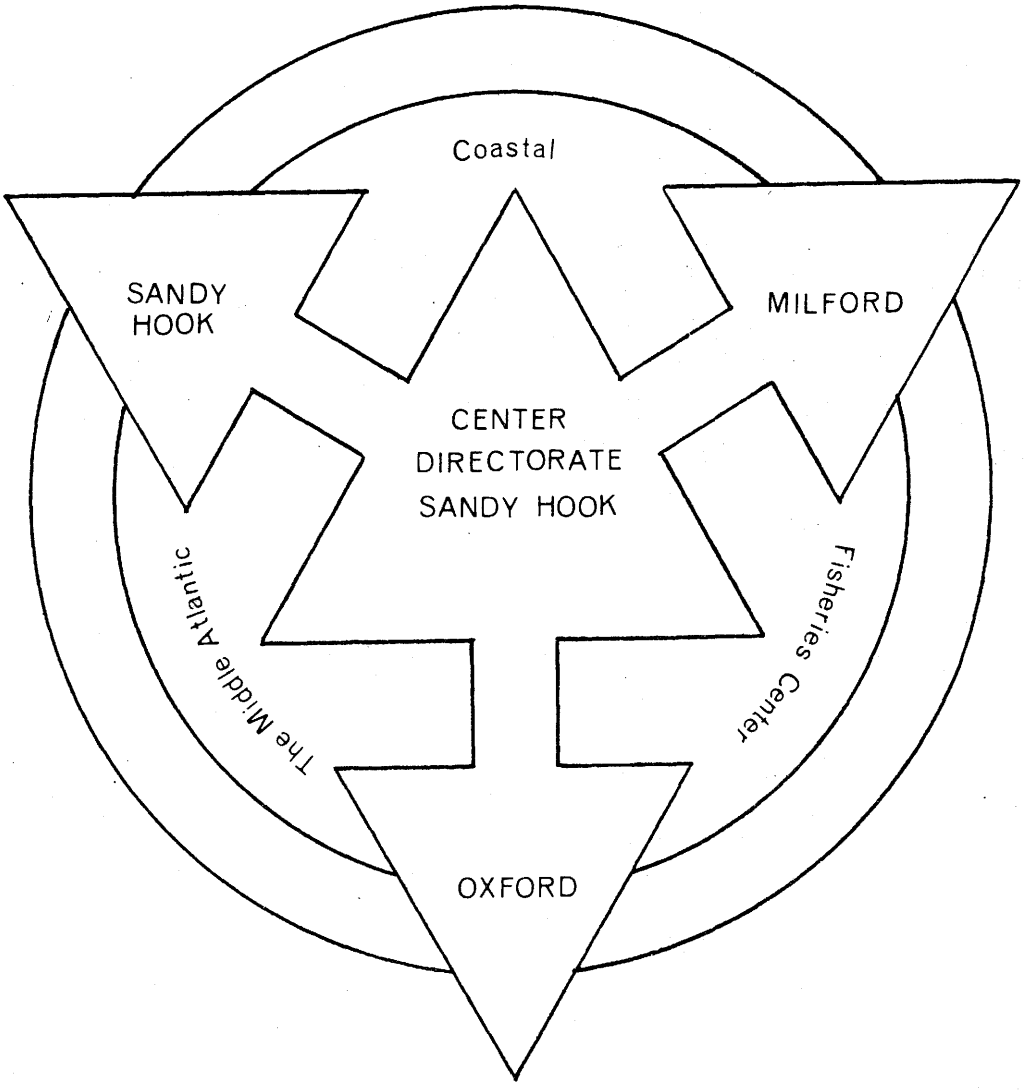
QUARTERLY REPORT ON MESA-FUNDED RESEARCH IN THE NEW YORK BIGHT - APRIL - JUNE 1974

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

MIDDLE ATLANTIC COASTAL FISHERIES CENTER



Informal Report No. 33

July 15, 1974

The major cruises during the quarters were those of the research vessels Atlantic Twin/Delaware II from April 1 - May 1, 1974. The Delaware II/Albatross IV from May 13-21, 1974, and the Mt. Mitchell from May 15-30, 1974. The Atlantic Twin/Delaware II cruise provided synoptic data on the incidence of fin rot disease from Nantucket, Mass., to Jacksonville, Fla. -- the third such investigation to be conducted (Appendix A). The Delaware II/Albatross IV cruises investigated jointly the benthos and water column, respectively, at Deep Water Dump Site 106 (Appendix B). The Mt. Mitchell cruise initiated USGS-NOAA cooperative studies of the characteristics of sediments and benthic macrofauna in the Baltimore Canyon Trough, part of which coincides with the most southerly of two proposed alternative dump sites.

Progress reports were received from three university contractors, summarized very briefly below:

1. Dr. Saul B. Saila has concluded from analyses of the available data on replications of samples of heavy metals in sediments and of nematodes that: (1) about 5 replicates of the metals samples are required to differentiate chromium, copper, nickel, lead, and zink "at an alpha level of 0.05", and (2) about 3 replicates are required to detect differences between stations of 150% of the mean number of nematodes (Appendix D).

2. Dr. Eugene B. Small reported "We can positively identify areas of sewage pollution" using ciliate protozoans as indicator organisms. The species initially suggested as indicator organisms continued in this role. He and his coworkers have established the fact that the ciliates are present, collectable, and countable. He plans an intensified sampling program during the important summer months and increasingly quantitative studies (Appendix E).

3. Dr. John J. Lee, whose work began somewhat later than the others, continued data collections on both benthic and pelagic foraminiferans. He has found that Elphidium sp. is numerous and utiquitous in benthic samples, and that planktonic forms were present in 4 of 20 samples examined to date. All work is quantitative (Appendix F).

4. Dr. John H. Tietjen has decided on the basis of statistical analyses of the variability of meiofaunal population densities, specifically nematode populations, to analyze three samples per station in future work on the temporal and areal distribution of nematodes in the New York Bight (Appendix G).

APPENDIX A

FIN ROT DISEASE

R/V ATLANTIC TWIN/DELAWARE II, APRIL 1-MAY 1, 1974

The third synoptic fin rot disease cruise along the Atlantic coast from Nantucket, Mass., to Jacksonville, Fla., was conducted from April 1 to May 1, 1974. Observations were made for the presence of gross anatomic anomalies as well as fin rot disease. As on previous cruises, more winter flounder, Pseudopleuronectes americanus, were affected with fin rot disease than any other species of demersal flat fish. All together, 833 winter flounder were examined; 27 fish exhibited fin rot disease (3.2%). Within the New York Bight MESA apex 21/208 (10.1%) winter flounder were diseased and outside the apex to the north and south 6/625 (1.0%) fish were diseased. The apex area included 28 trawl stations and the area outside the apex 137 trawl stations.

The number of fluke (Paralichthys dentatus) examined was 388; none exhibited fin rot disease. As would be expected, more fluke were obtained from the stations sampled south (337) of the apex than north (35). Only 16 fluke were obtained in the apex area. Numbers of yellowtail flounder (Limanda ferruginea) were substantially higher in the apex (427) than to the north (187) or south (22). Only one yellowtail flounder from the apex area exhibited fin rot disease; all together 636 yellowtail flounder were examined. Fourspot flounder (Parlichthys oblongus) were not abundant in the areas sampled. One of 21 fish in the apex area had fin rot disease; none of 22 fish north of the apex were diseased. Only one fish was obtained south of the apex. Table 1 contains a summary of fin rot disease prevalence in all areas sampled.

TABLE 1. Prevalence of fin rot disease in flounders examined on R/V Atlantic Twin/Delaware II Cruise, April 1-May 1, 1974.

	Species of Fish			
Area Sampled	Winter Flounder	Fluke	Yellowtail Flounder	Fourspot Flounder
North of Apex	1/300	0/35	0/187	0/22
MESA Apex	21/208	0/16	1/427	1/21
South of Apex	5/325	0/337	0/22	0/1

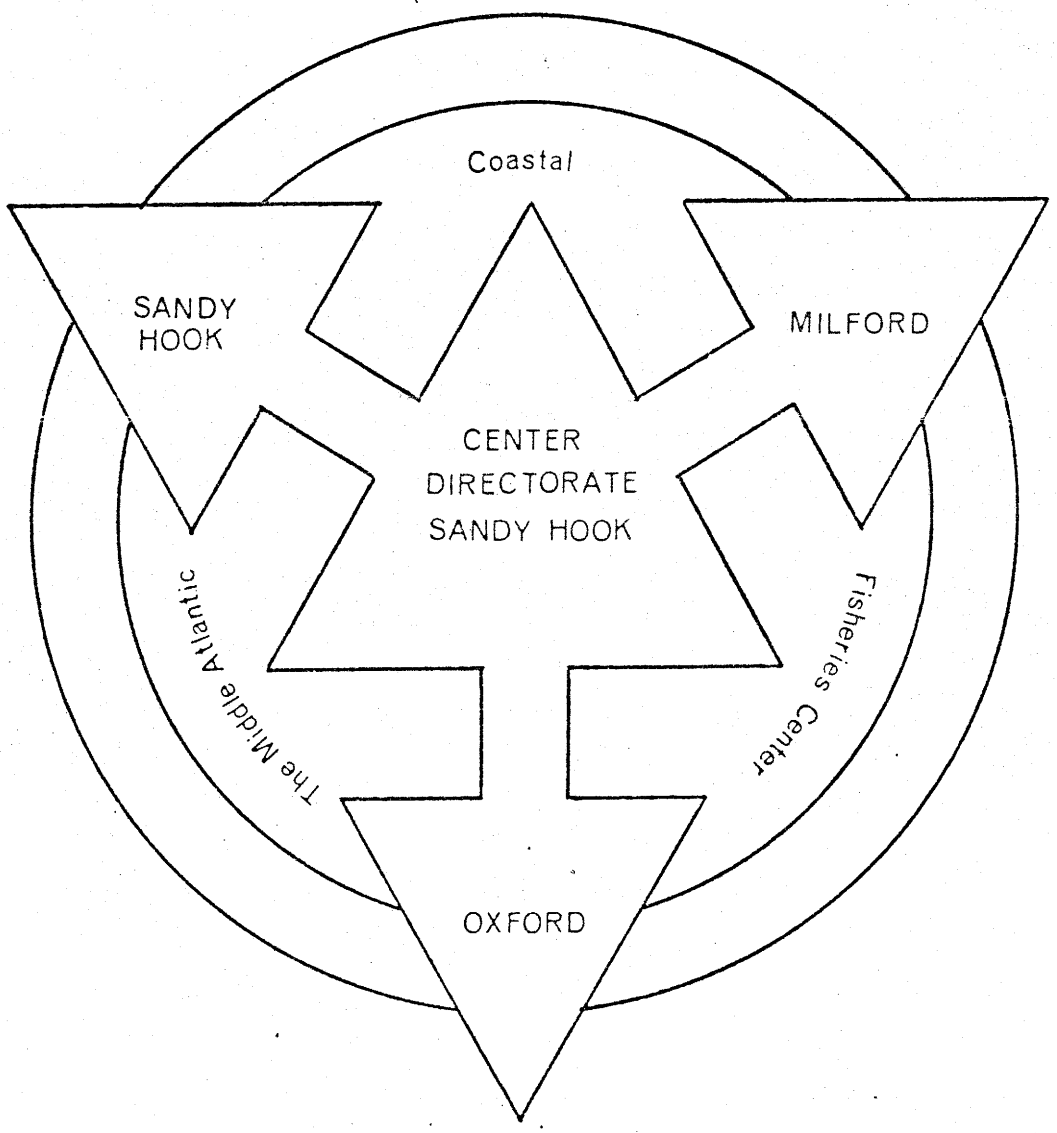
Received
JUN 3 1974
Knee Mc Nulty
cc: Dr. Sindermann
Mr. Ibelston
Dr. Pearce
Dr. Merrill

APPENDIX B

CRUISE REPORT
NOAA Ship Delaware II
13 - 21 May 1974

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

MIDDLE ATLANTIC COASTAL FISHERIES CENTER



May 23, 1974

CRUISE REPORT

NOAA SHIP DELAWARE II

13 - 21 May 1974

U. S. DEPARTMENT OF COMMERCE

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

NATIONAL MARINE FISHERIES SERVICE

MIDDLE ATLANTIC COASTAL FISHERIES CENTER

ECOSYSTEMS INVESTIGATIONS

SANDY HOOK LABORATORY

HIGHLANDS, NEW JERSEY 07732

This cruise was part of a joint effort with the NOAA Ship Albatross IV to characterize Deep Water Dump Site 106. The Albatross IV investigated the water column while the Delaware II investigated the benthos (see separate cruise report for the Albatross IV).

INTRODUCTION:

Prior to departure the hydrographic winch was tested and found inadequate to lift the Smith-McIntyre bottom grab sampler clear of the deck. Departure was delayed while wire was transferred from the hydrographic winch to the port trawl winch drum. The starboard trawl winch drum was filled with 9/16" trawl wire for deep water trawling by Dr. Musick, Virginia Institute of Marine Science (VIMS).

Following transfer of wire the NOAA Ship Delaware II departed Sandy Hook at 1420, 13 May. After a brief stop at Scotland Light to test the precision depth recorder (PDR) the vessel proceeded to a station near the edge of the continental shelf (54 fm) to test the operation of the Smith-McIntyre bottom grab and the deep-sea trawl to be used by Dr. Musick. A second test station was accomplished in 520 fm of water. The vessel then proceeded to Alvin dive site 3 where Smith-McIntyre and trawl operations commenced as part of the cruise plan. Smith-McIntyre sampling was accomplished at this station. During the trawling operations the hydraulic motor driving the starboard trawl drum became inoperative while the net was being hauled in. This necessitated switching the hydraulic lines from the port hydraulic motor to the starboard drum to retrieve the trawl net. The switching of hydraulic lines by ship's engineers took 3.5 hours; the net was successfully retrieved. Smith-McIntyre sampling was then postponed until the completion of all trawl stations. Time required to shift hydraulic lines and loss of hydraulic fluid were primary considerations in this decision. Trawl activities then continued at Alvin dive sites 3, 4, 5, around 6, and over 2. Trawl operations were suspended following site 2 on 17 May because of the increasingly apparent realization that the only remaining main trawl winch motor would not operate much longer under the strain of deep-sea trawling. At this point the hydraulic lines were shifted from the starboard drum back to the port drum to allow Smith-McIntyre operations. Smith-McIntyre bottom grab sampling commenced at Alvin dive site 1 and we proceeded to sample at Alvin dive sites 2, 4, 5, 7 and 6. At site 4 the Smith-McIntyre grab was run into the block and lost. The loss can be attributed to our use of a hard to control main trawl winch instead of a suitable oceanographic winch. A second Smith-McIntyre grab was brought into use and sampling continued uneventfully. Additional Smith-McIntyre samples were collected in the disposal area for detection of possible radioactive wastes by EPA personnel on board (see enclosed report by Robert Dyer). A final Smith-McIntyre bottom grab sample was taken at Alvin site 3 at 1700 on 20 May. From there the vessel proceeded to Sandy Hook arriving at 0615 on 21 May.

SCIENTIFIC PERSONNEL:

Thomas, Party Chief, NMFS, Smith-McIntyre
Phoel, NMFS, Smith-McIntyre
Musick, VIMS, Deep-sea trawl
Markle, VIMS, Deep-sea trawl
Wenner, VIMS, Deep-sea trawl
Sedberry, VIMS, Deep-sea trawl
Dyer, EPA, Radioactive Monitoring
Phillips, EPA, Radioactive Monitoring

CRUISE OBJECTIVES:

To characterize in terms of chemical, biological and geological parameters, the interim Deep Water Dump Site 106 (DWD Site 106) with the use of deep-sea bottom trawls and Smith-McIntyre bottom grab collections. To assess the distribution and abundance of the benthic biota. To determine the distribution and concentration of heavy metals in benthic biota and sediments. To determine sediment characteristics (grain size, etc.). To determine water column temperatures with depth using XBT's. To monitor the movements of the deep scattering layer. To obtain preliminary data concerning the fate of containerized radioactive wastes disposed of in a deep water radioactive waste disposal site located at 38°30'N, 72°06'W. To provide this data for preparation of an environmental impact statement on DWD Site 106.

This cruise report is divided into the following parts:

I. Deep-sea trawling
II. Smith-McIntyre sampling
III. Fate of radioactive wastes

Following is the report submitted by Dr. Jack Musick, Virginia Institute of Marine Science, on deep-sea trawling activities.

Part I: A study of the archibenthic and abysobenthic fishes of deep water dump site #106 and the adjacent area.

SCIENTIFIC PERSONNEL:

J. A. Musick, Supervising Scientist, Virginia Institute of Marine Science
Participating scientists: D. Markle, G. Sedberry, C. Wenner

CRUISE OBJECTIVES:

To describe the relative abundance, community structure, reproductive biology, and food habits of fishes of the dump site and adjacent areas.

Work accomplished: Trawling commenced on 14 May 1974 at 0030 hrs. A total of seventeen trawls was attempted (Table 1). The first three trawls were made to coordinate the peculiar fishing attributes of our 45' bridled trawl and the fishing characteristics of the Delaware II. The net failed to make contact with the bottom in 55 fm because of excessive ship speed at Station 1. This problem was rectified and all successive trawls, even as deep as 1500 fm gave evidence of bottom contact (collections of benthic animals, mud on doors, bridles, etc. indicated contact). The first two trawls at Alvin site 4 resulted in the destruction of two nets by ship wreckage and rough bottom. Trawl stations were added west (Station 4B), southwest (Station 4C) and east (Station 10) of Alvin Station 4 and DWD #106 to replace the aborted trawls at 4. Stations 4B, 4C, and 10 occupied about the same bathymetric region as Station 4 and should give some estimate of fish communities at Station 4. Stations 6, 6A and 6B were located on the south, east and north of Alvin site 6 in the radiological dump site because no trawling was allowed at Alvin 6 itself. These trawls were made to characterize the fish fauna near site 6 and to provide Robert Dyer, the EPA representative aboard, with material for radiological analyses. Trawling operations were suspended after trawl station Alvin 2 where the trawl "hung up" in clay bottom and put a severe strain on the only operational oceanographic and trawl winch aboard. The trawl was successfully retrieved with catch intact. However, because the Smith-McIntyre grab operation depended on the same winch motor, trawling was suspended rather than jeopardizing most of the benthic infaunal survey.

At all trawl stations each fish was identified, measured and weighed by species. Gonads, stomach contents and specimens infected with parasites were preserved for study. Biomass of invertebrates was noted and subsamples were preserved. All Geryon (red crabs) were measured, sexed and weighed. A large sample of these were subjected to organoleptic analysis. Specimens of dominant species were frozen for heavy metals analyses and specimens of both fishes and invertebrates were provided for radiological analyses to EPA personnel aboard.

Conclusions: Because the PDR provided us on this cruise did not operate properly all depths beyond 840 fm (the range of the SIMRAD recorder on board) were estimated from navigational charts. A permanent PDR, PGR or PESR should be installed on Delaware II. The use of a "Fish" transducer is undependable, time consuming and impossible in rough weather. The oceanographic winch provided us for grab collections was insufficiently powered to lift the weight of the grabs. Consequently the grab wire had to be jerry-rigged onto one of the main trawl winches. This situation led to the loss of one Smith-McIntyre grab because the large drum, high speed, and high power of the trawl winch resulted in a lifting system that was very difficult to control by the winch operator. In the future an oceanographic winch suitable for deep water grab work should be installed on Delaware II.

One main trawl winch motor broke down completely during station 3B and the hydraulic system from the other motor had to be switched over in order to retrieve the trawl. The only remaining winch motor became increasingly erratic in operation and finally when the trawl "hung up" at station Alvin 2 the winch motor could not lift the net free or even break the bridle wire. Finally through accomplished ship handling the trawl was retrieved. As a consequence trawling activities had to be terminated in order to prevent jeopardizing the remainder of the cruise. The main trawl winches are obviously in need of overhaul.

If mechanical provisions on the ship were inadequate, then cooperation by the ship's officers and crew were opposite in the extreme. The ultimate success of this mission is due only to the perseverance, expertise and cordial help of the personnel of Delaware II, and the Sandy Hook Marine Laboratory.

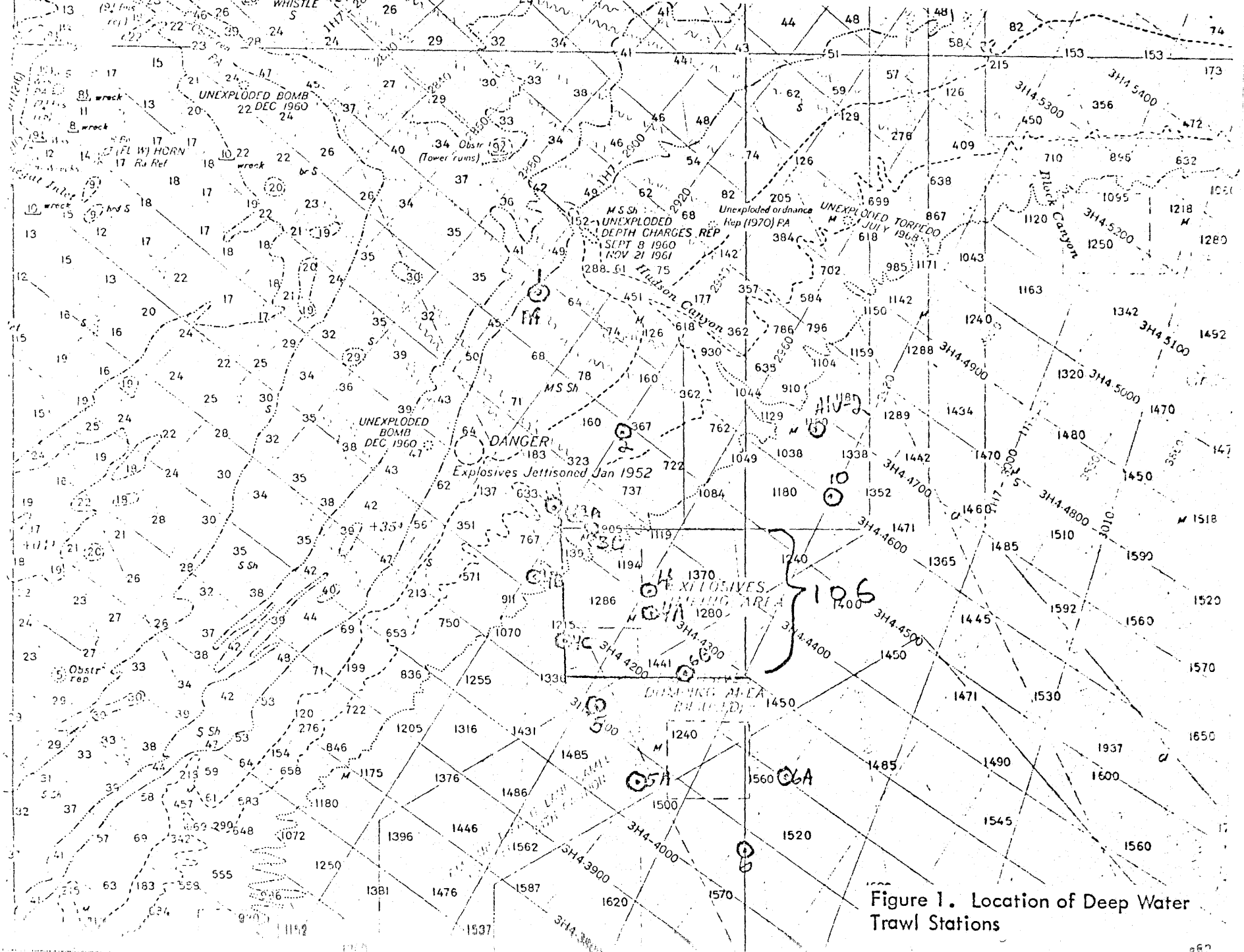


Figure 1. Location of Deep Water Trawl Stations

Trawl Station Number	Date May 1974	Time	Position	Depth (fm)	Designation
1	14	0130-0133	39°30'N, 72°34'W - 39°27'N, 72°33'W	55	Shakedown
1A	14	0215-0245	39°27'N, 72°35'W - 39°25'N, 72°37'W	55	Shakedown
2	14	1008-1108	39°09'N, 72°19.5'W-30°08'N, 72°22'W	490-530	Shakedown
3	14	1719-1819	39°04'N, 72°32'W - 39°00'N, 72°32.5'W	500-750	Alvin 3
3A	14	2100-2200	39°02'N, 72°29'W - 38°59.5'N, 72°26.5W	620-840	Alvin 3
3B	15	0106-0206	39°02'N, 72°25'W - 39°00'N, 72°26'W	520-800	Alvin 3
4	15	0926-1026	38°52'N, 72°16.5W-38°50'N, 72°14.5'W	~1300	Alvin 4
4A	15	1651-1751	38°47'N, 72°11'W - 38°47'N, 72°16'W	~1400	Alvin 4
5	15	2217-2317	38°35'N, 72°23'W - 38°32.5'N, 72°23'W	~1350-1480	Alvin 5
5A	16	0203-0303	38°27.5'N, 72°18.5'W, 38°25.5'N, 72°17.5'W	~1500	Between Alvin 5 & Alvin 6
6	16	0735-0905	38°18'N, 72°03'W - 38°19'N, 71°57'W	~1500	South of Alvin 6
6A	16	1215-1315	38°28'N, 71°55'W - 38°29'N, 71°52.5'W	~1500	West of Alvin 6
6B	16	1657-1757	38°38'N, 72°06'W - 38°39'N, 72°10'W	~1300	North of Alvin 6
4B	16	2300-0000	38°50'N, 72°34.5'W-38°48'N, 72°34.5'W	~1100-1230	West of Alvin 4
4c	17	0356-0456	38°43'N, 72°30'W - 38°42.5'N, 72°27'W	~1300	Southwest of Alvin 4
10	17	1020-1120	39°03'N, 71°47'W - 39°04.5'N, 71°45'W	~1200	Between Alvin 4 and Alvin 7
Alvin 2	17	1522-1622	39°10'N, 71°50.5'W-39°08'N, 71°48.5'W	~1250	Alvin 2

Part II: Smith-McIntyre grab sampling at Deep Water Dump Site 106, the deep water disposal area for radioactive wastes, and adjacent areas located as controls.

OBJECTIVES:

To assist in characterizing, in terms of chemical, biological and geological parameters, Deep Water Dump Site 106; assess the distribution and abundance of benthic fauna using a Smith-McIntyre bottom grab sampler; and determine the distribution and concentration of heavy metals burdens in sediment samples taken by grab. In addition, to carry out the analyses of heavy metals burdens on biota collected by deep water trawling; determine sediment characteristcs (grain size, etc.); supplement Albatross IV water column data by taking an XBT at each station; and monitor the movements of the deep scattering layer.

OPERATIONS:

At least two Smith-McIntyre bottom grab samples were taken at each station (see Table 2). The second or third sample taken at a station is the best, quantitatively, because it has the least material removed from it as aliquots for analyses for the presence of radioactive materials (see Table 3).

Each grab sample was brought aboard and if the sample was from the radioactive waste disposal area the sample was scanned with a portable Geiger survey meter before the sample was handled. Then four (occasionally five) cores were removed from near the center of the sample. Three 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 determinations, mechanical properties of sediment, and for radioactive materials (see Table 3 and Part III). The fourth core was taken with a 25 mm (1.0 inch) diameter plastic tube to a depth of approximately 5 cm. The sample was placed in a labeled jar containing formalin and a piece of clam shell and stored for meiofaunal examination. An additional 400 ml sediment sample (covering about one-quarter of the grab surface area) was removed from the first grab sample by EPA personnel on baord for their analyses (see Part III). In some cases more than one core or more than one 400 ml sediment sample was removed from the grab sample (see Table 3). In such cases the grab sample was not saved for macrofauna. Otherwise the remainder of the Smith-McIntyre grab sample was removed from the grab and washed through standard geological screens (1mm and 0.5mm). The material trapped on the individual screens was placed in separately labeled jars and preserved with formalin for macrofaunal examination.

In all twenty-seven Smith-McIntyre bottom grab samples were taken at sixteen stations (Table 3). The first three stations were test stations for the operation of the gear. Seven of the stations corresponded with the seven proposed Alvin dive

sites; six stations were added specifically to help characterize radioactivity in sediments from the disposal area used for radioactive wastes. The grab samples yielded 26 cores each for heavy metal analyses and sediment parameters. Thirty-three cores were taken from grab samples for radiation analyses (see Part III). Twenty-four subsamples exist for meiofaunal investigation. Twenty-six sediment subsamples of 400 ml size were taken for radiation analyses (see Part III). Twenty-two samples each of material greater than 1 mm and greater than 0.5 mm exist for macrofaunal examination. Twenty-three samples of biota for heavy metal analyses were taken from Dr. Musick's deep-sea trawl (Table 4). An XBT was dropped eleven different times during the cruise. Data is available for proposed Alvin dive sites 1, 3, 4, 5, 6, and 7. The PDR "Fish" transducer struck the hull of the vessel and was damaged at the first station. Without spare parts and an electronics technician the PDR proved to be beyond our repair capabilities. Because of this, no monitoring of the deep scattering layer was achieved.

Figure 2. Location of Smith-McIntyre Bottom Grab Stations

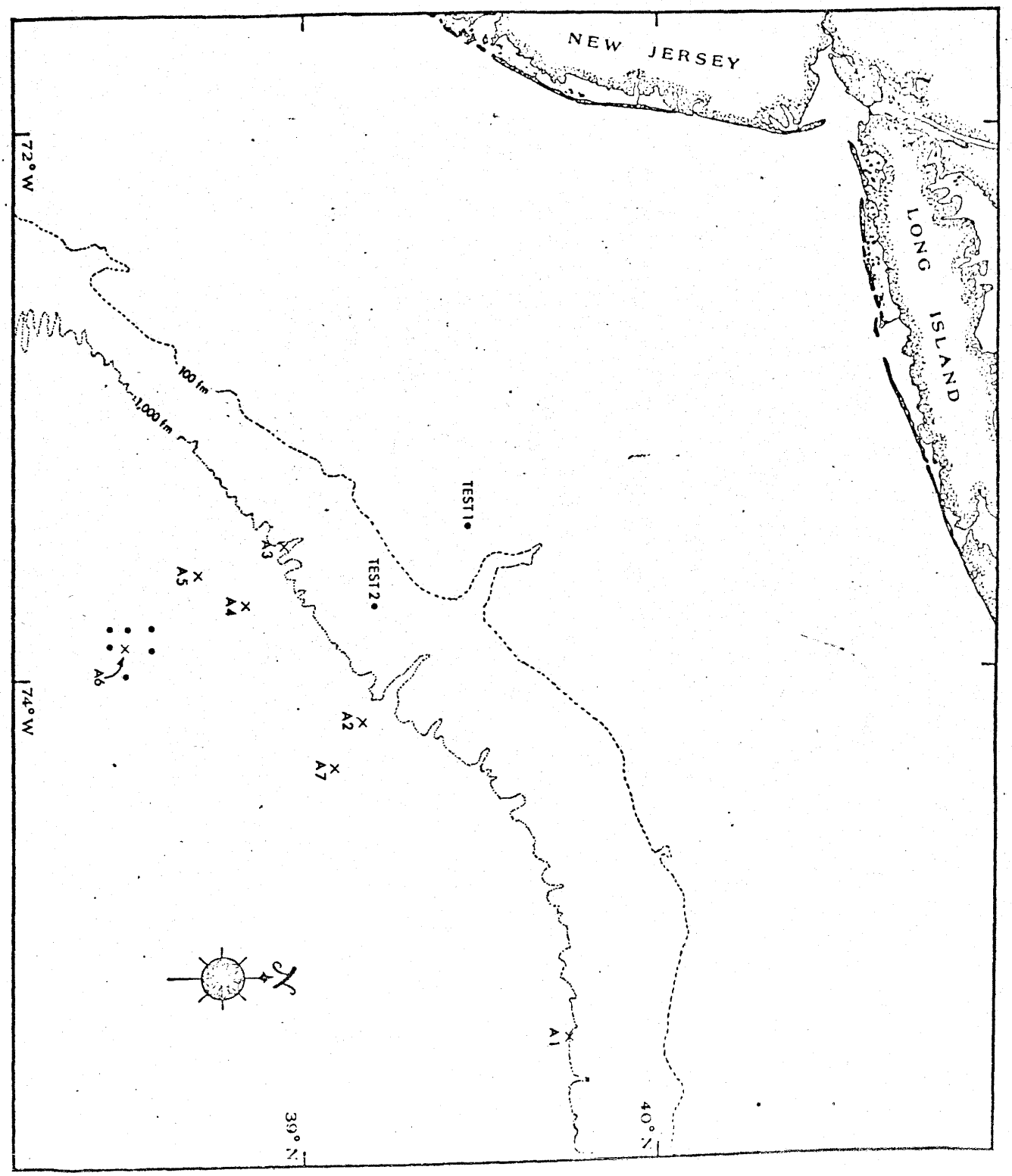


Table 2. Stations Sampled by Smith Mc-Intyre Bottom Grab Sampler.

Station	Alvin Site	Latitude	Longitude
1	-	39°32'N	72°32'W
2	-	39°11'N	72°15'W
1	1	39°46'N	70°40'W
2	2	39°101N	71°50'W
3	3	38°57'N	72°29'W
4	4	38°51'N	72°16'W
5	5	38°42'N	72°22'W
6	6	38°30'N	72°06' W
7	7	39°05'N	71°40'W
NW6	-	38°33'N	72°10'W
N6	-	38°34'N	72°06'W
W6	-	38°30'N	72°11.5'W
SW6	-	38°26.5'N	72°11'W
S6	-	38°26.5'N	72°07'W
E6	-	38°29'N	72°00'W

Table 3. List of Samples Obtained from Smith-McIntyre Sampling.

Station	Alvin Site	Date	Time	Grab #	Heavy Metals	Grain Size	Radiation Sediment	Meif.	400 ml Rad Bulk Sample	Macro >1	Macro >.5
SH dock	-	13 May	1400	1	-	-	1	-	1	-	-
1	-	13 May	2305	1	1	1	1	-	1	1	1
				2	1	1	1	-	1	1	1
2	-	14 May	0500	1	1	1	1	1	1	1	1
				2	1	1	1	1	1	1	1
3	3	14 May	1307	1	1	1	1	1	1	1	1
				2	1	1	1	1	1	1	1
		20 May	1630	3	-	-	-	-	-	-	-
1	1 standard	18 May	0035	1	1	1	1	1	1	1	1
				2	1	1	1	1	-	1	1
2	2 standard	18 May	0810	1	1	1	1	1	1	1	1
				2	1	1	1	1	-	1	1
4	4	18 May	1704	1	1	1	1	1	1	1	1
				2	1	1	1	1	-	1	1
5	5	19 May	0207	1	1	1	1	1	1	1	1
				2	1	1	1	1	-	1	1
7	7	19 May	0855	1	1	1	1	1	1	1	1
				2	1	1	1	1	-	1	1
6	6	20 May	0154	1	1	1	1	1	1	1	1
				2	1	1	1	1	1	1	1
		20 May	0940	3	1	1	1	1	-	1	1
NW 6	-	19 May	2130	1	1	1	2	1	2	*1	*1
N 6	-	20 May	0010	1	1	1	2	1	2	-	-
W 6	-	20 May	0440	1	1	1	2	1	2	-	-
SW 6	-	20 May	0615	1	1	1	2	1	2	-	-
S 6	-	20 May	0800	1	1	1	2	1	2	-	-
E 6	-	20 May	1212	1	1	1	2	1	2	-	-

*Probably no good because Rad bulk sample removed all surface of sample.

Table 4. Heavy Metal Samples of Biota Taken from Trawl Samples.

Trawl Station #	Sample
1A	Butterfish - *Peprilus triacanthus*
	Whiting - *Merluccius bilinearis*
2	Gadidae - *Phycis chesteri*
	Macrouridae - *Nezumia bairdi*
	Glyptocephalus cynoglossus
	Coryphaenoides rupestris
	Red crab - *Geryon quinquedens*
3B	*Alepocephalus agassizi*
	Nezumia bairdi
	Dicrolene intronigra
	♀ *Synaphobranchus kaupi*
	♂ *Synaphobranchus kaupi*
4	clay clumps from trawl
4B	*Benthodites giganteus*
	Alepocephalus agassizi
4C	*Nematonurus armatus*
5	Starfish
6A	♂ *Nematonurus armatus* with viscera
	♀ *Nematonurus armatus* eviscerated
	♀ *Nematonurus armatus* with organs
	Starfish
6B	480 gms Starfish
	Halosauropsis macrochir
	Nematonurus armatus

Part III. Fate of Radioactive Wastes.

Cruise Report, Office of Radiation Programs, Environmental Protection Agency

Cruise No. D74-2 May 13-21, 1974

OBJECT: To investigate a deep water radioactive waste disposal site approximately ten miles square centered on coordinates 38°30'N, 72°06'W.

The principal data gathering effort, as outlined in the operations plan, was to be performed by the deep submersible Alvin on May 20th. Prior to that time deep water trawl biological samples and sediment grab samples taken by the Delaware II in adjacent areas (including DWD 106) were to provide background or control levels of radioactivity attributable to naturally occurring and fallout radionuclides. Sediment and biota analysis would also indicate any radionuclide migration or possible disposal outside the dump site. The last minute cancellation of the Alvin operation at dive site 6 seriously restricted both the total information to be obtained from this study as well as conclusions drawn from the analytical results obtained from the Delaware II sampling program.

Attached is a list of the sites sampled. All sites except trawl stations 6, 6A, and 6B represent control sites for biota analysis. All sediment samples analyzed represent control sites except for Smith-McIntyre grabs in and around station 6 (EPA station numbers 20-28) and sediment taken from a trawl at station 6B. All samples around station 6 represent part of the radioactive dump site investigation.

Sediment samples were analyzed for gamma activity using a shielded 3" x 3" NaI crystal coupled to a multichannel analyzer. Each sample consited of 400 ml sediment counted for 100 minutes with background activity subtracted to yield net counts per 10 kev channel. The data was printed out on paper tape. Selected biota samples were also analyzed for gamma activity. Selected sediment and biota samples were dried and analyzed for alpha and beta activity using an internal proportional counter (IPC). IPC samples were generally counted for 100 minutes with background subtracted to yield net activity.

Most of the sediment and biota samples will require more extensive analysis at EPA's Eastern Environmental Radiation Facility in Montgomery, Alabama.

From the outset of the cruise the inoperability of the small Smith-McIntyre hydrowinch and Precision Depth Recorder (PDR) coupled with the loss of one of the main winch motors at station 3 created considerable logistics problems. It was necessary to finish the trawling operations at all stations and then return to each station for grab samples; this required long repeat steaming distances while recognizing that failure of the remaining winch would bring the cruise to a premature finish. In addition, there was no way of determining the

position of the trawl or sediment-grab equipment below 860 fathoms due to the failure of the PDR. In spite of these difficulties the Delaware II phase of our radioactive waste dump site sampling program was successful due in large part to the excellent response of the crew to each and all of the equipment and resultant logistics problems which arose. For any future deep-sea investigative operation it would seem imperative that not only a complete equipment check be performed, under operating conditions, prior to final departure but it must be insured that all equipment specifically directed towards a deep. water operation be in working order. This equipment check should also confirm that each winch have at least 500 m. additional wire beyond the calculated maximum sampling requirements.

Robert Dyer
Oceanographer
Office of Radiation Programs
Environmental Protection Agency
Washington, D. C. 20460

Mail Code: HM-560
Waterside Mall East Tower
4th and M Sts. SW

May 20, 1974

Sampling Sites

Station PA #	Operations Plan Dive Site #	Coordinates	Samples Analyzed Aboard Ship: Gamma	Alpha	Beta
.H. 1		40°28'N, 74°02'W	Sediment	Sediment	Sediment
.H. 2		39°32'N, 72°32'W	Sediment	Sediment	Sediment
.H. 3		39°11'N, 72°15'W	Sediment	Sediment	Sediment
.H. 4	3	38°56'N, 72°27'W	Sediment	Sediment	Sediment
			-	Coral	Coral
.H. 5	4	38°47'N, 72°16'W	Sediment	Sediment	Sediment
.H. 8	6	38°19'N, 71°57'W	fish viscera: *Nematonurus armatus*	-	-
			fish flesh: *Nematonurus armatus*	-	-
.H. 9	6A	38°29'N, 71°52.5'W	fish viscera: *Nematonurus armatus*	-	-
			starfish viscera	-	-
.H. 10	6B	38°39'N, 72°10'W	Sediment	-	-
.H. 12	4	38°42.5'N, 72°27'W	Sediment	-	-
.H. 14	2	39°08'N, 71°48.5'W	Sediment	Sediment	-
.H. 15	1	39°45.5'N, 70°40'W	Sediment	-	-
.H. 16	2	39°11'N, 71°51.5'W	Sediment	-	-
.H. 17	4	38°50.5'N, 72°16'W	Sediment	-	-
.H. 18	5	38°41'N, 72°22'W	Sediment	-	-
.H. 19	7	39°05'N, 71°40'W	Sediment	-	-
.H. 20	6	38°33'N, 72°10'W	Sediment	Sediment	Sediment
.H. 21	6	38°34'N, 72°06'W	Sediment	Sediment	Sediment
.H. 22	6	38°30'N, 72°06'W	Sediment	Sediment	Sediment
.H. 23	6	38°29.5'N, 72°07'W	Sediment	Sediment	Sediment
.H. 24	6	38°30'N, 72°11.5'W	Sediment	Sediment	Sediment
.H. 25	6	38°26.5'N, 72°11'W	Sediment	Sediment	Sediment
.H. 26	6	38°26.5'N, 72°07'W	Sediment	Sediment	Sediment
.H. 27	6	38°29'N, 72°00'W	Sediment	Sediment	Sediment

The following biological specimens were collected for later laboratory analysis at the EPA Eastern Environmental Radiation Facility in Montgomery, Alabama:

Station EPA #	Operations Plan Dive Site #	Trawl Coordinates	Type of Organism	Preservative
S.H. 2		39°27'N, 72°35'W	fish, *Leptophidium cervinum*	50% ETOH
			fish, *Urophycis regius*	50% ETOH
			crab, *Cancer borealis*	frozen
S.H. 3		39°08'N, 72°22'W	crab, *Geryon quinquedens*	frozen
			fish, *Nezumia bairdi*	50% ETOH
			fish, *Phycis chesteri*	frozen
			fish, *Coryphenoides rupestris*	frozen
S.H. 4	3	39°06'N, 72°32.5'W	sea urchin	50% ETOH
			sea squirt	50% ETOH
			holothurian	50% ETOH
			fish, *Coryphenoides rupestris*	frozen
			fish, *Phycis chesteri*	frozen
S.H. 6	5	38°32.5'N, 72°23'W	starfish	frozen
S.H. 6	5	38°32.5'N, 72°23'W	fish, *Nematonurus armatus*	frozen
			holothurian, *Euphoronides sp.* ?	frozen
			sea urchin	50% ETOH
S.H. 8	6	38°19'N, 71°57'W	fish (viscera) *Nematonurus armatus*	frozen
S.H. 9	6A	38°29'N, 71°52.5'W	starfish (specimen label accidentally tagged S.H. 8)	frozen
			fish, (eviscerated) *Nematonurus armatus*	frozen
S.H. 10	6B	38°39'N, 72°10'W	sea squirt	frozen
			starfish	frozen
			fish, *Nematonurus armatus*	frozen
			midwater shrimp	50% ETOH
S.H. 11	4B	38°48'N, 72°34.5'W	holothurian, *Benthodites sp.*	frozen
			decapod shrimp, *Pentachaeles sp.*	frozen

Thirty core samples were taken from Smith-McIntyre grabs. None were analyzed aboard ship. They will be analyzed for radionuclide content, depth distribution of radionuclides where applicable, and grain size distribution.

EPA Station #	# of Cores Taken
S.H. 1	1
S.H. 2 - 4	2 at each station
S.H. 15	1
S.H. 16	2
S.H. 17	1
S.H. 18 - 21	2 at each station
S.H. 22	1
S.H. 23	1
S.H. 24 - 27	2 at each station
S.H. 28	1

Submitted by:

James P. Thomas, Chief
Biological Oceanography Investigations

John B. Pearce, Director
Ecosystems Investigations

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

APPENDIX C

CRUISE REPORT

U.S.G.S.-N.O.A.A. COOPERATIVE CRUISE

BALTIMORE CANYON TROUGH AREA

N.O.A.A.-N.O.S. SHIP MT. MITCHELL MSS-22

MAY 15-30, 1974

INTRODUCTION

A cooperative cruise between the Office of Marine Geology U.S. Geological Survey (U.S.G.S.), Woods Hole, Massachusetts and the National Ocean Survey (N.O.S.) and National Marine Fisheries Service (N.M.F.S.) of the National Oceanic and Atmospheric Administration (N.O.A.A.) was conducted within the Baltimore Canyon Trough area from May 15 to May 30, 1974. The Baltimore Canyon Trough (fig. 1) is a structural depression which underlies the middle and outer continental shelf off the coasts of New Jersey, Delaware, and Maryland; it is considered a likely area for petroleum exploration and possibly production in the near future. Three sub-areas within the Baltimore Canyon Trough area were selected for detailed study (fig. 2). These areas (based on public information) are considered most likely for lease sales.

The purpose of the U.S.G.S.-N.O.A.A. cooperative cruise in the Baltimore Canyon Trough area was to commence studies of the movement and characteristics of bottom sediments and of the abundance and distribution of benthic organisms. The following acoustic systems were used to delineate the bathymetry and sub-bottom structure: (1) Ross Model 5000 shallow water fathometer; (2) 3.5 kHz high-resolution sub-bottom system; and (3) the EG&G Uniboom high-resolution sub-bottom system. Bottom samples were obtained with a Smith-McIntyre (0.10 m^2) grab. Water samples

were collected in Nansen bottles. An air-gun acoustic system and a side-scan sonar system were also aboard during the cruise, but these were not used. The air-gun system was taken aboard for use in case the EG&G Uniboom system failed to function. The side scan sonar system was not used because its signal interfered with the 3.5 kHz and EG&G Uniboom systems.

The cruise began and ended at N.O.S., Atlantic Marine Center, 439 West York Street, Norfolk, Virginia. The cruise was aboard the N.O.A.A.- N.O.S. Ship MT. MITCHELL (MSS-22).

SCIENTIFIC PERSONNEL

The scientific party during the cruise included the followin personnel from the U.S.G.S., Office of Marine Geology, Woods Hole Massachusetts:

Dr. Harley J. Knebel - - - - Chief Scientist

Mr. Frank Jennings - - - - - Electronics Technician

Mr. Charles J. O'Hara - - - - Cruise Leader

Mr. David Barnes

Mr. Robert Commeau

Ms. Patricia Forrestel

Mr. Charles Meeder

Ms. Barbara Tausey

The following personnel collected the benthic organisms and the heavy-metal samples and determined the temperature, salinity, and dissolved oxygen content of bottom water samples:

Mr. David Radosh - - - - - - -N.M.F.S., Sandy Hook Labs.

Ens. Karen O'Donnell - - - - N.O.A.A. Commissioned Corps

Ens. Robert Pawlowski - - - - N.O.A.A. Commissioned Corps

The following personnel from the MT. MITCHELL collected the necessary water samples and annotated and checked the bathymetric records:

Mr. Thomas J. McConnell - - - Chief Survey Technician

Mr. Frank Lamison

Mr. Everett Marsh

Mr. Paul Spithailer

OPERATIONAL STATISTICS

A. Total for the Entire Cruise

1. Tracklines (Entrance Chesapeake Bay and return) - - 1269 nm (2348 km)
2. Fathometer Records - - - - - - - - - - - 1159 nm (2144 km)
3. 3.5 kHz Records - - - - - - - - - - - - - - 978 nm (1809 km)
4. EG&G Uniboom Records - - - - - - - - - - - 966 nm (1787 km)
5. Sample Stations - - - - - - - - - - - - - - 93
6. Bottom Sediment Grabs - - - - - - - - - - 228
   a. Samples for size/composition - - - - 114
   b. Samples for benthic organisms - - - 114
   c. Samples for heavy metals - - - - - - 33
   d. Samples for foraminifera - - - - - - 114
7. Bottom Water Samples - - - - - - - - - - - 36
   a. Temperature - - - - - - - - - - - - - - 36
   b. Salinity - - - - - - - - - - - - - - - 36
   c. Dissolved Oxygen - - - - - - - - - - - 36

B. Total for Sub-area 1

1. Tracklines - - - - - - - - - - - - - - - - - 433 nm (801 km)
2. Fathometer Records - - - - - - - - - - - - - 433 nm (801 km)
3. 3.5 kHz Records - - - - - - - - - - - - - - 312 nm (577 km)
4. EG&G Uniboom Records - - - - - - - - - - - - 312 nm (577 km)
5. Sample Stations - - - - - - - - - - - - - - - 87
6. Bottom Sediment Grabs - - - - - - - - - - - 216
   a. Samples for size/composition - - - - 108
   b. Samples for benthic organisms - - - 108
   c. Samples for heavy metals - - - - - - - 30
   d. Samples for foraminifera - - - - - - - 108
7. Bottom Water Samples - - - - - - - - - - - 32
   a. Temperature - - - - - - - - - - - - - - 32
   b. Salinity - - - - - - - - - - - - - - - 32
   c. Dissolved Oxygen - - - - - - - - - - - 32

C. Total for Sub-area 2

1. Tracklines - - - - - - - - - - - - - - - - - 133 nm (246 km)
2. Fathometer Records - - - - - - - - - - - - - 133 nm (246 km)
3. 3.5 kHz Records - - - - - - - - - - - - - - 133 nm (246 km)
4. EG&G Uniboom Records - - - - - - - - - - - - 133 nm (246 km)
5. Sample Stations - - - - - - - - - - - - - - - 0
6. Bottom Sediment Grabs - - - - - - - - - - - 0
7. Bottom Water Samples - - - - - - - - - - - - 0

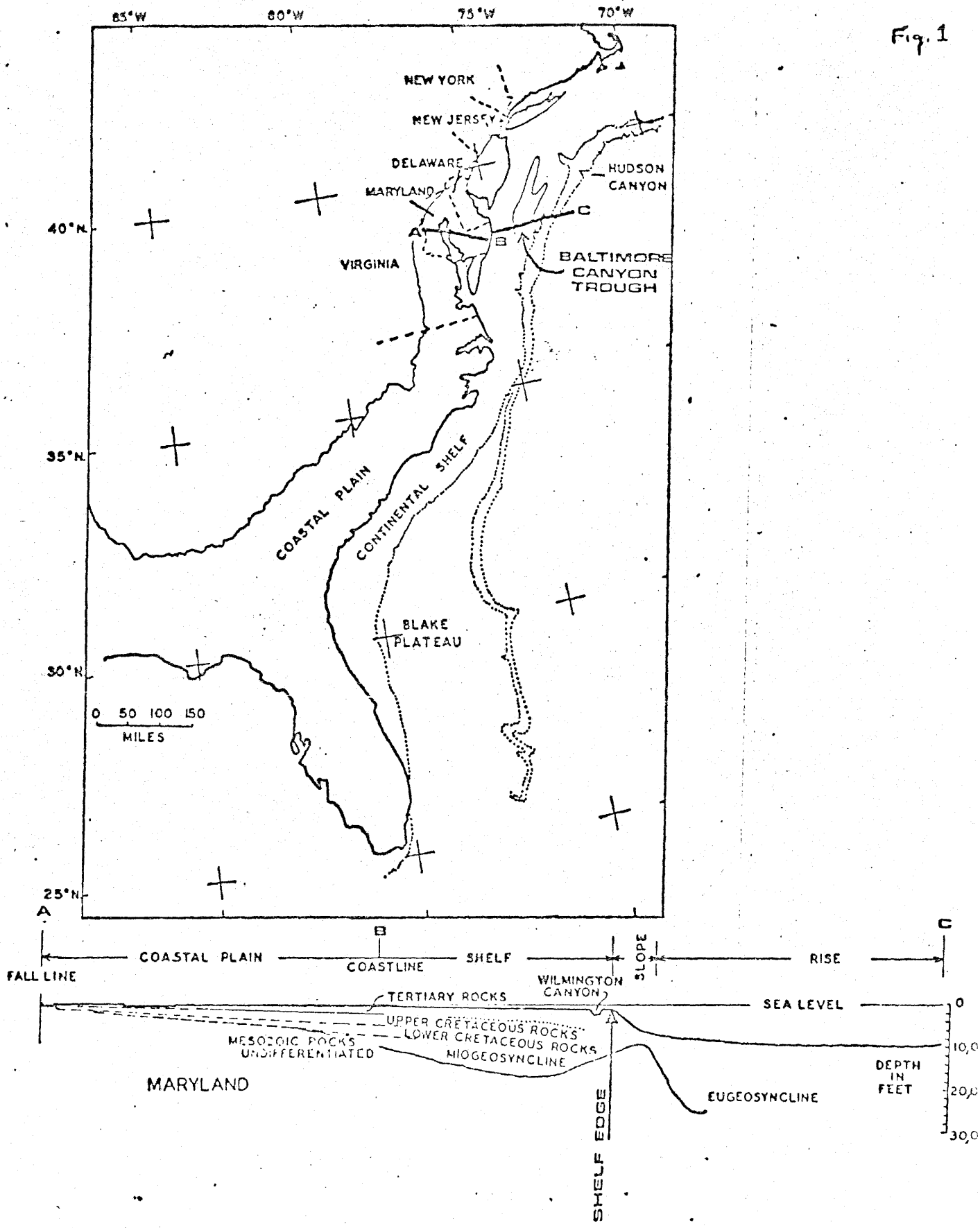
D. Total for Sub-area 3

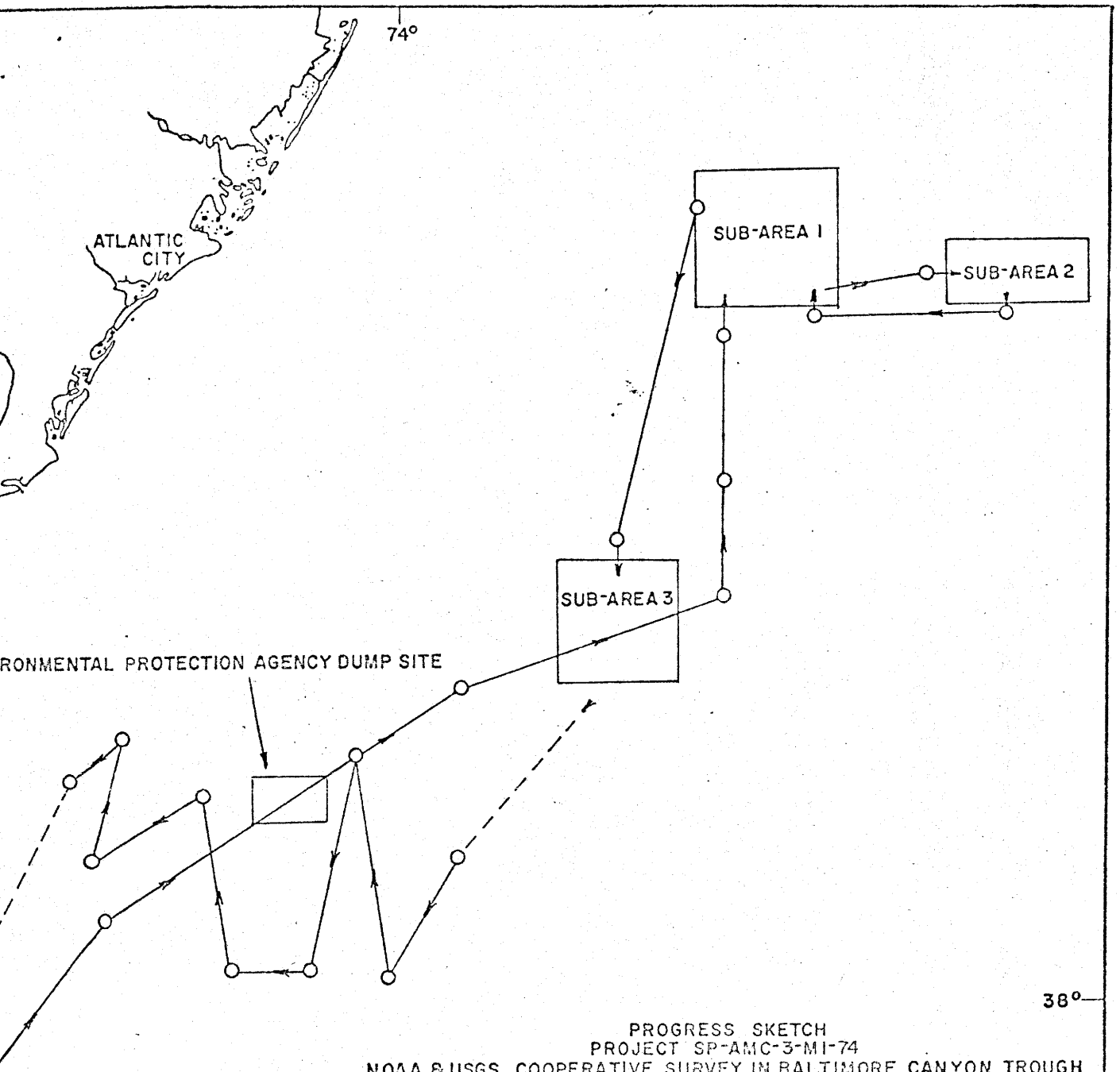
1. Tracklines - - - - - - - - - - - - - - - - - 200 nm (370 km)
2. Fathometer Records - - - - - - - - - - - - - 200 nm (370 km)
3. 3.5 kHz Records - - - - - - - - - - - - - - 200 nm (370 km)
4. EG&G Uniboom - - - - - - - - - - - - - - - - 200 nm (370 km)
5. Sample Stations - - - - - - - - - - - - - - - 6
6. Bottom Sediment Grabs - - - - - - - - - - - 12
   a. Samples for size/composition - - - - - 6
   b. Samples for benthic organisms - - - - 6
   c. Samples for heavy metals - - - - - - - 3
   d. Samples for foraminifera - - - - - - - 6
7. Bottom Water Samples - - - - - - - - - - - - 4
   a. Temperature - - - - - - - - - - - - - - 4
   b. Salinity - - - - - - - - - - - - - - - - 4
   c. Dissolved Oxygen - - - - - - - - - - - - 4

E. Total Exclusive of Sub-areas

1. Tracklines - - - - - - - - - - - - - - - - - 503 nm (930 km)
2. Fathometer Records - - - - - - - - - - - - - 393 nm (727 km)
3. 3.5 kHz Records - - - - - - - - - - - - - - 333 nm (616 km)
4. EG&G Uniboom Records - - - - - - - - - - - - 321 nm (594 km)
5. Sample Stations - - - - - - - - - - - - - - - 0
6. Bottom Sediment Grabs - - - - - - - - - - - 0
7. Bottom Water Samples - - - - - - - - - - - - 0

Fig. 1


85°W
80°W
75°W
70°W
40°N
35°N
30°N
25°N
NEW YORK
NEW JERSEY
DELAWARE
MARYLAND
VIRGINIA
HUDSON CANYON
BALTIMORE CANYON TROUGH
A
B
C
COASTAL PLAIN
CONTINENTAL SHELF
BLAKE PLATEAU
0 50 100 150
MILES
FALL LINE
COASTAL PLAIN
COASTLINE
SHELF
SLOPE
RISE
WILMINGTON CANYON
TERTIARY ROCKS
SEA LEVEL
UPPER CRETACEOUS ROCKS
LOWER CRETACEOUS ROCKS
MESOZOIC ROCKS UNDIFFERENTIATED
MIOGEOSYNCLINE
MARYLAND
SHELF EDGE
EUGEOSYNCLINE
DEPTH IN FEET
0
10,0
20,0
30,0

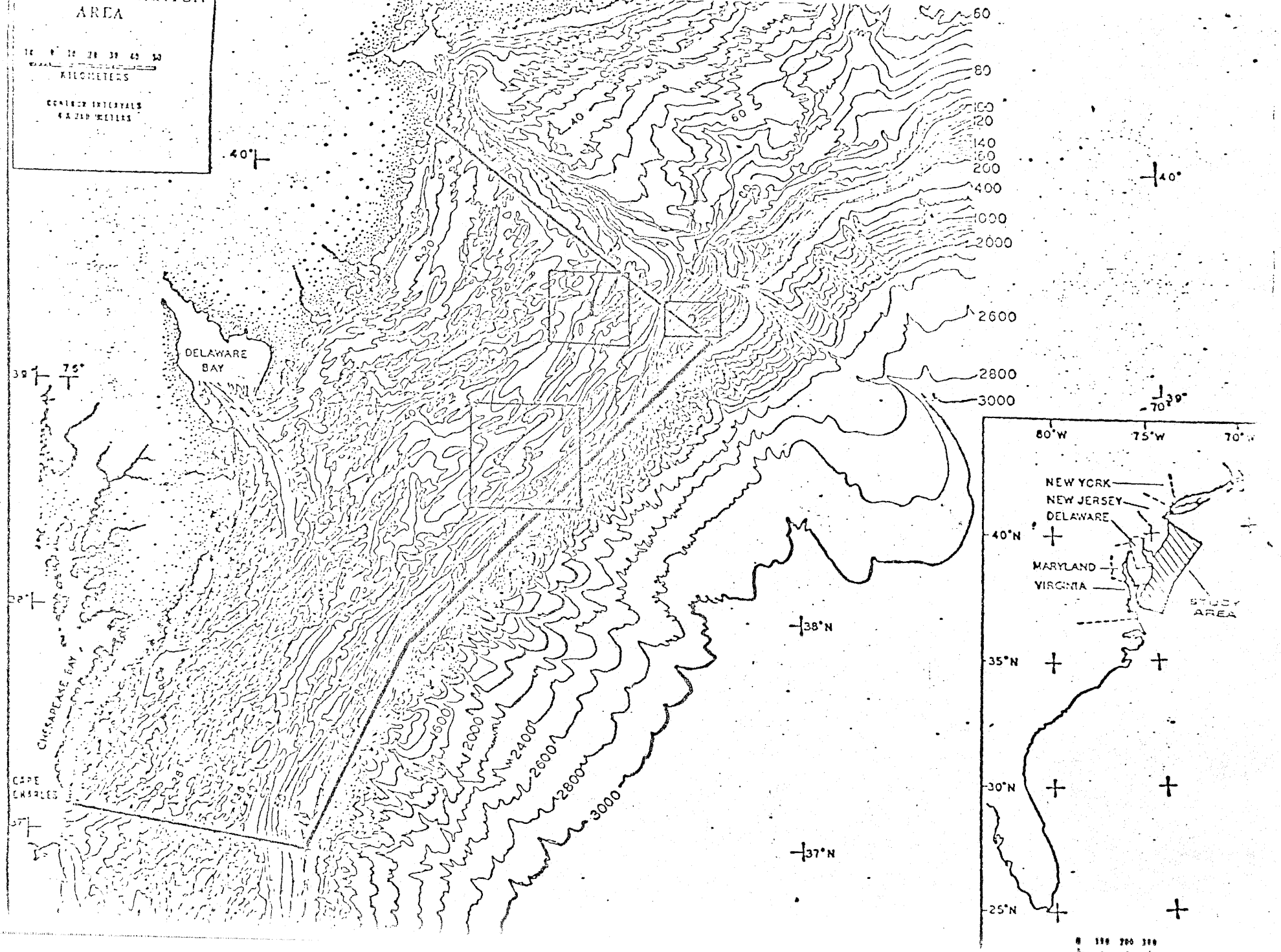


PROGRESS SKETCH
PROJECT SP-AMC-3-MI-74
NOAA & USGS COOPERATIVE SURVEY IN BALTIMORE CANYON TROUGH
OCEAN INVESTIGATIONS
MAY 15-30, 1974
NOAA SHIP MT MITCHELL (MSS-22)
RONALD M. BUFFINGTON, CDR, NOAA, COM'D'G.
DR. HARLEY J. KNEBEL, USGS, CHIEF SCIENTIST
SCALE OF NOS CHART 1000

	SUB-AREA 1	SUB-AREA 2	SUB-AREA 3	OTHER
M. SOUNDING LINE	433	133	200	393
M. DISTANCE TO & FROM				164
M. 3.5 KHZ HIGH-RESOLUTION SUB-BOTTOM SYSTEM	312	133	200	333
M. EG&G UNIBOOM HIGH-RESOLUTION SUB-BOTTOM SYSTEM	312	133	200	321
TOM GRAB (MORE THAN ONE SAMPLE PER GRAB)	216		12	
PLES FOR SIZE & COMPOSITION	108		6	
PLES FOR BENTHIC ORGANISMS	108		6	
PLES FOR HEAVY METALS	30		3	
PLES FOR FORAMINIFERA	108		6	
PLE STATIONS	87		6	
SEN CAST (1 BOTTLE, 2 PROTECTED THERMOMETERS)	32		4	

TLE ON THE BOTTOM - OBSERVATION FOR SALINITY, TEMPERATURE, DISSOLVED OXYGEN

74°


AREA
KILOMETERS
DELAWARE BAY
CHESAPEAKE BAY
CAPE HENLOPEN
40°
39°
38°N
37°N
75°
70°
80°W
75°W
70°
40°N
35°N
30°N
25°N
NEW YORK
NEW JERSEY
DELAWARE
MARYLAND
VIRGINIA
STUDY AREA
60
80
100
120
140
160
200
400
1000
2000
2600
2800
3000

APPENDIX D

MESA Progress Report

Saul B. Saila

1) A preliminary report entitled "Statistical Analysis of Benthic Sample Data From The New York Bight Area" has been submitted on December 30, 1973. A sequential sampling scheme for benthic invertebrates based on the negative binomial distribution was presented at this time. The following work was done during the last two quarters.

2) Sample sizes for detecting the differences between metal concentrations in sediments for two samples were determined with respect to the hypotheses:

$$H_o: \mu_1 = \mu_2$$

$$H_1: \mu_1 \neq \mu_2.$$

Under the null hypothesis (H_o), the population mean of the first station (μ_1) is assumed equal to the population mean of the second station (μ_2); that is, the metal concentration is the same for the two stations. The metals considered were Chromium (Cr), Copper (Cu), Nickel (Ni), Lead (Pb), and Zinc (Zn). About five (5) replicates for differentiating these elements between stations at an alpha level of 0.05 were suggested.

3) Sample sizes for constructing a confidence interval of fixed width (100% $\overline{X}$, 50% $\overline{X}$, 20% $\overline{X}$, and 10% $\overline{X}$) and with fixed alpha level (.05 and .10) for nematode data were estimated.

NOAA-MESA OFFICE
05 JUL 1974

The confidence intervals are based on the hypotheses:

$$H_o : \mu = \mu_o$$

$$H_1 : \mu \neq \mu_o$$

where the null hypothesis (H_o) assumes that the population mean (expected nematode count) is μ_o. The computed mean ($\overline{X}$) is used to estimate the true mean μ, and if μ_o does not lie in the confidence interval, the null hypothesis is rejected.

(In the above two statements, and underlying normal distribution for the populations sampled was assumed). Only about 3 replicates were required to detect differences of $\pm$ 50% $\overline{X}$.

4) Cluster analysis routines are being explored for the purpose of checking the efficacy of the present stratification scheme for the sampling stations. Cluster analysis will be performed on the 1 mm. counts.

5) Discriminant analysis techniques are being explored. This may provide the ability to assign a particular sample point to a given category with known probability of type I error (reject H_o when H_o true).

6) The stability and versatility of the unimodal negative binomical model was further demonstrated for describing the sampling distribution of benthic invertebrates.

APPENDIX E

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: Twelve Month Progress Report

Principal Investigator

Eugene B. Small
Associate Professor
Department of Zoology

Date of Submission
17 June, 1974

I. Introduction

Over the past year our concern with the populations of ciliated protozoa in the New York Bight has been primarily to establish the connections between the presence, species composition, and quantities of these populations with the presence and quality of man introduced pollutants. This type of correlation is only beginning to be investigated in true oceanic environments. Research into the correlative relationships between distinct groups of ciliates and specific nutrients or bacteria associated with pollution has advanced in fresh and brackish water environments to the point of identifying some of the communities of bacteria and protozoa responsible for the decomposition of types of decaying matter. These environmental relationships include: gram negative bacteria and ciliates in fresh water sewage plants (Curds, 1966, 1973); sulfurbacteria and ciliates in salt and brackish water sediments (Lackey, 1961, Fenchel, 1969, Fenchel and Reidl, 1970, Fenchel and Jorgensen, 1974); ciliates associated with decaying plant material and ciliates associated with decaying animal material, these constituting two distinct communities in the brackish water environment (Small, et al. Myrtle Beach Symposium, 1973). While familiarizing ourselves with the seasonal and spatial variability in generic composition of the New York Bight protozoan community we have also been investigating several methods for the quantification of these variations. Initial success with both of these considerations was presented in the six month report. Additional data from the previously reported methods and some preliminary analysis of the accumulated data is presented in this, the twelve month report.

Results from the spring cruises should be considered as a continuation of the information presented in the six month report. These results are therefore presented here as Appendices I and II in order to correlate with

the format of the aforementioned six month report.

II. Seasonal Variation

The ciliated protozoa are very small (10-400μ), unicellular, motile "animals". In order to survive and reproduce they need an almost constant source of food (foodstuffs are summarized as the X axis of the tables presented in Appendix ID pertaining to community structure as defined by trophism) and environmental characteristics which remain within a narrow range of variability (the specific characteristics and ranges change, of course, with each species). In the absence of food or when environmental variations exceed the acceptable range, most protozoa will die. This type of vulnerability leads to the observed food and nutrient limitations imposed upon protozoan species. Several genera (most notably scutico ciliates and most of the amoebae) are capable of forming resistant cysts. The encysted form can withstand such environmental extremes as des$ication, cold, heat, salinity change, or lack of food. Populations of encysting forms may encyst in response to extreme variations of environmental characteristics and thereby become effectively absent from the environment for a substantial period of time (weeks, months, even years) and return as a viable and important part of the protozoan community once the environment becomes "attractive" again. In the absence of direct observations of encysting and excysting forms, large fluctuations in numbers may be considered indicative of encysting forms. Cysts usually fall to the sediment and are found there. The Lackey jar method is one way of finding and obtaining sufficient numbers of encysters for cytological staining and identification. Simply because the protozoa are found in such a prolonged technique does not necessarily mean that they are present in the environment in the numbers and genera identified; they are present in the locale at some portion of the year, or have been present at some previous date.

The Lackey jar technique has been employed in an attempt to identify encysting forms. The table presented in Appendix III divides the data into that derived from direct observation and that from Lackey jars. In this way those ciliates which are actually present in the water column are distinguished from those which are most likely encysted in the sediment. It should be noted that the two results are, for the most part, comparable during the summer. Scutico ciliates, small bactivorous forms common in the water column in the summer, are found to be numerous under direct observation as well as after 4-6 weeks of culturing in the Lackey jars. In the winter this correlation between organisms present in the water column and those found in the sediment disappears. At this time of year tintinnid species predominate in the water column whereas the scutico ciliate species remain common in the sediment.

Tintinnids are planktonic loricate ciliates which are reported to eat algae (Gold, 1968, 1973) and possibly bacteria (Small, personal comminication). They are commonly reported in relatively clean, well mixed waters in conjunction with high numbers of algae. Their presence in higher numbers in the Bight during the winter than in the summer is indicated in the fact that the counts for both the January and March cruises represent predominantly ciliates of tintinnid species rather than those of scutico or hypotrich species. The counts were not broken down into the component families and genera because the initial counts for the August and October cruises were not conducted in such a manner. Our quantitative data for next year will more adequately reflect the true composition of the ciliate populations. The seasonal change in predominant ciliate forms may result from the direct effect of physical changes on the ciliate populations or from the indirect effect of these physical changes on their food supply. This type of change (scuticos: High numbers in the summer, absent in the winter; tintinnids: low numbers but present in the summer, fair numbers, but not as high as the summer scutico counts, in the winter) is also being found in the Rhode

River Estuary of the Chesapeake Bay (Coats, personal communication). There may be a correlation between high summer temperatures, high viable bacteria counts, and high scutico counts, and between low winter temperatures, high occurence of water mixing which would dilute the bacteria, and absence of scuticos which would allow an increased number of tintinnids in the area. It must be emphasized at this point that this is an extremely speculative line of reasoning and may not account for what actually occurs.

Like the planktonic ciliates, ciliates in the sediment are affected by food availability and physical parameters. Perhaps the single most important environmental characteristic for psammobiotic communities is the mean particle size coupled with the silt/clay fraction of the sediment in which they live. This factor determines the community structure by its selective effect on the specific types of ciliates and metazoa capable of living therein (Faure-Fremiet, 1950, Swedmark, 1964). Seasonal variation within the sediment to the extent seen in the plankton has not been indicated by the data collected. There is a decrease in numbers and diversity during the winter months but the communities had recovered well by the March cruise. Spatial variation across the Bight is a function of the types of sediments present and is fairly obviously indicated. This is elucidated in the next section.

III. Spatial Variation

Spatial variability will be considered in terms of three hypothetical axes at this point, with the possibility of adding a fourth at a later date. Horizontal variations of the species present occurs most obviously in the summer, both in the water column, as one axis, and in the sediment, as another. These two environments must be considered separately because, as close examination of Table I, App. IIIB shows, the populations of ciliates does not vary similarly in both areas. The third axis is drawn vertically through the water column and the fourth will describe vertical stratification in the sediment.

We have found several species of scutico ciliates in sewage polluted environments in the Bight which were also present in the water column and/or encysted in the sediment. These include Uronema nigricans, Cyclidium dimacronucleatum, and Cyclidium polyschizonucleatum. Uronema marinum, in contrast, has been found only at "clean" sites. The presence of the scutico ciliates correlated with sewage in the water column over the sewage dump site is most notable during the summer when there are few ciliates in the plankton at other sites. During the March-April cruise several additional stations were tested with Lackey jars to determine the presence of the sewage associated scutico ciliates in sites close to and surrounding the sewage dump site. The updated distributional map (App. IIC) shows that the entire area surrounding the sewage dump site has sewage associated scutico ciliates. Utilizing direct ciliate observations and counts during the summer and Lackey jars during the winter, we feel that we can positively identify areas of sewage pollution.

Horizontal variability of the protozoan communities in sublittoral sediments is almost directly a result of the type of sediment as defined by the mean sediment particle size and percentage of silt/clay fraction. Communities found by Fauré-Fremiet (1950) in sediments of 225μ mean particle size were the most diverse. Fenchel (1969) found that psammobiotic ciliates were almost entirely absent from sediments with a silt clay fraction greater than 6-10%. In the Bight, this is the type of sediment found in those ares near the sewage and dredging dump sites and in a few other areas, and the psammobiotic communities reflect this. Fine clean sand generally contains the more diverse communities of psammobiotic ciliates. Overall, the only areas without well developed communities of psammobiotic ciliates are those near the sewage dump site. This seems to be a result of the sediment characteristics caused by pollution rather than the direct results of pollution.

Vertical variability of the protozoan populations is effectively shown by quantitative samples taken on 27 and 29 August, 1973. The samples

were taken at the sewage dump site exclusively at 10' intervals in the vertical water column. The samples were counted by the inverted microscope method described by Lund, et al, 1956. We limited the sampling to the sewage dump site because scutico ciliates had been found in significant numbers at this site on two previous occasions. We have limited our twelve month report of counts and statistics to this site because we have the most extensive data for it. During the cruises other than the 27 and 29 August cruises the sampling depths were determined relative to the position of the euphotic zone as described by Beers and Stewart (1971). This procedure is described in detail in the six month report. Quantitative results are explained and elaborated upon in the next section.

IV. Quantification

Absolute statistical verity is limited at this point since we have only one count per sample which gives a value of zero for the degrees of freedom. To alleviate this problem more counts will be taken per sample or replicate samples counted. We expect to do both this summer in order to determine their feasibility and significance.

The 95% range is obtained from an equation given in Lund's (1956) paper, and is specifically designed for cases such as ours. The equations are as follows:

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

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

If two counts are 95% different statistically, their ranges do not coincide. Two counts whose ranges coincide may be representing the same true value. With this, the following conclusions are drawn. It must again be emphasized that this is preliminary and that different results may be indicated by the upcoming summer's work.

In both of the late August sample groups a pattern emerges involving the depth of the euphotic zone. Although the values differ for both days, there is a significant increase in the ciliates per liter of the top

sample and the sample taken below the bottom of the euphotic zone when these two counts are compared with the counts from the rest of the water column. This is in accordance with Beers and Stewart (1971). The bottom sample on the other hand is variable. The top counts are highest in both August counts and the January count; the weather during the August and January cruises was quite calm. The counts are low at the top during the October and the March cruises; at both times the seas were fairly rough. The middle counts are low in both the January and March cruises when tintinnids were the dominant form. These results may indicate that the ciliates can come up to the surface only during times when the sea is calm, a more common occurence in the summer. Also, it may be that scutico ciliates and not tintinnids follow the euphotic zone generalization (Beers and Stewart classified all ciliates found in one group of their counts, and therefore are no help at all in the clarification of this point).

Although quantification of the populations of ciliates raises further questions which can be solved only by further collections, we feel that we have the techniques of sampling, counting, and identification successfully perfected. It is definitely feasible to quantify the palnktonic populations of ciliates in the New York Bight.

IV. Conclusion

The ciliates have been shown to be an integral part of the microbiota of the New York Bight, in the plankton and in the benthos. We have not established the precise food source which is responsible for the appearance in, maintenance at, and limitation to certain areas by specific ciliates, however, we have established the fact that these ciliates are present, collectable, and countable. We have begun to establish baseline data for populations of ciliates. Counts need not be performed immediately after sampling and we have the capability, given aid in counting (one count represents 3-5 hours of work, one cytological identifying stain, 6-36 hours), of having counts available

for nearly every station that was sampled last year. A distributional map has been begun and is updated after every cruise. Those species initially suggested as indicator organisms continue to be in evidence in this role. We have modified and perfected several sampling, observation, and cytological techniques important to our stated goals and look forward to initiating and perfecting several more techniques and methods in these areas since the necessary equipment has finally arrived. In short, we have accomplished the goals set for this year and have made plans for next year based upon our experiences. Integral to those new plans is an increased sampling program during the important summer months, increased quantification, and continuation of our present lines of study.

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APPENDIX I A

Table 3

Cruise: Boat and Dates: R/V Albatross IV 23 January-1 February, 1974

Station & Date	Secchi EZ	Total Depth	Nisken Samples: Depth, Temp., Liters Filtered Top	Mid	Bottom	Grab Sample Jars	Bag	Grab Water	Uhlig Extraction	Sediment Type
St. 7 23 Jan.	14' 42'	52'	3' 5.5°C. 25 l.		47' 3.4°C 5 l.	2	1	1 l.	2-80 mesh	clean coarse sand, some pebbles
St. 16 24 Jan.	8' 24'	18'	3' 5.0° 5 l.		15' 5.2° 12.5 l.	2	1	.5 l.	2-80 mesh	fine grey clean sand
St. 32 25 Jan.	19' 57'	108'	3' 5.5° 7 l.	65' 6.8° 16 l.	105' 6.3° 5 l.	2	1	2 l.	-	black muck-top layer of grey-brown
St. 35 25 Jan.	11' 33'	75'	3' 4.5° 10 l.	40' 6.0° 7.5 l.	73' 6.3° 5 l.	2	1	1 l.	-	black muck-sand and rocks present
St. 51 26 Jan.	11' 33'	86'	3' 6.5° 28.5 l.	40' 6.8° 15 l.	84' 6.8° 15 l.	2	1	1 l.	2-80 mesh	fine sand
St. 82 28 Jan.	9' 27'	36'	3' 6.8° 9 l.		33' 6.4° 10 l.	2	1	2 l.	2-80 mesh	fine black sand, broken shells
St. 90 28 Jan.						2	1	4 l.	3-80 mesh	fine sand
St. 92 28 Jan.	16' 48'	210'	3' 6.7° 14 l.	60' 6.9° 27 l.	205' 7.5° 12.5 l.	2	1	.5 l.	2-80 mesh	grey silty sand

TABLE 6

Cruise: oat and Dates: R/V Oregon II 21 March-3 April, 1974

Statio Dat	Secchi EZ	Total Depth	Nisken Samples: Depth, Temp., Liters Filtered Top	Mid	Bottom	Crab Sample Jars	Bag	Grab Water	Uhlig Extraction	Sediment Type
St. 7 23 March	16' 48'	45'	3' 6.0°C 23 l.		42' 13	2		4 l.	2-80	very coarse clean sand
St. 16 23 March	9' 27'	23'	3' 9 l.		20' 7.0° 3 l.	2	1	2 l.	2-80	fine clean sand, grey-brown color
St. 31 24 March	16'	108'	3' 16 l.	53' 21 l.	105' 6.0° 5.5 l.	2		2 l.	2-T.K.S.	grey brown muck
St. 34 25 March	11.5' 33.5'	52'	3' 20 l.		45' 6.22° 14 l.	2		2 l.		black muck, grey-brown on top
St. 51 26 March	19.5' 58.5'	84'	3' 27 l.		75' 9 l.	2	1	4 l.	2-80 2-T.K.S.	fine grey-brown sand
St. 57 2 April		30'	Multiple Core Sample		5.6°	2				fine graded sand, some black muck on top
St. 82 28 March	15' 45'	51'	3' 7.0° 14 l.		45' 6.1° 4 l.	2		2 l.	2-80	coarse sand, some gravel
St. 90 29 March		190'	Sediment Grab Sample Only			2	1	1 l.	2-80	coarse sand, some pebbles, some silt
St. 92 30 March	13' 39'	200'	3' 5.5° 16 l.	50' 5.5° 17 l.	195' 6.0° 3 l.	2		0.5 l.		brown-black muck
St. 99 30 March		78'	Multiple Core Sample		5.5°	2				fine clean graded sand

Stations 21,22,23,29,30,32,33,43,44,45 had sediment samples taken via the Lackey jar method, two jars per station.

APPENDIX I D

Table 8

Feeding Preference

Sites: Tentative Genera/Species	Bacteria	Detritus or Algae a or d	Diatoms	Dino-flagellates	Euglenoids	Ciliates	Micro-metazoa	Histophages
R/V Albatross IV								
23 Jan. to 1 Feb., 1974								
St. 7 40°31'N 73°38'W								
Water col:								
Top: algae, diatoms, Ceratium, Peradinium								
Tintinnid sp.1	+	a	+	+	+			
Bottom: algae, diatoms, Ceratium, Peradinium								
Tintinnid sp.1	+	a	+	+	+			
Sed/Water:								
Metopids	+							
Scuticociliate	+							
Sediment:								
Hypotrichs	+	a,d	+	+	+	+	+	
Condylostoma			+		+	+		
Trachelonema			+	+	+	+		
Lacrymaria					+	+		
St.16 40°31'N 73°38'W								
Water col:								
Top: dense algae, diatoms, Ceratium, Polykrikos, copepods								
Tintinnid sp.1	+	a	+	+	+			
Tintinnid sp.2	+	a	+	+	+			
Tintinnid sp.3	+	a	+	+	+			
Tintinnid sp.4	+	a	+	+	+			
Bottom: algae, diatoms, foraminifera, Ceratium, Peradinium								
Tintinnid sp.1	+	a	+	+	+			
Sed/Water:								
Euplotes	+			+				
Sediment:								
Condylostoma			+		+	+		
Litonotus						+		
Nassula		a						
Lacrymaria						+		
Euplotes	+			+				
Trachelocercid sp.1			+	+	+	+		
Trachelocercid sp.2			+	+	+	+		
Scuticociliate	+							

Table 8 (cont'd.)

Site:Tentative Genera/Species	Feeding Preference							
	Bacteria	Detritus or Algae a or d	Diatoms	Dino-flagellates	Euglenoids	Ciliates	Micro-metazoa	Histophages
St. 32 40°25'N 73°48'W								
Water col:								
Top:algae, Ceratium								
Tintinnid sp.1	+	a	+	+	+			
Tintinnid sp.2	+	a	+	+	+			
Tintinnid sp.3	+	a	+	+	+			
Mid:algae, diatoms								
Tintinnid sp.1	+	a	+	+	+			
Tintinnid sp.2	+	a	+	+	+			
Bottom: all present seem dead								
Sed/Water:--								
Sediment:--								
St. 35 40°25'N 73°54'W								
Water col:								
Top:very dense with algae and diatoms, Ceratium								
Tintinnid sp.1	+	a	+	+	+			
Tintinnid sp.2	+	a	+	+	+			
Mid:very dense with algae and diatoms, Ceratium, Peradinium, Gymnodinium								
Tintinnid sp.1	+	a	+	+	+			
Bottom:algae and other phytoplankton seem dead								
Tintinnid sp.1	+	a	+	+	+			
Scuticociliate	+							
Sed/Water:--								
Sediment:--								
St. 51 40°19'N 73°42'W								
Water col:								
Top:algae,diatoms, Ceratium,Peradinium, Gymnodinium								
Tintinnid sp.1								
Mid:algae, diatoms, Ceratium, Gymnodinium								
Bottom:algae, few diatoms								
Sed/Water:--								
Sediment:								
Loxophyllum						+		
Geleia					+	+		
Helicoprorodon			+	+	+	+		
Frontonia			+	+				
Lacrymaria sp.1						+		
Lacrymaria sp.2						+		

Table 8 (cont'd.)

Sites:Tentative Genera/Species	Feeding Preferences							
	Bacteria	Detritus or Algae a or d	Diatoms	Dino-flagellates	Euglenoids	Ciliates	Micro-metazoa	Histophages
St. 51 (cont'd.)								
Sediment (cont'd.):								
Condylostoma			+		+	+		
Euplotes	+		+					
Trachelocercid sp.1			+	+	+	+		
Scuticociliate	+							
St. 82 40°13'N 73°59'W								
Water col:								
Top:extremely dense algae, diatoms, Ceratium								
Tintinnid sp.1	+	a	+	+	+			
Bottom:algae, copepods, Ceratium								
Sed/Water:								
Euplotes	+		+					
Lacrymaria						+		
Metopid	+							
Sediment:								
Loxophyllum sp.1						+		
Loxophyllum sp.2						+		
Trachelocerca sp.1			+	+	+	+		
Trachelocerca sp.2			+	+	+	+		
Tracheloraphis			+	+	+	+		
Lacrymaria						+		
Metopid sp.1	+							
Metopid sp.2	+							
Trachelonema			+	+	+	+		
Euplotes	+		+					
Geleia					+	+		
Scuticociliate	+							
St. 90 40°10'N 73°44'W								
Sediment:								
Loxophyllum						+		
Lacrymaria						+		
Trachelocerca sp.1			+	+	+	+		
Trachelocerca sp.2			+	+	+	+		
Euplotes	+		+					
Scuticociliate	+							

Table 8 (cont'd)

Sites:Tentative Genera/Species	Feeding Preference							
	Bacteria	Detritus or Algae a or d	Diatoms	Dino-flagellates	Euglenoids	Ciliates	Micro-metazoa	Histophages
St. 92 40°10'N 73°42'W								
Water col:								
Top:algae, *Ceratium*, *Peradinium*								
Tintinnid sp.1	+	a	+	+	+			
Mid:algae, diatoms, *Ceratium*, *Peradinium*								
Tintinnid sp.1	+	a	+	+	+			
Tintinnid sp.3	+	a	+	+	+			
Bottom:diatoms, *Ceratium*								
Sed/Water:very silty								
Euplotes	+		+					
Sediment:								
Euplotes	+		+					
Trachelocercid sp.1			+	+	+	+		

Table 9

Sites: Tentative Genera/Species	Bacteria	Detritus or Algae a or d	Diatoms	Dino-flagellates	Euglenoids	Ciliates	Micro-metazoa	Histophages
R/V Cromon II								
21 March-3 April, 1974								
St. 7 40°31'N 73°38'W 23 March Long Island Shore Control								
Water Column:								
Top: algal strands, sand, Ceratium, Peridinium, copepods, rotifer								
Tintinnid sp.1	+	a						
Bottom: algae, Ceratium, Gymnodinium, diatoms, nauplii								
Tintinnid sp.1	+	a						
Sed/Water: Ceratium, Peridinium, algae, nauplii								
Sediment: nematodes, debris, Peridinium, flatworm								
Hypotrich	+	a,d	+	+	+	+	+	+
Trachelocercid			+	+	+	+		
Colops spiralis			+					
Lacrymaria					+	+		
Tintinnid sp.1	+	a,d						
St. 16 40°31'N 73°38'W 23 March New York Harbor Control								
Water column:								
Top: algae, Ceratium, diatoms, nauplii								
Tintinnid sp.1	+	aaa						
Tintinnid sp.2	+	a						
Bottom: algae, sand, Ceratium, Gymnodinium, rotifers								
Sed/Water: algae, debris, Gymnodinium, Ceratium, gelatinous zooflagellates								
Scutico siliate	+							
Sediment:								
Trachelocercid sp.1			+	+	+	+		
Trachelocercid sp.2			+	+	+	+		
Trachelocercid sp.3			+	+	+	+		
Tracheloraphis			+	+	+	+		
Loxorhyllum sp.1						+		
Loxorhyllum sp.2						+		
Loxorhyllum sp.3						+		
Remanella						+		
Lacrymaria sp.1						+		
Lacrymaria sp.2						+		
Helicoprorodon			+	+	+	+		
Euplotes	+		+					
Condylostoma			+		+	+		
Hypotrichs	+	a,d	+	+	+	+	+	+
Metopids	+							
Scutico ciliates	+							

Table 9 (cont'd.)

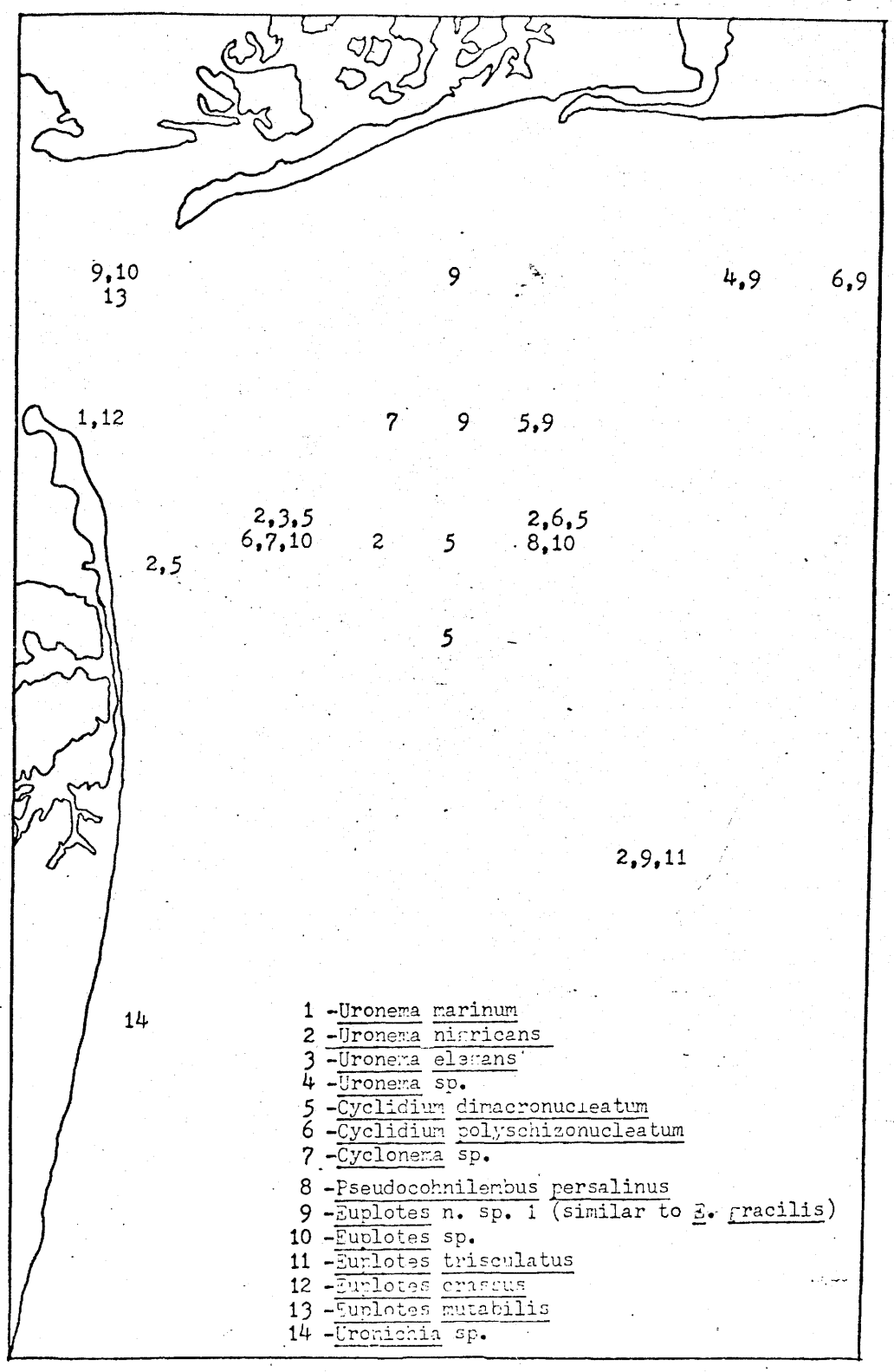
Sites: Tentative Genera/Species	Bacteria	Detritus or Algae a or d	Diatoms	Dino-flagellates	Euglenoids	Ciliates	Micrometazoa	Histophages
St. 31 40°25'N 73°48'W 24 March Sewage Dump Site								
Water column:								
Top: algae, Ceratium, nauplii, copepods, polychaete larvae, diatoms, Peridinium								
Tintinnid sp.1	+	a						
Nassula		a						
Middle: algae, nauplii, copepods, Ceratium, Gymnodinium, Polykrikos, other dinoflagellates								
Bottom: algae, Ceratium, foraminifers, debris								
Sed/Water: silt								
St. 34 40°25'N 73°54'W 25 March Dredging Spoils Dump Site								
Water column:								
Top: algae, sand, Ceratium, nauplii, copepods								
Tintinnid sp.1	+	a						
Hypotrich	+	a,d	+	+	+	+	+	+
Bottom: debris, Ceratium, Peridinium, nauplii, diatoms								
Tintinnid sp.1	+	a						
Sed/Water: debris, dead amphipods								
St. 51 40°19'N 73°42'W 26 March Acid Waste Dump Site								
Water column:								
Top: algae, Ceratium, Gymnodinium, Peridinium, other dinoflagellates, zooflagellates, euglenoids, rotifers								
Bottom: debris, algae, Ceratium, Peridinium, nauplii								
Tintinnid sp.1	+	a						
Sed/Water: debris, algae, sand, Ceratium, other dinoflagellates								
Sediment:								
Centrophorella sp.1						+		
Centrophorella sp.2						+		
Xenarella sp.1						+		
Xenarella sp.2						+		
Xenarella sp.3						+		
Xenarella sp.4						+		
Prorodon		a	+	+	+			
Trachelocercid sp.1			+	+	+	+		
Trachelocercid sp.2			+	+	+	+		
Trachelocercid sp.3			+	+	+	+		
Chaenia						+		
Loxophyllum						+		
Lacrymaria						+		
Loxodid sp.						+		

Table 9 (cont'd.)

Sites: Tentative Genera/Species	Bacteria	Detritus or Algae a or d	Diatoms	Dino-flagellates	Euglenoids	Ciliates	Micrometazoa	Histophages
Station 57 40°19' 73°52'W 2 April New Jersey Shore Control A								
Multiple Core Station								
Sediment: sand, oil, rotifers								
Trachelocercid			+	+	+	+		
St. 82 40°13'N 73°59'W 28 March New Jersey Shore Control B								
Water column:								
Top: algae, diatoms, *Ceratium*, *Cryptomonas*, *Peridinium*								
Tintinnid sp.1	+	a						
Bottom: algae, *Ceratium*, *Peridinium*								
Tintinnid sp.1	+	a						
Sed/Water: algae, dinoflagellates, diatoms								
Euplotes	+		+					
Sediment:								
Trachelocercid			+	+	+	+		
Centrophorella						+		
Lacrymaria						+		
St. 90 40°10'N 73°44'W 29 March Deep Water Sediment Station								
Sediment: *Cryptomonas*								
Euplotes	+		+					
St. 92 40°10'N 73°42'W 29 March Deep Water Control								
Water column:								
Top: algae, *Ceratium*, polychaete larvae, *Peridinium*								
Tintinnid sp.1	+	a						
Middle: algae, *Ceratium*, nauplii, copepods, diatoms								
Bottom: Debris, algae, diatoms, *Ceratium*, nauplii								
St. 99 40°22'N 73°36'W 2 April Outer Control Station								
Multiple Core Station								
Sediment: Euglenoid, flatworms, flagellates								
Tintinnid sp.1	+	a						
Trachelocercid sp.1			+	+	+	+		
Trachelocercid sp.2			+	+	+	+		
Trachelocercid sp.3			+	+	+	+		
Pseudoprorodon			+	+	+			
Letopid	+							
Loxophyllum								
Homionotus						+		
Centrophorella						+		
						+		

APPENDIX II C

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



APPENDIX IIIA

TABLE I.

Protozoology Sampling Cruises: June, 1973 to June, 1974

Dates	Research Vessel	Sampling Methods: Sediment	Sampling Methods: Water column	Number of Stations
1. 18-20 June, 1973	Rorqual	L,S,U,W		5
2. 2-8 August	Albatross IV	L,S,M,U,W	N-CF	5
3. 14 August	Xiphias	L,M,U	N-CF	4
4. 27 August	Xiphias		N-CF	1
5. 29 August	Xiphias		N-CF	1
6. 18 September	Ferrel	L,U		4
7. 20-27 October	Oregon II	L,M,U	N-CF	7
8. 26-30 November	Ferrel	L,U		8
9. 23 January-1 February,1974	Albatross IV	L,M,U	N-CF	8*
10. 21 March-3 April	Oregon II	L,M,U	N-CF,PP	20*

Methods:

Sediment

- L - Lackey's 16 oz. jars
- M - Millipore filtering grab water
- S - Spoon's test tube extraction method
- U - Uhlig's seawater ice method
- W - Winogradsky column

Water Column

- N-CF - Nisken water sample filtered through a cascade of graded filters
- PP - Peristaltic pump, to be combined with a Foerst centrifuge for summer,1974

* - 7 permanent stations to be sampled during every major MESA cruise

APPENDIX III B

Table I

CRUISES		17-19 June 1973		2-8 Aug.		14 Aug.		27-29 Aug.		19-26 Oct.		23 Jan.- 1 Feb. 1974		21 March- 3 April	
Stations MESA Grid		DO	LJ	DO	LJ	DO	LJ	DO	LJ	DO	LJ	DO	LJ	DO	LJ
St. 7	w.c.			S		S,H						T		T	
40°31'N 73°38'W	sed.			P+	H,S	P	H	P+		P		P	H	P+	
St. 8	w.c.					H,S,T									
40°31'N 73°40'W	sed.					P+	S,H								
St. 11	w.c.					S,T									
40°31'N 73°46'W	sed.			H,S		P+	H								
St. 16	w.c.			H,S		S				S		T		T	
40°31'N 73°36'W	sed.			P+		P+	S,H			P+		P	H,S	P	S
St. 21	w.c.														
40°28'N 73°48'W	sed.														S
St. 22	w.c.														
40°28'N 73°46'W	sed.														H
St. 23	w.c.														
40°28'N 73°44'W	sed.		Sp												H,S
St. 31	w.c.	S		S				H,S,T		H,S		T		T	
40°25'N 73°42'W	sed.	P	Sp		Sp				Sp		Sp		Sp		Sp
St. 32	w.c.														
40°25'N 73°48'W	sed.														Sp
St. 34	w.c.	S		H,S						S		T		H,T	
40°25'N 73°48'W	sed.		Sp		Sp								Sp		Sp
St. 43	w.c.														
40°22'N 73°48'W	sed.														Sp
St. 51	w.c.											T		T	
40°19'N 73°40'W	sed.			P+	H					P++		P+	H	P+	Sp
St. 57	w.c.														
40°19'N 73°52'W	sed.													P	
St. 82	w.c.											T		T	
40°13'N 73°59'W	sed.									P+		P+		P+	H
St. 90	w.c.														
40°10'N 73°46'W	sed.											P		P	
St. 92	w.c.											T		T	
40°10'N 73°42'W	sed.														
St. 99	w.c.													T	
40°22'N 73°36'W	sed.													P	

Abbreviations and Symbols:

w.c. - water column
sed. - sediment

S - scutico ciliate
Sp - scutico ciliates, pollution indicators
H - hypotrich ciliate
T - tintinnid ciliate
P - psammobiotic ciliates
P+ - high numbers of psammobiotic ciliates

APPENDIX IIIC

TABLE I.

PRELIMINARY
QUANTITATIVE DATA:
SEWAGE SITE 40°25'N x 73°48'W

Date	Depth Secchi EZ	Sample Depth	Liters Filtered	Temp.	DO	Direct Observ.	Ciliates Raw Count	95% Range	Ciliates / Liter	95% Range
27 August 1973	110'	3'	6	24°C	2.40	+	105	85-125	210.0	170-250
		10'	22	22.5	8.15	++	30	21-43	16.4	11-23
	10'	20'	17	22	7.52	+	38	27-53	26.8	19-37
		30'	22	22	7.40	++	40	29-55	21.8	16-30
	30'	40'	20.5	21	7.40	++	95	78-118	55.6	46-69
		50'	18	20	7.46		28	19-41	18.6	13-27
		60'	20	19		+	28	19-41	16.8	11-25
		70'	14	18	6.50		28	19-41	24.0	16-35
		80'	9	11			42	31-57	56.0	41-76
		90'	16	10.5	5.25	++	54	41-71	40.5	31-53
		100'	17.5	9		++	27	18-40	18.5	12-27
		110'	14		5.18	+	42	31-57	36.0	27-49
29 August	110'	3'	16	25	7.60	+	163	135-190	122.2	101-142
		10'	13.5	24	7.65		22	14-34	26.0	17-40
	21'	20'	20	23	7.72	+	44	32-60	35.2	26-48
		30'	14	22	7.44	+	32	22-46	27.4	19-39
	63'	40'	21.5	21	6.64	++	52	39-69	38.7	22-51
		50'	18	21	7.45		32	22-46	21.3	15-31
		60'	18.5	19	6.76		34	24-48	29.4	21-41
		70'	20	14	5.12	+	119	96-133	71.4	58-80
		80'	16	13	4.94	+	14	8-24	10.5	6-19
		90'	23	11	4.94	++	20	13-32	13.9	9-22
		100'	22	10		+	35	25-49	25.4	18-36
		110'	21.5		5.12	+	13	7-19	7.2	4-11
22 October	108'	3'	29.9	14		+	48	36-64	19.2	14-26
	32'	105'	13.5	11		+	40	29-55	47.4	34-65
	96'									
25 January 1974	108'	3'	7	5.5		+	70*	55-89	30.0	21-43
	19'	65'	16	6.8		+	49*	37-54	9.2	5-18
	57'	105'	5	6.3			35*	25-49	21.0	13-33
24 March	108'	3'	16			+	29*	20-42	5.4	2-13
	16'	53'	21				16*	9-27	2.2	0.4-8
	48'	105'	5.5	6.0			22*	14-34	12.0	7-22

APPENDIX F

QUARTERLY REPORT

to the

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

on the

FORAMINIFERA OF THE NEW YORK METROPOLITAN AREA

1 April 1974 - 30 June 1974

CONTRACT NO. 03-4-043-315

Dr. John J. Lee

The purpose of this investigation is to survey the quantitative and qualitative distribution of planktonic and benthic foraminifera in the lower Hudson River and New York Bight. To this end, benthic collections were begun in June 1973 and have continued on a seasonal basis. Laboratory analyses started on 1 January 1974 and are ongoing. Monthly sampling for planktonic foraminifera were initiated in January 1974. The methods of study were described in the first quarterly report and will not be reiterated. The results of the research to date are presented in this report.

Data for the benthic samples analyzed is presented in Table 1. No additional species of benthic foraminifera have been found and a plate of photographs of representative specimens is being prepared. The most numerous and cosmopolitan foram found so far is an unidentified species of the genus Elphidium, sometimes occurring as several thousand per 100 cm^3. Identification is difficult since the specimens are weakly calcified or not at all. Only a chitinous-like layer encloses the organisms and collapses on drying, thus preventing examination of the test.

Planktonic foraminifera found in samples analyzed to date are presented as number/M^3 in Table 2 and the positions of the stations are found in Table 3 and Fig. 1. Specimens initially identified as the progeny of adult forms cannot be confirmed after further study with the electron scanning microscope. Thus, the 20 μ samples have been discontinued.

A pertinent reference list is being compiled and is an addendum to this report.

Conclusions cannot be made at this time. However, the ubiquitous nature of the unidentified Elphidium species with the weak and chitinous-like test is interesting. Plans to collect specimens live are underway in order to determine if they are living in the Bight in the decalcified state or if it is an aberration of the sampling methods. McCrone and Schafer (1966) found forams with chitinous tests in the Hudson River.

TABLE 1

Numbers of benthic foraminifera found per unit volume in samples taken from New York Bight during June 1973.

Station	Grab	#/100cm^3	Live/Dead
1	4	46	
	14	289	
2	4	22	
	11	4,824	1.90
3	2	1,410	
	3	660	
	4	1,106	1.56
	6	1,103	0.73
	7	90	
	8	490	
	9	463	
	10	638	
	14	1,400	2.17
	15	638	0.56
	16	855	
	17	589	
	18	725	
	19	426	
4	2	5	
	3	10	
	4	0	
	5	21	
	6	14	
	7	16	
	8	0	
	9	8	
	10	0	
	11	14	
	12	5	
	13	13	
	14	4	
	15	51	
	16	17	
	17	21	
	18	48	
	19	8	
	20	4	
5	9	3,890	
	23	234	
6	2	19	
	3	406	0.22
	4	13	
	5	11	
	6	17	
	7	17	
	8	281	0.05
	9	57	
	10	26	
	11	40	
	12	166	0.65
	13	137	
	14	26	
	15	17	
	16	24	
	17	9	
	18	65	
	19	79	
	20	40	
7	3	7	
8	2	50	
	3	5	
	4	30	
	5	0	
	6	76	
	7	32	
	8	25	
	9	19	
	10	63	
	11	57	
	12	34	
	13	22	
	14	0	
	15	22	
	16	47	
	17	11	
	18	112	
	19	45	
	20	19	

TABLE 2

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

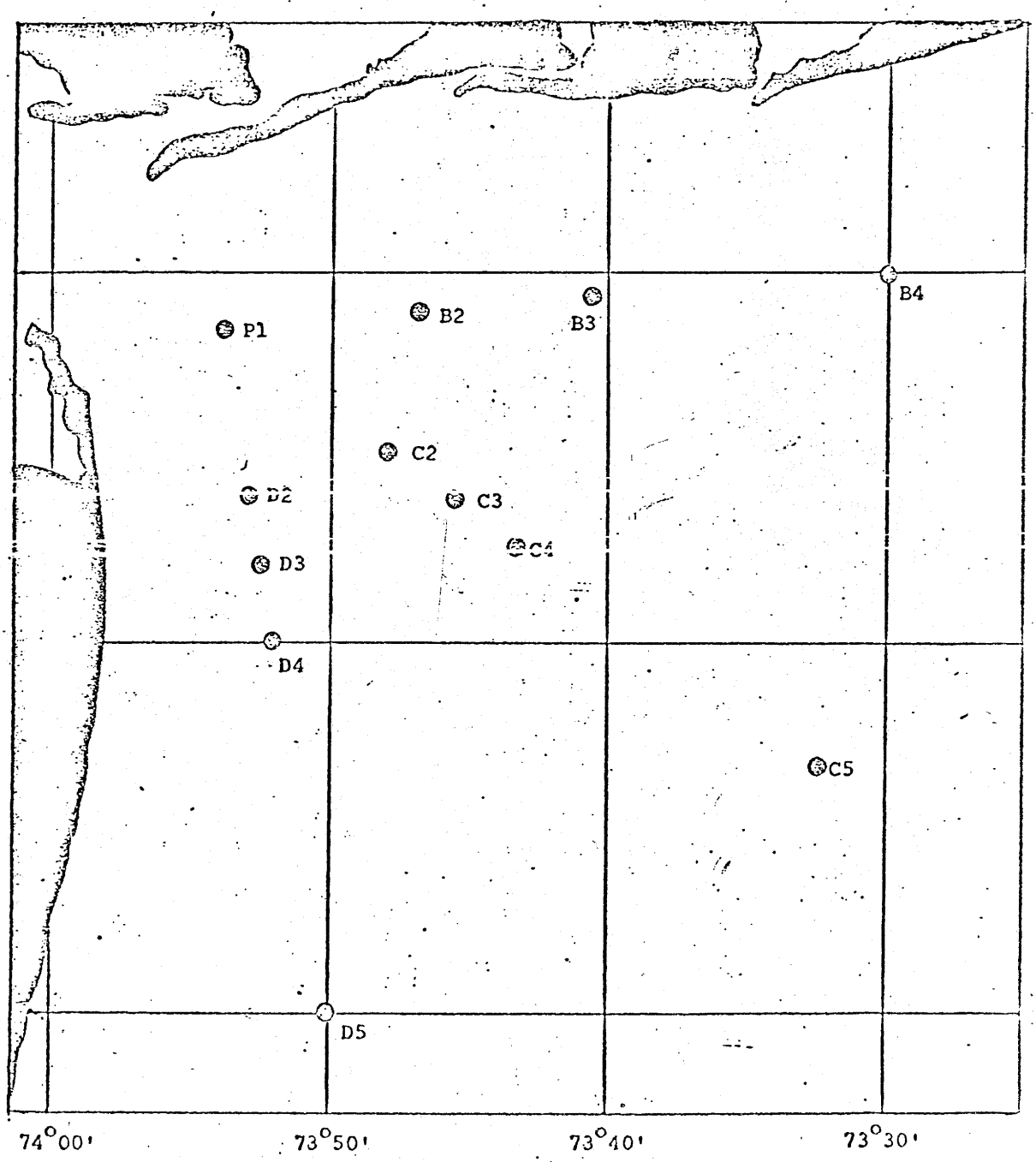
Date	Station	200 μ Samples #/m^3	80 μ Samples #/m^3
9/1/73	A3	0	
	P1	0	
	D3	0	
10/2/73	D5	2.3	
11/3/73	A1	0	
	A3	0	
	P1	0	
	D3	0	
	B4	0	
1/26/74	A1		0
	A2		0
	A3		0
	A4		0.08
4/10/74	B4		0
	C5		0
	D5		0.12
	D3		0
4/27/74	C3		0.02
	C5		0
	D5		0

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

Fig. 1. Collecting sites of planktonic foraminifera in the New York Bight.



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APPENDIX G

SUBLITTORAL MEIOBENTHOS OF THE NEW YORK BIGHT

Quarterly Report - July 1974

Prepared By: Dr. John H. Tietjen
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INTRODUCTION

The basic objective of this, our first year of the MESA study, is to obtain information on the variability of meiofauna population densities in the sediments of the study area. With this information on hand, we will be able to design a sampling protocol which will enable us to maximize our efficiency in describing the spatial and temporal occurrence of meiofauna in the New York Bight.

In the second year of study, we plan to initiate a more intensive investigation of selected stations in the New York Bight. The selection of stations will, to a large extent, be based on sediment distribution and hydrographic data now being gathered by other participants in the MESA program.

This report includes the information which has thus far been gathered on the variability of meiofauna population densities in the sampling area.

METHODS

A series of eight stations was taken on a cruise of the R/V ATLANTIC TWIN between June 5 and June 11, 1973 for the purpose of obtaining replicate samples for statistical analyses to determine the within and between station variance in the mechanical properties of the sediments, heavy metal concentrations, meiofauna density and macrofauna density. The number of replicate samples per station was 20.

Samples were taken with a Smith-McIntyre grab. The meiofauna were subsampled by inserting a 2.5 cm plastic core tube into the sediment near the center of the grab to a depth of 5 cm. Formalin containing a methyl-red stain was added, and the sample placed in a labeled jar. It was found that methyl-red did not function as an adequate stain; thus Rose Bengal was added to samples.

In the laboratory, the volume of the samples was noted. The samples were washed through a set of two sieves, the larger one with a mesh opening of 0.500 mm. and the smaller one with a mesh opening of 0.074 mm. Animals which passed through the larger sieve but which were retained on the smaller seive were regarded as meiofauna.

Statistical analysis of within station variation of nematode densities was conducted by Dr. Saul B. Saila of the University of Rhode Island. The X^2 - goodness of fit test was used to test the normality assumption. Where the data did not conform to a normal distribution the square-root transformation was used to normalize it. The sample sizes (n) for alpha levels of .05 and .10 were then calculated for various confidence intervals.

RESULTS

The meiofaunal data for stations 4, 6 and 8 were presented in the March quarterly report. The statistical analysis of the within station variability of nematods densities at these stations are presented in Tables 1 and 2. With a samle size (n) of 3 the mean density of nematodes could be estimated within $\pm$ 50% at the .05 alpha level (Table 2). This is considered a satisfactory estimate and, therefore, in the ongoing program three samples per station will be analysed.

The final samples analysed from the reconnaissance cruise include five samples from station 2 and nineteen samples from station 3. Station 2 (40°22.3' No. Lat., 73°47.1' West Long.) is located in the south west area of the sewage dump site and station 3 (40°19.5' Lat., 73°43.65' Long.) is located about three miles south of the sewage sludge dump site. The numbers of meiofauna per 100 cm^3 of sediment are given in Tables 3 and 4.

At Station 3 nematodes were the dominant taxon and foraminiferans ranked next in abundance. Substantial numbers of ciliated protozoans and gastrotrichs were also present. At Station 2 foraminiferans were the dominant taxon. Nematodes were the next dominant taxon, although their densities were usually several orders of magnitude lower than the foraminiferans. Comparing stations 2 and 3 it is clear that station 3 has a more diverse composition of major meiofaunal groups. However, the significance of this cannot be established without supplementary data.

Table 1: Nematoda Data

Grab Number	Station 4	Station 6	Station 8
1	932	152	2684
2	1880	622	3160
3	2538	126	2355
4	2020	340	2688
5	3375	2530	1625
6	1829	470	1533
7	3463	2551	2660
8	1588	339	2515
9	2435	615	4288
10	1692	84	3197
11	963	723	2235
12	2570	1315	2105
13	2121	540	3767
14	1830	388	2429
15	2081	473	1312
16	987	545	962
17	3088	165	2616
18	1818	288	1616
19	1145	295	2222
$\overline{X}$	2018.68	661.11	2419.42
s^2	576485.34	515498.32	683184.15
s	759.27	717.98	826.55
$100\%\overline{X}$	2018.68	661.11	2419.42
$50\%\overline{X}$	1009.34	333.06	1209.71
$20\%\overline{X}$	403.74	133.22	483.88
$10\%\overline{X}$	201.87	66.11	241.94

Table 2: Sample Sizes for Nematoda at Stations 4, 6, 8

Confidence Interval	Alpha level = 0.05			Alpha level = 0.10		
	k	ks^2	n	k	ks^2	n
Station 4:						
$\pm 100\%\bar{X}$	1.08×10^{-6}	0.62	1	7.38×10^{-7}	0.43	1
$\pm 50\%\bar{X}$	4.33×10^{-6}	2.50	3	2.95×10^{-6}	1.70	2
$\pm 20\%\bar{X}$	2.71×10^{-5}	15.61	16	1.85×10^{-5}	10.63	11
$\pm 10\%\bar{X}$	1.08×10^{-4}	62.44	63	7.38×10^{-5}	42.53	43
Station 6:*						
$\pm 100\%\bar{X}$	6.68×10^{-3}	0.88	1	4.55×10^{-3}	0.60	1
$\pm 50\%\bar{X}$	1.33×10^{-2}	1.75	2	9.03×10^{-3}	1.19	2
$\pm 20\%\bar{X}$	3.31×10^{-2}	4.37	5	2.26×10^{-2}	2.98	3
$\pm 10\%\bar{X}$	6.63×10^{-2}	8.74	9	4.52×10^{-2}	5.95	6
Station 8:						
$\pm 100\%\bar{X}$	7.54×10^{-7}	0.52	1	5.14×10^{-7}	0.35	1
$\pm 50\%\bar{X}$	3.02×10^{-6}	2.06	3	2.06×10^{-6}	1.40	2
$\pm 20\%\bar{X}$	1.89×10^{-5}	12.88	13	1.28×10^{-5}	8.77	9
$\pm 10\%\bar{X}$	7.54×10^{-5}	51.52	52	5.14×10^{-5}	35.09	36

*Calculations based on square-root transformation of original data.

Table 3. Numbers of meiofauna per 100 cm^3 of sediment at Station 2 in the New York Bight, 6 June 1973.

Meiofaunal Group	GRAB NUMBER				
	3	4	11	12	14
Nematoda	2615	790	642	1284	414
Foraminifera	7605	22	4824	5404	4416
Harpactacoidea	105		15	72	7
Ostracoda	5	94		16	
Polychaeta	50		64	40	4
Nauplii	165		7	16	11
Ciliated Protozoa	150			44	
Lamellibranchiata	150		236	120	43
Nemerteans	170	11	182		
Halacarids		11			

Table 4. Numbers of meiofauna per 100 cm^3 of sediment at station 3 in the New York Bight, 6 June 1973.

Meiofaunal Group	GRAB NUMBER																		
	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Nematoda	1360	900	2268	1670	3317	923	1235	1160	1452	1008	1596	1020	1893	676	2250	920	1510	1970	1751
Foraminifera	1410	660	1106	833	1103	90	490	463	638	760	1446	300	1400	638	855	589	725	426	1610
Harpactacoidea	41	19	48	12	32	35	46			12	7	26	110	5	31		79	38	
Ostracoda	22	15	11	35	77	24	31	10	33	4	11		74	14	41		83	35	
Polychaeta	15		22	23	63	107	15	33	95	24	14	7	36	5	7	3	26	50	
Nauplii	11	22	137	50	167	4	65	19	5	4	89		335	33	41	7	39	38	114
Ciliated Protozoa	185	130	636	540	1026	62	146	305	19	112	550	111	287	109	238		152	222	28
Lamellibranchiata	4	7	85	19	77	10	31	24		232	11	7	36	5	7	7	35	58	138
Nemerteans	37	15		920	1071	7	62	28		24	32		181	52	17		35	23	
Turbellaria	33		4			97	146	5		36		30			62		30	12	
Kinorhyncha	7	4		4	7		8			8			3		14		4		10
Gastrotricha	155	170	4	92	5		119	10	176	232	139	74	16	71	334	60	100		
Halacarids						4	4												
Acanthuria									5										
Total Meiofauna	3310	1942	4325	4198	6970	1363	2398	2072	2547	2240	3894	1575	4391	1608	3897	1586	2818	2872	3675