.47
	10					2.07		0.28
	16		4.07	29.6	0.36	1.10		0.81
B4	0		3.78	31.2	0.31	0.59		0.21
	3		3.88	29.0	0.39	0.65		0.13
	10		4.61	44.1	0.73	3.03		0.48
	18		4.14	27.6	0.35	0.95		0.82
C2	0		6.48	51.0	1.35	5.71		6.61
	3					2.88		2.21
	8					1.96		0.78
	15					1.06		0.59
	29		3.54	30.5	0.29	0.23		0.21
C3	0		7.40	38.3	0.83	3.79		2.30
	2		7.26	39.4	0.72	3.82		2.44
	5		6.98	39.4	0.68	3.41		2.02
	10		4.08	46.4	0.58	2.00		0.89
	21		3.90	33.0	0.35	0.59		0.38
C4	0		3.17	43.8	0.46	0.92		0.98
	3					0.97		0.83
	8					1.23		0.60
	12					1.73		0.23
	21		4.47	30.4	0.30	0.39		0.26

CRUISE NO. XI DATE 15-17 July 74

SUSPENDED PARTICULATE MATTER ($VOLUME^{-1}$)
TABLE II cont'd.

STA	Z	TURB.	TMS	% OMS	POC	CHL	% PHYTO-C	PHAEO
C5	0		8.04	31.5	0.61	0.58		0.28
	2		6.07	31.9	0.41	0.55		0.25
	6		3.80	40.4	0.53	0.65		0.25
	15		3.92	40.4	0.52	1.10		0.35
	22		2.77	38.7	0.85	0.70		0.13
D2	0		15.33	53.8	2.01	12.74		3.32
	2					1.96		0.98
	7					1.01		0.56
	13					1.19		0.57
	20		6.16	24.2	0.33	0.66		0.50
D3	0		2.49	50.8	0.67	0.90		0.56
	2		3.03	43.3	0.50	1.28		0.47
	5		3.07	43.6	0.46	1.23		0.64
	9		3.54	26.7	0.39	1.11		0.35
	19		7.29	22.3	0.41	0.55		0.46
D4	0		3.47	40.5	0.93	0.75		0.41
	3					0.79		0.63
	8					0.66		0.29
	12					1.50		0.56
	18		5.61	30.5	0.41	0.79		0.70
D5	0		4.00	25.8	0.43	0.25		0.15
	3		3.27	27.8	0.32	0.32		0.08
	9		4.70	25.8	0.36	0.34		0.15
	15		3.66	41.7	0.56	1.71		0.51
	21		3.98	28.6	0.29	0.50		0.26

CRUISE XII DATE 5-7 AUGUST 1974

SUSPENDED PARTICULATE MATTER (VOLUME^{-1})
TABLE II.

STA	Z	TURB.	TMS	% OMS	POC	CHL	% PHYTO-C	PHAEO
A1	0	9.8	18.14	3.5	1.06	3.34	7.9	3.51
	3	10.1				2.65		3.22
	6	10.1	26.11	4.5	1.21	2.30		3.18
A2	0	8.9	16.46	21.4	1.05	2.65	6.3	2.74
	3	9.9				1.96		2.74
	7	16.0	40.41	15.7	1.95	1.73		3.26
A3	0	3.5	16.44	36.9	0.97	3.00	7.7	2.00
	4	3.2	18.67	36.0	1.20	2.53		2.06
	10	5.3	20.89	27.7	1.38	2.65		4.29
A4	0	4.2	20.87	42.3	1.76	21.88	31.1	4.55
	4	3.9				17.27		1.32
	10	3.4	20.19	37.0	1.24	10.54		3.65
P1	0	2.5	8.42	44.8	0.80	6.07	15.2	1.55
	6	2.8	10.82	35.0	0.57	1.63		0.94
	10	4.0	14.17	30.9	0.60	0.86		1.54
B2	0	2.3	9.78	49.8	1.22	10.98	22.5	3.21
	4	2.2				9.67		1.91
	10	2.8				2.07		0.96
	23	1.8	6.53	35.1	0.35	0.44		0.53
B3	0	1.6	8.06	34.9	0.66	1.14	4.3	1.10
	2	1.8				1.32		1.26
	7	2.1				1.38		1.85
	19	3.1	8.42	33.8	0.60	1.27		2.06
B4	0	2.1	6.18	41.6	0.55	1.58	7.2	1.07
	3	2.1	7.83	36.8	0.59	1.45		1.01
	8	2.2	7.09	36.0	0.45	1.70		2.22
	17	3.5	9.53	34.5	0.81	2.21		2.88
C2	0	2.2	4.19	62.7	0.84	4.61	13.7	1.07
	5	2.5				2.07		0.86
	10	3.0				1.73		0.82
	15	3.6				0.79		0.70
	31	4.6	8.73	35.4	-	0.28		0.32
C3	0	2.4	7.54	42.8	0.45	1.63	9.1	0.65
	3	2.1	7.94	41.6	0.43	1.67		0.42
	6	1.6	4.43	48.5	0.46	2.55		0.50
	10	2.0	5.36	46.1	0.35	1.08		0.42
	23	3.2	5.06	45.2	0.38	0.67		0.29

SUSPENDED PARTICULATE MATTER ($VOLUME^{-1}$)
TABLE II. CONT.

STA	Z	TURB.	TMS	% OMS	POC	CHL	% PHYTO-C	PHAEO
C4	0	1.5	5.96	48.7	0.47	1.73	9.2	0.23
	5	2.1				2.30		0.73
	10	2.5				1.38		0.67
	18	3.0				1.05		0.44
	23	4.0	6.60	40.5	0.50	1.14		0.99
C5	0	2.1	3.16	30.1	0.29	0.82	7.0	0.21
	3	1.7	3.98	30.4	0.26	0.80		0.18
	7	2.2	6.53	29.4	0.35	0.80		0.23
	12	1.8	6.13	44.6	0.35	0.90		0.22
	24	2.4	3.86	46.9	0.32	1.06		0.42
D2	0	3.4	7.62	43.4	0.97	5.06	13.0	1.75
	3	2.5				5.76		1.40
	7	2.4				10.54		1.78
	12	2.1				1.19		0.76
	22	3.1	7.33	22.7	0.38	0.48		0.64
D3	0	4.1	26.73	28.4	0.61	2.02	8.2	0.82
	2	3.8	6.38	40.5	2.06	3.69		1.01
	7	3.4	4.01	28.3	0.31	1.80		0.66
	14	3.9	4.61	26.0	0.33	0.96		0.97
	22	5.1	6.18	21.3	0.33	0.58		0.61
D4	0	2.5	6.62	29.1	0.41	1.32	8.0	0.29
	2	2.6				1.54		0.59
	6	3.1				1.84		0.70
	11	4.0				2.53		0.79
	20	5.5	4.88	24.1	0.34	0.48		0.64
D5	0	2.6	3.42	27.3	0.32	0.36	2.8	0.13
	3	2.4	4.00	30.6	0.31	0.36		0.11
	8	2.5	3.75	29.8	0.27	0.38		0.12
	15	2.2	4.36	30.5	0.35	0.97		0.44
	25	4.0	3.32	28.1	0.39	0.68		0.60

CRUISE NO. VII DATE 10-11 April 74

SUSPENDED PARTICULATE MATTER (AREA^{-1})
TABLE III.

STA	Z_{wc}	K_d	K_p	TMS	%OMS	POC	CHL	PHYTO-C	PROD
A3	14	1.70	1.71	182.8	19.0	13.03	22.7	0.57	
P1	14	0.43	0.39	91.1	20.3	5.84	24.4	0.61	
B4	21	0.28	0.35	86.6	21.8	6.49	16.4	0.41	
C3	27	0.24	0.20	84.0	28.7	8.62	36.7	0.92	1305
C5	25	0.23	0.22	83.2	26.3	7.07	19.9	0.50	772
D3	23	0.34	0.29	77.0	26.2	8.33	33.0	1.16	
D5	25	0.34	-	81.1	29.9	10.23	41.1	1.44	

CRUISE NO. VIII DATE 27-29 April 74

SUSPENDED PARTICULATE MATTER ($AREA^{-1}$)
TABLE III.

STA	Z_{wc}	K_d	K_p	TMS	% OMS	POC	CHL	PHYTO-C	PROD
A1	8	3.4					8.3		
A2	8	3.4					10.7		
A3	11	1.1	1.16	163.6	18.2	11.50	36.4	0.91	368
A4	11	1.1					59.9		
P1	15	0.4	0.26	57.5	32.5	6.97	36.9	0.92	
B2	27	0.4					51.5		
B3	19	0.4					29.6		
B4	19	0.3	0.33	75.0	31.3	7.82	41.6		
C2	32	0.4					58.9		
C3	15	0.3	0.36	56.2	30.2	6.86	32.9	1.15	1246
C4	24	0.4					37.7		
C5	30	0.2	0.26	100.4	27.1	10.74	30.8	1.08	625
D2	25	0.4					69.1		
D3	25	0.4	0.46	126.6	23.5	10.06	51.8	1.30	
D4	20	0.3					51.2		
D5	27	0.3	0.21	102.4	29.3	11.43	36.8	1.29	

CRUISE NO. IX.　　　　DATE 25-27 May 74

SUSPENDED PARTICULATE MATTER (AREA^{-1})
TABLE III.

STA	Z_{wc}	K_d	K_p	TMS	% OMS	POC	CHL	PHYTO-C	PROD
A1	7	3.40					51.4		
A2	8	3.40					25.1		
A3	12	1.70	1.57	243.3	20.2	14.00	20.9	0.52	186
A4	10	0.97					19.8		
P1	14	0.36	0.26	75.4	49.1	11.86	39.1	0.98	
B2	24	0.34					38.8		
B3	19	0.23					30.5		
B4	20	0.34	0.25	83.5	43.4	9.24	28.4	0.71	
C2	32	0.38					60.3		
C3	23	0.24	0.19	104.8	41.1	11.60	28.5	1.00	603
C4	23	0.31					38.0		
C5	31	0.23	0.17	113.5	34.4	9.39	20.5	0.51	631
D2	23	0.40					32.0		
D3	23	0.49	0.22	100.2	36.6	9.93	26.5	0.66	
D4	24	0.36					34.3		
D5	26	0.16	0.19	101.0	34.7	9.53	12.6	0.32	

CRUISE NO. X   DATE 22-24 June 74

SUSPENDED PARTICULATE MATTER ($AREA^{-1}$)
TABLE III.

STA	Z_{wc}	K_d	K_p	TMS	% OMS	POC	CHL	PHYTO-C	PROD
A1	7	3.4					16.5	0.41	
A2	8	2.3					14.4	0.36	
A3	14	0.9	0.81	141.7	29.2	11.1	26.8	0.67	425
A4	20	0.8					75.4	1.88	
P1	15	0.7	0.45	110.8	34.9	10.2	110.9	2.77	
B2	29	0.7					140.5	3.51	
B3	22	0.6					58.2	1.46	
B4	18	0.5	0.29	63.8	50.9	10.3	49.9	1.25	
C2	32	0.6					210.0	5.25	
C3	25	0.9	0.76	122.8	43.8	12.8	89.7	2.24	3128
C4	24	0.5					54.8	1.37	
C5	31	0.6	0.21	111.1	42.3	11.9	35.5	0.89	544
D2	24	1.1					146.5	3.66	
D3	24	0.7	0.38	98.6	42.6	13.5	54.3	1.36	
D4	24	0.3					34.6	0.86	
D5	26	0.3	0.23	175.0	44.6	20.6	80.9	2.02	

CRUISE NO. XI DATE 15-17 July 74

SUSPENDED PARTICULATE MATTER (AREA^{-1})
TABLE III.

STA	Z_{wc}	K_d	K_p	TMS	% OMS	POC	CHL	PHYTO-C	PROD
A1	7	2.27					60.0		
A2	8	2.27					79.1		
A3	10	1.36	0.92	116.1	23.9	8.4	41.2	1.0	2218
A4	12	0.97					62.6		
P1	15	0.97	0.49	107.7	32.3	10.1	58.8	1.5	
B2	25	0.76					51.6		
B3	18	0.49					36.9		
B4	20	0.24	0.21	76.2	35.7	9.3	30.7	0.8	
C2	32	0.68					44.5		
C3	23	0.52	0.33	107.6	40.1	11.9	46.2	1.2	3310
C4	24	0.38					23.8		
C5	25	0.34	0.24	92.0	37.8	12.5	17.7	0.4	435
D2	23	0.76					35.2		
D3	21	0.57	0.24	82.0	29.3	8.3	18.9	0.5	
D4	21	0.38					17.1		
D5	25	0.20	0.17	82.8	30.8	8.5	15.6	0.4	

CRUISE XII DATE 5-7 AUGUST 1974

SUSPENDED PARTICULATE MATTER $(AREA^{-1})$
TABLE III.

STA	Z_{wc}	K_d	K_p	TMS	% OMS	POC	CHL	PHYTO-C	PROD
1	9	2.3					16.4		
2	9	2.3					14.3		
3	12	0.8	0.91	188.9	33.4	12.07	26.6	0.66	2022
4	12	1.1					161.8		
1	16	0.6	0.44	145.2	37.4	8.25	31.8	0.80	
2	26	0.6					92.8		
3	23	0.3					25.1		
4	20	0.3	0.30	133.1	36.1	9.99	30.0	0.75	
2	34	0.3					41.1		
3	26	0.2	0.19	129.1	45.1	9.01	29.8	0.74	1529
4	26	0.3					34.5		
5	27	0.2	0.11	123.3	39.2	7.81	21.6	0.69	680
2	25	0.5					86.5		
3	26	0.3	0.23	132.4	28.5	13.45	35.3	0.88	
4	24	0.3					34.1		
5	28	0.1	0.15	97.2	29.8	8.28	15.9	0.48	

CRUISE NO. VII　　　　DATE 10-11 April 74

PHOTOSYNTHETIC CAPACITY AND PRIMARY PRODUCTIVITY
TABLE IV.

STA	% LIGHT	PHOTO CAP	ASSIM NO.	I	% LD	PROD.	ASSIM RATIO
A3	100	19.55	16.4				
	60	19.25	16.2				
	30	9.56	8.0				
	15	3.09	2.6				
	1	0.48	0.4				
P1	100	15.93	8.6				
	60	17.34	9.4				
	30	8.75	4.7				
	15	3.06	1.7				
	1	0.20	0.1				
B4	100	9.53	14.9				
	60	10.87	17.0				
	30	5.63	8.8				
	15	2.70	4.2				
	1	0.17	0.3				
C3	100	13.46	8.6	674	0	49.23	31.4
	60	14.80	9.4	404	2	109.79	72.2
	30	8.50	5.4	202	5	93.58	61.6
	15	3.69	2.4	101	8	69.20	45.2
	1	0.76	0.5	7	19	39.33	23.4
C5	100	6.73	7.6	695	0	32.44	36.5
	60	7.05	7.9	417	2	78.75	86.5
	30	5.47	6.2	208	5	70.13	77.1
	15	2.41	2.7	104	8	39.75	50.3
	1	0.34	0.4	7	20	5.75	7.4
D3	100	7.36	4.5				
	60	7.26	4.5				
	30	5.33	3.3				
	15	3.00	1.8				
	1	0.34	0.2				
D5	100	9.30	5.1				
	60	8.66	4.8				
	30	5.60	3.1				
	15	1.72	1.0				
	1	0.57	0.3				

CRUISE NO. VIII DATE 27-29 April 74

PHOTOSYNTHETIC CAPACITY AND PRIMARY PRODUCTIVITY
TABLE IV.

STA	% LIGHT	PHOTO CAP	ASSIM NO.	I	% LD	PROD.	ASSIM RATIO
A3	100	49.26	13.2	576	0.0	175.9	47.0
	60	34.12	9.1	346	0.5	192.8	51.6
	30	15.39	4.4	173	1.0	144.5	38.6
	15	5.24	1.4	86	2.0	66.4	17.8
	1	1.68	0.5	6	4.0	19.7	5.3
P1	100	38.32	11.2				
	60	29.58	8.7				
	30	16.94	5.0				
	15	2.66	0.8				
	1	0.08	0.0				
B4	100	19.93	6.0				
	60	18.81	5.7				
	30	12.60	1.0				
	15	3.44	1.0				
	1	0.07	0.0				
C3	100	12.74	4.3	735	0.0	127.6	43.1
	60	12.55	4.2	441	2.0	216.4	74.9
	30	8.01	2.7	220	4.0	171.5	59.3
	15	1.78	0.6	110	6.0	65.3	22.3
	1	0.18	0.1	7	14.0	4.7	2.2
C5	100	9.14	4.2	694	0.0	76.9	35.3
	60	8.04	3.7	416	2.0	85.1	42.8
	30	4.48	2.1	208	5.0	68.4	34.4
	15	1.15	0.5	104	8.0	18.5	17.1
	1	0.20	0.1	7	19.0	0.1	-
D3	100	23.85	6.9				
	60	21.70	6.3				
	30	13.67	4.0				
	15	4.20	1.2				
	1	0.40	0.1				
D5	100	7.42	3.7				
	60	9.21	4.6				
	30	6.46	3.2				
	15	1.82	0.9				
	1	0.02	0.0				

CRUISE NO. IX DATE 25-27 May 74

PHOTOSYNTHETIC CAPACITY AND PRIMARY PRODUCTIVITY
TABLE IV.

STA	% LIGHT	PHOTO CAP	ASSIM NO.	I	% LD	PROD.	ASSIM RATIO
A3	100	27.49	12.70	280	0.0	328.43	152.1
	60	24.13	11.20	168	0.3	246.81	114.3
	30	10.96	5.10	84	0.7	69.82	32.3
	15	3.17	1.50	42	1.1	20.41	9.5
	1	0.02	0.00	3	2.7	3.10	1.4
P1	100	24.80	8.61				
	60	25.77	8.95				
	30	14.50	5.04				
	15	2.86	0.99				
	1	0.03	0.01				
B4	100	15.28	7.4				
	60	16.70	8.1				
	30	10.36	5.0				
	15	3.07	1.5				
	1	0.28	0.1				
C3	100	10.88	7.7	569	0.0	22.02	15.6
	60	12.33	8.7	341	2.2	81.54	61.8
	30	6.51	4.6	171	5.1	55.91	34.3
	15	2.15	1.5	85	8.0	25.60	18.2
	1	0.27	0.2	6	19.6	4.04	3.4
C5	100	5.45	8.9	526	0.0	59.56	97.6
	60	4.94	8.1	316	2.3	99.87	56.7
	30	2.32	3.8	158	5.3	47.32	32.6
	15	0.72	1.2	79	8.3	20.78	23.6
	1	0.03	0.1	5	20.3	0.00	0.0
D3	100	27.61	8.8				
	60	28.44	9.1				
	30	14.75	4.7				
	15	3.25	1.0				
	1	0.14	0.1				
D5	100	2.15	9.0				
	60	1.98	8.2				
	30	1.01	4.2				
	15	0.35	1.4				
	1	0.03	0.1				

CRUISE NO. X DATE 22-24 June 74

PHOTOSYNTHETIC CAPACITY AND PRIMARY PRODUCTIVITY
TABLE IV.

STA	% LIGHT	PHOTO CAP	ASSIM NO.	I	% LD	PROD.	ASSIM RATIO
A3	100	38.67	14.4	303	0.0	385.82	119.8
	60	35.64	13.2	182	0.6	253.77	78.8
	30	17.73	6.6	91	1.3	74.41	23.1
	15	8.32	3.1	45	2.1	34.42	10.7
	1	0.94	0.4	3	5.1	2.26	0.7
P1	100	218.74	17.9				
	60	174.67	14.3				
	30	85.52	7.0				
	15	27.44	2.2				
	1	6.75	0.6				
B4	100	40.11	8.6				
	60	40.03	8.6				
	30	24.74	5.3				
	15	7.19	1.5				
	1	0.89	0.2				
C3	100	200.21	13.8	326	0.0	588.32	40.6
	60	161.46	11.1	196	0.6	1425.23	132.1
	30	68.01	4.7	98	1.3	1251.53	116.0
	15	19.04	1.3	49	2.1	473.05	43.8
	1	2.79	0.2	3	5.1	4.34	1.5
C5	100	31.81	11.4	430	0.0	221.06	79.2
	60	27.20	10.0	258	0.8	176.65	62.0
	30	13.07	4.7	129	2.0	114.40	40.1
	15	2.22	0.8	64	3.2	39.76	14.0
	1	0.90	0.3	4	7.7	1.07	0.7
D3	100	81.83	13.4				
	60	84.98	13.9				
	30	44.30	7.2				
	15	11.96	2.0				
	1	0.45	0.1				
D5	100	15.06	12.6				
	60	14.79	12.4				
	30	12.63	10.6				
	15	1.43	1.2				
	1	.11	0.1				

CRUISE NO. XI DATE 15-17 July 74

PHOTOSYNTHETIC CAPACITY AND PRIMARY PRODUCTIVITY

TABLE IV.

STA	% LIGHT	PHOTO CAP	ASSIM NO.	I	% LD	PROD.	ASSIM RATIO
A3	100	107.07	11.8	699	0.0	1903	210
	60	98.76	10.9	419	0.4	1627	179
	30	41.12	4.5	210	0.9	902	99
	15	22.44	2.5	105	1.4	550	61
	1	0.63	0.1	7	3.4	1	0
P1	100	278.02	23.1				
	60	217.56	18.1				
	30	104.31	8.7				
	15	27.29	2.3				
	1	3.82	0.3				
B4	100						
	60						
	30						
	15						
	1						
C3	100	73.21	19.3	711	0.0	967	255
	60	63.71	16.8	427	1.0	1096	287
	30	36.92	9.7	213	2.3	622	163
	15	10.83	2.8	107	3.6	231	68
	1	1.37	0.4	7	8.8	13	6
C5	100	9.70	16.7	785	0.0	193	333
	60	9.45	16.3	471	1.5	77	140
	30	3.86	6.6	236	3.5	21	38
	15	2.18	3.8	118	5.6	19	29
	1	0.00	0.00	8	13.5	6	5
D3	100	16.14	17.9				
	60	13.98	15.5				
	30	6.08	6.8				
	15	1.45	1.6				
	1	0.93	1.0				
D5	100	4.77	19.1				
	60	4.48	17.9				
	30	2.61	10.4				
	15	0.72	2.9				
	1	0.07	0.3				

CRUISE XII DATE 5-7 AUGUST 1974

PHOTOSYNTHETIC CAPACITY AND PRIMARY PRODUCTIVITY
TABLE IV.

STA	% LIGHT	PHOTO CAP	ASSIM NO.	I	% LD	PROD.	ASSIM RATIO
A3	100	70.70	23.6	681	0	1043.22	347.7
	60	97.00	32.3	409	0.7	872.45	290.8
	30	27.93	9.3	204	1.6	437.51	145.8
	15	10.61	3.5	102	2.5	232.97	77.7
	1	1.25	0.4	7	6.1	22.80	7.6
P1	100	105.76	17.4				
	60	92.56	15.3				
	30	31.02	5.1				
	15	7.94	1.3				
	1	1.28	0.2				
B4	100	10.69	6.8				
	60	11.76	7.4				
	30	6.51	4.1				
	15	2.10	1.3				
	1	0.17	0.1				
C3	100	15.99	9.8	544	0	191.60	117.5
	60	14.52	8.9	326	2	185.79	111.3
	30	7.98	4.9	163	4	236.41	92.7
	15	3.04	1.9	82	7	29.95	27.7
	1	0.10	0.1	5	18	0.16	0.2
C5	100	9.90	12.1	415	0	79.02	96.4
	60	8.43	10.3	249	3	68.08	85.1
	30	3.75	4.6	124	7	37.10	46.4
	15	1.71	2.1	62	11	16.84	18.7
	1	0.58	0.7	4	27	0.84	0.8
D3	100	21.11	10.5				
	60	14.44	7.1				
	30	7.94	3.9				
	15	2.62	1.3				
	1	0.35	0.2				
D5	100	4.75	13.2				
	60	3.98	11.0				
	30	1.78	4.9				
	15	1.25	3.5				
	1	0.17	0.5				

CRUISE NO. VII DATE 10-11 April 74

PHYTOPLANKTON FRACTIONATION: PHOTOSYNTHETIC CAPACITY
TABLE V.

		PHOTO CAP		CHL A		ASSIM. NO.	
STA	% LIGHT	NANO	NET	NANO	NET	NANO	NET
A3	100	9.22	10.33	0.60	0.60	15.4	17.2
	60	7.37	11.89			12.3	19.8
	30	5.00	4.56			8.3	7.6
	15	1.61	1.48			2.7	2.5
	1	0.25	0.23			0.4	0.4
P1	100	6.14	9.79	0.68	1.17	9.0	8.4
	60	6.42	10.91			9.4	9.3
	30	3.41	5.34			5.0	4.6
	15	1.38	1.68			2.0	1.4
	1	0.07	0.14			0.1	0.1
B4	100	6.01	3.52	0.32	0.32	18.8	10.7
	60	6.92	3.94			21.6	11.9
	30	3.80	1.83			11.9	5.5
	15	1.69	1.01			5.3	3.1
	1	0.14	0.03			0.4	0.1
C3	100	6.53	6.93	0.57	0.99	11.5	7.0
	60	6.28	6.52			14.5	6.6
	30	4.13	4.36			7.3	4.4
	15	1.77	1.93			3.1	2.0
	1	0.54	0.22			1.0	0.2
C5	100	4.22	2.51	0.44	0.44	9.6	5.6
	60	4.44	2.61			10.1	5.8
	30	3.40	2.06			7.7	4.6
	15	1.60	0.80			3.6	1.8
	1	0.28	0.05			0.6	0.1
D3	100	3.56	3.81	0.70	0.93	5.0	4.1
	60	3.12	4.13			4.4	4.4
	30	2.64	2.69			3.7	2.9
	15	2.06	0.94			2.9	1.0
	1	0.20	0.14			0.3	0.1
D5	100	5.18	4.11	0.73	1.08	7.1	3.8
	60	3.68	4.98			5.0	4.6
	30	2.59	3.01			3.5	2.8
	15	0.86	0.85			1.2	0.8
	1	0.32	0.25			0.4	0.2

CRUISE NO. VIII DATE 27-29 April 74

PHYTOPLANKTON FRACTIONATION: PHOTOSYNTHETIC CAPACITY

TABLE V.

		PHOTO CAP		CHL A		ASSIM. NO.	
STA	% LIGHT	NANO	NET	NANO	NET	NANO	NET
A3	100	27.29	21.97	2.08	1.65	13.1	13.2
	60	21.57	12.55			10.4	7.6
	30	10.60	5.79			5.1	3.5
	15	3.13	2.11			1.5	1.3
	1	1.45	0.23			0.7	0.1
P1	100	18.84	19.48	1.73	1.68	10.9	11.6
	60	13.76	15.82			8.0	9.4
	30	7.99	8.95			4.6	5.3
	15	0.99	1.68			0.6	1.0
	1	0.00	0.08			0.0	0.1
B4	100	17.31	2.62	1.48	1.85	11.7	1.4
	60	16.14	2.68			10.9	1.5
	30	11.18	1.42			7.6	0.8
	15	3.03	0.41			2.1	0.2
	1	0.07	0.00			0.1	0.0
C3	100	7.62	5.13	1.65	1.30	4.6	4.0
	60	7.91	4.65			4.8	3.6
	30	4.17	3.84			2.5	3.0
	15	1.08	0.70			0.7	0.5
	1	0.12	0.07			0.1	0.1
C5	100	5.08	4.06	0.84	1.35	6.1	3.0
	60	4.22	3.82			5.0	2.8
	30	2.30	2.18			2.7	1.6
	15	0.66	0.48			0.8	0.4
	1	0.17	0.03			0.2	0.0
D3	100	11.75	12.09	1.91	1.54	6.2	7.9
	60	11.98	9.73			6.3	6.3
	30	7.29	6.38			3.8	4.1
	15	2.02	2.18			1.1	1.4
	1	0.22	0.18			0.1	0.1
D5	100	3.92	3.50	0.71	1.30	5.5	2.7
	60	4.34	4.87			6.1	3.8
	30	2.71	3.76			3.8	2.9
	15	0.76	1.06			1.1	0.8
	1	0.00	0.02			0.0	0.0

CRUISE NO. IX DATE 25-27 May 74

PHYTOPLANKTON FRACTIONATION: PHOTOSYNTHETIC CAPACITY
TABLE V.

		PHOTO CAP		CHL A		ASSIM. NO.	
STA	% LIGHT	NANO	NET	NANO	NET	NANO	NET
A3	100	25.12	2.37	1.50	0.66	16.8	3.6
	60	21.96	2.18			14.6	3.3
	30	9.79	1.17			6.5	1.8
	15	2.83	0.34			1.9	0.5
	1	0.00	0.02			0.0	0.0
P1	100	12.17	12.62	0.93	1.96	13.2	6.4
	60	12.05	13.72			13.1	7.0
	30	6.35	8.15			6.9	4.2
	15	1.37	1.49			1.5	0.8
	1	0.00	0.03			0.0	0.0
B4	100	11.37	3.90	1.23	0.84	9.3	4.7
	60	12.11	4.59			9.9	5.5
	30	7.74	2.63			6.3	3.1
	15	2.54	0.54			2.1	0.6
	1	0.28	0.01			0.2	0.0
C3	100	8.10	2.78	0.70	0.70	11.6	4.0
	60	9.02	2.51			14.0	3.6
	30	4.77	1.74			6.8	2.5
	15	1.87	0.28			2.7	0.4
	1	0.26	0.01			0.4	0.0
C5	100	5.15	0.30	0.45	0.16	11.4	1.9
	60	4.58	0.36			10.2	2.3
	30	2.17	0.15			4.8	0.9
	15	0.69	0.04			1.5	0.2
	1	0.03	0.00			0.1	0.0
D3	100	22.65	4.96	1.73	1.41	13.1	3.5
	60	23.28	5.16			13.5	3.7
	30	11.54	3.21			6.7	2.3
	15	2.57	0.68			1.5	0.5
	1	0.12	0.02			0.1	0.0
D5	100	2.10	0.05	0.17	0.07	12.4	0.7
	60	1.92	0.05			11.3	0.8
	30	0.98	0.02			5.8	0.3
	15	0.33	0.01			2.0	0.2
	1	0.03	0.00			0.2	0.0

CRUISE NO. X DATE 22-24 June 74

PHYTOPLANKTON FRACTIONATION: PHOTOSYNTHETIC CAPACITY
TABLE V.

		PHOTO CAP		CHL A		ASSIM. NO.	
STA	% LIGHT	NANO	NET	NANO	NET	NANO	NET
A3	100	36.33	2.34	2.69	0.62	17.6	3.8
	60	33.80	1.83			16.3	3.0
	30	16.70	1.03			8.1	1.6
	15	7.90	0.42			3.8	0.7
	1	0.82	0.12			0.4	0.2
P1	100	140.31	78.43	4.72	7.47	29.7	10.5
	60	98.14	76.53			20.8	10.2
	30	49.54	35.98			10.5	4.8
	15	17.08	10.36			3.6	1.4
	1	3.13	3.62			0.7	0.5
B4	100	31.40	8.71	3.34	1.32	9.4	6.6
	60	32.18	7.85			9.6	5.9
	30	20.16	4.57			6.0	3.5
	15	5.72	1.47			1.7	1.1
	1	0.56	0.33			0.2	0.2
C3	100	121.77	78.44	7.91	6.59	15.4	11.9
	60	87.27	74.19			11.0	11.0
	30	41.98	26.03			5.3	4.0
	15	12.62	6.42			1.6	1.0
	1	2.17	0.62			0.3	0.1
C5	100	25.08	6.73	1.96	0.84	12.8	8.0
	60	21.22	5.98			10.8	7.1
	30	10.51	2.56			5.4	3.0
	15	1.85	0.37			0.9	0.4
	1	0.90	0.00			0.4	0.0
D3	100	41.11	40.72	2.42	3.69	17.0	11.0
	60	54.64	30.35			22.6	8.2
	30	24.53	19.77			10.1	5.4
	15	6.08	5.87			2.5	1.6
	1	0.01	0.45			0.0	0.1
D5	100	4.92	10.14	0.30	0.89	16.4	11.4
	60	4.64	10.15			15.5	11.4
	30	2.46	10.17			8.2	11.4
	15	0.42	1.01			1.4	1.1
	1	0.06	0.05			0.2	0.1

CRUISE NO. XI DATE 15-17 July 74

PHYTOPLANKTON FRACTIONATION: PHOTOSYNTHETIC CAPACITY

TABLE V.

		PHOTO CAP		CHL A		ASSIM. NO.	
STA	% LIGHT	NANO	NET	NANO	NET	NANO	NET
A3	100	104.95	2.12	8.79	0.30	11.9	7.1
	60	97.44	1.32			11.1	4.4
	30	40.63	0.49			4.6	1.6
	15	22.26	0.18			2.5	0.6
	1	0.63	0.00			0.1	0.0
P1	100	228.65	49.37	10.54	1.50	21.7	32.9
	60	184.72	32.84			17.5	21.9
	30	93.07	11.24			8.8	7.5
	15	25.34	1.95			2.4	1.3
	1	3.56	0.25			0.3	0.2
B4	100			0.53	0.06		
	60						
	30						
	15						
	1						
C3	100	59.92	13.30	2.65	1.14	22.6	11.7
	60	54.86	8.85			20.7	7.8
	30	31.51	5.41			11.9	4.7
	15	8.87	1.96			3.3	1.7
	1	1.31	0.05			0.5	0.0
C5	100	8.52	1.18	0.41	0.18	20.8	6.5
	60	7.81	1.64			19.0	9.1
	30	3.18	1.14			7.8	6.4
	15	1.03	0.67			2.5	3.7
	1	0.00	0.00			0.0	0.0
D3	100	15.23	0.91	0.79	0.11	19.3	8.3
	60	13.01	0.97			16.5	8.8
	30	5.65	0.42			7.2	3.9
	15	1.32	0.13			1.7	1.2
	1	0.90	0.03			1.1	0.3
D5	100	4.41	0.35	0.20	0.06	22.1	5.9
	60	4.18	0.31			20.9	5.1
	30	2.21	0.40			11.0	6.6
	15	0.52	0.20			2.6	3.3
	1	0.44	0.27			2.2	4.6

CRUISE XII DATE 5-7 AUGUST 1974

PHYTOPLANKTON FRACTIONATION: PHOTOSYNTHETIC CAPACITY
TABLE V.

		PHOTO CAP		CHL A		ASSIM. NO.	
STA	% LIGHT	NANO	NET	NANO	NET	NANO	NET
A3	100	69.07	1.63	2.88	0.12	24.0	13.6
	60	95.13	1.87			33.0	15.6
	30	27.46	0.46			9.5	3.9
	15	10.42	0.19			3.6	1.5
	1	1.24	0.01			0.4	0.1
P1	100	98.47	7.29	4.84	1.23	20.3	5.9
	60	86.09	6.47			17.8	5.3
	30	28.86	2.16			6.0	1.8
	15	7 41	0.52			1.5	0.4
	1	1.23	0.05			0.3	0
B4	100	7.52	3.17	0.97	0.62	7.8	5.1
	60	9.60	2.16			9.9	3.5
	30	5.30	1.21			5.5	2.0
	15	-	-			-	-
	1	-	-			-	-
C3	100	13.00	2.98	0.92	0.70	14.1	4.3
	60	12.13	2.39			13.2	3.4
	30	6.63	1.35			7.2	1.9
	15	2.48	0.55			2.7	0.8
	1	0.01	0.09			0	0.1
C5	100	9.25	0.65	0.64	0.18	14.4	3.6
	60	7.97	0.46			12.4	2.6
	30	3.52	0.23			5.5	1.3
	15	1.64	0.08			2.6	0.4
	1	0.45	0.13			0.7	0.7
D3	100	14.46	6.65	1.01	1.01	14.3	6.6
	60	10.99	3.45			10.9	3.4
	30	6.25	1.69			6.2	1.7
	15	2.11	0.51			2.1	0.5
	1	0.28	0.07			0.3	0.1
D5	100	4.27	0.48	0.24	0.12	17.8	4.0
	60	3.54	0.45			14.8	3.7
	30	1.60	0.18			6.7	1.4
	15	1.14	0.11			4.8	0.9
	1	0.13	0.04			0.5	0.3

CRUISE NO. VII DATE 10-11 April 74

PHYTOPLANKTON FRACTIONATION: PRIMARY PRODUCTIVITY
TABLE VI.

		CHL A			PRIM PROD		ASSIM. RATIO	
STA	Z	NANO	NET	% LD	NANO	NET	NANO	NET
A3	0	0.60	0.60					
	3	0.88	0.66					
	12	0.86	1.73					
P1	0	0.68	1.17					
	3	0.95	1.01					
	12	0.57	1.62					
B4	0	0.32	0.32					
	4	0.34	0.40					
	10	0.25	0.60					
	19	0.57	0.57					
C3	0	0.57	0.99	0	30.12	19.11	52.8	19.3
	4	0.46	1.06	2	60.45	49.33	131.4	46.5
	8	0.47	1.06	5	53.72	39.85	116.8	37.6
	21	0.84	0.84	8	46.00	23.19	97.9	21.9
	23	0.71	1.17	19	22.02	17.30	26.2	20.6
C5	0	0.44	0.44	0	21.59	10.85	49.1	24.1
	4	0.44	0.47	2	48.86	29.89	111.0	63.6
	9	0.28	0.51	5	45.64	24.49	103.7	52.1
	15	0.31	0.47	8	25.15	14.60	89.8	28.6
	23	0.46	0.60	20	3.77	1.98	12.2	4.2
D3	0	0.70	0.93					
	3	0.68	0.93					
	6	0.57	0.73					
	15	0.77	0.84					
	21	0.79	1.15					
D5	0	0.73	1.08					
	3	0.62	1.26					
	6	0.66	0.88					
	15	0.62	1.17					
	23	0.62	1.45					

CRUISE NO. VIII DATE 27-29 April 74

PHYTOPLANKTON FRACTIONATION: PRIMARY PRODUCTIVITY
TABLE VI.

		CHL A			PRIM PROD		ASSIM. RATIO	
STA	Z	NANO	NET	% LD	NANO	NET	NANO	NET
A3	0	2.08	1.65	0	149.56	26.36	71.9	16.0
	5	1.85	2.43	1	163.18	29.66	78.5	18.0
	9	1.39	2.49	1	116.87	27.67	56.2	16.8
				2	60.81	5.56	29.2	3.4
				4	18.34	1.33	8.8	0.8
P1	0	1.73	1.68					
	3	1.85	1.19					
	13	1.01	1.39					
B4	0	1.48	1.85					
	3	1.79	1.85					
	15	0.73	0.44					
	17	0.62	0.46					
C3	0	1.65	1.30	0	72.21	55.40	43.8	42.6
	3	1.50	1.39	2	104.86	111.55	69.9	80.3
	6	1.35	1.59	4	102.08	69.39	68.1	43.6
	10	0.86	1.24	6	33.30	32.01	24.7	20.1
	13	0.77	0.66	14	0.00	4.65	0.0	3.8
C5	0	0.84	1.35	0	46.36	30.54	55.2	22.6
	3	0.93	1.06	2	47.94	37.16	51.6	35.1
	9	0.60	0.48	5	37.93	30.44	40.8	59.8
	21			8	11.30	7.21	18.8	15.0
	28	0.25	0.28	19	0.03	0.09	-	0.6
D3	0	1.91	1.54					
	3	2.02	1.39					
	6	1.16	0.99					
	14	0.71	0.68					
	23	0.99	1.85					
D5	0	0.71	1.30					
	3	0.77	1.54					
	8	0.97	0.88					
	18	0.71	0.32					
	25	0.20	0.37					

CRUISE NO. IX DATE 25-27 May 74

PHYTOPLANKTON FRACTIONATION: PRIMARY PRODUCTIVITY
TABLE VI.

		CHL A.			PRIM PROD		ASSIM. RATIO	
STA	Z	NANO	NET	% LD	NANO	NET	NANO	NET
A3	0	1.50	0.66	0.0	253.43	75.00	169.0	113.6
	4	1.27	0.75	0.3	201.51	45.30	134.3	68.6
	10	1.27	0.92	0.7	59.27	10.85	39.5	16.0
				1.1	17.53	2.88	11.7	4.4
				2.7	2.83	0.27	1.9	0.4
P1	0	0.93	1.96					
	5	1.27	3.69					
	12	0.40	0.21					
B4	0	1.23	0.84					
	5	1.10	0.79					
	10	1.10	0.79					
	17	0.53	0.18					
C3	0	0.70	0.70	0.0	9.15	12.87	13.1	18.4
	2	0.53	0.79	2.2	61.21	20.33	115.5	25.7
	5	0.66	0.97	5.1	31.46	24.45	47.7	25.2
	8	0.57	0.84	8.0	15.55	10.05	27.3	12.0
	21	0.75	0.44	19.6	3.21	0.83	4.3	1.9
C5	0	0.45	0.16	0.0	54.91	4.64	122.0	29.0
	2	0.75	1.01	2.3	73.01	26.86	97.4	26.6
	6	1.06	0.39	5.3	37.36	9.96	35.3	25.5
	9	0.53	0.35	8.3	14.54	6.24	27.4	17.8
	24	0.13	0.10	20.3	0.0	0.00	0.0	0.0
D3	0	1.73	1.41					
	2	1.73	1.41					
	4	0.97	0.97					
	10	0.62	0.39					
	20	0.00	0.27					
D5	0	0.17	0.07					
	3	0.48	0.11					
	7	0.37	0.97					
	11	0.44	0.00					
	24	0.17	0.01					

CRUISE NO. X DATE 22-24 June 74

PHYTOPLANKTON FRACTIONATION: PRIMARY PRODUCTIVITY

TABLE VI.

		CHL A			PRIM PROD		ASSIM. RATIO	
STA	Z	NANO	NET	% LD	NANO	NET	NANO	NET
A3	0	2.07	0.62	0.0	343.08	42.74	165.5	69.5
	5	1.84	0.57	0.6	230.52	23.25	111.2	37.8
	11	1.73	0.58	1.4	69.75	4.66	33.6	7.6
				5.4	2.26	0.00	1.1	0.0
P1	0	4.72	7.47					
	6	3.80	7.91					
	12	0.79	0.57					
B4	0	3.34	1.32					
	4	3.57	1.41					
	10	0.97	1.51					
	15	0.57	0.21					
C3	0	7.91	6.59	0.0	427.01	1087.33	54.0	165.0
	2	2.88	7.91	0.6	337.90	932.99	117.4	118.0
	6	1.61	1.36	1.4	318.54	320.15	110.6	40.5
	12	0.66	1.96	2.2	152.90	161.31	53.1	20.4
	22	0.53	0.88	5.4	1.50	2.84	0.9	2.1
C5	0	1.96	0.84	0.0	200.50	20.56	102.3	24.5
	3	2.19	0.61	0.9	157.27	19.37	71.9	29.4
	9	0.75	0.80	2.1	103.02	11.38	47.1	17.2
	15	0.39	0.34	3.3	34.13	5.62	15.6	8.5
	28	0.18	0.18	8.1	0.47	0.60	0.6	0.8
D3	0	2.42	3.69					
	3	2.19	2.19					
	8	1.14	1.14					
	14	0.34	1.71					
	21	0.25	0.24					
D5	0	0.30	0.89					
	5	0.70	2.07					
	10	0.79	1.96					
	18	0.18	7.03					
	23	0.17	0.42					

CRUISE NO. XI   DATE 15-17 July 74

PHYTOPLANKTON FRACTIONATION: PRIMARY PRODUCTIVITY
TABLE VI.

		CHL A			PRIM PROD		ASSIM. RATIO	
STA	Z	NANO	NET	% LD	NANO	NET	NANO	NET
A3	0	8.79	0.30	0.0	1874	29	213	97
	4	3.45	0.24	0.4	1603	24	182	80
	8	3.80	0.35	0.9	894	8	102	27
P1	0	10.54	1.50					
	5	2.88	1.14					
	13	0.38	0.25					
B4	0	0.53	0.06					
	3	0.62	0.04					
	10	1.80	1.23					
	18	0.83	0.11					
C3	0	2.65	1.14	0.0	594	373	224	327
	2	2.76	1.05	1.0	687	408	249	388
	5	2.53	0.88	2.3	458	164	166	156
	10	1.38	0.62	3.6	164	67	65	76
	21	0.36	0.22	8.9	13	0	9	0
C5	0	0.41	0.18	0.0	167	26	407	144
	2	0.38	0.17	1.5	66	11	174	65
	6	0.44	0.21	3.5	20	1	53	6
	15	0.35	0.75	5.5	17	2	39	10
	22	0.18	0.52	13.5	4	1	22	1
D3	0	0.79	0.11					
	2	1.14	0.14					
	5	1.10	0.14					
	9	0.92	0.18					
	19	0.36	0.18					
D5	0	0.20	0.06					
	3	0.22	0.09					
	9	0.28	0.06					
	15	1.23	0.48					
	21	0.39	0.10					

CRUISE XII DATE 5-7 AUGUST 1974

PHYTOPLANKTON FRACTIONATION: PRIMARY PRODUCTIVITY
TABLE VI.

		CHL A			PRIM PROD		ASSIM. NO.	
STA	Z	NANO	NET	% LD	NANO	NET	NANO	NET
A3	0	2.88	0.13	0	977.18	66.04	339.3	550.3
	4	2.42	0.11	0.7	830.21	42.24	288.3	352.0
	10	2.30	0.35	1.6	417.37	20.14	144.9	167.8
				2.5	228.02	4.95	79.2	41.3
				6.1	18.53	4.27	6.4	35.6
P1	0	4.84	1.23					
	6	1.38	0.25					
	13	0.70	0.15					
B4	0	0.97	0.62					
	3	0.83	0.62					
	8	1.04	0.66					
	17	1.15	1.05					
C3	0	0.92	0.70	0	150.89	40.7	164.0	58.2
	3	1.14	0.53	2.1	113.57	72.2	99.6	136.3
	6	1.64	0.70	4.9	169.50	66.9	92.1	95.6
	10	0.88	0.20	7.7	28.51	1.4	32.4	7.2
	23	0.48	0.18	18.9	0	0.2	0	0.9
C5	0	0.64	0.18	0	74.83	4.20	116.9	23.3
	3	0.66	0.14	3	64.45	3.62	97.6	25.8
	7	0.68	0.18	7	32.45	4.66	47.7	25.9
	12	0.76	0.14	11	15.20	1.64	20.0	11.7
	24	0.76	0.30	27	0.34	0.50	0.4	1.7
D3	0	1.01	1.01					
	2	1.73	1.96					
	7	1.05	0.75					
	14	0.53	0.44					
	22	0.25	0.32					
D5	0	0.11	0.06					
	3	0.14	0.04					
	8	0.14	0.06					
	15	0.88	0.09					
	25	0.53	0.15					

CRUISE NO. VII DATE 10-11 April 74

PHYTOPLANKTON FRACTIONATION: NET/NANO RATIOS
TABLE VII.

STA	P'_{max}	ASSIM NO.	CHL M^{-2}	PROD M^{-2}	ASSIM RATIO
A3	1.1	1.1	1.2		
P1	1.7	1.0	1.6		
B4	0.6	0.6	1.4		
C3	0.8	0.5	1.6	0.7	0.3
C5	0.6	0.6	1.3	0.6	0.4
D3	1.1	0.8	1.2		
D5	0.8	0.5	1.8		

CRUISE NO. VIII DATE 27-29 April 74

PHYTOPLANKTON FRACTIONATION: NET/NANO RATIOS
TABLE VII.

STA	P_{max}	ASSIM NO.	CHL M^{-2}	PROD M^{-2}	ASSIM RATIO
A3	0.8	1.0	1.1	0.2	0.2
P1	1.0	1.1	0.8		
B4	0.2	0.1	0.9		
C3	0.7	0.9	1.0	0.9	0.9
C5	0.8	0.5	1.0	0.7	0.9
D3	1.0	1.3	1.0		
D5	1.1	0.6	1.0		

CRUISE NO. IX

DATE 25-27 May 74

PHYTOPLANKTON FRACTIONATION: NET/NANO RATIOS
TABLE VII.

STA	P_{max}	ASSIM NO.	CHL M^{-2}	PROD M^{-2}	ASSIM RATIO
A3	0.1	0.2	0.6	0.2	0.5
P1	1.1	0.5	2.2		
B4	0.4	0.6	0.6		
C3	0.5	0.3	1.1	0.6	0.4
C5	0.1	0.2	0.7	0.3	0.4
D3	0.2	0.3	0.9		
D5	0.0	0.1	0.5		

CRUISE NO. X DATE 22-24 June 74

PHYTOPLANKTON FRACTIONATION: NET/NANO RATIOS
TABLE VII.

STA	P_{max}	ASSIM NO.	CHL M^{-2}	PROD M^{-2}	ASSIM RATIO
A3	0.1	0.2	0.3	0.1	0.3
P1	0.6	0.4	1.4		
B4	0.3	0.7	0.6		
C3	0.6	0.8	1.8	2.4	1.3
C5	0.3	0.6	0.6	0.1	0.2
D3	0.7	0.5	1.4		
D5	2.1	0.7	6.6		

CRUISE NO. XI DATE 15-17 July 74

PHYTOPLANKTON FRACTIONATION: NET/NANO RATIOS

TABLE VII.

STA	P_{max}	ASSIM NO.	CHL M^{-2}	PROD M^{-2}	ASSIM RATIO
A3	0.0	0.6	0.1	0.0	0.2
P1	0.2	1.5	0.2		
B4	-	-	0.5		
C3	0.2	0.5	0.4	0.5	1.2
C5	0.2	0.4	1.2	0.1	0.1
D3	0.1	0.5	0.2		
D5	0.1	0.3	0.3		

CRUISE XII DATE 5-7 AUGUST 1974

PHYTOPLANKTON FRACTIONATION: NET/NANO RATIOS
TABLE VII.

STA	P_{max}	ASSIM NO.	CHL M^{-2}	PROD M^{-2}	ASSIM RATIO
A3	0.02	0.5	0.1	0.05	0.7
P1	0.1	0.3	0.1		
B4	0.3	0.5	0.7		
C3	0.2	0.3	0.3	0.4	1.1
C5	0.1	0.3	0.3	0.1	0.3
D3	0.5	0.5	0.9		
D5	0.1	0.2	0.2		

PHYTOPLANKTON CELL DENSITY (10[illegible] LITER^{-1}), NETPLANKTON AND NANOPLANKTON CELL DENSITY, AND THE RELATIVE ABUNDANCE OF DOMINANT SPECIES AT STATION C3 (SMALLEST NUMBER OF SPECIES WHOSE CUMULATIVE ABUNDANCE EXCEEDED 75% OF TOTAL CELLS)

Phytoplankton	Month											
	9.9	10.9	11.6	12.5	1.9	2.6	4.4	4.9	5.8	6.8	7.5	8.2
Cell Density	3.20	1.07	0.66	0.70	1.78	3.32	0.57	0.68	0.11	4194	827	83.7
Netplankton	1.77	0.72	0.08	0.42	1.53	2.97	0.32	0.44	0.02	0.35	4.1	0.7
Nanoplankton	1.43	0.35	0.58	0.28	0.25	0.35	0.25	0.24	0.09	4194	823	83.0
Melosira sulcata			*									
Skeletonema costatum		37	*	31	57	66	14	18			*	*
Thalassiosira nordenskioldii			*									
Thalassiosira sp.				28	7			**				
Leptocylindrus danicus	50							39				
Rhizosolenia alata			*									
Rhizosolenia faeroense		22										
Rhizosolenia delicatula							28	9				
Hemiaulus sinensis			*									
Chaetoceros spp.			*									
Asterionella japonica					13	18				*		
Thalassionema nitzschioides				23								
Nitzschia seriata							18					
Nitzschia closterium										*		
Peridinium spp.			*									
Exuviella sp.									**			
Ceratium longipes									25			
Nannochloris atomus	**	20	58	**					50	99	99	99
Other Flagellates	33	**	29	**	**	**	28	9				

* Dominant Netplankters

** Dominant Nanoplankters

ANNUAL REPORT

(RESULTS ON WORK-TO-DATE AND PROJECTED FUTURE WORK)

to the

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

on the

FORAMINIFERA OF THE NEW YORK METROPOLITAN AREA

1 Jan 1974 - 31 Dec 1974

CONTRACT NO. 03-4-043-315

DR. JOHN J. LEE

(Research Assistant:E. Cosper, M.S.)

Introduction

The distribution patterns of living planktonic and benthic foraminifera have been shown to be useful measures of the biological effects of sewage effluent discharges on outfall areas in the coastal waters of California (Bandy et al. 1964 a, b, 1965; Watkins 1961; Zalesny 1961) and eastern Canada (Schafer 1973). Foraminifera are ideal organisms to use to establish the kinds and magnitude of effects of ocean pollution because they are abundant along the coasts and continental shelves of the U.S.; they have shells or tests which are left behind after the animals die, and their small size (meiofauna) makes it feasible to collect and characterize significant numbers of animals.

In California total populations of living foraminifera were twice as abundant at the outfall as elsewhere on the mainland shelf, with planktonic specimens about 50 times as abundant in sediments near the outfall as at similar depths along the mainland shelf. Two species, Buliminella elegantissima and Bolivina vaughani were especially abundant within 500 M of the outfall, where species diversity was low. The Nonionella miocenica stella and the Epistominella bradyana groups were excluded from the outfall area, the latter group living only at stations furthest from the outfall. Populations of other species, particularly the Buccella frigida group were depressed near the outfall. In Canadian studies the Elphidium incertum/clavatum group, E. margaritaceum, B. frigida, and occasionally Protelphidium orbiculare formed lenses of abundance adjacent to the outer edges of abiotic zones analagous to the Capitella capitata zones noted elsewhere. On the other hand, populations of Ammotium caccis, Ammomarginulina fluvalis, Pseudopolymorphina novangliae, Reophax fusiformis, R. arctica, R. scotti and R. nodosa and other species are reduced or absent near outfalls and could be characterized as pollution sensitive species.

Ocean disposal by outfall has many impact characteristics which are similar to dumping but the two processes are different. In the United States, the New York metropolitan area presents a unique locale for assessing ocean dumping impact on benthic biota. The aim of the present study is to assess the impact of the approximately 6 x 10^6 yd^3/yr sewage sludge and the 4 x 10^6 yd^3/yr of industrial wastes on the benthic foraminifera of the New York Bight and to integrate these data with co-ordinate studies aimed at characterizing and pinpointing the effects of major environmental stresses in the New York City region.

Methods

The general methodology of collection and laboratory treatment of samples have remained the same as those outlined in the first quarterly report. After the June 1973 collection approximately 90 stations arranged in a grid pattern in the New York Bight (see Figs. 1 and 2) were sampled with five successive grabs. Ten stations (4, 7, 10, 16, 23, 30, 31, 34, 37, 51; see Fig. 1) were selected for laboratory analysis; 3 grabs from each were counted.

In addition, qualitative samples using a Petersen grab were taken at 5 stations occupied for plankton samples during the summer of 1974 and microscopically examined particularly for the calcareous state of certain species of foraminifera.

Results and Discussion

Quantitative analysis of the total number of foraminifera at each of the stations and sampling dates studied thus far are tabulated (Table 1; Figs. 3 and 4). It is significant that high densities of foraminifera were found within and near the designated sewage dumping area. The majority of foraminifera were *Elphidium* spp. Unfortunately poor preservation techniques at the time of collection of the MESA samples resulted in decalcification of most foraminiferan tests. This is particularly regrettable since the use of benthic foraminifera as environmental indicators is possible only with precise identification. If the high standing crop of *Elphidium* found in the present study represents a single pollution tolerant species (perhaps *Elphidium clavatum-incertum* complex) then parallels can be drawn from Schafer's studies (Schafer, 1973) of distribution of foraminifera near pollution sources in Chaleur Bay (between Gaspé peninsula and northern New Brunswick). Five other speices, *Eggerella advena*, *Rosalina columbiensis*, *Ammodiscus* sp, *Hormosina* sp and *Trochammina* sp were also fairly common. We found heavily calcified species of *Elphidium* and *Quinqueloculina* in the qualitative samples we collected ourselves during the summer of 1974 in the Bight. This lends credence to our hypothesis that the original MESA samples we were given were poorly preserved. Extrapolation of findings from one year to the next must, however, be approached with caution. It is possible that the decalcified specimens of the summer of 1973 represent the living state. McCrone and Schafer (1966) found decalcified, chitinous-like specimens in the Hudson River between Peekskill and Haverstraw in a study done during the summer of 1964 and 1965. However, the more likely explanation is improper buffering of the formalin in the samples.

In general, the results of this study are not inconsistent with the findings of Gevirtz et al. (1971) in their study of the continental shelf and slope off Long Island, which also included the inner Bight. They collected core samples during the summer of 1965 and 1966. *Eggerella advena* dominated the inner Bight and species of *Elphidium* were numerous particularly in water less than 60 ft deep. Planktonic forams were absent from the inner Bight and were found in abundance only in water deeper than 65 fathoms (390 ft).

During 1961 and 1962 *Elphidium* species dominated the Long Island Sound fauna (Buzas 1965). *Eggerella advena* was also abundant. Standing crop estimates were within the same magnitudes as those we found in the Bight, approximately 1,770 per 100 cm^3 for 10-20 M, and 620 per 100 cm^3 for 20-40 M with an overall seasonal average of approximately 1,100 per 100 cm^3. No planktonic foraminifera were found in his study.

Twenty-two samples of plankton tows (Sept. 1973-July 1974) made in cooperation with Dr. T. Malone's MESA cruises have been analyzed for planktonic foraminifera. Small numbers of several species of planktonic and, in the river, benthic forams have been found (Tables 2 and 3). We found no pattern of distribution in the samples thus far examined. The benthic species we presume are swept into the water column by turbulence. The numbers of planktonic specimens in either the water column or sediments near the dump sites were not comparable to the California situation where planktonic foraminifera have been shown to bloom near a sewage outfall.

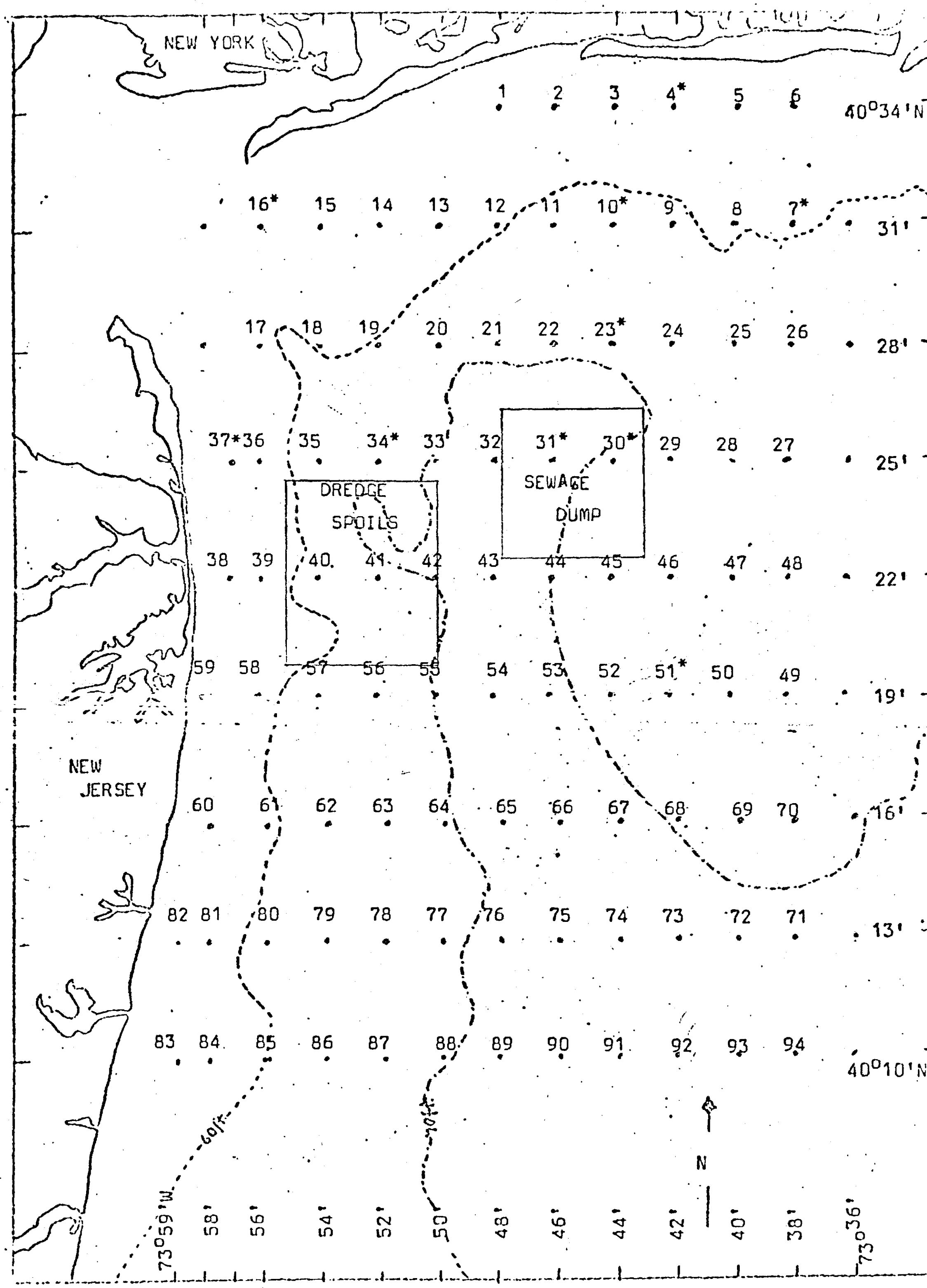


Fig. 1 Collection sites for benthic foraminifera in the New York Bight as of August 1973.
* stations analyzed in the laboratory.

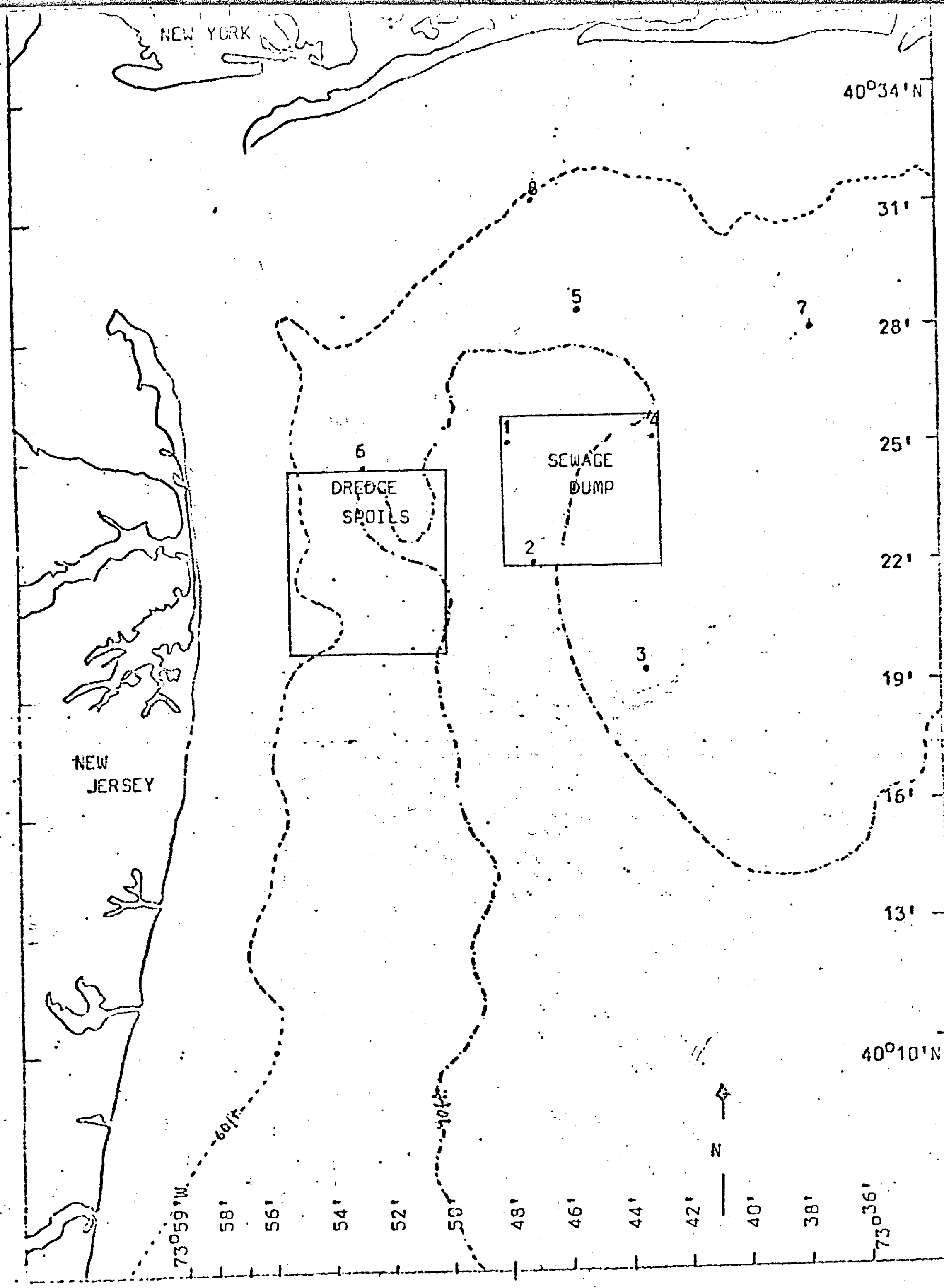


Fig. 2 Collection sites for benthic foraminifera in the New York Bight for June 1973.

DATE	STATION	COMMENT	DEPTH ft.	GRAB 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
6/73	1	NW Sewage Dump	113				46										78					
	2	SW Sewage Dump	120			7,605	22*							4,824	5,404		4,416					
	3	Outer Bight	83		1,410	660	1,106	833	1,103	90	90	463	638	760	1,446	300	1,400	638	855	589	725	426
	4	NE Sewage Dump	82		5	10	0	21	14	16	-	8	-	14	5	13	4	51	17	21	48	8
	5	N of Sewage Dump	85									3,890										234
	6	N border Dredge Spoils	90		19	406	13	11	17	17	81	57	26	40	166	137	26	17	24	9	65	79
	7	NE of Dumps	70			7																
	8	N toward L.I.	66		12	1	6	-	18	9	5	4	14	14	10	6	-	7	11	3	28	10
8/73	4	Off L.I.	35	5,850		2,492	412															
	7	Off L.I.	55	181			969	1,245														
	10	Off L.I.	69		1,231		2,420	244														
	16	Mouth of Estuary	28		726	4	10															
	23	N of Sewage Dump	86		1,580	4,507	2,142															
	30	N Sewage Dump	83	93																		
	31	N Sewage Dump	100	330																		
	34	Off Sandy Hook	80			29	136															
	37	Off Sandy Hook	40		1,658	212	68															
	51	Outer Bight	80		585	1,360	1,420															

Table 1 Numbers of live benthic foraminifera found per 100 cm^3 in samples taken from the New York Bight during June and August 1973.
* deleted from average.

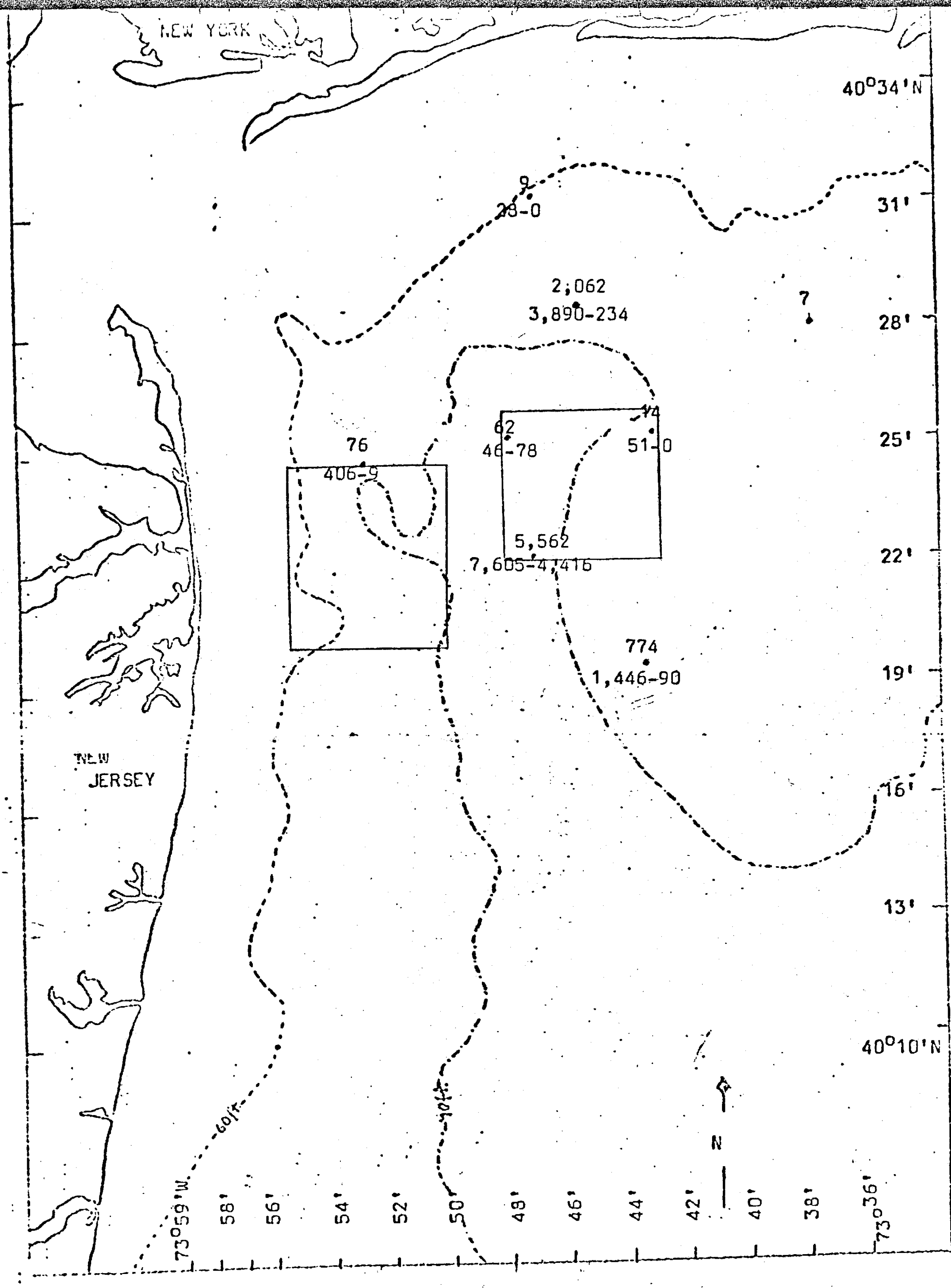


Fig. 3 Numbers of live benthic foraminifera found per 100 cm^3 in samples taken from the New York Bight during June 1973 - means and ranges.

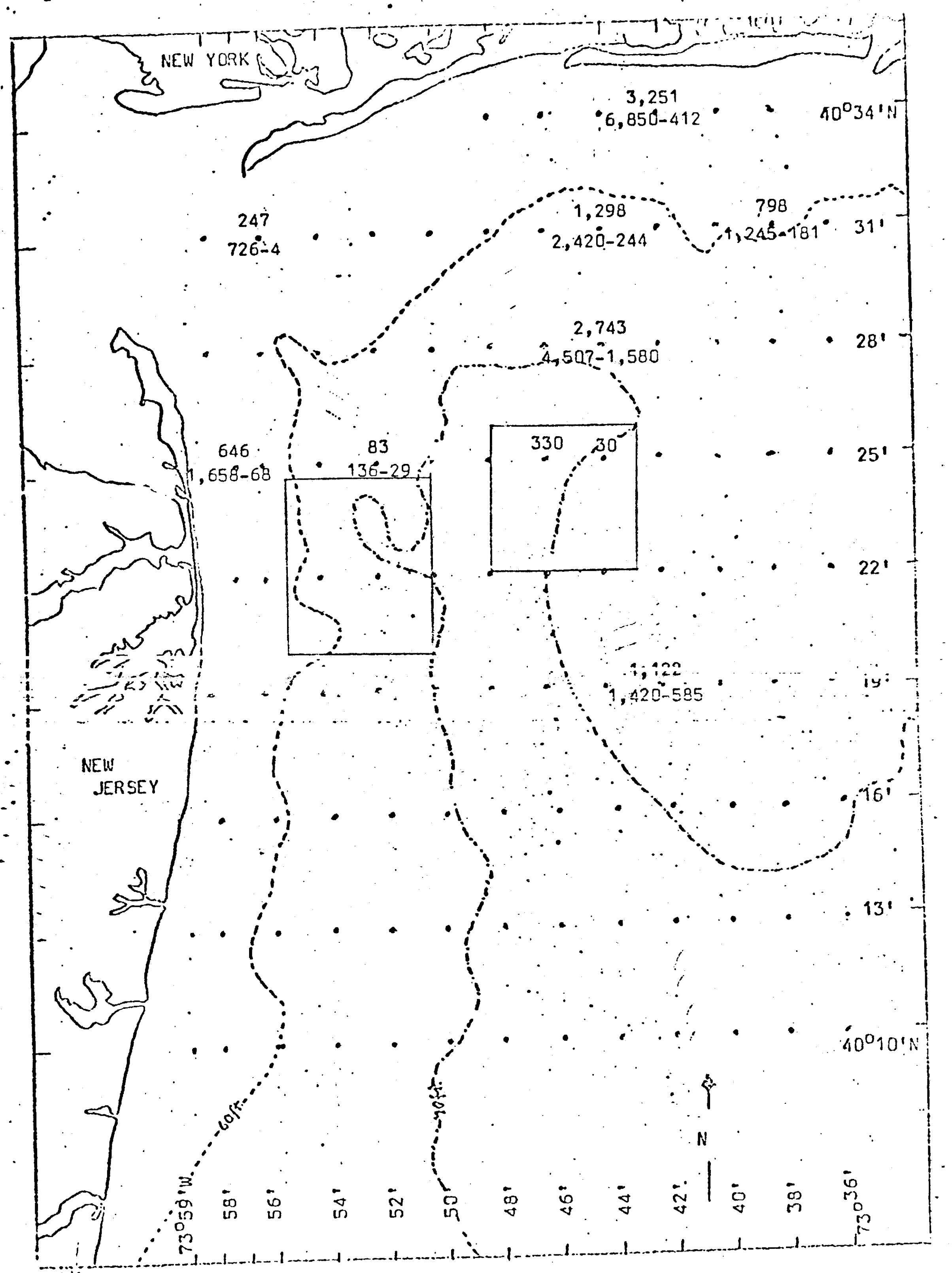


Fig. 4 Numbers of live benthic foraminifera found per 100 cm^3 in samples taken from the New York Bight during August 1973 - means and ranges.

TABLE 2

Number of planktonic foraminifera found in the Hudson River estuary and New York Bight.

Date	Station	200 µ Samples #/m^3	80 µ Samples #/m^3
9/1/73	A3	0	
	P1	0	
	D3	0	
10/2/73	D5	2.3	
11/3/73	A1	0	
	A3	0	
	P1	0	
	D3	0	
	B4	0	
1/26/74	A1		0
	A2		0
	A3		0
	A4		0.08
4/10/74	B4		0
	C5		0
	D5		0.12
	D3		0
4/27/74	C3		0.02
	C5		0
	D5		0
6/22/74	C5		0
7/15/74	C5		0

TABLE 3

Stations sampled for plankton in Hudson River and the New York Bight.

Station	Latitude	Longitude	Comments
A1	40°52'53"	mid channel	river, above G.W. Bridge
A2	40°49'31"	mid channel	river, below G.W. Bridge
A3	40°40'18"	74°02'18"	upper bay, above V.B.
A4	40°35'18"	74°02'39"	lower bay, below V.B.
P1	40°28.6'	73°54.0'	Sandy Hook
B2	40°29.1'	73°46.8'	North Transect off Long Island
B3	40°29.4'	73°40.5'	"
B4	40°30.0'	73°30.0'	"
C2	40°25.4'	73°48.0'	Sludge dump, fringe
C3	40°24.0'	73°45.5'	Sludge dump, center
C4	40°22.4'	73°42.0'	Sludge dump, fringe
C5	40°16.7'	73°32.4'	Reference
D2	40°24.0'	73°53.0'	Dredge dump, fringe
D3	40°22.0'	73°52.5'	Dredge dump, center
D4	40°20.0'	73°52.1'	Dredge dump, fringe
D5	40°10.0	73°50.0'	Reference

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Conclusions and Recommendations

In order to properly evaluate the effects of dumping on the foraminifera in the apex and the Bight, and to be able to compare dumping impact with outfall disposal, identification of the species is as important as the enumeration of the total population. The foraminifera in the samples studied thus far were either weakly calcified (aberrant growth) or decalcified during sample storage. The calcareous foraminifera in the samples can be identified to genus but specific identification is tenuous. Since the freshly collected specimens we obtained from the Bight this summer were normally calcified it is probable that the MESA benthic samples collected in June and August 1973 (and probably Oct. 1973) were improperly buffered.

In view of projected abandonment of dumping at present sites (EPA briefing report, April 1974), there is urgency to properly sample the foraminifera in the apex and Bight in the next 2 years in order to assess seasonal variation. Foraminiferan species distribution maps could then be drawn. Without a solid pre-abandonment study, impact and recovery cannot be validly assessed.

Based on the sediment types in the samples we have studied thus far we estimate one experienced research assistant can count and identify the foraminifera in one quantitative benthic sample or 5 planktonic samples per week. There were 3 more sampling cruises made on MESA cruises which we have not studied. If we examine 10 stations, 3 grabs per sample, for each of the cruises it will require approximately 23 months to complete examination of the samples. In 6 months (see appended budget) we could examine approximately 24 samples - less than completion of the 30 October 1973 cruise. We have analyzed 22 of 62 samples of planktonic foraminifera. Twelve more samples will be collected this month. The analysis of these samples will take approximately 3 months.

The work on foraminifera proposed is too important to the basic NOAA mission not to receive greater attention and support than it has thus far received. To properly do the job of assessing the impact of dumping on the foraminifera of the New York Bight and apex approximately 36-48 man months of research assistance in a 2 year period with concurrent new sampling as needed. I believe the MESA samples taken after 4 January 1974 were properly buffered and preserved and can be used in the proposed studies.

RESEARCH REPORT TO

U.S.Department of Commerce
National Oceanographic and Atmospheric
Administration

National Marine Fisheries Service
Middle Atlantic Coastal Fisheries Center
Sandy Hook Laboratory
Highlands, New Jersey 07732

Institution

University of Maryland
College Park, Maryland 20742

Title of Research

Analysis of the Ciliate Protozoa Associated with the Man Induced Change to the Sublittoral Environment of the New York Bight: Progress Report covering August to December, 1974.

Principal Investigator

Eugene B. Small
Eugene B. Small
Associate Professor
Department of Zoology

Received
DEC 23 1974
Knee McNulty
cc: Dr. Sindermann/Holston
Dr. Pearce
Dr. Thomas

Date of Submission
20 December, 1974

Errata sheet for the 12 month report

The formulae for quantification statistically of the ciliate counts were incorrectly given and should be as follows:

$$\text{Upper Limit} = \text{count} + 2.42 + 1.960\sqrt{\text{count} + 1.5}$$

$$\text{Lower Limit} = \text{count} + 1.42 - 1.960\sqrt{\text{count} + 0.5}$$

The reference is Lund et al,. 1958, Hydrobiologia 11:143-170.

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Protozoological studies were continued through the late summer and fall of 1974 following a two and a half month hiatus during the important months of June, July, and August. Due to lack of data from this period of time, many of the hypothetical theories proposed in the last report continue to be purely hypothetical theories. Further critical analysis and comparison of all the data presented in this report as well as that given in the two previous reports is forthcomingin the final report. The scope of this paper is intentionally limited due to the immediacy of the final report. As in the twelve month report, Appendices and data are presented following the format of the six month report so that correlation and continuity are facilitated.

There has been little change in the materials and methods used since the first report. During the August cruise aboard the R/V Delaware II a peristaltic pump was set up in order to test its sampling feasibility under oceanic conditions. The pump is run by a power window motor off of a 12 volt car battery and collects seawater through a Tygon tube lowered into the water to the desired depth. Limitations of the method, its slowness and loss of coherence to the sample as opposed to that obtained by Nisken bottle, as well as the inconvenience of the tube running over the side of the boat were enough to discontinue this sampling procedure. A Foerst centrifuge modified for protozoa was also set up until it became obvious that the cascade of filters method is far more flexible for ship-board filtration.

Methods that continue to be successfully used for sampling include a 30 liter Nisken water bottle, a Smith-MacIntyre bottom grab, and, when necessary, either a Petersen or a Shipeck bottom grab. Extraction and concentration methods used include the Uhlig seawater ice extraction for sediment ciliates and Lackey jars and the cascade of filters for planktonic organisms. Quantification continues as part of the plankton protozoa study.

Perhaps the most important aspect of this past fall has been the relative frequency of collection of the plankton samples as opposed to last year's work. Although sampling at two to four week intervals is imperfect in a system where the animals one is sampling have generation times on the order of hours and days and may be affected almost immediately by any environmental perturbations, there are some trends that may be inferred from the quantitative data presented in Appendix IIIC.

The first cruise was during the late summer. At the sewage station when it was initially sampled it was noted that the water was extremely murky (Secchi disk reading- 4') and a surface slick was present; these are characteristics of a recent sewage dump. A five liter surface water sample was obtained and filtered. An hour later after returning to the station the water was quite clear (Secchi disk reading - 34') and the surface slick was absent. Two 30 liter water samples were obtained and filtered. The contrast between the first sample and the second set of samples was obvious when examined under a microscope (as well as the gross characteristics previously mentioned).

Peritrichs, stalked bactivorous ciliates, were found to be extremely prominent in the first five liter sample. The count shows them present at a level of from 211 to 273 peritrichs per liter, a count that is higher than the highest count for scutico ciliates from the 27 August cruise last year. Peritrichs are important components of fresh water sewage treatment plants (Curds, 1973), are voracious bacterivores, and require fairly high dissolved oxygen contents in the water in which they live. In a small stream which carried the effluent from a sewage treatment plant in Illinois, Small (1973) found the peritrichs to be most numerous in the fall when the water temperature dropped enough to increase the oxygen solubility, and the bacterial counts remained high. In contrast, during the summer portion of the year free-swimming scutico ciliates were most numerous. It may be that such a seasonal cycle is also present in the portions of the New York Bight that are affected by the sewage dump. Scutico ciliates are most definitely present in the summer as shown by the quantitative counts from 27 and 29 August, 1973, where almost the entire count represents scutico ciliates. The peritrichs were obseved to be attached to small pieces of debris (a substrate of some sort is necessary for stalked ciliates).

Peritrichs were almost entirely absent from the second set of 30 liter water samples and the rest of the faunal component was almost entirely different. The most dramatic change in the phytoplankton was the reduction of numbers. Radiolaria and an Acantharian were observed in the surface water; both are considered to be characteristic of open ocean plankton forms. Trichophrya salparum, a voracious ciliate predator, was observed attached by its stalk to a ctenophre. This ciliate has long sucking tentacles instead of an oral orifice and literally sucks out the protoplasm of its selected prey. Other ciliate species, mostly free-swimming bacterivores and "omnivores" were also observed as well as several metazoan larval forms and a predacious Daphnia.

On 11 October peritrichs were also found at the sewage site. It may be significant that they were not found at the surface, but were just above the limit of the euphotic zone. It has been hypothesized (Segar, personal communication) that the sewage sludge, when dumped, does not immediately fall to the ocean floor but rather it drifts to the thermocline where it may stay for a peiod of time before continuing on to the floor of the ocean. In this case, the bactivorous ciliates would be found at the level of the thermocline happily munching away. If the thermocline coincides with the depth of the euphotic zone, or if the samples obtained have collected organisms in this level, such a system would be findable using the present data. The presence of the peritrichs in the 11 October sample at a depth of 80' and their absence at the surface may indicate such a system, but without exact thermocline data and a sufficient vertical profile of ciliate counts, it is difficult to say.

By 19 October and 1 November the tintinnids were the major ciliate plankton component. This is in accordance with last year's data from this season and coincides with our ideas on the seasonal faunal shift (from bacterivores in the summer to algivores- essentially an open ocean type fauna- in the winter).

Phytoplankton counts were initiated in order to expand our concepts of important plankton components and possible indicator organisms to be used in conjunction with the ciliate data. There do not seem to be such indicators in the phytoplankton organisms counted, at least none that would serve as elegantly as do the ciliates. Several individual species are included in the categories (Silicoflagellates, Ceratium, etc...) in the interest of expediency of the count.

Lackey jars have continued to be useful diagnostic tools. The updated distribution map is presented in Appendix II C. Uronema nigricans is reported from more stations peripheral to the sewage sludge dump site. Euplotes crassus showed up at another station designated arbitrarily as "clean". These two ciliates continue to be important possible indicator organisms for sewage and clean sites, respectively.

Examination and identification of the sediment ciliates has also continued. Cytological stains for taxonomic identification are now modified to the point where they are successful. Further information on this sector will be forthcoming in the final report and will constitute a major portion of Ms. Cady Soukup's thesis for her Master's degree. The generalizations made previously for the psammobiotic ciliates, absent from sluge and gravel stations and present only in clean sand and at the acid waste dumping site, are still valid.

In summary, identification and quantification have been continued through the months of August to December, 1974. Seasonal variations in the populations of the planktonic and benthic protozoa have been observed and, in the case of the planktonic ciliates, quantified. The magnitude of this change has been established. Possible reasons for the variability have been indicated and are beginning to be explored. Temporally, the distributional map has been expanded. Further quantification at sites other than the sewage is being done and will give a more complete idea of the horizontal space these populations occupy and affect. Correlation between this data and that of other aspects of the MESA study have been begun and will be reported in the final paper.

APPENDIX I A

Table 7

Cruise: Boat and Dates: R/V Delaware II 26-31 August, 1974

Station & Date	Secchi EZ Depth	Nisken Samples: Depth, Temp., Liters Filtered Top	Mid	Bottom	Grab Sample Jars	Bag	Grab Water	Uhlig Extraction	Sediment Characteristics
St. 8 27 August		3'		18'					
					2	1	1 l.	2-80u	fine brown sand with shell debris mixed in
	22'	8.0 l.		9.0 l.					
St. 15 28 August		3'		45'					
				19.3°	2	1	1 l.	2-80u	coarse sand, some gravel, well aerated
	52'	18.0 l.		16.0 l.					
St. 30 29 August	a) 4'	3'							
	12'	23.9°							
	95'	5.0 l.			Plankton Tow- Vertical				
	b) 33'	3'		75'					
	99'	24.0°		15.5°	2	1	2 l.		black, unctuous muck
	80'	24.0 l.		18.0 l.					
St. 33 29 August	42'	3'		95'	Plankton Tow- Vertical				
	126'	23.5°		15.0°	2	1	1 l.		black muck, some sand and a little gravel
	100'	22.5 l.		10.0 l.					

Stations 21, 22, 23, 31, 32, 34, 42, and 43 had sediment samples taken via the Lackey Jar method, two jars per station.

Table 8

Cruise: Boat and Dates: R/V Xiphias 11 October and 1 November, 1974

Station & Date (Loran fix)	Secchi EZ Depth	Nisken Samples Depth, Temp., Liters Filtered Top	Mid	Bottom	Grab Sample Jars	Bag	Uhlig Extraction	Sediment Characteristics
3207x4587 Edge sewage 11 Oct.	95'				2			spaghetti mud, dark brown to black, worm tubes
3204x4609 Just out of sewage area 11 Oct.	90'				2	2 lge.		clean medium mixed sand, brown to tan color
3224x4615 Sewage 11 Oct.	28' 84' 120'	3' 17.0° 12.0 l.	80' 14.8° 21.5 l.	110' 11.5° 8.0 l.	2			black muck
3286x4576 Edge dredge 11 Oct.	65'				2	1	4-80 u	coarse sand with black muck present in the interstices
3290x4576 Edge dredge 11 Oct.	47'				2	1	4-80 u	medium, clean looking sand
3303x4571 Edge beach 11 Oct.	40'				2	1	4-80 u	medium to fine clean looking sand, many sand dollars present in sample
3219x4623 Sewage 1 Nov.	11' 33' 108'	3' 15.0° 18.0 l.	35' 10.0° 18.0 l.	100' 8.5° 25.0 l.	Plankton tow-vertical 2			black muck
3308x4566 Edge beach	40'				2	1	4-80 u	fine sand with some black muck in the interstices

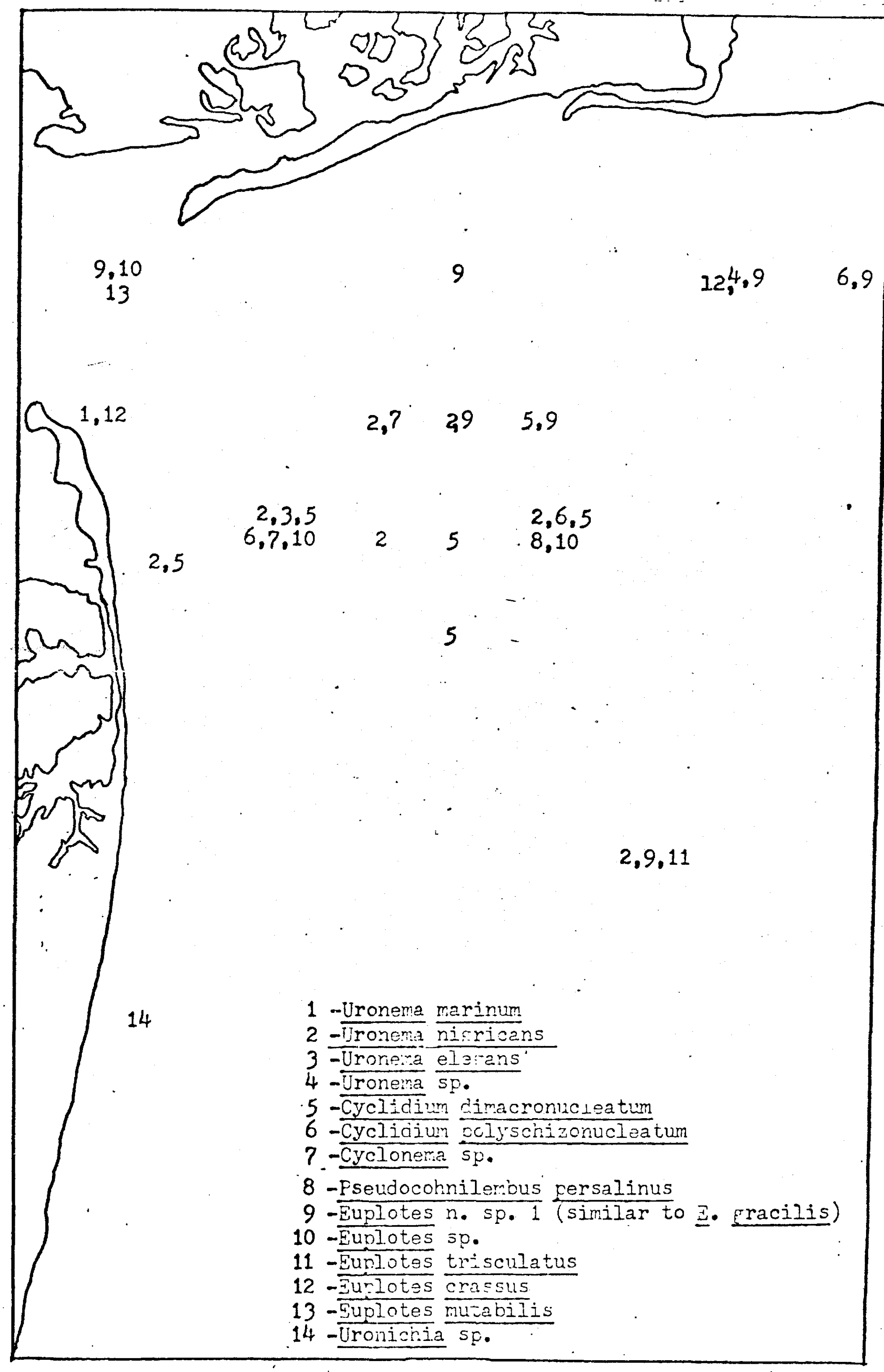
Table 9

Cruise: Boat and Dates: R/V Commonwealth 18-19 October, 1974

Station & Date	Secchi EZ Depth	Nisken Samples: Depth, Temp., Liters Filtered Top	Mid	Bottom	Grab Sample Jars	Bag	Uhlig Extraction	Sediment Characteristics
St. 35 Dredge 18 Oct.	11' 33' 64'	3' 24.0 l.	37' 15.3° 13.0 l.	61' 15.2° 7.0 l.	2			Black muck with greyish surface layer (5 cm.)
St. 37 Edge dredge near beach 18 Oct.					2	1	2-80 u	fine sand, clean looking
St. 82 N.J.shore,control 18 October					2			mucky sand and large gravel pieces
St. 16 Near N.Y.Harbor 19 October					2			medium sand, some black muck present
St. 92 Hudson canyon 18 October	180'	3' 14.65° 16.0 l.		175' 12.00° 8.0 l.	2			fine, somewhat mucky sand
St. 32 Sewage 19 Oct.	28' 84' 110'	3' 15.37° 16.0 l.		95' 13.20° 15.0 l.	2			black muck
St. 51 Acid waste 19 Oct.	73'	3' 15.40° 16.0 l.		60' 15.45° 16.0 l.	1	1	1-80 u	fine sand with a little muck in interstices

APPENDIX II C

Figure 1: Distribution of indicator organisms within the New York Bight



APPENDIX I D

Table 10
Feeding Preference

Sites:Tentative Genera/Species	Bacteria	Detritus or Algae a or d	Diatoms	Dino-flagellates	Euglenoids	Ciliates	Micro-metazoa	Histophages
R/V Delaware II								
26-31 August, 1974								
St. 8								
Water col:								
Top: heliozoa, acantharian, desmid, ctenophores, polychaete larvae, diatoms, Gymnodinium, euglenoid								
Tintinnid	+	a						
Oligotrich	+	a						
Bottom: acantharia, polychaete larvae, diatoms, copepods, radiolarian								
Tintinnid	+	a						
Scutico ciliate	+							
St. 15								
Water col:								
Top: acantharia, diatoms, Gymnodinium, euglenoid								
Bottom: diatoms, copepods, rotifers, hydroid, Cryptomonas, Chromulina, Ceratium								
Tintinnid sp.1	+	a						
Tintinnid sp.2	+	a						
Sediment;								
Metopid	+							
Litonotus								
Prorodon		a	+	+	+	+		
Euplotes								
Remanella						+		
St. 30								
Water col:								
Top AM: many ciliates (peritrichs, tintinnids, scuticos)								
Vorticella	+							
Philasterid	+							
Uronema	+							
Uronema nigricans	+							
Top PM: copepods, ctenophores with Trichophrya salparum, ceratium, daphnia, pelecypod larva, chaetognath larvae, dinoflagellates rotifer								
Pseudocohnilembus	+							
Euplotes	+	a,d	+	+	+			
Oligotrich	+							
Tintinnid	+	a						
Cyclidium	+							
[illegible] nigricans	+							

Table 11
FEEDING PREFERENCE

Site:Tentative Genera/Species	Bacteria	Detritus or Algae a or d	Diatoms	Dino-flagellates	Euglenoids	Ciliates	Micro-metazoa	Histophages
R/V Xiphias								
11 October, 1974								
Sewage dump site								
Water column:								
Top: diatoms, Ceratium, copepods, rotifer								
Peritrichs	+							
Vorticella	+							
Mid: Ceratium, Gymnodinium, copepods, flagellates								
Bottom:								
Uronema nigricans	+							
Dredge edge(a)								
Sediment: nematodes								
Dredge edge(b)								
Sediment:								
Keronopsis			+		+			
Uronema	+							
Cyclidium	+							
Pleuronema	+							
Condylostoma			+		+	+		
Spirostomum								
Metopids	+							
Trachelocerca sp.1			+	+	+	+		
Trachelocerca sp.2			+	+	+	+		
Dredge edge(c)								
Sediment: nematodes, copepods								
Remanella						+		
Pleuronema	+							
Coleps			+					

Table 12
Feeding Preference

Site:Tentative Genera/Species	Bacteria	Detritus or Algae a or d	Diatoms	Dino-flagellates	Euglenoids	Ciliates	Micro-metazoa	Histophages
R/V Commonwealth								
18-19 October, 1974								
Station 35 Dredge								
Water column :								
Top: copepods, pelecypod larvae, Ceratium, radiolaria								
Hypotrich	+		+	+	+			
Mid: copepods, organic debris, oil blobs, Ceratium								
Bottom: chaetognath larva, sand, debris								
Station 92 Hudson canyon								
Water column:								
Top: copepods, sand, debris								
Bottom: diatoms, copepods, sand, debris								
Station 32 Sewage								
Water column:								
Top: diatoms, salps, copepods, debris, flagellates, hydroid								
Bottom: copepods, pelecypod larvae, debris								
Station 51 Acid waste								
Water column:								
Top: hydroid medusa, copepods, fish and pelecypod larvae, debris								
Hypotrich	+		+	+	+			
Bottom: copepods, euglenoids, pelecypod larvae, sand								

Table 13
Feeding Preference

Sites:Tentative Genera/Species	Bacteria	Detritus or Algae a or d	Diatoms	Dino-flagellates	Euglenoids	Ciliates	Micro-metazoa	Histophages
R/V Xiphias								
1 November, 1974								
Sewage								
Water column:								
Top: copepods, silicoflagellates, Ceratium								
Mid: Ceratium, silicoflagellates, debris								
Tintinnids	+	a						
Bottom: copepods, flagellates								
Uronema	+							
Station 37 Beach edge								
Sediment: nematodes								
Coleps			+					
Pleuronema	+							
Plagiopyla	+	a	+					
Prorodon		a	+	+	+			
Centrophorella						+		
Loxophyllum						+o		
Frontonia			+					
Helicoprorodon			+	+	+	+		
Remanella						+		
Lacrymaria						+		
Litonotus						+		
Trachelocerca sp.1			+	+	+	+		
Trachelocerca sp.2			+	+	+	+		

APPENDIX III C

QUANTITATIVE DATA
SEWAGE SITE

Date	Secchi EZ Depth	Sample Depth	Liters Filtered	Temp.	Ciliates per Liter-95% Range: Hypo-trichs	Peri-trichs	Tintin-nids	Cili-ates	TOTAL	Other Microplankton 95% Range, Count per Liter: Silico-flagellates	Cera-tium	Gymno-dinium	Dino-physis	Foramin-ifera	Radio-laria
	4'														
29 Aug.	12'	3'	5.0	23.9°		211-273	5-16	130-180		393-476	16-36	122-170		26-50	
) 10:30	95'								364-445						
) 14:15	34'	3'	24.0	24.0°		.3-8	1-11			14-34		14-34	.5-10	2-12	.5-10
	102'								2-14						
	90'														
		80'	18.0	15.5°			24-49			15-35	18-39		21-43		
									24-49						
11 Oct.	28'	3'	12.0	17.0°	1-11					86-128	42-72	2-12	2-12	2-12	
	84'								1-11						
	120'	80'	21.5	14.8°		4-18	4-18			28-54	242-308	.6-9	55-89		
									11-29						
		110'	8.0	11.5°			31-57	2-14		3-16	3-16		3-16	3-16	
									36-64						
19 Oct.	30'	3'	16.0	15.37°			13-33			73-111	13-33		9-25	2-14	
	90'								13-33						
	110'	100'	15.0	13.20°	.8-10		14-34			75-114	28-53		72-111		
									17-38						

Middle Atlantic Coastal Fisheries Center
Sandy Hook Laboratory (F161)
Highlands, New Jersey 07732

June 6, 1974

Dr. Saul Saila
Narragansett Marine Laboratory
University of Rhode Island
Kingston, Rhode Island 02881

Dear Saul:

Enclosed please find the heavy metal data for the remaining reconnaissance sampling sites collected from the New York Bight. This includes the stations where 20 samples were collected for heavy metal analyses as well as those stations at which we collected five grab samples for metal analyses. You will note that in some samples several aliquots were removed from the same grab. I would appreciate it if you could review these data and give us some final word as to the variants and confidence limits that we could work in if we planned to collect one sample, five samples and ten samples per station.

Again, just looking at the data it appears that we get very good consistency in the replicate grab samples taken at what we assume to be one station. However, there does seem to be some variation at some of the stations indicating that we are probably sampling a diverse sediment at what we assume to be one station.

I will also furnish this information to Jim Thomas. He may have some feeling for the degree of movement of the vessel during the collection of the individual grab samples at a station. Before you subject these data to analyses, it might be well to talk with Jim about this.

I will be in Seattle, Washington, during all of the week of 10 June but will return to the laboratory on the 17th. In my absence, please feel free to contact Jim Thomas.

Sincerely,

cc: J. Thomas, K. McNulty, J. O'Connor ✓
Center

John B. Pearce
Officer-in-Charge

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Middle Atlantic Coastal Fisheries Center
Milford Laboratory
Milford, Connecticut, 06460

Date: June 3, 1974

Reply to Attn. of: FNE 13

To: Dr. John B. Pearce, Director, Ecosystems Investigations, Sandy Hook, New Jersey

From: Richard Greig, Chemist

Subject: Metals Data for MESA Sediments

Enclosed please find 13 tables of data. These are additional data from the special MESA cruise in which 20 grab samples were taken at eight stations and five grab samples were taken at about 30 stations.

According to my records we have not done the analyses of cores with the prefix R from these collections. I have not received the cores that were missing from this group of samples. I wrote Dr. Thomas about these cores sometine ago. I am listing the missing cores below.

Please bring this list to Dr. Thomas's attention:

R-73-1-1
R-73-1-2
R-73-1-3
R-73-1-4
R-73-1-5
R-73-1-6

R-73-2-6 (A,B,C,D) We have E.
R-73-2-7
R-73-2-8
R-73-2-9

MESA SEDIMENTS

LAB CODE	FIELD CODE		Ag	Cd	Cr	Cu	Ni	Pb	Zn
7884	A-73-1-2	Grab 1	<2.5	3.5	58.	76.	20.0	55.	115.
7887	A-73-1-2	Grab 2	<2.5	<2.5	36.0	60.	13.5	45.0	73.
7889	A-73-1-2	Grab 3	2.0	3.8	55.	108.	20.4	80.	290.
7892	A-73-1-2	Grab 4	<1.0	1.2	26.0	41.8	12.0	42.0	76.
7895	A-73-1-2	Grab 5	1.8	1.6	45.0	61.	17.2	68.	96.
7899	A-73-1-2	Grab 6	--	--	--	--	--	--	--
7901	A-73-1-2	Grab 7	< 2.5	<2.5	38.0	62.	14.0	135.	70.
7904	A-73-1-2	Grab 8	< 2.5	<2.5	32.0	192.	12.0	125.	62.
7907	A-73-1-2	Grab 9	< 2.5	< 2.5	43.5	88.	15.5	70.	90.
7910	A-73-1-2	Grab 10	<2.5	<2.5	17.5	35.5	13.0	35.0	54.
7913	A-73-1-2	Grab 11	<2.5	<2.5	41.5	62.	15.0	175.	78.
7916	A-73-1-2	Grab 12	<2.5	<2.5	36.5	51.	15.0	50.	114.
7919	A-73-1-2	Grab 13	<2.5	<2.5	51.	68.	20.0	65.	115.
7922	A-73-1-2	Grab 14	<2.5	<2.5	44.0	56.	16.0	65.	112.
7925	A-73-1-2	Grab 15	<2.5	<2.5	41.0	48.5	16.0	50.	72.
7928	A-73-1-2	Grab 16	<2.5	<3.0	62.	81.	21.0	80.	121.
7931	A-73-1-2	Grab 17	<2.5	<2.5	49.5	62.	19.0	65.	90.
7934	A-73-1-2	Grab 18	<2.5	<2.5	54.	68.	19.0	65.	118.
7937	A-73-1-2	Grab 19	<2.5	<2.5	63.	78.	18.5	70.	118.
7940	A-73-1-2	Grab 20	<2.5	<2.5	54.	66.	20.0	65.	97.
7940	A-73-1-2	Grab 20	<2.5	<2.5	60.	70.	19.5	65.	105.
7940	A-73-1-2	Grab 20	<2.5	<2.5	66.	79.	20.0	70.	103.

MESA SEDIMENTS

LAB CODE	FIELD CODE	Ag	Cd	Cr	Cu	Ni	Pb	Zn
7942	A-73-1-3 Grab 1	<1.0	<1.0	6.8	<7.2	2.4	8.0	16.6
7942	A-73-1-3 Grab	<1.0	<1.0	7.2	<7.2	2.0	10.0	17.8
7944	A-73-1-3 Grab 2	<1.0	<1.0	5.6	<4.0	<3.2	8.0	14.4
7946	A-73-1-3 Grab 3	<1.0	<1.0	6.0	<7.2	<2.0	10.0	15.2
7948	A-73-1-3 Grab 4	<1.0	<1.0	6.0	<7.2	<2.0	8.0	16.0
7950	A-73-1-3 Grab 5	<1.0	<1.0	6.4	<7.2	<1.0	10.0	15.0
7952	A-73-1-3 Grab 6	<1.0	<1.0	6.2	<7.2	2.0	6.0	15.4
7954	A-73-1-3 Grab 7	<1.0	<1.0	5.4	<4.0	<3.2	10.0	13.6
7956	A-73-1-3 Grab 8	<1.0	<1.0	6.6	<7.2	<2.0	8.0	16.0
7958	A-73-1-3 Grab 9	<1.0	<1.0	6.6	<7.2	2.4	6.0	16.0
7960	A-73-1-3 Grab 10	<1.0	<1.0	6.0	<4.0	<3.2	10.0	14.6
7962	A-73-1-3 Grab 11	<1.0	<1.0	6.8	<7.2	2.8	10.0	15.8
7964	A-73-1-3 Grab 12	<1.0	<1.0	8.0	<7.2	2.8	10.0	17.4
7967	A-73-1-3 Grab 13	<1.0	<1.0	6.8	<7.2	<2.0	6.0	15.4
7970	A-73-1-3 Grab 14	<1.0	<1.0	14.8	7.2	4.2	20.0	32.0
7972	A-73-1-3 Grab 15	<1.0	<1.0	6.2	<7.2	2.0	8.0	15.8
7974	A-73-1-3 Grab 16	<1.0	<1.0	6.4	<4.0	<3.2	10.0	14.6
7976	A-73-1-3 Grab 17	<1.0	<1.0	5.8	<7.2	2.0	10.0	15.0
7978	A-73-1-3 Grab 18	<1.0	<1.0	6.0	<7.2	2.2	6.0	15.2
7980	A-73-1-3 Grab 19	<1.0	<1.0	6.6	<7.2	<2.0	8.0	17.0
7982	A-73-1-3 Grab 20	<1.0	<1.0	6.8	<7.2	3.6	6.0	17.4

MESA SEDIMENTS

LAB CODE	FIELD CODE	Ag	Cd	Cr	Cu	Ni	Pb	Zn
7985	A-73-1-4 Grab 1	<1.0	<1.0	5.8	<7.2	<2.0	<6.0	17.6
7987	A-73-1-4 Grab 2	<1.0	<1.0	7.4	<7.2	<2.0	6.0	18.4
7990	A-73-1-4 Grab 3	<1.0	<1.0	11.2	9.2	2.4	16.0	21.8
7993	A-73-1-4 Grab 4	<1.0	<1.0	7.0	<7.2	<2.0	6.0	14.6
7996	A-73-1-4 Grab 5	<1.0	<1.0	9.0	10.4	<2.0	8.0	19.8
7999	A-73-1-4 Grab 6	<1.0	<1.0	7.2	<7.2	2.4	6.0	13.8
8001	A-73-1-4 Grab 7	<1.0	<1.0	9.8	<7.2	2.4	<6.0	19.6
8003	A-73-1-4 Grab 8	<1.0	<1.0	9.8	<11.0	<2.0	16.0	23.0
8006	A-73-1-4 Grab 9	<1.0	2.0	7.6	7.2	2.8	6.0	17.4
8008	A-73-1-4 Grab 10	<1.0	<1.0	6.2	<7.2	2.4	6.0	13.2
8010	A-73-1-4 Grab 11	<1.0	<1.0	7.6	9.8	2.4	12.0	17.4
8012	A-73-1-4 Grab 12	<1.0	1.2	10.8	10.6	3.0	6.0	24.6
8014	A-73-1-4 Grab 13	<1.0	<1.0	8.8	<7.2	2.0	10.0	35.3
8016	A-73-1-4 Grab 14	<1.0	1.2	6.2	7.4	4.8	6.0	16.8
8018	A-73-1-4 Grab 15	<1.0	<1.0	4.8	<7.2	2.6	<6.0	11.0
8021	A-73-1-4 Grab 16	<1.0	<1.0	5.8	<7.2	2.4	<6.0	14.0
8024	A-73-1-4 Grab 17	--	--	--	--	--	--	--
8026	A-73-1-4 Grab 18	<1.0	<1.0	5.4	<7.2	<2.0	8.0	26.6
8028	A-73-1-4 Grab 19	<1.0	<1.0	4.8	15.0	2.0	18.0	13.6
8030	A-73-1-4 Grab 20	<1.0	<1.0	4.6	<7.2	2.4	<6.0	10.6

MESA SEDIMENTS

LAB CODE	FIELD CODE	Ag	Cd	Cr	Cu	Ni	Pb	Zn
8033	A-73-1-5 Grab 1	2.2	2.2	60.	64.	12.8	72.	114.
8036	A-73-1-5 Grab 2	1.4	2.0	44.9	52.	11.2	60.	92.
8039	A-73-1-5 Grab 3	1.4	2.2	44.9	54.	12.0	62.	92.
8042	A-73-1-5 Grab 4	<2.5	3.0	49.0	52.	12.0	60.	88.
8045	A-73-1-5 Grab 5	<2.5	<2.5	49.5	53.	11.5	55.	88.
8048	A-73-1-5 Grab 6	3.0	<2.5	28.5	28.0	12.0	35.0	54.
8051	A-73-1-5 Grab 7	<2.5	2.5	32.5	33.5	8.0	40.0	78.
8054	A-73-1-5 Grab 8	<2.5	3.0	61.	71.	16.6	75.	116.
8057	A-73-1-5 Grab 9	<2.5	3.5	60.	68.	12.0	70.	106.
8060	A-73-1-5 Grab 10	<2.5	2.5	47.0	49.0	12.5	50.	88.
8063	A-73-1-5 Grab 11	<2.5	<2.5	45.0	50.0	12.0	55.	85.
8066	A-73-1-5 Grab 12	<2.5	<2.5	40.5	38.5	12.0	45.	70.
8069	A-73-1-5 Grab 13	<2.5	<2.5	45.5	46.5	12.0	55.	85.
8072	A-73-1-5 Grab 14	<2.5	<2.5	33.5	34.0	8.0	40.0	66.
8074	A-73-1-5 Grab 15	<2.5	<2.5	18.0	11.5	<7.0	25.0	39.0
8076	A-73-1-5 Grab 16	<2.5	<2.5	16.0	10.0	7.5	25.0	35.0
8078	A-73-1-5 Grab 17	<2.5	<2.5	22.5	12.0	<7.0	25.0	43.5
8081	A-73-1-5 Grab 18	<2.5	3.0	54.	54.	12.5	60.	100.
8084	A-73-1-5 Grab 19	<2.5	<2.5	42.0	40.0	<7.0	45.0	79.
8087	A-73-1-5 Grab 20	<2.5	<2.5	53.	46.0	10.0	55.	89.
8090	A-73-1-5 Grab 21	<2.5	<2.5	55.	49.5	10.5	60.	92.
8092	A-73-1-5 Grab 22	<2.5	<2.5	23.0	15.5	7.5	25.0	43.0
8094	A-73-1-5 Grab 23	<2.5	<2.5	22.5	9.0	<7.0	20.0	42.0

MESA SEDIMENTS

LAB CODE	FIELD CODE	Ag	Cd	Cr	Cu	Ni	Pb	Zn
8157	A-73-1-7 Grab 1	< 2.5	< 2.5	58.	59.	7.0	70.	110.
8160	A-73-1-7 Grab 2	2.5	2.5	76.	88.	14.0	90.	135.
8162	A-73-1-7 Grab 3	< 2.5	2.5	58.	63.	7.5	70.	102.
8165	A-73-1-7 Grab 4	2.5	3.0	70.	74.	15.5	80.	133.
8168	A-73-1-7 Grab 5	2.5	3.0	68.	74.	15.0	85.	133.
8171	A-73-1-7 Grab 6	2.5	3.0	75.	90.	15.0	90.	138.
8174	A-73-1-7 Grab 7	< 2.5	3.5	76.	80.	13.5	85.	135.
8177	A-73-1-7 Grab 8	< 2.5	< 2.5	60.	70.	13.0	75.	105.
8180	A-73-1-7 Grab 9	2.5	2.5	68.	80.	13.5	85.	123.
8183	A-73-1-7 Grab 10	< 2.5	3.0	74.	78.	19.0	75.	123.
8186	A-73-1-7 Grab 11	< 2.5	2.5	68.	78.	16.5	80.	127.
8189	A-73-1-7 Grab 12	2.5	3.0	60.	70.	10.5	75.	122.
8192	A-73-1-7 Grab 13	< 2.5	2.5	60.	66.	10.5	75.	110.
8195	A-73-1-7 Grab 14	2.5	3.5	76.	82.	11.5	90.	137.
8198	A-73-1-7 Grab 15	< 2.5	3.0	67.	73.	10.5	80.	122.
8201	A-73-1-7 Grab 16	< 2.5	2.5	58.	64.	10.5	70.	105.
8204	A-73-1-7 Grab 17	3.5	4.0	88.	78.	15.5	95.	170.
8207	A-73-1-7 Grab 18	< 2.5	2.5	55.	64.	10.5	60.	105.
8210	A-73-1-7 Grab 19	< 2.5	3.0	62.	64.	7.5	65.	98.
8213	A-73-1-7 Grab 20	2.5	3.0	66.	74.	10.0	80.	113.
8213	A-73-1-7 Grab 20	2.5	3.0	64.	77.	10.5	80.	120.
8213	A-73-1-7 Grab 20	2.5	2.5	65.	74.	11.5	75.	117.

MESA SEDIMENTS

LAB CODE	FIELD CODE	Ag	Cd	Cr	Cu	Ni	Pb	Zn
8216	A-73-1-8 Grab 1	<1.0	<1.0	14.0	<7.2	3.4	16.0	43.3
8218	A-73-1-8 Grab 2	<1.0	<1.0	14.0	<7.2	4.4	14.0	42.7
8220	A-73-1-8 Grab 3	<1.0	<1.0	15.4	<7.2	2.8	14.0	46.7
8222	A-73-1-8 Grab 4	<1.0	<1.0	12.6	<7.2	<2.8	16.0	41.3
8224	A-73-1-8 Grab 5	<1.0	<1.0	14.2	<7.2	4.8	14.0	44.0
8226	A-73-1-8 Grab 6	<1.0	<1.0	14.0	<7.2	3.0	16.0	47.3
8228	A-73-1-8 Grab 7	<1.0	<1.0	14.0	<7.2	4.0	16.0	47.3
8230	A-73-1-8 Grab 8	<1.0	<1.0	14.0	<7.2	4.2	14.0	42.7
8232	A-73-1-8 Grab 9	<1.0	<1.0	15.4	<7.2	4.6	14.0	44.0
8234	A-73-1-8 Grab 10	<1.0	<1.0	13.4	7.0	3.6	16.0	43.0
8236	A-73-1-8 Grab 11	<1.0	<1.0	13.2	7.0	3.4	16.0	48.0
8238	A-73-1-8 Grab 12	<1.0	<1.0	13.0	6.6	4.6	18.0	41.0
8240	A-73-1-8 Grab 13	<1.0	<1.0	13.4	7.0	5.4	16.0	44.6
8242	A-73-1-8 Grab 14	<1.0	<1.0	18.6	6.0	3.6	14.0	41.0
8244	A-73-1-8 Grab 15	<1.0	<1.0	14.2	6.8	5.2	16.0	51.
8246	A-73-1-8 Grab 16	<1.0	<1.0	16.6	6.0	3.4	18.0	43.0
8248	A-73-1-8 Grab 17	<1.0	<1.0	14.0	6.4	4.6	14.0	48.0
8250	A-73-1-8 Grab 18	<1.0	<1.0	13.8	<5.6	4.6	16.0	46.0
8252	A-73-1-8 Grab 19	<1.0	<1.0	12.8	5.6	4.6	18.0	45.3
8254	A-73-1-8 Grab 20	<1.0	<1.0	12.0	<5.6	3.0	16.0	32.4

MESA SEDIMENTS

LAB CODE	FIELD CODE	Ag	Cd	Cr	Cu	Ni	Pb	Zn
8257	A-73-1-9 Grab 1	<2.5	<2.5	19.5	14.5	8.0	20.0	38.0
8260	A-73-1-9 Grab 2	<2.5	<2.5	32.0	27.0	12.0	40.0	70.
8263	A-73-1-9 Grab 3	<2.5	<2.5	22.0	18.0	11.0	30.0	49.0
8266	A-73-1-9 Grab 4	<2.5	<2.5	30.5	24.0	8.0	40.0	60.
8268	A-73-1-9 Grab 5	<2.5	<2.5	26.0	19.5	8.0	30.0	50.0
8271	A-73-1-10 Grab 1	<2.5	<2.5	44.5	40.5	10.0	45.0	93.
8274	A-73-1-10 Grab 2	<2.5	<2.5	50.	45.0	14.0	50.0	103.
8277	A-73-1-10 Grab 3	<2.5	<2.5	35.0	29.0	9.5	35.0	70.
8280	A-73-1-10 Grab 4	<2.5	<2.5	42.5	35.0	13.0	60.	90.
8280	A-73-1-10 Grab 4	<2.5	<2.5	40.0	33.0	8.5	55.	77.
8280	A-73-1-10 Grab 4	<2.5	<2.5	36.5	33.0	13.0	50.0	80.
8282	A-73-1-10 Grab 5	<2.5	<2.5	21.0	14.0	7.5	25.0	42.5
8285	A-73-1-11 Grab 1	<2.5	<2.5	30.0	26.0	9.0	40.0	62.
8288	A-73-1-11 Grab 2	<2.5	2.5	60.	55.	14.0	80.	119.
8290	A-73-1-11 Grab 3	<2.5	<2.5	31.0	26.5	9.5	40.	62.
8292	A-73-1-11 Grab 4	<2.5	<2.5	39.0	37.0	10.0	50.0	80.
8295	A-73-1-11 Grab 5	<2.5	<2.5	38.5	36.0	10.0	50.0	97.
8298	A-73-1-12 Grab 1	2.5	<2.5	27.0	24.5	8.5	40.0	52.
8300	A-73-1-12 Grab 2	<2.5	<2.5	36.0	31.5	9.5	50.0	79.
8303	A-73-1-12 Grab 3	<2.5	<2.5	41.5	45.0	12.5	60.	93.
8305	A-73-1-12 Grab 4	<2.5	<2.5	23.5	48.5	8.0	40.0	62.
8307	A-73-1-12 Grab 5	<2.5	<2.5	46.5	44.0	11.0	75.	100.

MESA SEDIMENTS

LAB CODE	FIELD CODE	Ag	Cd	Cr	Cu	Ni	Pb	Zn
8310	A-73-1-13 Grab 1	2.5	3.0	73.	65.	15.5	100.	155.
8313	A-73-1-13 Grab 2	2.5	3.0	70.	62.	15.0	100.	150.
8316	A-73-1-13 Grab 3	3.5	4.0	93.	79.	22.5	140.	195.
8319	A-73-1-13 Grab 4	2.5	3.0	80.	78.	20.0	110.	162.
8322	A-73-1-13 Grab 5	3.0	3.0	64.	60.	16.5	80.	138.
8325	A-73-1-14 Grab 1	<2.5	3.0	69.	62.	14.0	80.	138.
8328	A-73-1-14 Grab 2	<2.5	3.0	72.	69.	13.0	90.	150.
8331	A-73-1-14 Grab 3	2.5	2.5	74.	65.	15.0	80.	140.
8334	A-73-1-14 Grab 4	<2.5	2.5	78.	61.	13.0	70.	113.
8337	A-73-1-14 Grab 5	3.5	4.0	56.	95.	16.5	130.	190.
8340	A-73-1-15 Grab 1	3.0	4.0	98.	78.	22.0	120.	180.
8343	A-73-1-15 Grab 2	4.0	5.0	82.	91.	25.5	135.	205.
8346	A-73-1-15 Grab 3	2.5	3.0	92.	64.	16.5	95.	140.
8349	A-73-1-15 Grab 4	2.5	3.0	62.	57.	16.0	100.	145.
8352	A-73-1-15 Grab 5	4.0	5.0	103.	104.	23.0	150.	228.
8355	A-73-1-16 Grab 1	5.0	6.5	138.	118.	31.0	195.	315.
8358	A-73-1-16 Grab 2	8.0	9.0	190.	190.	37.5	275.	450.
8361	A-73-1-16 Grab 3	4.0	4.5	100.	94.	27.0	155.	235.
8364	A-73-1-16 Grab 4	7.5	7.0	135.	135.	37.0	210.	340.
8367	A-73-1-16 Grab 5	5.5	7.0	136.	135.	37.0	210.	315

MESA SEDIMENTS

LAB CODE	FIELD CODE		Ag	Cd	Cr	Cu	Ni	Pb	Zn
8428	A-73-1-21	Grab 1	<2.5	<2.5	58.	49.0	33.0	85.	210.
8431	A-73-1-21	Grab 2	3.5	3.5	108.	73.	58.	130.	195.
8434	A-73-1-21	Grab 3	2.5	3.0	88.	69.	43.0	105.	160.
8437	A-73-1-21	Grab 4	4.0	5.0	143.	104.	41.5	155.	235.
8440	A-73-1-21	Grab 5	4.5	5.0	155.	109.	36.0	195.	350.
8443	A-73-1-22	Grab 1	7.5	10.5	258.	206.	42.0	290.	500.
8446	A-73-1-22	Grab 2	6.5	8.0	233.	161.	41.0	295.	488.
8449	A-73-1-22	Grab 3	6.5	9.5	260.	169.	41.0	280.	500.
8452	A-73-1-22	Grab 4	5.0	8.5	225.	149.	39.5	250.	438.
8455	A-73-1-22	Grab 5	6.0	10.0	245.	156.	41.0	275.	475.
8458	A-73-1-23	Grab 1	< 2.5	<2.5	45.	31.0	10.5	50.0	83.
8461	A-73-1-23	Grab 2	<2.5	<2.5	50.0	36.0	12.5	55.	93.
8464	A-73-1-23	Grab 3	<2.5	<2.5	55.	36.0	11.0	50.0	93.
8467	A-73-1-23	Grab 4	<2.5	<2.5	43.0	29.5	10.5	50.0	78.
8470	A-73-1-23	Grab 5	<2.5	<2.5	22.5	15.0	7.5	30.0	39.0
8472	A-73-1-24	Grab 1	< 2.5	<2.5	53.	74.	20.5	100.	180.
8474	A-73-1-24	Grab 2	<2.5	<2.5	27.5	105.	13.5	65.	95.
8476	A-73-1-24	Grab 3	<2.5	<2.5	37.5	56.	17.5	80.	110.
8478	A-73-1-24	Grab 4	2.5	<2.5	75.	66.	21.0	335.	160.
8480	A-73-1-25	Grab 1	<2.5	<2.5	30.5	46.5	10.5	50.	66.
8482	A-73-1-25	Grab 2	<2.5	<2.5	25.0	47.0	11.0	40.0	56.
8485	A-73-1-25	Grab 3	<2.5	<2.5	53.	73.	16.0	75.	113.
8488	A-73-1-25	Grab 4	<2.5	<2.5	53.	57.	11.0	90.	98.
8491	A-73-1-25	Grab 5	2.5	<2.5	64.	84.	18.5	90.	125.

MESA SEDIMENTS

LAB CODE	FIELD CODE		Ag	Cd	Cr	Cu	Ni	Pb	Zn
8370	A-73-1-17	Grab 1	5.0	10.0	188.	131.	38.0	205.	300.
8370	A-73-1-17	Grab 1	5.0	9.5	193.	134.	40.0	210.	575.
8370	A-73-1-17	Grab 1	5.5	9.5	185.	133.	39.0	215.	325.
8373	A-73-1-17	Grab 2	6.0	9.5	210.	144.	43.5	240.	375.
8376	A-73-1-17	Grab 3	7.0	11.0	285.	201.	51.	335.	475.
8379	A-73-1-17	Grab 4	4.0	7.0	175.	104.	37.	180.	280.
8382	A-73-1-17	Grab 5	4.5	6.5	173.	118.	36.	185.	310.
8385	A-73-1-18	Grab 1	2.5	<2.5	78.	52.	25.0	75.	128.
8388	A-73-1-18	Grab 2	<2.5	<2.5	63.	124.	775.	65.	103.
8391	A-73-1-18	Grab 3	3.0	6.0	108.	81.	28.5	140.	195.
8394	A-73-1-18	Grab 4	2.5	12.5	75.	59.	20.0	100.	158.
8396	A-73-1-18	Grab 5	<2.5	3.0	65.	50.	18.5	75.	125.
8399	A-73-1-19	Grab 1	2.5	<2.5	125.	71.	29.0	125.	175.
8402	A-73-1-19	Grab 2	2.5	<2.5	113.	72.	26.0	125.	175.
8405	A-73-1-19	Grab 3	3.0	<2.5	140.	84.	28.0	145.	195.
8408	A-73-1-19	Grab 4	3.0	<2.5	130.	78.	25.0	130.	183.
8411	A-73-1-19	Grab 5	3.0	<2.5	118.	71.	25.0	120.	163.
8414	A-73-1-20	Grab 1	<2.5	<2.5	58.	39.0	23.5	90.	105.
8417	A-73-1-20	Grab 2	<2.5	<2.5	40.0	31.0	21.0	45.0	120.
8420	A-73-1-20	Grab 3	<2.5	<2.5	55.	36.0	23.5	60.	90.
8423	A-73-1-20	Grab 4	<2.5	<2.5	47.5	35.0	23.5	70.	100.
8426	A-73-1-20	Grab 5	<2.5	<2.5	50.	36.0	28.5	60.	90.

MESA SEDIMENTS

LAB CODE	FIELD CODE		Ag	Cd	Cr	Cu	Ni	Pb	Zn
8493	A-73-1-26	Grab 1	3.0	<2.5	38.0	112.	21.5	105.	265.
8495	A-73-1-26	Grab 2	<2.5	<2.5	34.0	60.	10.5	70.	73.
8497	A-73-1-26	Grab 3	<2.5	<2.5	24.0	47.0	15.5	105.	90.
8500	A-73-1-27	Grab 1	2.5	3.0	75.	118.	16.5	110.	141.
8503	A-73-1-27	Grab 2	3.5	<2.5	98.	166.	28.5	150.	190.
8506	A-73-1-27	Grab 3	3.0	<2.5	85.	140.	24.0	105.	150.
8509	A-73-1-27	Grab 4	<2.5	<2.5	60.	111.	13.5	65.	109.
8512	A-73-1-27	Grab 5	3.0	<2.5	71.	158.	20.5	90.	135.
8515	A-73-1-28	Grab 1	--	--	--	--	--	--	--
8518	A-73-1-28	Grab 2	3.5	2.5	94.	103.	25.5	110.	158.
8521	A-73-1-28	Grab 3	4.5	2.5	117.	130.	32.0	140.	192.
8524	A-73-1-28	Grab 4	4.5	3.0	120.	143.	35.5	140.	196.
8527	A-73-1-28	Grab 5	5.0	3.0	122.	120.	34.5	140.	203.
8530	A-73-1-29	Grab 1	8.0	4.0	166.	200.	42.5	200.	308.
8533	A-73-1-29	Grab 2	5.5	4.0	152.	175.	40.5	190.	290.
8536	A-73-1-29	Grab 3	5.0	4.5	145.	153.	41.5	185.	280.
8539	A-73-1-29	Grab 4	6.5	5.0	152.	178.	36.5	200.	298.
8542	A-73-1-29	Grab 5	6.5	5.0	155.	198.	44.0	195.	312.

LAB CODE	FIELD CODE	Ag	Cd	Cr	Cu	Ni	Pb	Zn
8546	W-2 A	4.5	3.0	104.	147.	26.5	115.	185.
8550	W-2 B	4.5	3.0	117.	150.	29.0	130.	211.
8554	W-2 C	5.5	4.0	127.	155.	32.5	150.	240.
8557	W-2 D	< 2.5	< 2.5	29.5	40.5	11.5	35.0	64.
8560	W-2 E	1.4	< 1.0	41.8	55.	13.4	42.0	73.
8562	V-1 A	< 1.0	< 1.0	30.2	46.6	10.8	64.	170.
8564	V-2 B	< 1.0	< 1.0	21.6	32.8	9.8	26.0	48.0
8567	V-3 C	1.0	< 1.0	36.6	51.	10.8	44.0	67.
8570	V-4 D	< 1.0	< 1.0	32.0	44.6	9.6	52.	77.
8573	V-5 E	1.0	< 1.0	33.0	39.8	9.6	48.0	63.
8575	36 A	< 1.0	< 1.0	3.6	2.2	< 2.4	< 6.0	4.6
8578	36 B	< 1.0	< 1.0	< 2.0	2.0	< 2.4	< 6.0	4.6
8580	36 C	< 1.0	< 1.0	< 2.0	2.0	< 2.4	< 6.0	5.0
8582	36 D	< 1.0	< 1.0	< 2.0	< 2.0	< 2.4	< 6.0	4.6
8584	36 E	< 1.0	< 1.0	2.0	2.6	< 2.4	< 6.0	6.4
8584	36 E	< 1.0	< 1.0	2.6	2.8	< 2.4	< 6.0	6.4

SEDIMENTS FROM COK OF ADELPHI

LAB CODE	FIELD CODE	Ag	Cd	Cr	Cu	Ni	Pb	Zn
8586	G-1 0-10 cm	<1.0	1.0	16.8	25.0	14.4	60.	74.
8587	G-1 10-15 cm	1.0	1.0	18.6	30.0	14.4	46.0	62.
8588	G-2 0-5 cm	<1.0	<1.0	24.4	11.0	11.4	--	84.
8608	G-2 10-14 cm	<1.0	<1.0	32.4	12.6	9.2	40.0	40.0
8589	G-6 0-10 cm	1.4	2.8	84.	7.4	16.6	20.0	35.3
8590	G-6 0-15 cm	1.0	1.8	59.	7.8	14.4	12.0	31.6
8590	G-6 0-15 cm	<1.0	1.8	50.0	5.8	14.8	12.0	28.0
8591	G-7 0-5 cm	<1.0	<1.0	42.2	9.0	11.8	24.0	79.
8592	G-7 10-12 cm	<1.0	<1.0	51.	8.6	18.6	28.0	100.
8592	G-7 10-12 cm	<1.0	<1.0	59.	9.2	18.4	26.0	94.
8593	G-8 0-5 cm	<1.0	<1.0	7.4	9.2	3.2	10.0	1030.
8594	G-8 10-13 cm	<1.0	<1.0	9.6	8.4	<2.4	10.0	108.
8595	G-9 0-5 cm	1.6	2.2	31.8	11.	13.2	26.0	166.
8596	G-9 10-15 cm	<1.0	<1.0	11.8	19.8	6.2	54.	240.
8597	G-15 0-7 cm	<1.0	<1.0	13.2	16.2	5.8	44.0	1080.
8598	G-15 10-15 cm	<1.0	<1.0	21.6	10.6	6.6	18.0	41.3
8599	G-16 0-5 cm	<1.0	<1.0	14.6	5.2	3.6	34.0	700.
8600	G-16 10-15 cm	<1.0	<1.0	16.0	9.6	4.8	26.0	87.
8601	G-37 0-5 cm	<1.0	<1.0	23.4	31.2	23.8	32.0	90.
8602	G-37 10-13 cm	<1.0	<1.0	20.0	28.4	20.8	26.0	60.
8603	G-41 0-16 cm	<1.0	<1.0	5.4	10.2	4.6	12.0	750.
8604	G-48 0-16 cm	<1.0	<1.0	5.4	178.	3.8	40.0	2500.
8605	G-49 0-16 cm	<1.0	<1.0	9.8	4.6	<2.4	6.0	144.
8606	G-50 0-16 cm	<1.0	<1.0	18.2	9.4	5.2	46.0	3140.
8607	G-51 0-16 cm	<1.0	<1.0	15.4	13.6	3.4	22.0	3080.
8609	G-41 0-16 cm	<1.0	<1.0	7.2	10.0	<2.4	38.0	1000.

Dr. McNulty

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Middle Atlantic Coastal Fisheries Center
Sandy Hook Laboratory (F161)
Highlands, New Jersey 07732

ate : July 23, 1974

Reply to Attn. of:

: Distribution List

om : John B. Pearce, Director, Ecosystems Investigations

ibject: Definition of Organic Matter Occurring off of the Southern Shore of Long Island; Cruise Report for R/V Rorqual Cruise, 22 July 1974

On 17 July 1974 I was informed by Dr. Carl Sindermann, Center Director, MACFC, that it was important to attempt to define the organic matter reported as occurring off the south shore of Long Island. On 16 July 1974 Dr. Sindermann had been told at a meeting with Dr. Wilmont Hess and Mr. David Wallace that it was most important to resolve this issue as soon as possible. A proposed hearing to be held by Senator James Buckley on 2 August 1974 added considerable emphasis to this problem.

On 18-19 July 1974 a one-day cruise was arranged for the R/V Rorqual. It was proposed that samples would be collected at selected stations along and parallel to the north-south SUMP transect. Samples were to be collected starting at the center of the sewage sludge disposal area and at points north of the sludge disposal area to the south shore of Long Island at Atlantic Beach. In addition, samples were to be collected at stations located inside of East Rockaway Inlet. Subsequently these samples were to be analyzed by personnel of Ecosystems Investigations, MACFC, AOML-NOAA, New York State Department of Environmental Conservation and Nassau County Department of Public Health.

The samples to be obtained were sediment samples collected with the Smith-McIntyre bottom grab. The analysis to be done by Ecosystems Investigations personnel included a determination of the amounts of heavy metals in sediments at each station as well as the amounts of total and fecal coliform bacteria in each sample. Dr. Pearce arranged with Dr. Douglas Segar, AOML, to analyze each sample for the carbohydrate to total organic carbon ratio. Dr. Pearce arranged with Mr. Jack Foehrenbach, New York State Department of Environmental Conservation, to analyze the samples for the presence of specific pesticides and certain other hexane extractable hydrocarbons. Samples were given to the Nassau County Department of Public Health for as yet undefined analysis. Lt. Robert Rausch, MESA Office, Stony Brook, was given

N 1

samples to be analyzed by Dr. Iver Duedall. The rationale behind the cruise and the various analyses was that organically loaded sediments in East Rockaway Inlet might be characterized by different chemical constituents when compared with samples collected from the sewer sludge disposal area. If this proved to be true, it might allow environmental scientists and administrators to define the origins of sludge like organic matter found off the south shore of Long Island.

Table 1 indicates the location of sampling stations, water depth, temperature and unusual visual observations concerned with the individual samples. Figures 1 and 2 indicate the location of stations on standard navigational charts.

Stations collected from in East Rockaway Inlet were selected on the basis of their yielding sediment samples likely to have a high organic matter content. Station 1 was located immediately off a sewer outfall on Black Banks. Station 2 was located in Hog Island Channel through which sewer sludge barges regularly pass.

It has been emphasized to all parties involved with the analysis of samples collected, that the data must be available to this office no later than Monday, 29 July 1974. Most data will be available on Friday, 26 July 1974.

It should be noted that we are dealing with a limited number of sampling stations. It was impossible to sample a larger number of stations in the short period of time available to us. Samples taken, however, should be sufficient to allow some definition of the chemical characteristics of the organic matter found at the definitive sewer sludge disposal area, the stations between the disposal area and the shoal waters found off the south shore of Long Island and, finally, sediments inside East Rockaway Inlet. Parties evaluating these data should be aware that materials disposed of inside East Rockaway Inlet or at the sewer sludge disposal area may change in terms of their physical and chemical characteristics if they are moved away from their respective points of disposal by prevailing currents and tidal flux. For instance, at the sewer sludge disposal area coarser materials will settle out quite rapidly, but finder materials will remain entrained in the water column for varying periods of time. While entrained and being carried to areas of deposition by water currents, the chemical characteristics may change because of oxidation and other chemical phenomena.

Personnel for Ecosystems Investigations will be able to conduct a much more comprehensive sampling program of sludges during a Delaware II cruise planned for 26 August-6 September 1974. Microbiologists will be aboard this cruise and should be able to collect from sufficient stations to define the distribution of microorganisms associated with sediments at stations throughout the entire Bight apex. During this period of sampling, additional samples for chemical analyses at numerous Bight apex stations can be carried out. These samples will then be available for analyses of their chemical and physical characteristics. Prior to, or concomittant with, this Delaware II cruise, additional samples can be taken inside Rockaway Inlet with a smaller vessel.

It should be noted that this particular research problem should have been addressed prior to this time. It is possible that the analyses that are being performed in regard to the present cruise and analytical protocol may be sufficient to "fingerprint" the various organic materials. It is equally possible that the analyses will not be sufficient to define these organic materials and more sophisticated chemical analyses will have to be performed.

Encl:

DISTRIBUTION:
J. Foehrenbach
J. Graikoski
K. McNulty
D. Segar
C. Sindermann
L. Swanson
J. Thomas
L. Trott
Dir., Nassau County Dept. of Health

Table 1

R/V Rorqual Day Cruise, 22 July 1974

Station	Loran	Depth	°C	Comments
1	N/A E. Rockaway Inlet	8'		medium sand with high organics
2	N/A E. Rockaway Inlet	30'	18.7	fine mud with amphipod tubes
3	4622 X 3220	109'	9.5	sludge with oxidized surficial layer
4	4650 X 3208	86'	10.5	sludge with oxidized surficial layer
5	4672 X 3195	75'	8.7	
6	4685 X 3182	67'	13.0	
7	4693 X 3178	57'	14.5	
8	4704 X 3160	55'	18.0	coarse gravel with sludge balls (charlies?)
9	4710 X 3152	50'	15.0	
10	4717 X 3142	48'	15.0	coarse gravel with sludge balls (charlies?)
11	4731 X 3135	30'		no sample
12	4720 X 3154	30'	18.5	

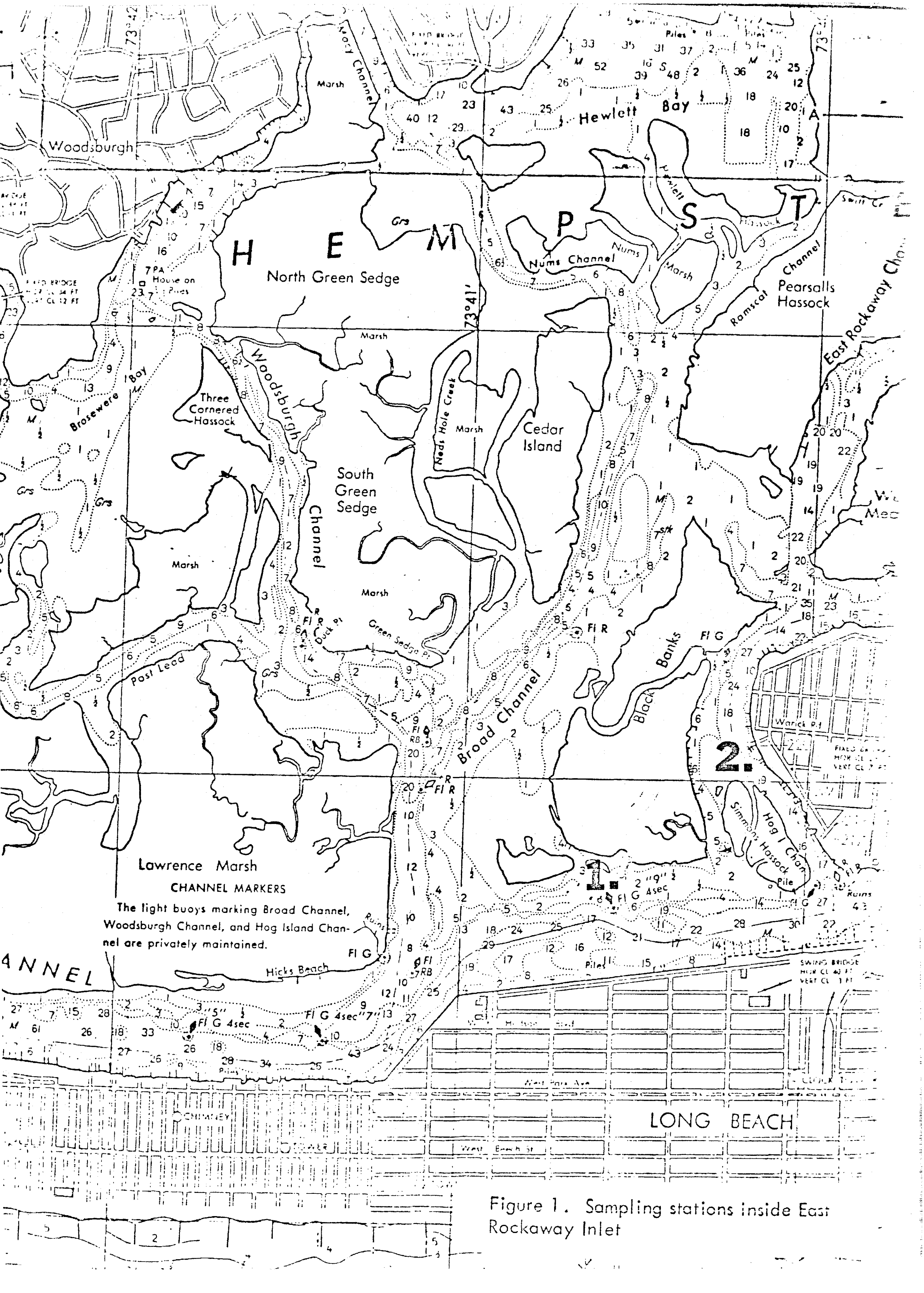


Figure 1. Sampling stations inside East Rockaway Inlet

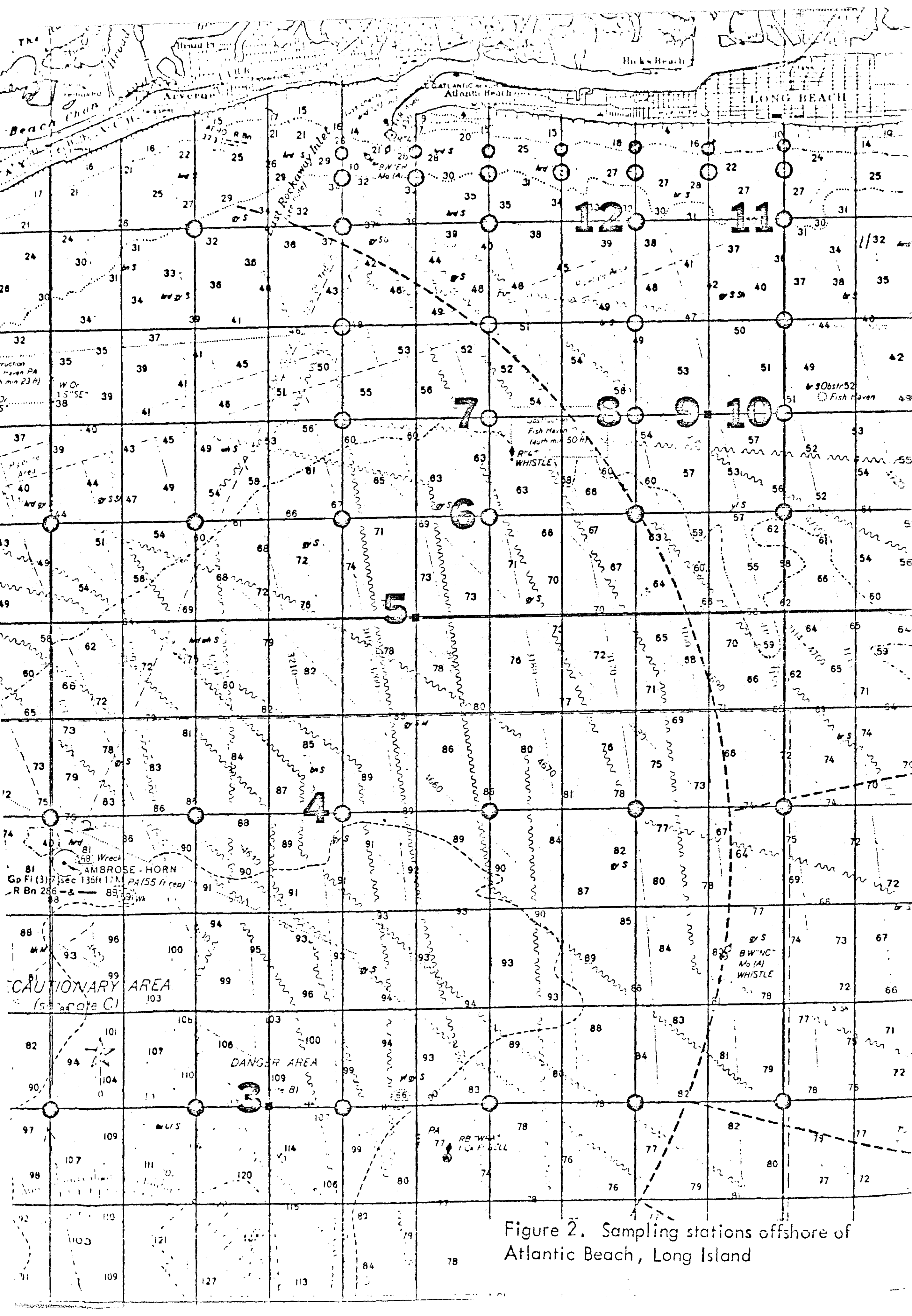


Figure 2. Sampling stations offshore of Atlantic Beach, Long Island