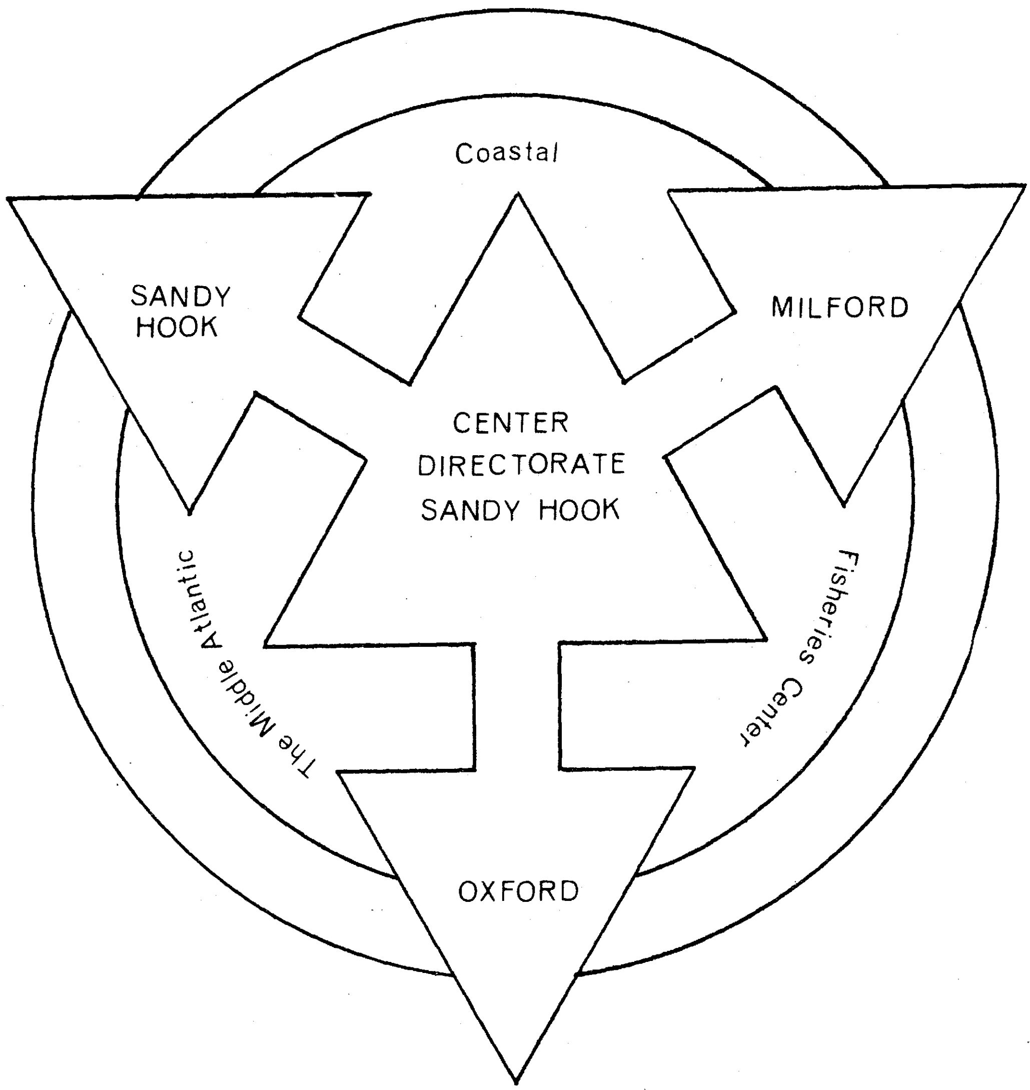
QUARTERLY REPORT ON MESA-FUNDED RESEARCH
IN THE NEW YORK BIGHT - JANUARY-MARCH 1974

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

MIDDLE ATLANTIC COASTAL FISHERIES CENTER



Informal Report No. 32

June 1, 1974

Two major cruises were conducted during the quarter, that of NOAA R/V Albatross IV from 22 January to 5 February 1974 and that of NOAA R/V Oregon II from 21 March to 4 April 1974. The primary purpose of the cruises was to obtain the third and fourth quarterly samples for biological, physical and chemical analyses. The Albatross cruise included Substrate Monitoring Program (SUMP) observations by AOML personnel which were completely coordinated with biological-chemical-physical sampling being conducted by MACFC and university contract personnel. Both cruises accomplished planned goals. Complete cruise reports are attached (Appendixes A and B). Worthy of special note is that navigation utilizing RAYDIST was greatly improved on the Oregon II cruise compared with previous cruises (Appendix C).

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

1. After six months of monthly analyses of phytoplankton productivity, nutrient cycling, and energy flow, Dr. Thomas C. Malone finds that primary production is higher in the inner Bight (0.1 to 1.6 g C day $^{-1}$m^{-2}) than in the Upper Bay (0.01 to 0.27 g C day $^{-1}$m^{-2}), that zooplankton biomass is higher in the Bight than in the Upper Bay, and that particle grazers (copepods and cladocerans) rather than predators (chaotognaths, ctenophores, and polichaetes) are predominant throughout both areas (Appendix D).

2. Of all meiofaunal elements, nematodes are the dominant taxa in samples examined to date, according to Dr. John H. Tietjen (Appendix E).

3. The presence of live planktonic and benthic foraminifera is assured but distributions have not yet been worked out (Appendix F -- Dr. John J. Lee).

4. Landings of food finfish in New Jersey have declined steadily since the end of World War II whereas landings of food shellfish have increased dramatically over the same period of time (Appendix G -- Dr. J. L. McHugh).

In a letter, Dr. Saul B. Saila reported that the first samples of heavy metal data are remarkably consistent with respect to replicate analyses (Appendix H).

One in-house report was prepared in which the distribution of coliform and metal concentrations in sediments of the ocean areas south of Long Beach was described (Appendix I).

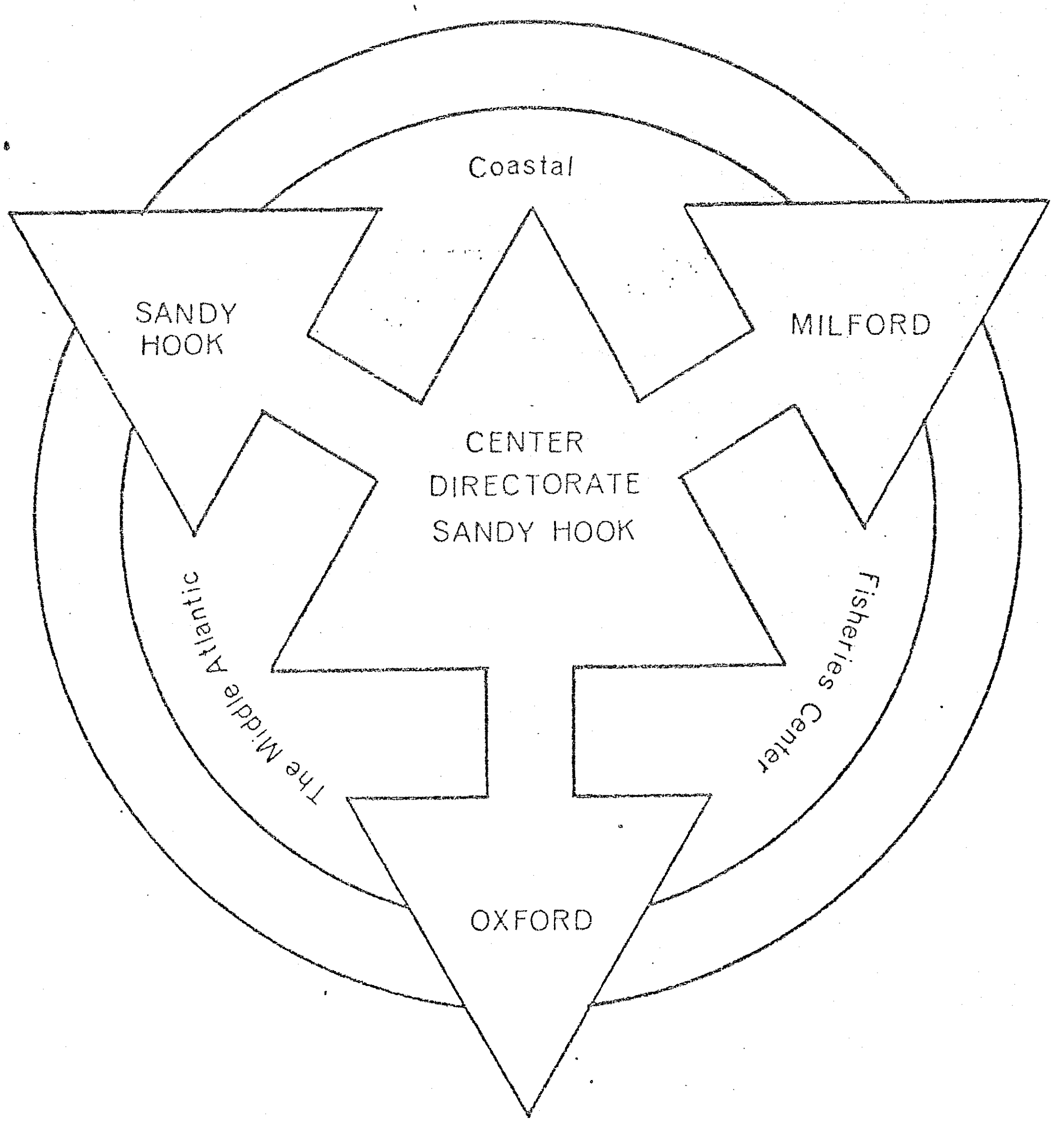
One manuscript bearing on the biology of organisms inhabiting the Bight was submitted for publication. Young and Pearce described a shell disease syndrome in crabs and lobsters.

APPENDIX A

CRUISE REPORT
NOAA Ship Albatross IV
22 January - 5 February 1974

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

MIDDLE ATLANTIC COASTAL FISHERIES CENTER



February 1974

CRUISE REPORT

NOAA Ship *Albatross* IV

22 January - 5 February 1974

U. S. Department of Commerce
National Oceanic and Atmoshperic Administration
National Marine Fisheries Service

Middle Atlantic Coastal Fisheries Center

Ecosystems Investigations

Resource Assessment Investigations

Sandy Hook Laboratory

Highlands, New Jersey

(Funded by NOAA-MESA Appropriations)

INTRODUCTION:

The NOAA Ship Albatross IV arrived Sandy Hook at 0830 hrs., 22 January 1974 and loading commenced immediately. The RAYDIST had been previously installed at Woods Hole, Mass. Loading completed, the vessel departed Sandy Hook at 1530 hrs. to calibrate RAYDIST off Monmouth Beach. Following calibration the vessel proceeded to station 1 to commence sampling at 2000 hrs. The weather was excellent and the cruise proceeded smoothly. RAYDIST operations were still subject to problems, although these did not interfere with the completion of the cruise. Smith-McIntyre grab bottom sampling, multiple core sampling and sampling for ciliated protozoa were completed by 0800 hrs. on 30 January. The vessel was then met off Monmouth Beach by the R/V Rorqual for the purpose of taking on board Lt. Cdr. Stubblefield and George Lapiene (AOML) to operate the Substrate Monitoring Program (SUMP). During this phase personnel from the Ecosystems Investigation at Sandy Hook assisted by collecting 88
bottom grab samples with the Smith-McIntyre. From each sample AOML removed two 12 dram quantities of sediment from one-half the surface area of the Smith-McIntyre sample. The remainder of the sample was treated according to procedures outlined later in this report under operations. The significance is that in addition to the SUMP parameters being sampled, heavy metals, the mechanical properties of sediment, meiofauna (nematodes and foraminifera), and macrofauna (greater than 1 mm in size), samples were also collected from the same grab sample to facilitate biological and geological comparisons. SUMP operations terminated at 1800 hrs. on 31 January.

SCIENTIFIC PERSONNEL:

Phase 1 - Smith-McIntyre grab (bottom) sampling and multiple core operations:

James Thomas, Party Chief
William Phoel
Clyde MacKenzie
Frank Steimle
Leslie Rogers
Cady Soukup
Richard Hurd
Michael Davis
Richard Carl
Phillip Fallon
Allen Poriando
Nick Prahl
Robert Robinson

Phase 2 - Substrate Monitoring Program - AOML

William Stubblefield, Party Chief
George Lapiene
James Thomas
Clyde MacKenzie
William Phoel
Frank Steimle
Leslie Rogers
Cady Soukup
Richard Hurd
Richard Carl
Phillip Fallon
Allen Poriando
Nick Prahl
Robert Roush
Robert Robinson

CRUISE OBJECTIVES:

Phase 1 - Smith-McIntyre grab (bottom sampling and multiple core operations.

Objective of Phase 1 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 (amoeboid and ciliated protozoans, nematodes and foraminifera), heavy metal burdens in sediments, and mechanical properties in sediments (grain size distribution, etc.). Multiple coring operations for benthic respiration were initiated during this phase of the 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 sample was placed in a labeled jar containing buffered formalin and rose bengal and stored for meiofaunal (nematodes and foraminfera) examination. The remainder of the Smith-McIntyre grab sample was removed from the grab and washed through standard geological screens. The material trapped on screens (larger than 1 mm) was placed in labeled jars and seawater and magnesium chloride were added to narcotize the organisms. After 30 minutes 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 .025 N PAO with liquid starch as the indicator. The salinity samples were stored at Sandy Hook for later analysis using an RS7-B salinometer.

Multiple core casts to obtain undisturbed bottom sediment with overlying bottom water were made at every other station (Fig. 1) to measure sea-bed oxygen consumption. Certain 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. At stations successfully sampled, a minimum of four cores per station were used to measure total oxygen consumption by the sea-bed according to the methods of Pamatmat (1971). The cores were equilibrated for 1 hour in a water bath regulated to within one degree 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 iodometric method using 0.025N 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.

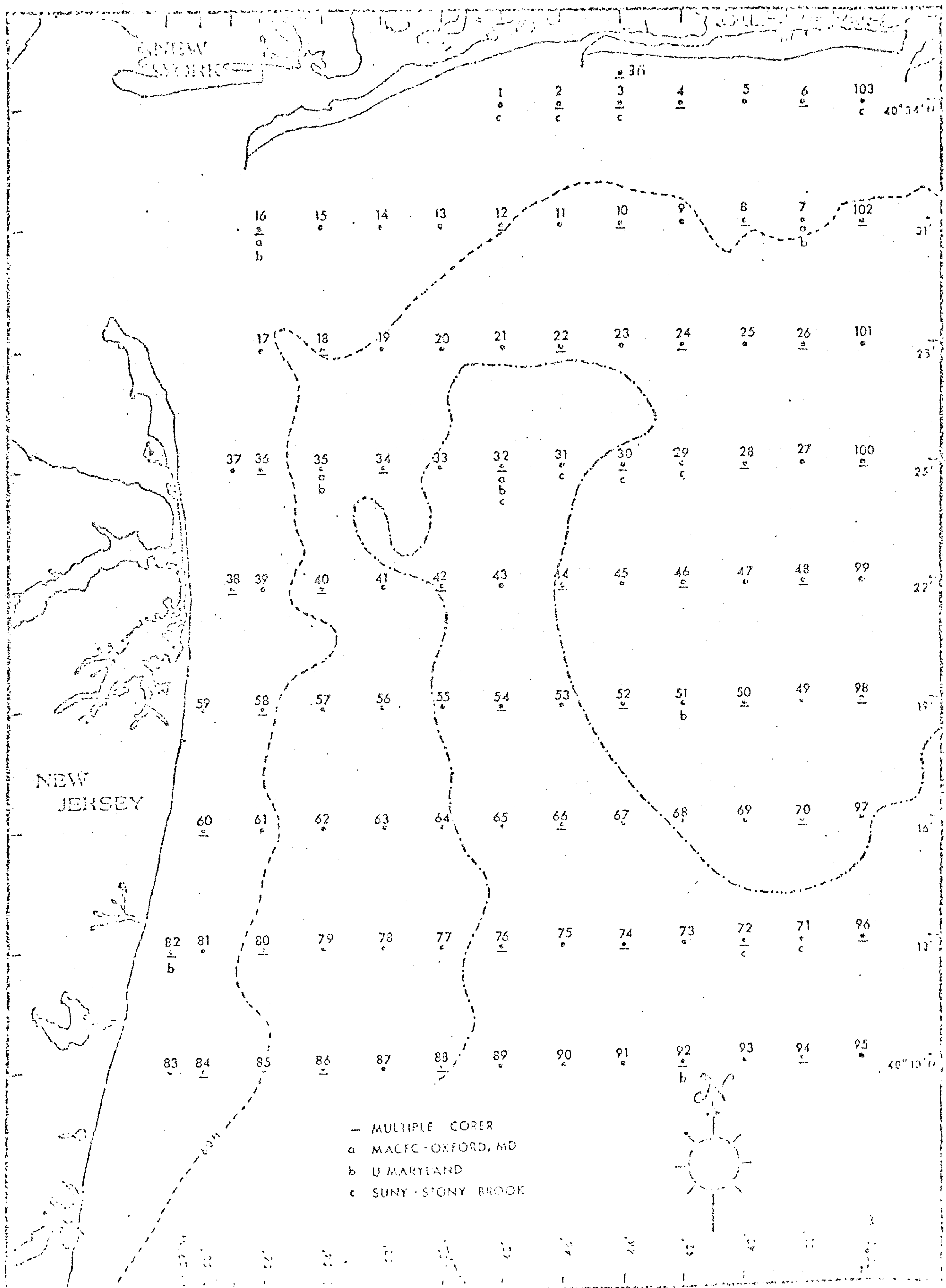
At stations where the multiple corer was used a Niskin bottle with reversing thermometer was attached to the multiple corer to collect bottom water for salinity and dissolved oxygen determinations and to record bottom temperature.

RESULTS:

Each of 103 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.

Five hundred fifteen frozen core samples for heavy metal analyses are awaiting distribution. Five hundred fifteen core samples for geological analyses were transported to Dr. Anthony Cok (Adelphi University) on 22 February and five hundred fifteen samples for meiofaunal (nematodes and foraminifera) examination were transferred to Dr. John Tietjen and Dr. John Lee (CCNY). Macrofaunal samples have been transferred to alchohol and glycerin and are being sorted, counted, identified and recorded on standard forms by contract personnel (Trenton State College).

Forty-five stations (Fig. 1) were sampled to measure total oxygen consumption by the sea-bed. The data from these samples are now being processed.



NEW YORK
NEW JERSEY
40°34'N
31'
28'
25'
22'
19'
16'
13'
40°10'N
— MULTIPLE CORER
a MACFC - OXFORD, MD
b U MARYLAND
c SUNY - STONY BROOK

st

40°34'N, 73°48'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

outh & then west

40°31'N, 73°38'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°48'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 and 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°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°25'N, 73°57'W

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
40°13'N, 73°59'W

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

Additional stations

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°28'N, 73°36'W
40°31'N, 73°36'W
40°34'N, 73°36'W

Samples for examing ciliated protozoa were collected by Cady Soukup and Michael Davis for Dr. Eugene Small (University of Maryland) at stations 7 (control), 16 (control), 32 (sewage sludge), 35 (dredge spoil), 51 (acid wastes), 82 (control), and 92 (control) (Fig. 1). Their cruise report follows:

As expected numbers on this winter cruise were generally low compared to earlier cruises last summer and fall. The small bactivorous Scuticociliates were nearly absent (we are finding them in cultures made from the water, so they were present). Tintinnids, the only group of loricate ciliates, were present in the plankton to a greater extent than has been previously seen. They are reported to eat predominantly microagae and possibly bacteria. A possible factor in their presence is the increased dissolved oxygen values found during this cruise compared with values found on previous cruises. Phytoplankton numbers also were high, comparable to what was found on the August 1973 cruise. The major changes in the phytoplankton were the predominant species, although many of the same species were present both times. Psammobiotic ciliates were less numerous than during the fall months. Diversity did not appear to decrease with decreasing numbers; many of the genera and species found before were represented by at least one individual. As before, these ciliates were found in the sediment at the relatively clean sites.

Photomicrography with the Nomarski phase interference Zeiss microscope proved to be very successful aboard ship. The "bugs" have been worked out of the system and it is now set up so that the vibrations of the ship are nullified. We look forward to using additional sampling methods for the next cruise since several pieces of long awaited equipment have finally arrived. These new sampling methods will give us a further idea of the diversity and numbers of ciliates in the plankton, a component which we have found to be important.

Additional samples for other investigations were also taken during the cruise. A deep water sample to be used as sub-standard water for salinity determinations was taken at station 92 for Robert Reid, Sandy Hook Laboratory. Nine sediment cores (one each from stations 1, 2, 3, 29, 30, 31, 71, 72 and 103) were removed from the Smith-McIntyre grab (bottom) sample and frozen for Drs. Duedall, Araktingi, O'Connor and Miloski at the State University of New York, Stony Brook.

Three stations (16, 32, and 35) were sampled by Cady Soukup for Dr. Thomas Sawyer, MACFC/Oxford, Md. His report follows:

Preliminary observations have been made on surface water and water immediately above the sediment (grab sample water), and cultures have been prepared for further work with pure strains of amoebae.

Direct observations on material from water collected on Millipore filters have been made and are summarized below:

#16 Surface	#32 Surface	#35 Surface
Tintinnids	Tintinnids	Not Done
Euplotes sp.	Euplotes sp.	
Hypotrich (Kahlia?)	--	
Flagellates (colorless)	Flagellates (colorless)	
Asterionella	Asterionella	
Coscinodiscus	Coscinodiscus	
Thalassiothrix	Thalassiothrix	
Skeletonema	Skeletonema	
Chaetoceros	--	
Corethron	Corethron	
Gyrosignum	--	
Guinardia (?)	Guinardia	
--	Melosira	
--	Thallasiosira	
--	Rhizoselenia	
--	Navicula	
--	Silicoflagellate	
--	Ceratium	
--	Gyrosignum	

#16 Bottom	#32 Bottom	#35 Bottom
Scuticociliate	Scuticociliate	Scuticociliate
Flagellates (Colorless)	Flagellates (Colorless)	Flagellates (Colorless)
Asterionella	--	--
Coscinodiscus	Coscinodiscus	Coscinodiscus
Skeletonema	Skeletonema	--
Gyrosignum	Gyrosignum	Gyrosignum
Melosira	Melosira	Clams (Tiny)
Biddulphia	Rhizoselenia	
Nematode		

Comments:

a. Surface water had a high diversity of phyto- and zooplankton with Skeletonema, Thalassiothrix, Chaetoceros, and Asterionella making up most of the biomass.

b. Bottom water had less species diversity than surface water and biomass was sparse.

c. Station #16 (control) was peculiar in that bottom water sample contained numerous fibers in matted clusters (possibly paper). Biddulphia was found for the first time in this sample.

d. Grab water and sediment from station #32 and 35 were black muck and difficult to examine. A colorless diatom, probably Gyrosignum, was present in moderate numbers in #35, a species which has been found in other samples. A second larger Gyrosignum, golden yellow-brown has been found in all stations.

Identifications of marine amoebae will be reported later. Growth studies and the preparation of pure strains require about 30 days to complete.

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Middle Atlantic Coastal Fisheries Center
Pathobiology Investigations
Oxford, Maryland 21654

Date : 2/19/74

Reply to Attn. of: FNE14

To : Dr. J. Thomas, MACFC, Highland, N. J.
THROUGH: Officer in Charge, Oxford, Md.

From : Dr. T. K. Sawyer, Fishery Biology (Research)

Subject: Appendix to Albatross Cruise Report, 1/31/74--(Amoebae)

1. Culture studies on marine amoebae from stations 16, 32, 35 have been completed and are summarized on attached sheet.

2. Twenty-four species of amoebae were recognized from the water column and sediment, 11 from surface water, 18 from grab wash water, and 16 from sediment cores. Small bactiverous amoebae were numerous in sediments. Sewage and dredge spoil sediments had a remarkably large species diversity.

3. Preliminary studies indicate that suitable food microorganisms are present in the compacted muck of sewage and dredge spoil areas and support the growth of about a dozen species of marine amoebae. In contrast, a narrow diversity of algae and diatoms occur in the same substrate, primarily Coscinodiscus and Gryrosigma.

Enclosure

Genus/species	Surface Water *	Grab Water	Sediment
Flabellula sp.	-	32	32,35
Dactylosphaerium sp.	16,32	16,32	-
Paramoeba pemiquadensis	-	16	16,32,35
Paramoeba aesturina	16	16	16,35
Vexillifera sp. #1	-	32,35	-
Vexillifera sp. #2	16	-	35
Triainamoeba sp.	-	35	-
Unda maris	32	-	-
Unda sp.	-	16,32,35	16
Hyalodiscus sp.	32	32	32
Rugipes vivax	32	16,32,35	32,35
Rugipes sp. #1	-	16,35	35
Rugipes sp. #2	32	32	-
Rugipes sp. #3	32	-	16
Vannella sp.	-	16,32	32
Platyamoeba sp.#1	-	32,35	32,35
Platyamoeba sp. #2	32	16,32,35	16,32,35
Platyamoeba sp. #3	-	32	-
Platyamoeba sp. #4	-	-	32
Lingualamoeba sp.	-	32	-
Styxamoeba sp.	-	-	35
Cochliopodium sp.	-	32,35	16
Limax	16	32	16,32,35
Saccamoeba	16	-	-
	11/24	18/24	16/24

*Station 35 not sampled.

Cruise Report R. V. Albatross IV - February 1974

INTRODUCTION

Phase 3, the groundfish assessment segment of the cruise, began on February 1, at 1400 hours. The last station was made at 0700 hours on February 5. Because of weather conditions the vessel did not dock at Sandy Hook but steamed for Woods Hole. Sandy Hook personnel disembarked at Woods Hole the morning of February 6.

Scientific Personnel:

Phase III --

A. Pacheco - Party Chief
R. Murchelano - Oxford
V. Anderson
J. Moore - Salem College
W. Keese - Chesapeake Biol. Lab.
Mal. Silverman - Watch Chief
J. Ziskowski
E. Steady
S. Roberts

Cruise Objectives

Groundfish trawl stations were made on the Albatross IV from February 1 through February 5 for the purpose of assessing groundfish resources, collecting finfish tissues for heavy metals and pesticide analyses, and observing the catch for the incidence of fin rot. Hydrographic determinations of surface and bottom salinity and temperature were made at each station.

Operations

The coastal area covered is between Shinnecock Inlet, N.Y. to 8 miles south of Barnegat Inlet, N.J. Trawl station locations were selected prior to the cruise by a random selection in eight strata with depths ranging from 10 to 50 meters. The MESA apex boundary (within the dashed lines) and the location of stations are shown in Figure 1.

A standard station consisted of temperature and salinity samples taken at the surface and bottom; and a ½ hour tow with a 3/4 Yankee trawl with a 54' sweep. The catch was sorted by species, weighed and measured, all fish were examined by personnel from Pathobiology Investigations for incidence of fin rot.

Results

Fifty trawl hauls were made during phase III of the cruise, of these 27 were in the MESA apex area with 13 and 10 made in control areas east and south, respectively of the apex. The catch for all areas is summarized by catch wt., catch per tow (C/T) and frequency of occurrence (% occur) in Table I.

The most dominant species by weight were little skate, 753 lbs.; cod, 722 lbs; and yellowtail flounder, 330 lbs. Cod, yellowtail, silver hake and winter flounder all of commercial and recreational value comprised 63% of the bony fish catch. A difference in the frequency of occurrence of cod between the MESA area (56%) and the control areas (87%) was observed.

Station positions and hydrographic data are presented in Table II. Bottom temperatures ranged from 4.1 to 7.8°C and bottom salinities from 27.1 to 33.4 ‰.

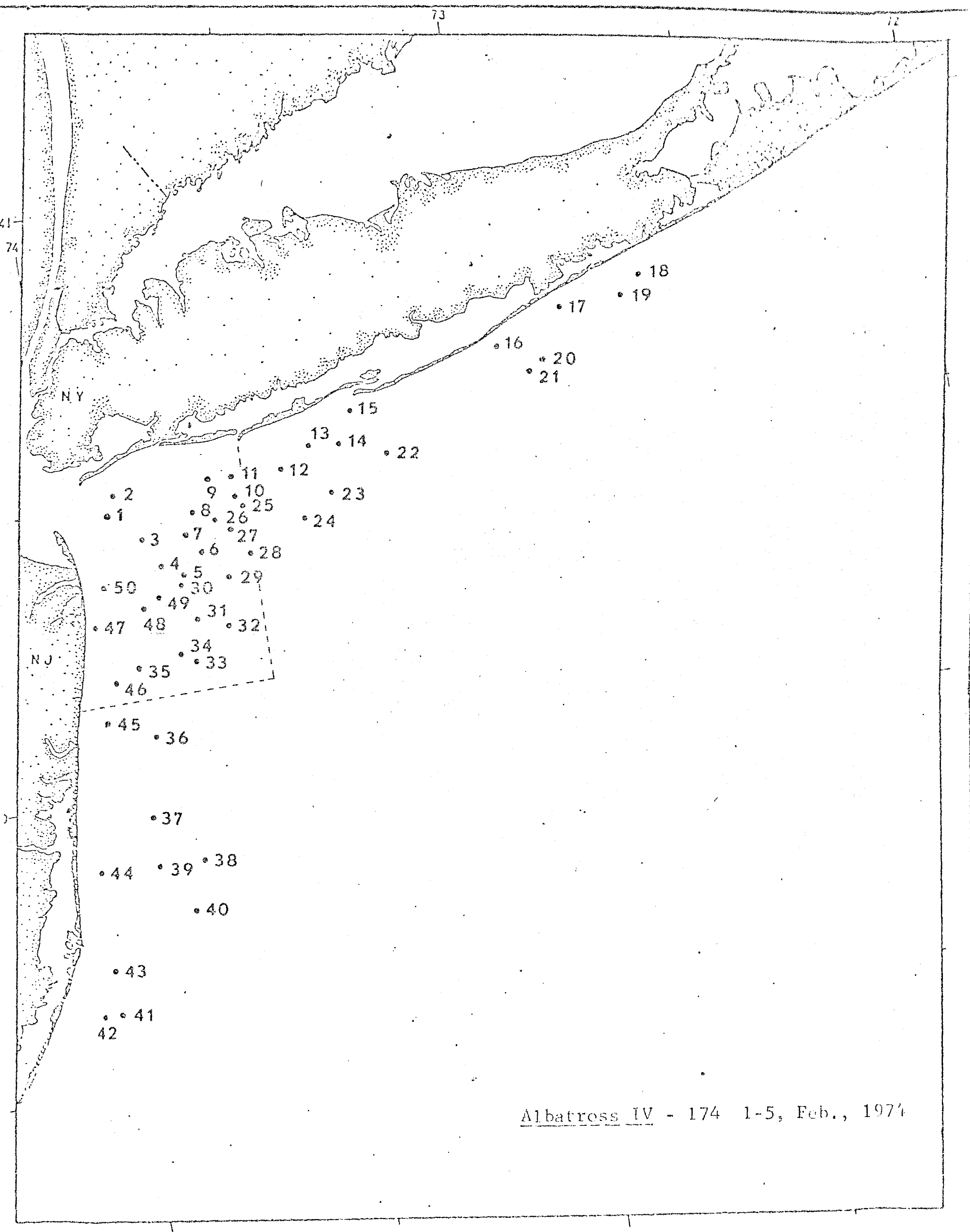
Special collections of hake, flounders and mackerel were made for pesticide and heavy metal studies. These samples were forwarded to the NMFS laboratory at College Park, Maryland and the Environmental Protection Agency laboratory at Gulf Breeze, Florida.

Submitted by:

T. R. Azarovitz
Coastal Resource Assessment Investigations

Approved by:

Arthur S. Merrill, Director
Resource Assessment Investigations



Albatross IV - 174 1-5, Feb., 1974

able I. Species composition and weight (in lbs) Albatross IV 1-74

rea	MESA			East			South			Tot
ows	27			13			10			
pecies	Catch Wt.	C/T	% Occur	Catch Wt.	C/T	% Occur	Catch Wt.	C/T	% Occur	% Occ
piny dog	13	.5	7	38	2.9	23	116	11.6	40	18
ittle skate	502.5	18.6	96	129	9.9	92	121.5	12.2	90	94
inter skate	31	1.1	11	53	4.1	46	7	0.7	10	20
Elasmobranch Total	546.5	20.2		220	16.9		244.5	24.5		
lueback herring	0.3		11	0.1		8	1	0.1	10	10
lewife	20.9	0.8	56	0.4		31	19.1	1.9	80	54
merican shad	6	0.2	7				15	1.5	20	8
t. herring				1.3	0.1	31	2.1	.2	30	14
oosefish	83.5	3.1	15	90	6.9	38	25	2.5	30	24
t. cod	305	11.3	56	215	16.5	85	202	20.2	90	70
ilver hake	91.7	3.4	85	23.1	1.8	77	57	5.7	100	86
ed hake	70.7	2.6	74	0.5		38	10.2	1	40	58
cean pout	34.3	1.3	48	21	1.6	46	43.1	4.3	70	52
t. silverside	0.3		11	0.4		31				14
hreespine stickleback				0.1		8				2
. pipefish	.3		11	0.1		8	0.1		10	10
unner	4.2	0.2	15							8
. Sand lance	0.2		7	0.1		8	0.3		30	12
t. mackerel							31	3.1	10	2
ea raven	6.5	0.2	7	1		8	5	.5	10	8
onghorn sculpin	21.5	0.8	67	3.5	0.3	46	1.5	.2	30	54
easnail							0.1		10	2
ourspot fldr.	0.4		15							8
indowpane	143	5.3	93	56	4.3	77	54	5.4	100	90
tropus sp.	0.4		15	0.3		23	0.4		40	22
tch fldr.	3	0.1	4							2
llowtail	180	6.7	85	84.5	6.5	100	65	6.5	100	92
nter fldr.	61.5	2.3	85	44.5	3.4	100	15.5	1.6	70	86
Fish Total	1033.7	38.3		541.9	41.7		547.4	54.7		
uid				1.2		23	3.1	.3	20	10
bster	37	1.4	33							18
ncer crabs	48.5	1.8	89	5	.4	62	5	.5	50	74
ue crab				0.5		8				2
lico crab	0.2		7							4
Invert. Total	85.7	3.2		6.7	.5		8.1	.8		
tal for area	1665.9	61.7		768.6	59.1		800	80		

tal for all areas Wt. 3234.5 C/T 64.7

le II. Station data and hydrographic results - Albatross IV 1-74

Date	EST Time	Location MESA SQ Lat.	Long.	M. Depth	Temp °C Sur.	Bot.	Salinity Sur.	Bot.
2/1	1402	40°29'	73°53'	11	6.2	7.0	29.94	32.73
2/1	1517	40°31'	73°52'	11	5.5	6.7	28.69	32.89
2/1	1644	40°26'	73°49'	28	5.1	5.5	27.93	33.34
2/1	1844	40°23'	73°47'	35	5.5	7.8	28.22	33.37
2/1	2010	40°22'	73°44'	24	5.0	7.0	29.61	32.89
2/1	2137	40°24'	73°41'	24	4.8	7.2	29.24	33.04
2/1	2255	40°26'	73°43'	27	5.0	7.5	29.38	33.33
2/2	0003	40°28'	73°42'	22	5.0	6.5	31.05	32.89
2/2	0125	40°31'	73°39'	15	5.0	6.2	30.99	32.70
2/2	0230	40°29'	73°36'	20	5.2	5.7	30.00	32.33
2/2	0358	40°31'	73°36'	18	5.0	6.0	31.83	32.68
2/2	0539	40°31'	73°29'	18	4.5	5.0	30.94	31.92
2/2	0714	40°33'	73°25'	15	4.0	4.2	31.37	31.35
2/2	0833	40°33'	73°21'	16	4.5	4.5	31.06	31.81
2/2	1007	40°36'	73°19'	15	3.8	3.8	31.53	31.51
2/2	1318	40°40'	72°58'	18	4.0	4.2	31.90	31.92
2/2	1521	40°43'	72°49'	22	4.5	4.5	32.00	32.05
2/2	1745	40°45'	72°38'	26	4.5	5.0	32.19	32.13
2/2	1934	40°43'	72°41'	10	5.0	5.0	32.21	32.19
2/2	2049	40°38'	72°52'	29	5.0	5.0	32.23	32.23
2/2	2203	40°37'	72°54'	10	5.0	5.1	32.32	32.32
2/3	0010	40°31'	73°15'	24	4.5	4.5	32.26	32.34
2/3	0128	40°28'	73°23'	26	4.2	4.5	31.95	31.95
2/3	0241	40°26'	73°27'	24	4.2	4.5	32.00	32.04
2/3	0423	40°28'	73°35'	20	4.0	4.1	31.37	31.38
2/3	0537	40°27'	73°39'	21	4.0	5.5	31.25	31.27
2/3	0655	40°26'	73°37'	19	3.8	4.4	31.34	31.36
2/3	0936	40°23'	73°35'	20	4.6	5.5	31.61	31.59
2/3	1120	40°21'	73°38'	22	4.2	6.7	31.50	31.68
2/3	1253	40°21'	73°45'	27	4.7	7.2	31.45	31.55
2/3	1446	40°17'	73°43'	29	4.0	6.7	31.41	31.44
2/3	1650	40°16'	73°39'	27	4.5	5.2	31.66	31.65
2/3	1825	40°13'	73°44'	35	4.5	6.5	31.76	31.80
2/3	1944	40°14'	73°46'	50	4.0	6.2	31.39	32.90
2/3	2126	40°13'	73°52'	18	4.5	4.8	30.74	30.77
2/3	2320	40°06'	74°51'	26	4.5	4.7	31.57	31.55
2/4	0149	39°58'	73°53'	22	5.2	5.5	31.99	32.01
2/4	0353	39°53'	73°47'	27	6.0	6.5	32.91	32.91
2/4	0606	39°53'	73°53'	24	4.8	5.4	31.90	31.85
2/4	0800	39°48'	73°49'	27	5.8	6.0	32.52	32.56
2/4	1114	39°38'	74°01'	20	4.5	5.0	31.90	31.89
2/4	1258	39°38'	74°03'	15	4.5	4.7	31.95	31.87
2/4	1412	39°43'	74°01'	13	4.2	4.5	31.16	31.41
2/4	1650	39°53'	74°01'	16	4.5	4.8	31.37	31.38
2/4	1918	40°08'	73°57'	20	4.5	4.7	31.06	31.03
2/4	2105	40°12'	73°55'	17	3.6	4.8	28.77	30.15
2/4	2248	40°18'	73°57'	12	4.2	-	26.29	27.08
2/5	0042	40°19	73°50'	24	4.2	4.6	31.00	31.49
2/5	0207	40°20'	73°48'	38	3.0	4.3	30.66	31.02
2/5	0425	40°22'	73°55'	16	4.1	-	27.49	-

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Middle Atlantic Coastal Fisheries Center
Pathobiology Investigations
Oxford, Maryland 21654

Date : *2/28/74*

Reply to Attn. of:

To : *Dr. J. Thomas*

From : *R. A. Murchelano*

Subject: *Fin rot disease prevalence, RV Albatross IV, Feb. 1-6, 1974*

The prevalence of fin rot disease in demersal fish was determined by the Pathobiology Investigations during a groundfish assessment cruise conducted on the RV Albatross IV from February 1-6, 1974. All fish collected by otter trawl (particularly flounders) were examined for the presence of fin rot disease and other gross anatomic anomalies. Altogether 51 trawl stations were occupied during the 5-day cruise period. The area sampled included the MESA New York Bight apex and immediately adjacent waters to the south and east.

In all, 1227 flounders were examined; only 8 (0.006%) exhibited fin rot. Winter flounder accounted for 5/1227 (0.004%) of the flounders with fin rot and yellowtail flounder for 3/1227 (0.002%). Of 560 windowpane flounder examined, none displayed any evidence of fin rot; 5/215 (0.02%) winter flounder and 3/452 (0.006%) yellowtail flounder exhibited fin rot. Flounders with fin rot were obtained at trawl stations 1 (40° 29' x 73° 53'), 4 (40° 23' x 73° 46'), 11 (40° 31' x 73° 35'), 12 (40° 32' x 73° 30') and 36 (40° 06' x 73° 51'). The overall prevalence of fin rot disease was very low in the fish examined.

Submitted by:

John B. Pearce, Director
Ecosystems Investigations

James P. Thomas, Chief
Biological Oceanography

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

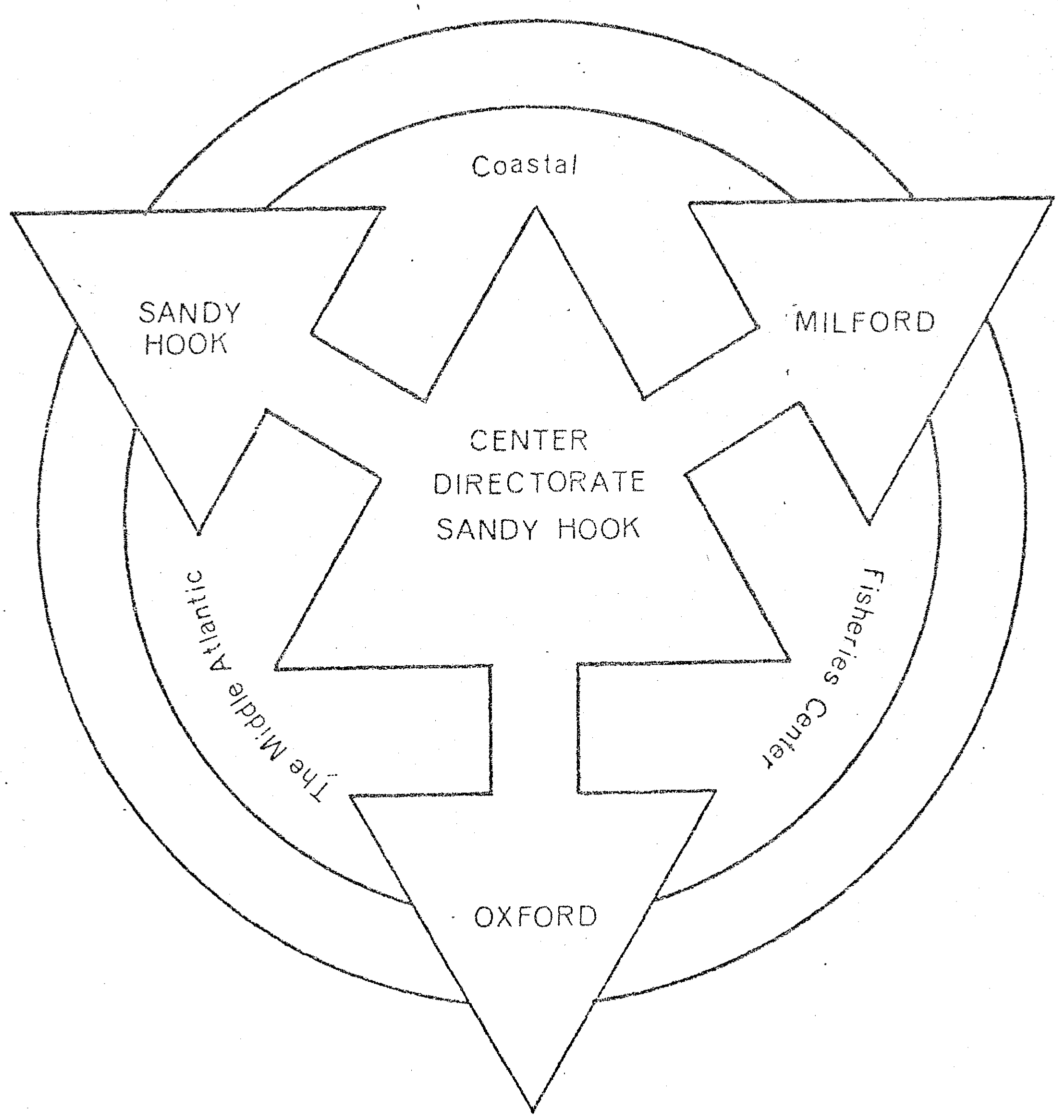
March 11, 1974

APPENDIX B

CRUISE REPORT
NOAA Ship *Oregon II*
21 March – 4 April 1974

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

MIDDLE ATLANTIC COASTAL FISHERIES CENTER



June 12, 1974

CRUISE REPORT

NOAA Ship Oregon II

21 March - 4 April 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

(Funded by NOAA-MESA Appropriations)

INTRODUCTION:

The NOAA Ship Oregon II arrived at Sandy Hook (SH) at 1140 on 21 March 1974. RAYDIST had been previously installed at Pascagoula, Mississippi. Discussion ensued with Capt. Adams concerning rigging for Smith-McIntyre and multiple cores. Laboratory space was assigned to each subtask. Loading commenced at 1300. Electrical requirements (75 amps) for seabed oxygen consumption studies were a major problem. Loading was completed by 0300 on 22 March. Due to weather ship's departure was delayed until 0900 on 22 March. Following departure, RAYDIST was calibrated at Ambrose Light Tower by two NOS officers, part of our scientific complement. Sampling began at 1200 on 22 March at station 1 near Long Island. Sampling was slow because of the awkwardness of rigging and the additional manpower required to handle the gear. Sampling continued uneventfully until a powerful cold front came through the area on 24 March causing additional delays because of slowness of personnel due to ice on deck and lines and additional bulk of clothing which hampered their actions.

On 27 March at 1647 we received a new stainless steel Smith-McIntyre grab built at Rhode Island and brought to us via R/V Shang Wheeler. The new grab worked extremely well and much better than our previous grabs.

On 29 March we were forced to suspend sampling due to weather (snow, winds E at 25 kns with gusts at 30 - 40 kns). Attempted RAYDIST calibration near New Jersey coast, but visibility was too poor. Thus, went to Ambrose Light Tower and calibrated there. Thence to Sandy Hook by 2135 to escape weather. Docked at SH at 0830 on 30 March to wait out gale force winds.

Departed SH on 31 March at 0830 to return to apex of Bight. Accomplished RAYDIST calibration off N. J. coast and then ran to station 92 to commence sampling again. RAYDIST continued to be trouble-free.

By 1 April at 1300 we had completed the standard grid of stations. Additional stations were then added for Smith-McIntyre bottom grab sampling for seabed oxygen consumption measurements, and for sampling ciliated protozoa. With cores for seabed oxygen consumption measurements still running, the vessel returned to SH on 3 April at 1800. These cores were processed through the night and the seabed oxygen consumption equipment was offloaded the following morning. Equipment for macrofauna, ciliated protozoa, and RAYDIST operations was offloaded during the evening after arriving at SH. Offloading of the vessel was completed by 1130 on 4 April 1974. The vessel departed SH at 1600 bound for Miami.

SCIENTIFIC PERSONNEL:

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

James Thomas - Party Chief
William Phoel
Frank Steimle
Clyde MacKenzie
Leslie Rogers
Cady Soukup
Ken Dewire
Bruce Arnold
Ken Holden
John Shortheff
Phillip Fallon
Jim Machaitis
Rob Hillman

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 (amoeboid and ciliated protozoans, nematodes and foraminifera), heavy metal burdens in sediments, and mechanical properties in sediments (gran 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 33 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 sample was placed in a labeled jar containing buffered formalin, rose bengal, and clam shell chip as additional buffer and stored for meiofaunal (nematodes and foraminfera) 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 and seawater and magnesium chloride were added to narcotize the organisms. After 30 minutes 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 liquid starch 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 every other station plus additional stations (Fig. 1) to measure seabed oxygen consumption. Twelve cores were taken at stations 32 and 108 to test for variability. Certain 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 total 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 one degree 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 iodometric 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 after 12 hours. 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. 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 (one each) were taken at stations 104, 105, 106 and 107.

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. Additional core samples (two from an additional grab sample) were taken at selected stations (sta. 1, 2, 3, 5, 29, 31, 32, 33, 34, 35, 71, 72) for Dr. Duedall and frozen (Fig. 1). These cores have since been distributed to Dr. Duedall. 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).

Fifty-seven stations (245 cores) (Fig. 1) were sampled to measure total oxygen consumption by the seabed. The data from these samples are now being processed.

Figure 1.

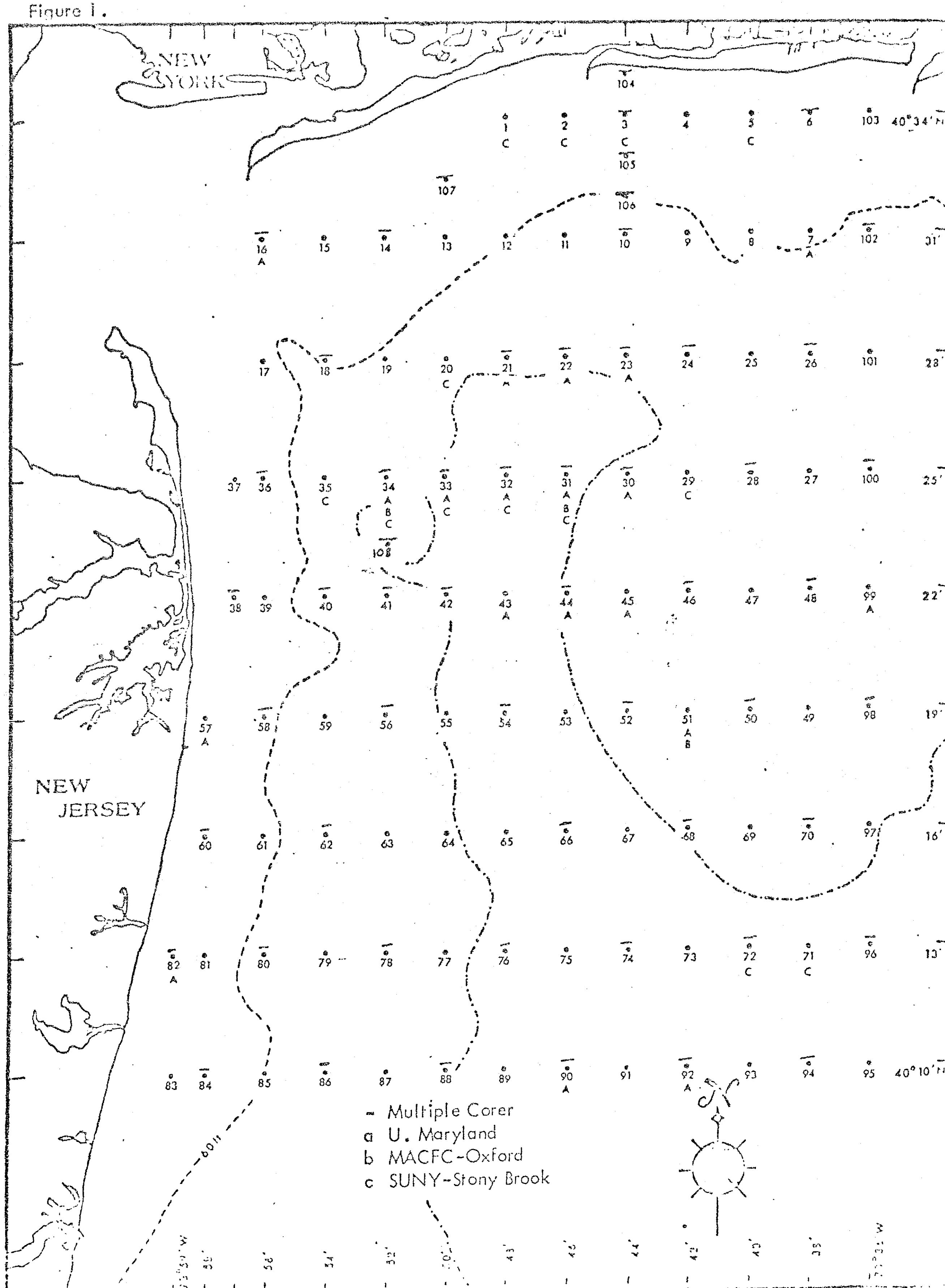


Figure 1.

East

40°34'N, 73°48'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°38'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°48'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°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°25'N, 73°57'W

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
40°12'N, 73°59'W

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

40°34.75'N, 73°44'W
40°33'N, 73°44'W
40°32'N, 73°44'W
40°31'N, 73°50'W
40°26.5'N, 73°52'W

Samples for examining ciliated protozoa were collected by Cady Soukup and Ken Dewire for Dr. Eugene Small (University of Maryland) at selected stations (Fig. 1). Sediments only were sampled at stations 21, 22, 23, 29, 30, 32, 33, 43, 44, 45, and 90. Sediments and water were sampled at stations 7, 16, 31, 34, 51, 82 and 92. Two additional stations (sta. 57 and 99) were sampled using the multiple corer to collect protozoan samples.

Their Cruise Report follows:

Several new sites and techniques for protozoological sampling were added to those previously used during the recent cruise aboard the R/V Oregon II from 21 March to 3 April 1974. Both sediment and water samples were taken using the standard methods, Smith-McIntyre bottom sampler for the sediment and 30 l. Nisken water sampler for the water column. Seven sites strategically placed in both the impacted and (assumed) control areas were fully sampled in this manner, an eighth site was sampled for the sediment only (Lackey jars to check for possible encysted forms, Uhlig extraction to find interstitially living forms) due to its proximity to another fully sampled site.

Ten sites proximal to the sewage sludge dump site were also sampled, sediment only. Aliquots of sediment were placed in Lackey jars for laboratory monitoring over a period of at least 6-8 weeks. Stained and identified ciliates from these sites will give us some indication of the extent of the sewage sludge effects in this area.

A new peristaltic pump, recently (finally!) acquired, proved successful in obtaining surface water samples. This pump will be used in conjunction with a Foerst centifuge for summer sampling.

Two sites, chosen in order to extend the scope of our sampling in the future, were sampled for sediment using the multiple corer. The cores obtained were either placed into a jar or an Uhlig extraction was done. The extractions were successful, results from the jars will be forthcoming.

Overall results, given non-quantitatively and in a very 'dirty' fashion, seem to indicate a lessening of the water column forms at this point in the seasonal cycle and a slow increase in the sediment forms. Further lab work remains to be done in both areas before a certified statement can be made.

Samples for examing amoeba were collected at selected stations (Fig. 1) by Cady Soukup and Ken Dewire for Dr. T. K. Sawyer (NMFS/MACFC/Oxford). His cruise report follows:

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Middle Atlantic Coastal Fisheries Center
Pathobiology Investigations
Oxford, Maryland 21654

te : 4/8/74

Reply to Attn. of:

: Dr. J. Thomas, MACFC, Highlands, N. J.
THROUGH: Officer in Charge, MACFC, Oxford, Md.

om : T. K. Sawyer, Fishery Biologist (Research)

bject: Oregon II Cruise, March-April 1974

A. 1. Three stations were sampled for marine amoebae: (1) 51 (acid waste), (2) 34 (dredge spoil), (3) 31 (sewage spoil). Direct observations were made on marine organisms in surface water and sediment cores from #51, grab water and sediment from station 31, and grab water only from #34.

2. Preliminary results from the cruise samples confirm several important observations from 6 previous cruises:

a. Paramoeba occurs throughout the water column and may be recovered from all stations throughout the year.

b. Small rounded bactiverous amoebae occur in sediments at all stations.

c. Small bactiverous amoebae in the sediments also are present throughout the water column except for Cochliopodium.

d. Large amoebae that feed on algae, diatoms, etc., have never been found in sediments.

e. Acid waste and control stations yield about 50% more meiofaunal species (including diatoms, ciliates, dinoflagellates, tintinnids, sarcodina) than do sewage and dredge stations.

f. Sediments from sewage and dredge spoil areas are dense compacted mucks which are probably biologically active only at the sediment: water interface. Marine "sediment" amoebae do not appear to be spatially or temporally limited in the New York Bight, and possibly are among the most active biodegraders of bacteria and micro-detritus.

g. Marine amoebae that revert to a rayed or floating form probably move vertically and horizontally with little effort, and this transformation probably accounts, in part, for their univeral distribution.

3. Tentative identifications are as follows:

Station 51 - Acid

Surface Water

Nitzschia
Leptocylindrus (?)
Chaetoceros
Rhizosolenia
Coscinosira
Asterionella
Tintinnid
Coleps (?)
Dinophysis
Ceratium tripos
C. longipes
Peridinium sp.
P. ovatum
Dinoflagellates (small)
Heliozoan
Paramoeba aesturina
Platyamoeba sp. #1
Platyamoeba sp. #2

Diatoms	6
Tintinnid	1
Ciliates	1
Dinoflag-ellates	5
Heliozoa	1
Amoebae	3
	17 species

Sediment Core

Flabellula sp.
Vexillifera sp.
Rugipes sp.

Lingulamoeba sp.

Rugipes vivax
Platyamoeba #1
Platyamoeba #2

Amoebae	7
	7 species

Total Species - 14
8
22

Station 34 - Dredge

Grab Water

Coscinodiscus
Skeletonema
Melosira
Scuticociliates
Zoospores
Nematode
Rugipes sp.
Vannella sp.
Paramoeba aesturina

Surface Water

Not done

Sediment

Not done

Diatoms	-	3
Ciliates	-	1
Amoebae	-	3
		7 species

Station 31 - [illegible]

Grab Water

Coscinodiscus
Scuticociliates
Zoospores
Flabellula
Cochliopodium
Rugipes vivax

Sediment Core

Paramoeba peniquadensis
Rugipes vivax
Rugipes sp.
Platyamoeba sp. #1
Platyamoeba sp. #2
Zoospores

Diatoms	-	1
Ciliates	-	1
Amoebae	-	7
		9 species

B. Conclusions:

1. Field sampling for qualitative and distributional data is almost complete. Two future collections (June and September 1974) will complete a one year seasonal study and termination of this study will occur in September 1974 unless otherwise directed.

2. Quantitative studies are needed in the future to determine whether differences occur at different sites.

3. *In situ* benthic sampling is needed to determine whether active feeding amoebae are present in the sediments, or whether they are in an arrested or resting stage. Large populations which appear in laboratory cultures are not necessarily in the active feeding stage at the time of collection.

4. Microbiological studies are needed to determine the types of organisms which serve as real or potential food for marine protozoa.

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NATIONAL MARINE FISHERIES SERVICE
Middle Atlantic Coastal Fisheries Center
Pathobiology Investigations
Oxford, Maryland 21654

ate : 4/26/74

Reply to Attn. of:

: Dr. J. Thomas, MACFC, Highlands, N. J.
THROUGH: Officer in Charge, Oxford, Md.

om : Dr. T. K. Sawyer, Fishery Biologist (Research)

bject: Appendix to OREGON II Cruise Report, 4/8/74 - (Amoebae)

1. Culture studies on marine amoebae from stations 31, 34, and 51 have been completed and are summarized on attached sheet.

2. Sixteen species were recognized from surface water, grab water, and sediment cores. Six were in the surface water of station 51, four in grab water of station 34, seven in the sediment of station 31, and eleven in sediment of station 51.

3. Results from the OREGON cruise showed again that acid waste sediments have a diversity of amoebae comparable to control station sediments, and sewage and dredge sediments have about half of the total species recovered.

Enclosure

Species	Station 51* Surface	Station 51 Core	Station 34** Grab	Station 31 **** Core
amoeba	-	+	-	-
moeba aesturina	+	-	+	-
emaquidensis	-	-	-	+
eomyxan sp.	+	+	+	-
llifera sp. #1	-	-	+	-
enamoeba sp.	-	+	-	+
ellula sp. #1	-	+	-	+
ellula sp. #2	-	+	-	+
amoeba sp.	-	+	-	-
liopodium sp.	-	+	-	+
pes vivax	+	+	-	+
pes sp. #1.	-	+	-	-
yamoeba sp. #1	+	-	-	-
yamoeba sp. #2	+	+	-	+
ulamoeba sp.	+	-	+	-
x	-	+	-	-
	6/16	11/16	4/16	7/16

*Acid Waste
**Dredge
***Sewage

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

John McNulty

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

ite : April 11, 1974

Reply to Attn. of: FNE18

: Distribution List

John B. Pearce VB

om : John B. Pearce, Officer-in-Charge and Director, Ecosystems Investigations

bject: Use of RAYDIST

The attached memo from Dr. Thomas indicates what appears to be an order of magnitude improvement in our navigational capabilities. I gather from Dr. Thomas' memo that all personnel involved in the recent Oregon II cruise should be congratulated on their cooperation in making the most effective use of this sophisticated navigational system.

Attachment:

DISTRIBUTION:
Cdr. Swanson
J. Thomas
Dr. O'Connor
Capt. Adams
W. Phoel
Cdr. Austin
Center
Dr. McNulty ✓

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
MACFC, Sandy Hook

ite : April 8, 1974 Reply to Attn. of:

: John B. Pearce, Officer-in-Charge and Director, Ecosystems Investigations

om : James P. Thomas, Chief, Biological Oceanography Investigations

bject: Greatly Improved Accuracy and Precision in MESA Biological Sampling during Cruise on NOAA Ship Oregon II, 21 March - 4 April 1974

Sampling was more accurate and precise than ever before for a major cruise in the apex of the New York Bight concerned with biological sampling. Most samples were taken within one-eighth of a nautical mile of the true station. All but several samples were taken within one-quarter of a nautical mile of the true station.

The operation of RAYDIST during this cruise was a complete success. Two NOAA-NOS officers, Lts. Bruce Arnold and Ken Holden, are to be commended for their most successful RAYDIST operations. RAYDIST calibrations were fast, efficient, and precise taking little cruise time. RAYDIST equipment functioned superbly and without difficulty. Cdr. Austin's efforts along these lines are most appreciated. The two NOS officers not only assisted in guiding the vessel to station, but once there, they monitored all sampling to insure that it occurred within one-quarter of a nautical mile of the true station point. They also recorded and plotted the location of each Niskin, grab, and multiple corer cast. Such plots and data logs are available for inspection.

Other factors that contributed to such precise sampling included 1) the use of a lighted temporary buoy set at each station, 2) the positioning of the sampling gear forward where the bridge could observe it, and 3) the use of the main engine throughout the entire station to maintain vessel heading and location. Captain Adams of the Oregon II was most cooperative in this effort. Mr. William Phoel is to be commended for the successful use of a temporary buoy at each station.

9 APR 1974

JOHN B. PEARCE

APPENDIX D

Progress Report

to

National Oceanic and Atmospheric Administration

PHYTOPLANKTON PRODUCTIVITY, NUTRIENT RECYCLING AND ENERGY FLOW IN THE INNER NEW YORK BIGHT

September 1973 - February 1974

Contract No. 03-4-043-310

Thomas C. Malone

Principal Investigator

INTRODUCTION

The composition and quantity of suspended organic and inorganic material in the water column will have a pronounced effect on energy flow through pelagic and benthic food chains. The purpose of our research contribution to the MESA Project is to determine the relative importance of organic detritus and phytoplankton as food sources in planktonic food chains on a seasonal basis in the New York Bight. In this context, the dumping of sewage sludge and dredge spoils, the Hudson and Raritan River Estuaries, and the benthos represent major sources of detritus and dissolved nutrients which influence the growth and standing crop of planktonic organisms of the Bight ecosystem. Phytoplankton standing crop will be a function of growth within the system and advection of phytoplankton into or out of the system. Evaluation of the effects of current dumping practices is dependent on the degree to which we understand the importance of estuarine related inputs which vary in proportion to river flow.

The objectives of our first years research are to document temporal and spatial variations in suspended sediments, organic detritus, inorganic nutrients, and phytoplankton and to determine the environmental processes responsible for these variations. The distributions of these variables will be evaluated in terms of location, time of year, fresh water volume flow of the Hudson River, water column stratification, zooplankton abundance and phytoplankton productivity.

This report presents the results of our first six months of work (September 73 through February 74) with the exception of the February zooplankton data and the data for phytoplankton cell density and taxonomic composition. The report is intended to be a presentation of data and includes little data analysis.

We would like to thank Dr. Chris Garside for kindly performing the nutrient analyses.

RESULTS

Sampling Program

The station positions and designated MESA Areas are listed in Table A. Of the 16 stations occupied each month, four are currently in the lower Hudson River Estuary and twelve are in the apex of the New York Bight (Fig. 1). The stations are located along four transect designated by letters. The "A" transect includes station in the lower Estuary from Spyten Dyvil to the Lower Bay. The three remaining transects radiate out into the Bight from a common station near the mouth of the Estuary (Station P1). The "B" transect run east parallel to the Long Island coastline. The "C" transect run southeast across the sludge dumping area, and the "D" transect runs south across the dredge spoil dumping area.

The reference stations (B4, C5, D5) are located far enough from the dumping grounds to be free of the direct effects of dumping but close enough so that water depths are similar to the dumping ground stations (C2, C3, C4, D2, D3, D4).

Data Presentation

The data available to date are tabulated in Tables I - X by cruise. The units for the tabulated variables are given in Table B. We have expanded the phytoplankton fractionation work (Tables V, VI and VII) so that we are now measuring netplankton ($> 20\ \mu$) and nanoplankton ($< 20\ \mu$) photosynthetic capacity, primary productivity and chlorophyll <u>a</u> at 7 stations (A3, P1, B4, C3, C5, D3 and D5). An Eppley pyranometer was installed on the RV COMMONWEALTH prior to our December cruise so that we have continuous records of incident light energy for all cruises from December 1973 on. Data on phytoplankton cell densities and taxonomic composition (Table VIII) will not be available until this summer.

We contacted Mr. Kenneth Darmer of the Water Resources Division of the U. S. Geological Survey for data on the fresh water discharge of the Hudson River, but it will be several months before the 1973 data is available.

TABLE A. Position, Mesa-Area identification and location of stations.

	STATION	POSITION	MESA AREA	LOCATION
	A1 (M1)	40°52'53"N, midchannel		Spyten Dyvil
	A2 (M2)	40°49'31"N, midchannel		Manhattan
	A3 (M3)	40°40'18"N, 74°02'18"W	40407402	Upper Bay
Drop	(M4)*	40°38'30"N, 74°02'18"W	40387402	Upper Bay
	A4 (M5)	40°35'18"N, 74°02'39"W	40357402	Lower Bay
	P1 (M6)	40°28.6' N, 73°54.0' W	40287354	Sandy Hook
Add	B2**	40°29.1' N, 73°46.8' W	40297346	Long Island Transect
Add	B3**	40°29.4' N, 73°40.5' W	40297340	" " "
	B4 (M16)	40°30.0' N, 73°30.0' W	40307330	" " "
	C2 (M7)	40°25.4' N, 73°48.0' W	40257348	Sludge Transect
	C3 (M8)	40°24.0' N, 73°45.5' W	40247345	" "
	C4 (M9)	40°22.4' N, 73°42.0' W	40227342	" "
	C5 (M10)	40°16.7' N, 73°32.4' W	40167332	" "
	D2 (M11)	40°24.0' N, 73°53.0' W	40247353	Dredge Spoil Transect
	D3 (M12)	40°22.0' N, 73°52.5' W	40227352	" " "
	D4 (M13)	40°20.0' N, 73°52.1' W	40207352	" " "
	D5 (M14)	40°10.0' N, 73°50.0' W	40107350	" " "
Drop	(M15)*	40°23.0' N, 73°49.0' W	40237349	" " "

* Occupied during Sept. - Dec., 1973 and Jan., 1974 only.

** Occupied from Feb., 1974 on.

TABLE B. Description of variables listed in Tables I through X.

TABLE	VARIABLE	UNITS	DESCRIPTION
I	Z	meters	sample depth
	$T^{o}C$	centigrade	temperature
	S^{o}/oo	ppt	salinity
	DO	ppm	dissolved oxygen
	NO_3	µM	nitrate-nitrogen
	NH_3	µM	ammonia-nitrogen
	PO_4	µM	phosphate-phosphorus
	SiO_4	µM	silicate-silicon
	N:P	none	atomic ratio $(NO_3+NH_3)/PO_4$
II	Z	meters	sample depth
	TURB.	FTU	turbidity
	TMS	mg liter^{-1}	total microseston
	% OMS	percent	proportion of TMS which is organic
	POC	mg liter^{-1}	particulate organic carbon
	CHL	µg liter^{-1}	chlorophyll a
	% PHYTO-C	percent	proportion of POC which is phytoplankton
	PHAEO	µg liter^{-1}	phaeopigments
III	Z_{wc}	meters	water column depth
	K_d	meters^{-1}	secchi disc extinction coefficient
	K_p	meters^{-1}	photometer extinction coefficient
	TMS	g meter^{-2}	total microseston
	% OMS	percent	proportion of TMS which is organic
	POC	g meter^{-2}	particulate organic carbon
	CHL	mg meter^{-2}	chlorophyll a
	PHYTO-C	g meter^{-2}	phytoplankton bound carbon
	PROD	mgC day^{-1} m^{-2}	primary productivity
IV	% LIGHT	percent	% incident light
	PHOTO CAP	µgC hr^{-1} liter^{-1}	photosynthetic capacity
	ASSIM NO.	µgC hr^{-1} ugChl	assimilation number
	I	g-cal cm^{-2} day^{-1}	incident sunlight energy
	% LD	meters	depths corresponding to % LIGHT
	PROD	µgC day^{-1} liter^{-1}	primary productivity
	ASSIM RATIO	µgC day^{-1}ugChl	assimilation ratio
V,VI	% LIGHT	percent	% incident light
	NANO		nanoplankton (< 20 u)
	NET		netplankton (> 20 u)
	% LD	meters	depths corresponding to % LIGHT
VII	P_{max}	none	net:nano ratio of maximum PHOTO CAP
	ASSIM NO	none	net:nano ratio of maximum ASSIM NO.
	CHL M^{-2}	none	net:nano ratio of water column CHL
	PROD M^{-2}	none	net:nano ratio of water column PROD
	ASSIM RATIO	none	net:nano ratio of water column ASSIM RATIO
VIII	TAXONOMIC GROUP	numbers liter^{-1}	density of cells
IX	TAXONOMIC GROUP	numbers m^{-3}	density of individuals
X	WT	mg m^{-3}	dry weight
	WT/ORG	mg organism^{-1}	weight/individual

Environmental Variables

A. Temperature and Salinity (Table I; Fig. 2)

During the Sept.-Feb. period, the Bight was characterized by high salinities (29 - 33°/oo), a steady decline in water temperature from 19°C to 3°C, and a well mixed water column with little or no vertical stratification.

Increased estuarine runoff caused the sharp decline in surface salinities observed in January.

B. Turbidity and Light Penetration (Tables II and III; Fig. 3, 4, 5, 6)

Spatial variations in surface turbidity were inversely related to the salinity ratio (Fig. 3) and reflected concurrent variations in total microseston (Fig. 4). The relationship between light extinction and turbidity is complex (Fig. 5), but does indicate that most of the extinction observed was due to suspended particulate matter (microseston) transported into the Bight by estuarine runoff (Fig. 3).

The amount of inorganic microseston in the water column showed a pronounced decrease between November and December observations followed by a gradual decline through February (Fig. 6). Phytoplankton standing crop, expressed as percent particulate organic carbon (POC), showed the opposite trend (Fig. 6).

Organic microseston, as a proportion of total microseston, was low in the Estuary (< 25% with most values between 5% and 15%) and high in the Bight (5% to 85% with most values between 15% and 30%). The proportion of organic microseston in the water column followed the same pattern, ranging between 6% and 14% at station A3 in the Estuary and between 8% and 30% in the Bight (Table III). Phytoplankton made up less than 1% of the microseston in the Estuary and between 2% and 13% in the Bight by weight.[1] The chlorophyll a content of the water column was generally higher in the sludge dumping area than elsewhere in the Bight.

While statistical analyses of the data have yet to be done, the dumping of sewage sludge and dredge spoils does not appear to have had a measurable effect on turbidity during the period of our observations. The absence of a persistent impact may reflect the well mixed nature of the Bight as well as the spatial and temporal sampling patterns used.

---

1 The proportion of microseston which is phytoplankton (by weight) can be estimated from % organic microseston and PCC data assuming a C:Chl ratio of 25, 35 or 60 and organic matter of constant carbon content. The C:Chl ratio used depended on the observed assimilation number. Ratios of 25, 35 or 60 were used when the assimilation number was greater than 5, 3 to 5, or less than 3, respectively.

C. Dissolved Inorganic Nutrients (Table I; Figs. 7 and 8)

Spatial variations in the concentrations of nutrients are shown in Fig. 7. Nutrient concentrations were generally high and variable in the Estuary and low and uniform in the Bight at any one time (Table I). N:P ratios followed the same trend, with values above 15 characteristic of the estuary and values below 10 characteristic of the Bight.

Nutrient concentrations often decreased as a linear function of the salinity ratio (Fig. 7). This was especially true of nitrate and occasionally of silicate. Ammonia[2] and the N:P ratio remained high in the Estuary out to station P1 and declined rapidly to low levels over a short distance during the Sept.-Dec. period. By January and February, however, their distributions also appeared to be conservative.

Monthly variations in the concentrations of nutrients at the surface in the Bight are shown in Fig. 8. Nitrate concentrations were less than 1.0 ug-at/l at most stations through November and increased to a semi-annual maximum in January. Silicate, phosphate and ammonia concentrations followed the same basic trends, with the January peak coinciding with decreased salinities in the Bight (Fig. 2).

These data strongly support the argument that phytoplankton productivity in the apex of the Bight is supported by nutrients transported into the region by estuarine runoff. Also, based on concentrations alone, it is unlikely that phytoplankton growth was nutrient limited, i.e. while phytoplankton growth appears to have had an impact on nutrient concentrations during the Sept.-Dec.

period (especially on silicate and ammonia), it appears that nutrient supply was in excess of demand at all stations except station C5 throughout the period of observation.

Phytoplankton Productivity

The production of particulate organic carbon (C-14) by phytoplankton was measured by two methods. The first involves 24-hr incubations under natural sunlight at sea surface temperature and will be referred to a "primary production" (mg C day^{-1} m^{-2}). The second involves 2-hr incubations under artificial light (cool-white fluorescent light with an incident intensity of about 0.08 g-cal cm^{-2} min^{-1}) and will be referred to as "photosynthetic capacity" (ug C hr^{-1} $liter^{-1}$). The primary production values given in Table III are estimates of in situ production and reflect local (in both time and space) variations in cloud cover. The values of photosynthetic capacity given in Table IV do not reflect local variations in cloud cover but are affected by light adaptation physiological stress (e.g. nutrient limitation , extremes of temperature and growth inhibiting agents).

A. Phytoplankton Production (Tables III and IV; Figs. 9 and 10)

Primary productivity was higher at station C3 than at either station A3 or C5 (Fig. 9). Production in the Bight varied from 0.1 g C day^{-1} m^{-2} to 1.6 g C day^{-1} m^{-2} compared to 0.01 to 0.27 g C day^{-1} m^{-2} in the Upper Bay.

Productivity per unit chlorophyll a was light limited at daily light fluxes less than 20 x 10^3 g-cal cm^{-1} day^{-1} (surface to 1% light depth) and saturated at fluxes above about 25 (Fig. 10).

B. Photosynthetic Capacity (Table IV; Figs. 11 and 12)

Photosynthetic capacity per unit chlorophyll a at light saturation (assimilation number) ranged between 4 and 10, with high values observed in Sept.-Oct. and Jan.-Feb. and low values in Nov.-Dec. (Fig. 11).

Photosynthesis at light saturation was inversely related to the assimilation number in Sept. and Oct. and positively related in November, December, January and February. The slopes of these relationships decreased to a minimum in

November and increased in December. It would appear, therefore, that cropping factors limited production in September and October while resource factors and/or temperature limited production from November on. Since temperature was lowest in January and February and dissolved inorganic nutrient pools were never depleted and, in fact, increased to a maximum in January, light-limitation is a likely candidate.

When assimilation numbers were high (September, October, January, February), station C3 in the sludge dumping area always exhibited the highest assimilation numbers. Assimilation numbers were lowest at stations P1, D3 and D5 (dredge spoil transect).

Nanoplankton photosynthetic capacity and chlorophyll a exceeded that of the netplankton in November and December, but by January the netplankton fraction dominated (Tables V, VI, and VII). Nanoplankton assimilation numbers were consistently higher than netplankton assimilation numbers (Fig. 12) and were highest at stations C3 and C5 and lowest at D5. Netplankton assimilation numbers were highest at station C3 and lowest at stations C5, D3 and D5.

Zooplankton Abundance

The numerical abundances of major taxa are given in Table IX. Copepods accounted for 20% to 50% of the zooplankton by number in late September and October and for over 90% thereafter in the Bight. The cladocerans *Penilia* sp., *Evande* sp. and *Podon* sp. accounted for 45% to 55% in September and October. Zooplankton numbers decreased from a September-November high (most values between 3,000 and 10,000 individuals/m^3 with occassional blooms to 20,000 individuals/m^3) to a December-January low (most values less than 1,000 individuals/m^3) (Fig. 13).

Particle grazers dominated the zooplankton, and predators, such as chaetognaths, ctenophores and polychaetes remained rare except in November when chaetognath abundance peaked.

Variations in zooplankton biomass are shown in Table X. Variations in displacement volume reflect changes in the abundance of tunicates (*Doliolum* sp.

and Oikopleura sp.) and medusae to a great extent. Displacement volumes in the Bight were high in September and decreased in October and November as the abundance of tunicates declined. Variations in displacement volume paralleled variations in numbers from November on.

Copepod dry weights (mg m^{-3}) decreased from September to October and increased to maximum values in November. The October-November increase was due to an increase in number and size of the individuals (mg $organism^{-1}$). Copepod biomass decreased from the November maximum (65 to 350 mg m^{-3}) to a December-January minimum (less than 50 mg m^{-3}).

Zooplankton biomass and numberical abundance was higher in the Bight than in the Estuary, but a consistent pattern was not observed between stations in the Bight.

CRUISE NO. I

DATE 28-30 Sept. 73

HYDROGRAPHIC DATA
TABLE I.

STA.	Z	T°C	S°/oo	DO	NO_3	NH_3	PO_4	SiO_4	N:P
A1	0	20.2	13.71	3.4	44.7	52.5	5.88	30.9	16.5
	2	20.2	13.69						
	6	20.1	13.81	3.1	42.4	55.0	5.88	30.6	16.6
A2	0	20.2	17.39	2.8	31.5	67.5	5.25	29.1	18.8
	3	20.2	18.83						
	8	20.2	20.09	1.7	20.0	64.4	5.37	21.6	15.7
A3	0	20.2	23.95	2.6	17.8	46.9	3.84	12.0	16.8
	3	20.0	24.29	2.4	17.0	78.1	5.52	23.1	
	10	19.6	26.02	3.1	14.4	68.1	4.50	18.9	18.3
M4	0	20.3	23.86	2.5	17.5	78.1	5.22	24.2	18.3
	5	20.1	24.55						
	10	19.9	25.44	2.6	11.3	65.6	4.08	17.0	18.8
A4	0	20.2	23.97	2.5	10.9	55.0	3.66	12.8	18.0
	5	19.8	25.32						
	8	19.8	25.81	3.4	10.7	68.8	3.69	16.4	21.5
P1	0	19.1	28.13	5.2	9.8	48.1	2.88	12.3	20.1
	6	18.8	30.62	6.2	1.8	11.8	1.05	3.9	
	12	17.2	31.08	3.9	2.1	10.0	1.50	11.2	8.1
C2	0	18.6	30.66	7.8	0.0	0.9	0.45	9.0	2.0
	2	18.6	30.66						
	6	18.6	30.68						
	14	18.4	30.90						
	20	17.0	31.04	4.6	1.9	5.7	1.35	6.3	5.6
C3	0	19.1	29.61	7.3	0.3	2.2	0.48	1.4	5.4
	2	19.1	30.72	7.7	0.1	5.7	0.69	0.8	
	6	19.0	30.76	7.4	0.4	1.4	0.81	0.8	
	13	-	31.40	6.7	0.3	1.8	0.66	2.4	
	20	18.0	31.60	5.4	0.5	4.4	0.96	3.9	5.1
C4	0	18.7	30.55	7.4	0.7	1.6	0.72	1.8	3.2
	2	18.8	30.56						
	6	18.7	30.56						
	14	18.4	30.96						
	20	18.0	31.57	5.6	0.4	6.1	0.63	3.0	10.3
C5	0	19.1	30.94	6.9	0.1	1.8	0.54	2.0	3.6
	2	19.1	30.91	7.1	0.2	1.6	0.57	1.5	
	4	18.9	30.97	7.4	0.2	4.0	0.69	1.8	
	7	18.7	31.23	7.0	0.2	1.6	0.63	1.5	
	18	18.3	31.86	6.6	0.6	2.7	0.60	3.3	
	25	18.3	31.91	6.2	0.1	2.9	0.60	3.4	5.0

CRUISE NO. I　　　　DATE 28-30 Sept. 73

HYDROGRAPHIC DATA

TABLE I.

STA.	Z	T°C	S°/oo	DO	NO_3	NH_3	PO_4	SiO_4	N:P
D2	0	18.6	30.48	7.6	0.4	1.6	0.66	1.8	3.0
	2	18.6	30.59						
	6	18.6	30.53						
	14	18.5	30.60						
	22	18.6	30.34	4.0	3.2	7.1	1.14	11.2	9.0
D3	0	19.6	29.48		0.7	7.4	0.78	2.4	10.4
	2	19.3	30.07		2.6	6.4	1.08	2.0	
	4	19.2	30.30		1.7	6.1	0.93	1.8	
	8	18.9	30.75		0.4	4.1	0.81	1.8	
	18	16.1	31.58		1.6	8.1	1.26	9.9	7.7
D4	0	-	30.25	7.2	2.9	3.6	1.11	2.2	5.8
	2	18.6	30.25						
	6	18.7	30.25						
	14	18.6	30.50						
	18	-	30.91	4.9	1.6	6.8	1.20	11.0	7.0
D5	0	20.4	30.24	7.8	0.0	1.5	0.45	1.2	3.3
	1	19.9	30.41	7.7	0.1	1.2	0.51	0.6	
	3	19.6	30.89	6.9	0.1	5.2	1.02	0.9	
	5	19.6	30.94	7.1	0.0	1.6	0.54	0.9	
	12	19.3	30.96	6.3	0.2	3.0	0.60	1.4	
	20	16.9	31.58	5.2	1.1	3.4	0.87	5.4	5.2
M15	0	18.6	30.72	7.5	0.0	0.8	0.39	0.6	2.0
	2	18.6	30.73						
	4	18.6	30.75						
	11	18.4	30.92						
	18	16.1	31.21						
	28	11.9	31.93	5.2	4.1	2.6	0.93	10.8	7.2
B4	0	19.0	30.37	6.8	1.5	4.6	0.90	6.9	6.8
	2	19.0	30.38						
	5	18.6	30.36						
	13	17.5	31.08						
	17	17.4	31.12	4.9	1.3	6.0	1.05	6.8	7.0

CRUISE NO. II   DATE 27-28 Oct. 73

HYDROGRAPHIC DATA
TABLE I.

STA.	Z	T°C	S°/oo	DO	NO_3	NH_3	PO_4	SiO_4	N:P
A1	0	15.3	14.74	5.0	19.5	35.0	2.45	10.7	22.2
	3	15.4	15.66						
	8	15.5	16.96	5.1					
A2	0	15.4	19.65	5.1	22.1	43.1	3.41	13.9	19.1
	3	15.5	20.36						
	7	15.5	23.84	3.8	14.3	42.5	3.19	11.2	17.8
A3	0	15.1	26.35	4.9	13.0	46.9	2.86	12.3	20.9
	4	14.8	27.05	5.0	13.9	60.6	2.48	14.3	
	9	14.5	28.43	5.6	9.4	33.1	2.26	9.6	18.8
M4	0	15.1	26.22	4.7	15.8	56.9	3.19	16.5	22.8
	5	14.8	26.94						
	10	14.5	28.08	5.6	9.2	34.4	2.86	8.8	15.2
A4	0	15.2	26.25	5.3	10.6	41.2	-	10.7	
	5	14.8	27.39						
	8	14.6	27.76	6.0	7.9	22.8	2.53	6.9	12.1
P1	0	14.4	29.64	7.5	14.3	18.7	2.09	10.2	15.8
	6	14.3	30.78	8.1	2.8	5.7	0.41	2.5	
	13	14.8	30.96	8.2	2.4	6.1	0.58	1.9	14.6
C3	0	15.7	32.10	7.2	0.3	2.5	0.72	0.9	4.0
	3	15.7	32.12	6.9	0.3	1.9	0.52	0.9	
	6	15.6	32.14	7.0	0.4	2.0	0.74	0.8	
	9	15.6	32.14	7.0	0.2	1.3	0.60	0.9	
	21	15.6	32.17	6.9	0.6	4.2	0.78	1.6	6.2
C5	0	15.8	31.75	6.9	0.3	5.5	0.72	1.1	8.0
	2	15.8	31.77	7.1	0.0	3.8	0.38	0.9	
	4	15.8	31.79	6.9	0.3	2.6	0.69	0.8	
	7	15.8	31.81	7.0	0.2	2.3	0.91	0.9	
	16	15.8	31.82	7.0	0.2	6.0	0.77	1.1	
	24	15.8	31.84	7.0	0.3	1.2	7.97?	2.5	
D3	0	-	31.68	7.4	0.9	4.6	0.60	0.6	9.0
	2	-	31.70	7.5	0.8	2.9	0.44	2.2	
	6	-	31.71	7.5	0.8	1.9	0.63	0.8	
	9	-	32.50	7.6	0.6	3.5	0.55	0.6	
	21	-	32.09	4.8	2.9	4.9	0.77	4.7	10.1
D5	0	15.8	32.14	7.2	0.1	1.6	0.88	1.7	1.9
	3	15.8	32.14	7.1	0.3	1.2	0.66	0.9	
	6	15.6	32.15	7.1	0.0	1.0	0.69	0.8	
	11	15.6	32.17	7.2	0.1	2.0	0.55	0.9	
	21	15.6	32.19	7.2	0.2	1.9	0.60	2.0	3.5

CRUISE NO. III DATE 17-19 Nov. 73

HYDROGRAPHIC DATA
TABLE I.

STA.	Z	T°C	S°/oo	DO	NO_3	NH_3	PO_4	SiO_4	N:P
A1	0	9.4	9.70	8.7	16.1	16.1	2.62	6.5	12.3
	2	9.4	9.80						
	6	9.5	10.36	8.2	21.6	19.4	2.50	10.1	16.4
A2	0	9.8	12.64	7.7	10.6	14.2	2.14	5.2	11.6
	2	9.8	12.65						
	7	10.0	14.06	7.3	33.2	41.2	2.67	17.5	27.9
A3	0	10.5	22.08	6.9	16.9	39.4	2.92	11.7	19.3
	3	10.5	22.22	6.4	9.5	22.3	0.66	6.3	
	10	10.7	24.52	5.8	9.7	25.5	1.18	7.6	29.8
M4	0	10.4	23.55	6.8	17.4	41.9	1.10	12.3	53.9
	5	10.4	26.48						
	10	10.4	27.10	7.0	7.9	22.5	-	6.8	
A4	0	10.3	27.42	7.0	9.6	21.5	2.04	7.4	15.2
	5	10.4	27.88						
	10	10.4	29.19	7.3	8.5	19.2	2.06	8.0	13.4
P1	0	11.2	31.67	8.1	3.3	6.4	0.99	4.1	9.8
	5	11.3	31.71	7.8	3.8	6.8	1.16	4.2	
	15	12.1	32.96	6.6	4.0	-	1.15	5.7	
C2	0	11.4	32.04	8.0	0.3	5.0	0.52	1.4	10.2
	3	11.4	32.04						
	8	11.4	32.05						
	19	11.8	32.46						
	30	12.5	34.61	4.8	10.2	2.7	1.32	14.0	9.8
C3	0	11.5	32.33	8.0	0.6	3.2	0.60	1.7	6.4
	2	11.5	32.32	7.8	0.5	1.7	2.20	1.4	
	4	11.5	32.32	7.9	0.4	1.8	0.63	1.4	
	8	11.5	32.34	7.8	0.6	4.1	0.82	2.0	
	15	11.5	32.36	7.7	0.3	1.8	3.80	1.2	0.6
C4	0	11.6	32.09	7.9	0.4	1.0	-	1.2	
	4	11.6	32.11						
	8	11.6	32.14						
	21	12.1	32.63						
	30	12.5	34.65	5.0	10.1	1.9	0.74	16.2	16.2
C5	0	11.2	32.06	8.2	0.6	1.0	0.77	1.1	2.1
	2	11.2	32.05	8.0	0.4	1.4	0.66	1.2	
	4	11.2	32.05	8.0	0.6	2.0	0.55	1.1	
	8	11.2	32.05	7.9	0.4	2.2	0.55	1.7	
	15	11.2	32.05	8.0	0.5	1.2	0.72	1.4	
	22	11.3	32.07	7.8	0.6	1.3	1.04	1.2	1.8

CRUISE NO. III DATE 17-19 Nov. 73

HYDROGRAPHIC DATA
TABLE I.

STA.	Z	T°C	S°/oo	DO	NO_3	NH_3	PO_4	SiO_4	N:P
D2	0	11.1	31.80	8.2	0.5	3.4	0.38	1.2	10.2
	3	11.1	31.81						
	7	11.1	31.80						
	12	11.3	31.96						
	20	12.3	34.36	5.2	7.9	3.4	1.21	9.0	9.3
D3	0	11.4	32.17	7.8	0.8	1.8	0.77	2.4	3.4
	2	11.4	32.18	7.8	0.7	4.4	1.13	2.0	
	4	11.5	32.18	7.9	1.0	5.1	0.74	2.0	
	7	11.4	32.19	7.8	0.9	5.3	0.55	2.0	
	18	11.5	32.22	7.5	0.7	4.3	0.55	1.4	9.1
D4	0	11.0	31.74	8.2	0.4	1.0	0.77	1.4	1.8
	3	11.0	31.74						
	7	11.0	31.76						
	11	11.4	31.96						
	18	12.1	33.67	6.2	6.6	2.4	1.04	8.0	8.6
D5	0	11.8	32.28	8.1	0.2	3.9	0.60	0.9	6.8
	3	11.8	32.29	8.0	0.3	4.4	–	0.9	
	8	11.8	32.29	7.9	0.1	1.8	0.66	0.8	
	12	11.9	32.33	7.9	0.2	2.7	2.58	1.1	
	20	11.9	32.34	8.0	0.2	3.2	0.63	0.9	5.4
M15	0	11.3	32.08	8.0	0.2	2.6	0.72	7.4	3.9
	2	11.3	32.04						
	6	11.3	32.04						
	10	11.4	32.08						
	14	11.4	32.12						
	19	11.6	32.20	7.8	0.2	2.5	0.55	2.2	4.9
B4	0	10.8	31.64	6.9	3.5	8.1	3.68	5.0	3.2
	4	10.8	31.66						
	14	11.9	32.87						
	18	12.0	33.01	7.7	2.8	1.8	0.66	4.2	7.0

CRUISE NO. IV DATE 15-16 Dec. 73

HYDROGRAPHIC DATA
TABLE I.

STA.	Z	T°C	S°/oo	DO	NO_3	NH_3	PO_4	SiO_4	N:P
A1	0	6.4	2.38	9.7	39.1	10.7	1.65	10.0	30.2
	3	6.4	2.46						
	6	6.4	2.58	9.7	39.7	11.2	1.50	10.5	33.9
A2	0	6.8	5.08	9.8	29.3	13.8	1.95	8.6	22.1
	3	6.9	5.83						
	7	7.0	9.46	8.2	26.4	19.6	1.95	10.8	23.6
A3	0	8.2	16.50	6.9	15.6	25.3	1.92	8.8	21.3
	4	8.4	20.21	6.6	19.9	29.9	2.00	13.0	
	11	8.6	24.52	7.1	12.0	19.3	1.67	2.8	18.7
M4	0	8.3	17.44	6.6	14.2	33.9	2.70	9.0	17.8
	4	8.2	21.33						
	12	8.4	24.16	7.4	12.0	18.9	1.60	8.1	19.3
A4	0	8.1	19.75	6.5	21.0	31.0	2.07	12.6	25.1
	4	8.1	22.95						
	9	8.6	26.51	7.0	12.5	18.3	1.58	9.3	19.5
P1	0	8.8	28.74	7.9	11.2	14.8	1.32	8.0	19.7
	6	8.7	28.89	8.1	8.5	12.1	1.35	6.0	
	12	9.8	31.98	7.8	3.5	4.5	0.90	2.7	8.9
C3	0	9.6	32.36	8.3	4.0	4.0	0.80	2.2	10.0
	3	9.6	32.37	8.2	3.2	3.2	0.80	2.0	
	6	9.6	32.37	8.0	3.4	2.6	0.80	3.6	
	13	9.6	32.37	7.9	3.3	2.6	0.88	2.2	
	20	10.0	32.44	7.9	2.9	4.2	0.62	1.5	11.4
C5	0	9.4	32.24	8.3	3.1	3.0	0.68	0.8	9.0
	3	9.4	32.24	8.1	2.6	2.1	0.60	0.8	
	7	9.4	32.23	8.1	2.8	2.4	0.68	0.6	
	15	9.4	32.23	8.2	-	-	-	-	
	21	9.4	32.23	8.2	3.3	2.6	0.60	1.4	9.8
D3	0	-	31.02	8.2	4.1	4.9	0.80	2.1	11.2
	3	9.2	31.03	8.5	4.0	3.7	0.88	2.0	
	6	9.3	31.03	8.3	3.9	3.8	0.85	2.6	
	14	9.5	32.07	7.9	3.0	3.9	0.75	1.8	
	17	9.8	32.25	8.1	3.5	3.8	0.82	17.1	8.9
D5	0	9.4	32.40	7.9	2.7	2.6	0.62	2.0	8.5
	3	9.6	32.40	7.9	2.6	3.7	0.65	1.5	
	7	9.6	32.40	7.9	3.6	2.5	0.70	1.5	
	13	9.6	32.40	7.9	2.7	2.2	0.68	1.8	
	22	9.6	32.40	7.9	2.8	2.3	0.65	1.2	7.8

CRUISE NO. V DATE 26-28 January 1974

HYDROGRAPHIC DATA
TABLE I.

STA.	Z	T°C	S°/oo	DO	NO_3	NH_3	PO_4	SiO_4	N:P
A1	0	1.2	3.93	11.5	34.1	24.9	1.47	51.10	40.1
	2	1.2	3.99						
	6	1.2	4.26	12.0	36.8	24.6	2.25	50.75	27.3
A2	0	1.7	7.63	10.1	27.0	19.8	1.80	46.55	26.0
	3	1.8	10.20						
	7	3.2	15.67	8.4	17.9	19.6	1.83	18.90	20.5
A3	0	3.7	17.88	8.2	17.4	19.8	2.07	18.20	18.0
	5	3.9	20.13	8.2	13.9	18.0	1.89	13.51	
	9	4.2	22.76	8.7	11.9	16.0	1.86	12.04	15.0
M4	0	3.9	17.78	7.4	15.7	21.0	2.25	16.59	16.3
	4	3.9	19.71						
	8	4.3	23.01	7.8	21.6	24.4	2.61	21.07	17.6
A4	0	4.0	17.39	7.6	13.2	17.9	1.80	14.07	17.3
	2	4.5	23.50						
	5	4.6	24.87	8.1	10.6	14.5	1.98	10.01	12.7
P1	0	5.2	27.36	8.5	14.2	15.2	1.71	11.90	17.2
	5	5.4	28.89	8.5	7.1	6.9	1.53	5.46	
	12	6.4	32.66	8.5	4.8	3.0	1.62	2.24	4.8
C2	0	5.6	28.15	10.0	8.7	15.4	1.35	5.25	17.8
	4	5.6	29.66						
	12	6.1	32.05						
	20	6.7	32.58						
	27	7.2	32.73	9.0	4.5	2.6	1.95	2.87	3.6
C3	0	5.1	29.71	10.1	10.8	7.1	1.44	4.06	12.4
	2	5.1	29.71	9.8	7.8	5.2	1.11	2.73	
	4	5.1	29.73	10.6	9.2	6.6	1.41	3.36	
	10	5.1	30.13	10.2	6.9	4.8	1.62	2.38	
	20	5.3	31.73	10.0	3.3	2.4	1.05	0.35	5.4
C4	0	5.9	29.00	10.5	11.2	20.5	2.61	4.55	12.1
	4	5.6	29.75						
	9	5.6	30.64						
	15	6.3	32.28						
	29	7.9	32.91	9.0	3.9	3.7	1.20	3.36	6.3
C5	0	5.5	31.46	9.9	5.9	5.8	1.29	0.77	9.1
	4	5.5	31.46	10.0	5.1	2.0	1.29	0.63	
	8	5.4	31.69	10.0	5.0	1.8	1.11	0.42	
	15	5.3	31.77	9.8	6.0	3.7	1.29	3.99	
	23	5.1	31.96	9.6	5.0	4.6	1.38	1.26	7.0

CRUISE NO. V DATE 26-28 January 1974

HYDROGRAPHIC DATA
TABLE I. (cont.)

STA	Z	T°C	S°/oo	DO	NO_3	NH_3	PO_4	SiO_4	N:P
D2	0	6.0	30.90	9.4	5.9	4.3	1.14	1.89	8.9
	3	6.0	30.62						
	8	6.4	32.14						
	15	6.2	32.18						
	20	6.6	32.43	9.0	5.1	4.8	1.62	2.03	6.1
D3	0	5.7	30.31	9.4	7.1	4.5	1.29	2.17	9.0
	2	5.7	30.32	10.0	6.0	4.8	1.26	2.17	
	6	5.6	30.53	9.7	7.6	5.4	1.32	2.66	
	12	6.8	32.67	8.9	4.3	1.9	1.32	2.03	
	17	7.0	32.74	8.7	4.9	2.5	1.44	2.66	5.1
D4	0	5.7	30.35	9.3	10.4	5.4	1.29	3.92	12.2
	5	5.7	30.40						
	10	5.7	31.22						
	15	5.7	32.26						
	25	6.9	32.78	8.7	3.7	3.5	1.23	1.82	5.8
D5	0	5.6	30.76	10.0	4.8	2.1	1.17	2.17	5.9
	3	5.6	30.77	10.1	6.9	3.1	0.96	0.63	
	8	5.7	31.30	9.9	5.7	2.1	1.08	0.63	
	15	6.7	32.51	9.2	3.8	3.1	1.92	1.05	
	21	7.5	32.81	8.2	4.3	-	1.23	2.94	

CRUISE NO. VI DATE 16-18 February 1974

HYDROGRAPHIC DATA
TABLE I.

STA.	Z	T°C	S°/oo	DO	NO_3	NH_3	PO_4	SiO_4	N:P
A-1	0	0.9	6.90	13.3	31.7	21.5	1.50	61.6	35.5
	2	1.4	9.39						
	5	2.9	20.94	10.9	16.2	17.4	1.43	16.9	23.5
A-2	0	0.6	7.92	13.4	23.6	19.0	1.35	39.2	31.6
	3	2.0	18.75						
	7	3.2	22.55	11.6	15.0	15.8	1.61	15.0	19.1
A-3	0	1.9	15.77	12.2	18.7	18.0	1.40	23.0	26.2
	2	2.2	17.48	12.0	13.9	14.9	1.30	16.4	
	12	3.2	27.26	12.0	8.2	6.4	1.04	5.5	14.0
A-4	0	2.5	18.32	12.0	18.8	19.0	1.53	21.7	24.7
	4	3.6	25.65						
	9	3.9	27.82	12.5	9.8	5.9	1.17	5.7	13.4
P-1	0	4.2	30.30	11.5	3.4	2.2	0.83	1.1	6.7
	4	4.2	30.33	11.6	3.6	2.9	0.84	1.2	
	10	4.4	30.98	11.4	2.1	2.2	0.80	0.3	5.4
B-2	0	4.0	30.86	11.8	2.6	1.4	0.81	0.7	4.9
	5	4.0	30.74						
	15	4.0	30.44						
	20	6.1	32.03	9.7	4.1	2.0	1.17	2.6	5.2
B-3	0	4.9	31.43	11.0	3.0	1.8	0.88	0.9	5.4
	4	4.9	31.43						
	10	4.9	31.42						
	17	5.0	31.38	11.4	2.6	1.4	0.80	0.9	5.0
B-4	0	2.4	31.04	11.0	3.7	2.0	0.83	0.6	6.9
	4	2.4	30.98	11.8	5.8	2.2	1.06	1.8	
	11	2.4	30.87	11.5	4.9	1.4	1.06	1.3	
	15	2.5	31.05	11.0	6.7	1.6	1.30	1.7	6.4
C-2	0	3.6	30.62	11.2	4.1	4.0	0.96	0.8	8.4
	3	3.6	30.67						
	8	3.6	30.65						
	15	3.6	30.53						
	25	6.3	32.08	9.7	3.1	1.8	0.84	2.7	5.8
C-3	0	3.3	31.44	12.3	4.4	2.2	0.80	1.0	8.2
	2	3.2	31.43	11.8	4.0	1.6	0.86	0.8	
	4	3.2	31.42	11.2	4.0	1.9	0.68	0.4	
	12	3.6	31.71	11.0	4.5	3.2	0.86	0.8	
	23	5.9	32.98	9.8	3.3	1.4	0.94	2.2	5.0

CRUISE NO. VI DATE 16-18 February 1974

HYDROGRAPHIC DATA
TABLE I. (cont.)

STA.	Z	T°C	S°/oo	DO	NO_3	NH_3	PO_4	SiO_4	N:P
C-4	0	4.3	31.41	11.6	3.5	3.0	0.88	0.8	7.4
	3	4.3	31.44						
	7	4.3	31.37						
	12	4.4	31.42						
	20	4.5	31.24	11.3	3.6	2.8	0.94	1.1	6.8
C-5	0	3.7	32.09	12.5	3.0	1.4	0.86	0.4	5.1
	3	3.7	32.14	11.1	2.7	1.2	0.81	0.6	
	8	3.7	32.13	10.7	3.3	2.4	0.91	0.4	
	21	4.0	32.17	10.2	3.8	1.5	0.78	0.9	
	25	4.0	32.17	10.2	3.7	1.3	0.83	0.7	6.0
D-2	0	3.6	31.22	12.6	3.7	3.8	0.91	1.3	8.2
	3	3.7	31.30						
	6	3.6	31.53						
	15	3.9	31.64						
	20	5.8	32.51	10.6	3.8	2.6	0.91	1.9	7.0
D-3	0	3.8	31.58	12.3	2.3	2.2	0.70	0.4	6.4
	3	3.9	31.57	12.0	2.1	1.1	0.83	0.5	
	7	3.9	31.51	11.8	1.9	1.1	0.78	0.4	
	12	4.0	31.67	11.5	2.5	2.5	0.76	0.5	
	20	6.3	32.73	9.5	3.0	1.7	0.91	1.9	5.2
D-4	0	4.0	31.66	12.8	2.7	1.0	0.80	1.4	4.6
	3	4.0	31.55						
	7	4.0	31.62						
	12	4.1	31.80						
	18	6.0	32.70	10.3	3.8	3.3	0.94	2.0	7.6
D-5	0	3.8	31.72	13.2	2.3	1.1	0.81	0.5	4.2
	3	3.7	31.63	12.6	4.0	1.7	0.88	1.0	
	6	3.7	31.60	12.2	3.3	1.8	0.84	0.6	
	16	5.8	32.65	9.7	3.4	1.8	0.96	1.5	
	22	6.0	32.77	9.6	3.8	3.0	0.99	1.9	6.9

CRUISE NO. I DATE 28-30 Sept. 1973

SUSPENDED PARTICULATE MATTER (VOLUME^{-1})

TABLE II.

STA.	Z	TURB.	TMS	% OMS	POC	CHL	% PHYTO-C	PHAEO
A1	0	8.0	51.58	6.8	1.24	0.76	1.5	1.51
	2	8.0				0.76		1.77
	6	12.0	41.60	10.5	1.49	0.80		2.18
A2	0	3.7	-	-	1.12	1.29	2.9	0.75
	3	4.4				0.93		0.80
	8	10.0	27.76	18.6	1.79	1.05		1.92
A3	0	3.1	37.87	8.4	-	1.75	-	0.83
	3	3.4	38.47	7.5	0.80	1.63		0.84
	10	3.7	35.46	9.3	1.03	1.40	-	1.08
M4	0	3.5	32.84	7.5	1.10	1.75	4.0	0.93
	5	13.0				1.63		2.13
	10	7.0	49.66	7.8	1.45	1.28		1.89
A4	0	3.0	31.63	8.9	0.94	1.75	4.6	0.93
	5	4.2				1.40		1.97
	8	5.8	41.84	8.8	1.45	1.75		2.41
P1	0	1.8	9.76	12.4	0.49	1.98	10.1	0.79
	6	1.4	9.60	12.2	0.44	0.89		1.15
	12	3.6	18.95	11.9	0.82	1.16		3.59
C2	0	1.4	9.91	23.1	0.72	4.42	15.3	0.52
	2	1.3				3.96		0.79
	6	1.4				3.96		0.59
	14	1.2				2.68		0.29
	20	0.8	8.80	16.1	0.47	0.62		0.55
C3	0	1.2	5.60	31.2	0.54	4.66	21.6	0.59
	2	0.8	10.28	16.7	0.60	6.66		1.26
	6	1.1	9.46	27.8	0.63	7.55		2.64
	13	1.1	6.92	15.5	1.23	1.24		0.34
	20	1.1	9.61	12.7	0.36	1.10		0.48
C4	0	1.1	9.36	27.7	0.73	4.08	14.0	1.17
	2	1.1				4.42		1.22
	6	1.1				4.31		1.33
	14	1.1				1.98		0.79
	20	1.0	8.68	21.9	0.58	1.38		0.85
C5	0	0.7	4.35	45.5	0.54	1.98	9.2	0.40
	2	1.2	6.42	31.3	0.36	2.10		0.28
	4	1.2	7.58	23.4	0.62	2.10		0.28
	7	1.0	11.04	12.1	0.64	1.98		0.40
	18	1.0	10.23	14.0	0.28	1.69		0.46
	25	1.1	9.69	15.0	0.44	1.24		0.61

CRUISE NO. I DATE 28-30 Sept. 1973

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

STA.	Z	TURB.	TMS	% OMS	POC	CHL	% PHYTO-C	PHAEO
D2	0	1.0	11.95	20.7	0.64	4.89	19.1	0.95
	2	1.2				5.01		0.83
	6	0.9				4.66		0.79
	14	0.9				3.14		0.72
	22	1.5	8.05	15.5	0.51	0.34		0.37
D3	0	2.0	11.13	27.4	1.15	11.54	25.1	1.29
	2	1.8	8.50	28.6	0.76	7.10		0.82
	4	1.5	7.00	26.8	0.67	4.08		1.57
	8	1.4	7.21	16.7	0.54	0.71		1.33
	18	2.0	10.45	13.6	0.59	0.58		1.16
D4	0	0.8	8.17	22.9	0.57	2.68	11.8	0.88
	2	0.9				2.79		1.16
	6	0.7				3.14		0.91
	14	1.4				0.89		1.15
	18	2.2	7.68	26.7	0.51	0.80		1.92
D5	0	1.4	13.52	26.5	1.14	9.32	20.4	3.13
	1	1.1	12.74	16.9	0.92	3.96		0.59
	3	1.1	11.24	16.7	0.62	1.38		0.62
	5	1.2	7.65	18.6	0.59	0.98		0.53
	12	1.3	9.56	10.5	0.42	0.93		0.65
	20	1.5	5.71	15.4	0.29	0.80		0.56
M15	0	2.5	8.86	36.1	0.73	3.03	10.4	0.54
	2	2.5				2.56		0.60
	4	2.5				2.68		0.88
	11	0.9				1.98		0.30
	18	0.9				0.37		0.40
	28	2.0	8.51	16.9	0.50	0.58		0.67
B4	0	1.4	9.50	25.0	0.70	3.61	12.9	1.14
	2	1.3				4.08		0.87
	5	1.3				3.84		1.80
	13	1.5				0.93		1.03
	17	1.6	9.94	14.5	0.59	0.53		1.09

CRUISE NO. II DATE 27-28 Oct. 1973

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

STA	Z	TURB.	TMS	% OMS	POC	CHL	% PHYTO-C	PHAEO
A1	0	3.6	48.46	6.7	0.82	1.84	5.6	0.60
	3	4.4				1.20		0.92
	8	6.3	43.67	7.3	1.10	1.20		1.10
A2	0	3.7	29.74	10.1	1.05	2.53	6.0	0.60
	3	3.8				1.16		0.70
	7	3.6	35.12	10.8	1.47	0.98		1.67
A3	0	2.6	36.74	6.9	0.77	2.07	6.7	0.47
	4	2.6	36.84	7.2	1.09	2.18		0.84
	9	3.5	40.37	7.2	1.15	2.30		1.61
M4	0	2.4	33.88	7.6	1.28	1.38	2.7	0.77
	5	2.6				1.26		0.98
	10	6.6	46.11	7.1	1.61	2.53		3.62
A4	0	3.2			1.25	1.95	3.9	0.88
	5	7.1				4.44		6.13
	8	9.9	24.98	10.5	2.39	4.89		10.22
P1	0	4.6	39.96	6.5	1.20	5.78	12.0	2.16
	6	4.6	38.78	7.0	1.24	6.67		2.02
	13	2.9	39.81	8.7	1.19	4.36		1.40
C3	0	1.5	10.36	13.5	0.57	1.61	7.1	0.34
	3	1.6	9.42	11.4	0.70	1.61		0.34
	6	1.9	8.75	13.9	0.67	1.84		0.31
	9	1.4	10.36	15.8	0.43	1.84		0.31
	21	1.4	8.47	14.5	0.53	1.61		0.34
C5	0	1.4	9.58	9.1	0.49	1.29	6.6	0.30
	2	1.4	10.33	7.2	0.53	1.07		0.44
	4	1.4	9.27	10.0	0.57	1.20		0.39
	7	1.4	10.55	8.5	0.56	1.16		0.32
	16	1.5	29.74	5.7	0.48	1.20		0.35
	24	1.6	8.24	9.6	0.54	1.24		0.38
D3	0	0.8	10.78	15.7	0.78	6.67	21.4	0.51
	2	1.1	11.70	14.8	0.76	6.67		0.51
	6	0.8	10.49	17.6	0.88	6.22		0.58
	9	0.9	10.04	16.3	0.87	5.78		1.02
	21	4.4	16.38	15.1	0.88	8.67		2.10
D5	0	0.6	6.07	15.8	0.43	0.42	3.4	0.25
	3	0.4	6.56	16.7	0.50	0.45		0.23
	6	0.4	7.55	16.2	0.59	0.46		0.24
	11	0.4	6.83	10.5	0.76	0.42		0.25
	21	0.4	3.77	24.4	0.50	0.48		0.22

CRUISE NO. III DATE 17-19 Nov. 1973

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

STA.	Z	TURB.	TMS	% OMS	POC	CHL	% PHYTO-C	PHAEO
A1	0	8.7	46.82	6.6	1.30	4.51	12.1	1.19
	2	8.9				4.51		1.19
	6	8.4	43.02	6.9	1.22	3.93		1.28
A2	0	7.3	39.44	6.8	1.25	3.00	8.4	1.02
	2	7.1				2.77		1.16
	7	8.6	43.21	7.6	1.39	2.08		1.55
A3	0	3.6	35.29	6.4	1.12	1.94	6.1	0.39
	3	3.6	35.56	6.7	1.05	1.76		0.45
	10	6.6	44.14	6.5	1.43	1.59		0.90
M4	0	2.7	33.26	7.6	1.06	1.73	5.7	0.43
	5	3.6				1.39		0.77
	10	5.2	45.67	8.6	1.49	1.39		1.46
A4	0	2.6	-	-	0.70	1.62	8.1	0.54
	5	2.6				1.62		0.64
	10	3.6	12.31	15.6	0.80	1.62		1.33
P1	0	1.6	-	-	0.31	1.63	18.4	0.62
	5	1.6	-	-	0.35	1.68		0.61
	15	1.4	11.61	12.0	0.38	1.59		0.59
C2	0	1.3	10.11	22.2	0.64	2.20	12.0	0.65
	3	1.4				2.20		0.65
	8	1.3				2.20		0.65
	19	1.5				1.50		0.46
	30	1.6	12.22	10.6	0.65	0.24		0.32
C3	0	1.7	7.14	13.4	0.38	2.55	23.5	0.45
	2	1.4	2.33	83.9	0.66	2.60		0.35
	4	1.1	9.41	13.1	0.49	2.62		0.35
	8	1.1	7.67	21.0	0.50	2.31		0.53
	15	1.4	8.69	14.7	0.52	1.58		0.71
C4	0	1.4	9.58	17.6	0.57	2.08	12.8	0.47
	4	1.3				1.96		0.69
	8	1.4				1.96		0.69
	21	1.1				1.23		0.41
	30	1.3	13.15	10.0	0.58	0.16		0.24
C5	0	1.6	8.87	17.4	0.68	2.55	13.1	0.70
	2	1.2	10.05	13.4	0.55	2.51		0.63
	4	1.4	5.11	30.8	0.56	2.60		0.66
	8	1.4	5.24	36.0	0.63	2.62		0.85
	15	1.4	10.10	20.2	0.57	2.60		0.60
	22	1.4	7.13	19.9	0.55	2.47		0.50

CRUISE NO. III DATE 17-19 Nov. 1973

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

STA.	Z	TURB.	TMS	% OMS	POC	CHL	% PHYTO-C	PHAEO
D2	0	1.6	6.09	37.6	0.63	1.68	9.3	0.54
	3	2.1				1.62		0.44
	7	2.2				1.59		0.55
	12	1.6				0.32		0.30
	20	2.4	11.51	10.7	0.62	1.23		0.41
D3	0	1.9	7.13	19.6	0.46	1.23	9.4	0.26
	2	1.4	6.51	26.4	0.53	1.41		0.35
	4	1.5	7.32	18.8	0.51	1.45		0.38
	7	1.6	5.76	22.8	0.54	1.19		0.38
	18	1.6	9.11	16.6	0.48	1.68		0.39
D4	0	1.6	10.94	28.4	0.75	2.20	10.3	0.65
	3	1.6				2.66		0.68
	7	1.4				2.43		0.72
	11	1.3				1.50		0.46
	18	1.4	7.74	14.2	0.55	0.97		0.42
D5	0	1.4	4.23	40.2	0.53	2.16	14.3	0.69
	3	1.5	11.07	12.6	0.48	2.16		0.54
	8	1.5	9.58	26.3	0.61	2.25		0.64
	12	1.2	7.10	23.9	0.55	1.96		0.39
	20	1.5	8.62	18.4	0.52	1.96		0.49
M15	0	1.5	6.29	41.3	0.57	2.31	14.2	0.73
	2	0.6				2.20		0.56
	6	0.9				2.31		0.64
	10	1.1				2.08		0.57
	14	1.1				1.85		0.51
	19	1.1	11.00	12.2	0.57	1.39		0.58
B4	0	2.1	7.08	29.3	0.68	1.73	8.9	0.43
	4	2.1				1.85		0.51
	14	1.6				1.50		0.41
	18	1.6	7.10	19.8	0.71	1.06		0.37

CRUISE NO. IV DATE 15-16 Dec. 1973

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

STA.	Z	TURB.	TMS	% OMS	POC	CHL	% PHYTO-C	PHAEO
A1	0	12.0	25.57	7.1	0.93	2.66	10.0	1.96
	3	15.0				2.66		2.25
	6	21.0	47.18	7.7	1.75	3.00		3.48
A2	0	10.0	18.37	8.3	0.83	1.62	6.8	1.33
	3	11.0				1.39		1.46
	7	26.0	76.35	8.4	3.16	1.50		3.70
A3	0	5.6	11.14	20.8	0.82	1.13	4.8	0.92
	4	5.6	16.86	13.2	1.03	0.71		0.97
	11	9.1	32.52	13.4	1.81	1.41		2.64
M4	0	6.1	13.01	12.5	1.06	0.84	2.8	0.85
	4	5.3				1.06		0.96
	12	6.2	14.46	11.3	1.09	1.16		1.20
A4	0	5.2	11.23	15.3	0.90	1.19	4.6	0.83
	4	4.6				1.15		0.88
	9	6.2	19.45	12.2	1.08	1.62		1.72
P1	0	3.6	9.27	17.3	1.14	1.98	6.1	0.90
	6	3.5	9.07	17.7	1.17	2.07		0.93
	12	4.7	11.56	13.7	1.15	2.56		1.01
C3	0	3.4	3.95	20.9	0.67	3.76	19.6	0.42
	3	2.9	7.04	19.3	0.54	4.29		0.38
	6	3.3	4.48	23.7	0.81	3.93		0.51
	13	3.4	5.38	23.5	0.73	3.55		0.33
	20	5.6	7.65	24.6	0.81	3.19		0.65
C5	0	4.4	3.42	24.2	0.49	4.29	30.6	0.86
	3	3.3	4.89	26.1	0.53	4.26		1.04
	7	2.9	4.53	26.7	0.53	4.44		0.94
	15	2.7	7.13	22.9	0.56	4.07		0.80
	21	3.2	5.36	25.2	0.61	3.91		0.85
D3	0	0.8	5.86	19.6	0.63	2.68	14.9	0.52
	3	1.3	4.08	24.4	0.60	3.18		0.61
	6	1.1	4.72	22.2	0.53	2.98		0.66
	14	1.1	5.26	22.0	0.61	2.72		0.48
	17	1.3	5.59	18.50	0.57	2.50		0.71
D5	0	3.4	4.42	26.0	0.59	3.11	18.4	0.63
	3	2.9	7.52	21.6	0.55	2.95		0.85
	7	3.1	4.47	24.5	0.56	2.98		0.68
	13	2.2	3.49	23.8	0.52	2.61		0.71
	22	2.1	5.31	22.5	0.49	2.86		0.63

CRUISE NO. V   DATE 26-28 January 1974

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

STA.	Z	TURB.	TMS	% OMS	POC	CHL	% PHYTO-C	PHAEO
A1	0	18.0	33.31	10.3	1.30	0.57	1.1	1.94
	2	17.0				0.57		2.20
	8	41.0	88.88	10.3	3.22	0.49		5.02
A2	0	10.1	17.18	14.5	0.85	0.31	0.9	1.04
	3	10.3				0.35		1.22
	7	60.0	158.47	12.0	6.44	1.73		6.81
A3	0	34.0	7.78	26.4	0.86	0.72	2.1	0.64
	5	5.0	13.40	21.9	1.00	0.93		0.69
	9	5.0	13.55	20.5	1.02	1.76		0.96
M4	0	6.1	9.57	23.2	0.86	0.84	2.4	0.57
	4	5.4				0.97		0.64
	8	8.1	14.73	19.6	1.15	1.39		1.86
A4	0	4.6	9.12	23.7	0.76	0.84	2.8	0.51
	2	5.4				1.50		0.95
	5	5.8	16.34	17.4	1.06	1.73		1.51
P1	0	3.6	6.25	23.0	0.52	2.20	10.6	0.64
	5	3.1	8.34	20.6	0.48	2.64		0.65
	12	2.4	7.63	22.6	0.35	1.54		0.48
C2	0	3.6	4.71	29.2	0.54	4.74	21.9	0.57
	4	3.4				6.24		0.24
	12	3.0				1.72		0.19
	20	1.9				0.66		0.31
	27	2.1	5.83	19.4	0.27	0.62		0.36
C3	0	3.1	4.93	27.0	0.60	4.01	16.7	0.56
	2	3.9	6.61	26.1	0.42	3.87		0.62
	4	3.4	4.90	28.0	0.42	3.83		0.78
	10	3.1	4.77	27.4	0.44	4.16		0.28
	20	1.4	4.74	21.4	0.24	1.13		0.33
C4	0	4.9	5.39	42.4	0.92	3.93	10.7	1.08
	4	3.8				6.01		0.47
	9	2.7				4.28		0.73
	15	2.5				1.28		0.22
	29	2.6	6.86	18.6	0.27	0.49		0.23
C5	0	1.7	2.66	27.4	0.40	1.72	10.8	0.34
	4	2.4	5.14	22.6	0.44	1.73		0.40
	8	1.9	2.81	26.4	0.33	1.83		0.37
	15	2.1	5.00	23.9	0.34	2.32		0.48
	23	2.5	4.42	22.5	0.31	1.80		0.79

CRUISE NO. V DATE 26-28 January 1974

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

STA.	Z	TURB.	TMS	% OMS	POC	CHL	% PHYTO-C	PHAEO
D2	0	2.4	6.97	24.6	0.37	2.66	18.0	0.88
	3	2.2				2.89		0.55
	8	2.3				1.96		0.39
	15	2.3				1.06		0.37
	20	2.8	8.13	16.8	0.40	1.23		0.68
D3	0	3.1	4.50	31.5	0.48	3.80	19.8	0.92
	2	2.2	7.35	24.3	0.47	4.09		0.72
	6	2.4	5.37	25.9	0.44	3.61		0.89
	12	2.4	4.78	20.8	0.29	0.78		0.43
	17	2.4	4.82	19.2	0.42	0.97		0.62
D4	0	3.1	5.09	29.5	0.46	4.39	23.8	1.01
	5	3.4				4.74		0.86
	10	2.5				3.24		0.60
	15	2.5				1.41		0.28
	35	2.3	4.42	22.1	0.20	0.62		0.32
D5	0	2.7	4.80	32.3	0.44	5.23	29.7	1.15
	3	3.0	4.55	36.4	0.44	5.62		0.76
	8	2.8	4.56	29.7	0.31	4.49		0.73
	15	2.4	3.25	26.5	0.20	1.26		0.29
	21	2.6	4.29	23.7	0.21	1.22		0.43

CRUISE NO. VI DATE 16-18 February 1974

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

STA.	Z	TURB.	TMS	% OMS	POC	CHL	% PHYTO-C	PHAEO
A-1	0	7.9	10.03	14.0	0.64	0.93	3.6	0.76
	2	7.0				1.50		0.56
	5	9.9	30.15	14.2	1.69	4.39		1.50
A-2	0	8.6	12.47	13.6	0.91	1.19	3.3	0.87
	3	4.3				3.47		0.95
	7	3.7	17.74	19.5	1.13	4.51		1.29
A-3	0	4.9	9.98	19.9	0.99	2.88	7.3	1.01
	2	4.9	15.49	18.8	1.08	3.66		1.12
	12	3.4	16.85	17.1	1.10	7.49		2.16
A-4	0	4.1	9.95	21.6	0.87	3.24	9.3	1.18
	4	4.1				6.47		1.78
	9	3.7	17.31	18.5	0.97	8.79		2.02
P-1	0	2.3	6.61	24.8	0.60	8.66	36.1	1.21
	4	2.4	7.57	24.0	0.65	8.57		1.42
	10	3.4	10.10	19.6	0.80	10.68		2.37
B-2	0	1.5	5.04	29.6	0.52	9.25	44.5	1.17
	5	1.6				9.25		2.15
	15	1.6				9.71		1.30
	20	1.1	4.97	19.3	0.28	1.32		0.74
B-3	0	2.5	7.65	22.6	0.48	5.32	27.7	1.95
	4	2.6				5.09		2.18
	10	2.5				6.24		1.62
	17	2.5	6.53	22.4	0.56	5.32		1.76
B-4	0	3.1	6.82	17.80	0.45	2.07	11.5	1.56
	4	3.1	6.38	18.07	0.43	1.94		2.07
	11	3.2	6.87	16.71	0.40	2.69		2.24
	15	2.5	7.03	17.42	0.40	2.07		2.01
C-2	0	2.1	4.93	32.9	0.66	6.94	26.3	0.92
	3	2.4				7.40		1.44
	8	2.4				8.09		1.34
	15	2.3				8.32		0.32
	25	1.4	5.17	18.2	0.28	1.63		0.50
C-3	0	1.6	4.96	29.6	0.55	5.51	25.0	1.50
	2	1.9	4.91	30.8	0.44	6.48		1.72
	4	1.7	2.82	32.2	0.54	4.76		4.37
	12	1.7	4.27	27.6	0.48	3.18		0.72
	23	0.9	4.32	23.7	0.34	1.41		0.70

CRUISE NO. VI   DATE 16-18 February 1974

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

STA.	Z	TURB.	TMS	% OMS	POC	CHL	% PHYTO-C	PHAEO
C-4	0	1.9	6.15	24.4	0.46	6.70	36.4	1.16
	3	2.7				5.78		1.49
	7	2.2				7.17		0.89
	12	2.0				6.70		0.76
	20	2.9	7.64	20.9	0.64	6.24		1.62
C-5	0	1.5	4.40	26.9	0.47	2.68	14.2	1.22
	3	1.6	4.59	28.8	0.35	2.54		0.97
	8	1.3	4.49	26.2	0.37	2.54		1.24
	21	1.3	7.58	20.4	0.46	2.48		1.46
	25	1.4	5.12	22.7	0.41	2.82		1.40
D-2	0	1.9	4.81	29.5	ND	2.08		0.87
	3	1.5				5.78		1.10
	6	1.9				6.70		0.76
	15	1.7				5.32		1.17
	20	1.5	5.15	20.4		6.94		1.51
D-3	0	1.6	4.89	28.1	0.58	5.28	22.8	1.06
	3	1.5	4.63	27.2	ND	5.52		0.95
	7	1.5	7.08	24.9	0.56	6.44		0.85
	12	1.8	7.81	29.0	0.41	6.35		1.38
	20	1.5	5.56	18.2	0.31	2.07		0.65
D-4	0	2.2	5.00	29.6	0.61	7.17	29.4	0.69
	3	1.4				8.09		1.14
	7	1.4				7.86		0.98
	12	1.3				8.79		0.00
	18	1.6	4.80	18.5	0.39	2.08		0.67
D-5	0	1.3	4.00	29.9	0.58	4.62	19.9	1.21
	3	1.3	4.82	28.7	0.49	4.73		0.99
	6	1.4	4.83	29.3	0.52	4.97		1.03
	16	1.1	7.07	18.9	0.33	2.26		0.52
	22	0.9	4.23	20.4	0.30	1.81		0.63

CRUISE NO. I DATE 28-30 Sept. 1973

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

STA.	Z_{WC}	K_d	K_p	TMS	% OMS	POC	CHL	PHYTO-C	PRO
A1	8	1.7					3.84		
A2	10	1.1					8.28		
A3	12	1.0	1.21	373.3	8.3	8.80	15.66	0.39	214.
M4	12	0.8					15.72		
A4	9	0.8					12.57		
P1	13	0.6	0.22	143.7	12.2	6.57	14.76	0.37	
C2	33	0.7					60.66		
C3	23	0.4	0.25	170.6	19.4	15.69	78.74	1.97	1630.
C4	24	0.4					61.17		
C5	28	0.3	0.17	239.4	17.2	11.36	44.80	1.12	1601.
D2	25	0.3					74.35		
D3	22	0.5	0.26	151.9	19.4	11.44	45.83	1.14	
D4	22	0.3					36.84		
D5	24	0.4	0.19	177.3	14.8	10.14	27.93	0.70	
M15	32	0.5					40.07		
B4	20	0.4					41.59		

CRUISE NO. II DATE 27-28 Oct. 1973

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

STA.	Z_{wc}	K_d	K_p	TMS	% OMS	POC	CHL	PHYTO-C	PROD
A1	16	1.0					10.56		
A2	9	1.0					9.79		
A3	11	0.6	0.88	340.2	7.1	9.33	19.69	0.49	214.7
M4	13	0.6					16.08		
A4	10	0.6					29.99		
P1	16	1.0	1.45	511.3	7.3	15.84	75.94	1.90	
C3	24	0.2	0.24	198.6	14.4	11.37	36.16	0.90	354.8
C5	28	0.3	0.27	402.5	7.8	12.55	28.54	0.71	107.3
D3	23	0.2	0.21	256.2	15.9	17.91	143.78	3.60	
D5	24	0.2	0.16	129.1	16.2	12.71	9.39	0.33	

CRUISE NO. III DATE 17-19 Nov. 1973

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

STA.	Z_{wc}	K_d	K_p	TMS	% OMS	POC	CHL	PHYTO-C	PROD
A1	9	2.3					25.89		
A2	10	2.3					17.91		
A3	12	0.8	0.7	385.3	6.5	11.92	17.28	0.60	225.7
M4	15	0.8					14.74		
A4	13	0.7					16.18		
P1	18	0.4	0.3	-	-	5.30	24.58	0.86	
C2	34	0.3					47.48		
C3	18	0.2	0.1	112.6	25.8	7.73	33.86	1.18	959.1
C4	37	0.2					42.98		
C5	28	0.2	0.2	168.8	24.8	12.87	56.62	1.98	844.7
D2	24	0.3					22.36		
D3	26	0.3	0.2	128.9	20.6	9.17	25.23	0.88	
D4	23	0.3					33.96		
D5	25	0.2	0.2	170.8	22.3	10.83	41.63	1.46	
M15	23	0.3					38.25		
B4	23	0.4					29.01		

CRUISE NO. IV DATE 15-16 Dec. 1973

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

STA.	Z_{wc}	K_d	K_p	TMS	% OMS	POC	CHL	PHYTO-C	PROD
A1	9	1.7					16.5		
A2	10	1.7					10.3		
A3	14	1.1	1.1	229	14.0	13.9	11.1	0.39	14.4
M4	16	1.1					12.6		
A4	13	1.1					11.6		
P1	15	0.7	-	117	16.4	13.9	26.1	0.91	
C3	24	0.4	0.3	114	22.9	14.6	58.0	2.03	257.7
C5	27	0.3	0.3	116	24.5	11.5	88.2	3.09	316.8
D3	21	0.3	0.2	84	21.9	9.9	48.6	1.70	
D5	26	0.3	0.2	105	23.4	11.7	62.4	2.18	

CRUISE NO. V DATE 26-28 January 1974

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					3.3		
A2	9	1.7					5.2		
A3	11	1.0	0.40	106.8	22.4	8.7	9.5	0.24	84.12
A4	6	1.0					7.2		
P1	15	0.4	0.20	92.4	21.5	5.4	26.8	0.67	
B2									
B3									
B4									
C2	30	0.4					67.8		
C3	23	0.6	0.22	99.6	25.9	7.8	66.0	1.65	963.68
C4	32	0.6					74.6		
C5	27	0.2	0.10	96.3	24.0	8.1	45.0	1.12	
D2	23	0.4					36.8		
D3	21	0.3	0.15	86.7	29.6	6.7	40.8	1.02	
D4	39	0.3					74.6		
D5	26	0.3	0.18	91.7	23.5	6.2	69.1	1.73	

CRUISE NO. VI DATE 16-18 February 1974

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

STA.	Z_{wc}	K_d	K_p	TMS	%OMS	POC	CHL	PHYTO-C	PROD.
A1	7	1.1					11.3		
A2	9	1.7					23.0		
A3	16	1.1	1.01	187.2	18.1	12.96	62.3	1.56	269.26
A4	13	0.8					57.6		
P1	13	0.5	0.31	81.3	22.5	6.86	92.2	2.30	
B2	24	0.3					168.6		
B3	20	0.4					95.3		
B4	18	0.5	0.30	100.6	17.4	6.26	33.7	0.84	
C2	31	0.7					167.4		
C3	24	0.4	0.51	93.2	28.8	10.54	80.2	2.00	1160.64
C4	24	0.4					131.1		
C5	28	0.2	0.24	140.0	23.3	10.14	63.8	1.60	1023.16
D2	25	0.4					115.2		
D3	23	0.3	0.32	128.4	25.8	9.36	105.8	2.64	
D4	21	0.3					129.0		
D5	25	0.3	0.29	121.1	23.5	9.22	76.9	1.92	

CRUISE NO. I DATE 28-30 Sept. 73

PRIMARY PRODUCTIVITY
TABLE IV.

STA.	% LIGHT	PHOTO CAP	ASSIM. NO.	I	%LD	PROD.	ASSIM. RATIO
A3	100	17.35	9.94		0.0	178.1	102.0
	60	14.04	8.04		0.4	169.0	96.7
	30	5.89	3.37		1.0	76.8	43.9
	15	2.76	1.58		1.6	34.6	19.7
	1	1.45	0.83		3.8	0.0	0.0
P1	100	19.72	9.96		0.0		
	60	15.73	7.95		2.3		
	30	6.33	3.20		5.4		
	15	2.72	1.37		8.6		
	1	0.46	0.23		20.9		
C3	100	43.82	9.41		0.0	192.2	41.3
	60	26.46	5.68		2.0	168.5	25.2
	30	9.48	2.04		4.8	160.8	21.4
	15	2.79	0.60		7.6	82.8	66.7
	1	0.49	0.10		18.4	3.8	3.4
C5	100	18.31	9.25		0.0	130.3	65.8
	60	13.08	6.61		3.0	160.8	76.8
	30	6.26	3.16		7.0	94.6	45.1
	15	1.52	0.77		11.1	49.4	25.0
	1	0.05	0.02		27.1	2.9	1.7
D3	100	76.82	6.65		0.0		
	60	69.05	5.98		2.0		
	30	28.54	2.47		4.6		
	15	7.44	0.64		7.3		
	1	0.74	0.06		17.7		
D5	100	71.43	7.66		0.0		
	60	56.43	6.05		2.7		
	30	19.04	2.04		6.3		
	15	7.48	0.80		9.9		
	1	0.05	0.00		24.2		

CRUISE NO. II DATE 27-28 Oct. 73

PRIMARY PRODUCTIVITY
TABLE IV.

STA.	% LIGHT	PHOTO CAP	ASSIM. NO.	I	%LD	PROD.	ASSIM. RATIO
A3	100	13.63	6.59		0.0	120.7	58.3
	60	11.89	5.75		0.6	110.6	53.5
	30	4.79	2.32		1.4	53.8	25.9
	15	1.09	0.53		2.1	30.0	14.4
	1	0.09	0.04		5.2	2.4	1.2
P1	100	32.28	5.59		0.0		
	60	25.72	4.45		0.3		
	30	10.19	1.76		0.8		
	15	3.66	0.63		1.3		
	1	0.58	0.10		3.2		
C3	100	12.66	7.88		0.0	61.4	38.2
	60	10.97	6.83		2.1	52.6	32.6
	30	5.58	3.47		5.0	26.9	14.6
	15	2.14	1.33		7.9	9.6	5.3
	1	0.24	0.15		19.2	1.4	1.0
C5	100	10.07	7.81		0.0	24.2	18.7
	60	7.29	5.66		1.9	17.5	16.3
	30	3.41	2.64		4.4	8.2	6.7
	15	1.72	1.33		7.0	3.4	2.9
	1	0.31	0.24		17.0	0.7	0.5
D3	100	36.51	5.48		0.0		
	60	30.98	4.65		2.4		
	30	14.30	2.14		5.7		
	15	6.51	0.98		9.0		
	1	0.94	0.14		21.9		
D5	100	2.06	4.88		0.0		
	60	2.01	4.76		3.2		
	30	1.22	2.89		7.5		
	15	0.48	1.14		11.8		
	1	0.08	0.19		28.8		

CRUISE NO. III DATE 17-19 Nov. 73

PRIMARY PRODUCTIVITY
TABLE IV.

STA.	% LIGHT	PHOTO CAP	ASSIM. NO.	I	%LD	PROD.	ASSIM. RATIO
A3	100	9.79	5.05		0.0	84.8	43.7
	60	10.49	5.41		0.7	99.4	51.3
	30	6.30	3.25		1.7	63.3	32.7
	15	2.65	1.37		2.7	15.2	7.8
	1	0.55	0.28		6.6	0.5	0.2
P1	100	5.20	3.19		0.0		
	60	6.82	4.18		1.7		
	30	5.37	3.29		4.0		
	15	2.09	1.28		6.3		
	1	0.64	0.39		15.3		
C3	100	10.05	3.94		0.0	61.9	24.2
	60	11.73	4.59		5.1	63.9	24.6
	30	9.52	3.73		12.0	43.0	16.4
	15	3.95	1.55		18.9	18.0	7.8
	1	0.88	0.34		46.0	2.2	1.4
C5	100	16.97	6.64		0.0	88.7	34.7
	60	17.50	6.85		2.6	106.0	42.2
	30	12.17	4.76		6.0	69.7	26.8
	15	4.27	1.67		9.4	38.8	14.6
	1	0.40	0.16		23.0	1.6	0.6
D3	100	7.91	6.41		0.0		
	60	7.72	6.26		2.6		
	30	6.75	5.47		6.0		
	15	2.91	2.36		9.4		
	1	0.45	0.36		23.0		
D5	100	9.45	4.38		0.0		
	60	11.93	5.52		2.6		
	30	10.51	4.87		6.0		
	15	4.11	1.90		9.4		
	1	1.00	0.46		23.0		

CRUISE NO. IV.　　　　　　　　DATE 15-16 Dec. 73

PRIMARY PRODUCTIVITY
TABLE IV.

STA.	% LIGHT	PHOTO CAP	ASSIM. NO.	I*	%LD	PROD.	ASSIM. RATIO
A3	100	4.70	4.16	45.6	0.0	16.1	14.2
	60	4.84	4.28	27.4	0.5	9.5	8.4
	30	3.16	2.80	13.7	1.1	3.7	3.3
	15	1.96	1.73	6.8	1.8	1.7	1.5
	1	0.22	0.19	0.4	4.3	0.0	0.0
P1	100	8.82	4.45		0.0		
	60	9.64	4.87		0.8		
	30	7.98	4.03		1.8		
	15	2.61	1.32		2.8		
	1	0.70	0.35		6.8		
C3	100	17.19	4.57	31.7	0.0	74.7	19.9
	60	19.61	5.22	19.0	1.6	56.2	13.1
	30	13.49	3.59	9.5	3.6	20.8	4.8
	15	4.20	1.12	4.8	5.7	9.4	2.4
	1	1.15	0.31	0.3	13.9	1.4	0.4
C5	100	20.71	4.83	27.8	0.0	78.9	18.4
	60	23.93	5.58	16.7	2.0	50.5	11.9
	30	17.48	4.07	8.3	4.6	18.9	4.4
	15	5.99	1.40	4.2	7.3	9.2	2.1
	1	1.38	0.32	0.3	17.7	2.2	0.6
D3	100	9.40	3.51		0.0		
	60	14.01	5.23		2.1		
	30	11.50	4.29		5.0		
	15	4.79	1.79		7.9		
	1	0.93	0.35		19.2		
D5	100	13.64	4.38		0.0		
	60	14.46	4.65		2.2		
	30	12.65	4.07		5.2		
	15	4.91	1.58		8.2		
	1	1.27	0.41		20.0		

* All values should be reduced by 50% to estimate photosynthetically active light energy.

CRUISE NO. V DATE 26-28 January 1974

PRIMARY PRODUCTIVITY
TABLE IV.

STA.	% LIGHT	PHOTO CAP	ASSIM. NO.	I*	% LD	PRIM. PROD.	ASSIM. RATIO
A3	100	7.13	9.90	185.0	0.0	39.25	54.82
	60	7.64	10.61	111.0	0.6	35.83	50.04
	30	4.88	6.78	55.5	1.3	30.72	42.90
	15	1.76	2.44	27.8	2.1	12.92	18.04
	1	0.54	0.75	1.8	5.0	1.46	2.04
P1	100	17.60	8.00		0.0		
	60	18.08	8.22		1.2		
	30	11.42	5.19		2.8		
	15	3.36	1.53		4.4		
	1	0.35	0.16		10.7		
C3	100	32.22	8.03	260.2	0.0	331.40	82.64
	60	36.05	8.99	156.1	0.9	276.02	71.32
	30	21.87	5.45	78.1	2.1	165.39	42.74
	15	7.95	1.98	39.0	3.3	101.53	26.51
	1	1.07	0.27	2.6	8.1	9.03	2.17
C5	100	13.10	7.62		0.0		
	60	13.16	7.65		2.2		
	30	7.47	4.34		5.2		
	15	3.62	2.10		8.2		
	1	0.69	0.40		20.0		
D3	100	29.15	7.67		0.0		
	60	34.90	9.18		1.5		
	30	26.07	6.86		3.5		
	15	8.62	2.27		5.6		
	1	1.19	0.31		13.5		
D5	100	29.25	5.59		0.0		
	60	31.31	5.99		1.6		
	30	23.92	4.57		3.9		
	15	8.84	1.69		6.1		
	1	0.88	0.17		14.8		

*All values should be reduced by 50% to estimate photosynthetically active light energy.

CRUISE NO. VI

DATE 16-18 February 1974

PRIMARY PRODUCTIVITY
TABLE IV.

STA.	% LIGHT	PHOTO CAP.	ASSIM. NO.	I*	%LD	PRIM. PROD.	ASSIM. RATIO
A3	100	35.22	8.8	411.0	0.0	109.76	38.1
	60	27.53	9.6	246.6	0.4	147.29	51.1
	30	17.23	6.0	123.3	1.1	75.82	26.3
	15	5.52	1.9	61.6	1.7	68.19	23.7
	1	0.77	0.3	4.1	4.1	12.28	4.3
P1	100	62.09	7.2		0.0		
	60	61.95	7.2		1.0		
	30	48.09	5.6		2.4		
	15	15.65	1.8		3.8		
	1	1.99	0.2		9.4		
B4	100	11.17	5.4		0.0		
	60	11.54	5.6		1.0		
	20	7.58	3.7		2.4		
	15	2.36	1.1		3.8		
	1	0.20	0.1		9.4		
C3	100	51.71	9.4	199.5	0.0	254.76	46.2
	60	54.18	9.8	119.7	1.2	274.69	42.4
	30	38.70	7.0	59.8	2.8	165.37	25.5
	15	13.29	2.4	29.9	4.4	86.94	18.3
	1	2.00	0.4	2.0	10.7	4.83	1.5
C5	100	22.42	8.4	213.2	0.0	122.03	45.5
	60	23.24	8.7	127.9	2.2	129.92	51.1
	30	15.67	5.8	64.0	5.2	75.62	29.8
	15	6.65	2.5	32.0	8.2	39.54	15.6
	1	0.84	0.3	2.1	20.0	5.37	2.2
D3	100	33.58	6.4		0.0		
	60	36.20	6.8		1.7		
	30	24.00	4.5		4.0		
	15	7.52	1.4		6.3		
	1	1.06	0.2		15.3		
D5	100	38.52	8.3		0.0		
	60	36.40	7.9		1.7		
	30	25.84	5.6		4.0		
	15	9.98	2.2		6.3		
	1	1.46	0.3		15.3		

* All values should be reduced by 50% to estimate photosynthetically active light energy.

CRUISE NO. III   DATE 17-19 Nov. 1973

PHYTOPLANKTON FRACTIONATION: PHOTOSYNTHETIC CAPACITY
TABLE V.

		PHOTO CAP		CHL A		ASSIM. NO.	
STA.	% LIGHT	NANO	NET	NANO	NET	NANO	NET
A3	100	5.70	4.09	1.19	0.75	4.79	5.46
	60	6.50	3.99			5.46	5.33
	30	3.93	2.37			3.30	3.16
	15	1.90	0.75			1.60	1.00
	1	0.40	0.15			0.34	0.20
C3	100	7.58	2.47	1.85	0.70	4.10	3.50
	60	9.36	2.37			5.06	3.36
	30	7.81	1.71			4.22	2.42
	15	3.22	0.73			1.74	1.03
	1	0.78	0.10			0.42	0.14
C5	100	13.99	2.98	1.85	0.70	7.57	4.23
	60	14.43	3.07			7.80	4.35
	30	10.40	1.77			5.62	2.51
	15	3.78	0.49			2.04	0.70
	1	0.40	0.00			0.22	0.00

CRUISE NO. IV DATE 15-16 Dec. 1973

PHYTOPLANKTON FRACTIONATION: PHOTOSYNTHETIC CAPACITY

TABLE V.

		PHOTO CAP		CHL A		ASSIM. NO.	
STA.	% LIGHT	NANO	NET	NANO	NET	NANO	NET
A3	100	4.04	0.66	0.97	0.16	4.16	4.10
	60	4.11	0.73			4.24	4.53
	30	2.78	0.38			2.86	2.36
	15	1.76	0.20			1.81	1.24
	1	0.20	0.02			0.21	0.12
P1	100	6.28	2.54	1.28	0.70	4.91	3.60
	60	7.18	2.46			5.62	3.49
	30	5.59	2.39			4.37	3.39
	15	1.93	0.68			1.51	0.96
	1	0.56	0.14			0.44	0.20
C3	100	11.98	5.21	2.08	1.68	5.76	3.11
	60	13.75	6.36			6.37	3.80
	30	9.78	3.71			4.70	2.21
	15	3.02	1.18			1.45	0.70
	1	0.79	0.36			0.38	0.21
C5	100	17.25	3.46	2.66	1.63	6.49	2.12
	60	19.95	3.98			7.50	2.44
	30	14.60	2.88			5.49	1.76
	15	4.80	1.19			1.80	0.73
	1	1.16	0.22			0.44	0.13
D3	100	6.87	2.53	1.62	1.06	4.24	2.39
	60	10.99	3.02			6.79	2.85
	30	9.16	2.34			5.66	2.21
	15	3.66	1.13			2.26	1.07
	1	0.73	0.20			0.45	0.19
D5	100	9.93	3.71	1.96	1.15	5.06	3.24
	60	10.52	3.94			5.36	3.44
	30	9.54	3.11			4.86	2.71
	15	3.70	1.21			1.88	1.06
	1	1.01	0.26			0.51	0.23

CRUISE NO. V

DATE 26-28 January 1974

PHYTOPLANKTON FRACTIONATION: PHOTOSYNTHETIC CAPACITY
TABLE V.

		PHOTO CAP		CHL A		ASSIM. NO.	
STA.	% LIGHT	NANO	NET	NANO	NET	NANO	NET
A3	100	3.82	3.31	0.31	0.41	12.4	8.1
	60	4.23	3.41			13.7	8.4
	30	2.88	2.00			9.4	4.9
	15	1.16	0.60			3.8	1.5
	1	0.30	0.14			1.0	0.3
P1	100	7.12	10.48	0.70	1.50	10.1	7.0
	60	7.01	11.07			9.9	7.4
	30	4.86	6.56			6.9	4.4
	15	1.58	1.78			2.2	1.2
	1	0.14	0.21			0.2	0.1
C3	100	8.67	23.55	0.66	3.35	13.12	7.0
	60	10.61	25.44			16.05	7.6
	30	7.53	14.34			11.39	4.3
	15	2.87	5.08			4.34	1.5
	1	0.36	0.71			0.54	0.2
C5	100	6.30	6.80	0.57	1.15	11.0	5.9
	60	7.00	6.16			12.2	5.4
	30	3.28	4.19			5.7	3.7
	15	1.56	2.06			2.7	1.8
	1	0.38	0.31			0.7	0.3
D3	100	11.03	18.12	0.79	3.00	13.91	6.0
	60	16.26	18.64			20.50	6.2
	30	9.04	17.03			11.40	5.7
	15	3.62	5.00			4.56	1.7
	1	0.69	0.50			0.87	0.2
D5	100	7.51	21.74	0.84	4.39	9.0	5.0
	60	7.90	23.41			9.4	5.3
	30	4.80	19.12			5.7	4.4
	15	2.24	6.60			2.7	1.5
	1	0.16	0.72			0.2	0.2

CRUISE NO. VI DATE 16-18 February 1974

PHYTOPLANKTON FRACTIONATION: PHOTOSYNTHETIC CAPACITY
TABLE V.

		PHOTO CAP.		CHL A.		ASSIM. NO.	
STA	% LIGHT	NANO	NET	NANO	NET	NANO	NET
A3	100	8.00	17.22	0.79	2.08	10.1	8.3
	60	9.46	18.07			11.9	8.7
	30	6.13	11.10			7.7	5.3
	15	2.29	3.23			2.9	1.6
	1	0.23	0.54			0.3	0.3
P1	100	8.23	53.86	0.79	7.86	10.4	6.8
	60	8.82	53.13			11.1	6.8
	30	7.86	40.23			9.9	5.1
	15	2.20	13.45			2.8	1.7
	1	0.41	1.58			0.5	0.2
B4	100	7.27	3.90	1.10	0.97	6.6	4.0
	60	7.30	4.24			6.6	4.4
	30	4.89	2.69			4.4	2.8
	15	1.36	1.00			1.2	1.0
	1	0.01	0.19			0.0	0.2
C3	100	11.17	40.54	0.88	4.62	12.7	8.8
	60	11.37	42.81			12.9	9.3
	30	9.77	28.93			11.1	6.3
	15	3.50	9.79			4.0	2.1
	1	0.70	1.30			0.8	0.3
C5	100	5.00	17.42	0.48	2.20	10.4	7.9
	60	5.29	17.95			11.0	8.2
	30	3.58	12.09			7.5	5.5
	15	1.70	4.95			3.5	2.2
	1	0.20	0.64			0.4	0.3
D3	100	5.56	28.02	0.88	4.39	6.3	6.4
	60	6.44	29.76			7.3	6.8
	30	5.19	18.81			5.9	4.3
	15	1.81	5.71			2.1	1.3
	1	0.34	0.72			0.4	0.2
D5	100	6.14	32.38	0.57	4.05	10.8	8.0
	60	6.19	30.21			10.9	7.5
	30	4.80	21.04			8.4	5.2
	15	1.96	8.02			3.4	2.0
	1	0.53	0.93			0.9	0.2

CRUISE NO. III

DATE 17-19 Nov. 1973

PHYTOPLANKTON FRACTIONATION: PRIMARY PRODUCTIVITY
TABLE VI.

		CHL A			PRIM PROD		ASSIM. NO.	
STA.	Z	NANO	NET	% LD	NANO	NET	NANO	NET
A3	0	1.19	0.75					
	3	1.06	0.70					
	10	0.88	0.70					
C3	0	1.85	0.70					
	2	1.85	0.75					
	4	1.96	0.66					
	8	1.73	0.57					
	15	1.50	0.08					
C5	0	1.85	0.70					
	2	1.85	0.66					
	4	1.85	0.75					
	8	1.96	0.66					
	15	1.85	0.75					
	22	1.85	0.62					

CRUISE NO. V   DATE 26-28 January 1974

PHYTOPLANKTON FRACTIONATION: PRIMARY PRODUCTIVITY
TABLE VI.

		CHL A			PRIM PROD		ASSIM. RATIO	
STA.	Z	NANO	NET	% LD	NANO	NET	NANO	NET
A3	0	0.31	0.41					
	5	0.44	0.49					
	9	0.44	1.32					
P1	0	0.70	1.50					
	5	0.88	1.76					
	12	0.48	1.06					
B4								
C3	0	0.66	3.35					
	2	0.75	3.12					
	4	0.71	3.12					
	10	0.93	3.24					
	20	0.34	0.79					
C5	0	0.57	1.15					
	4	0.41	1.32					
	8	0.38	1.45					
	15	0.42	1.90					
	23	0.39	1.41					
D3	0	0.79	3.00					
	2	0.97	3.12					
	6	0.84	2.77					
	12	0.12	0.66					
	17	0.31	0.66					
D5	0	0.84	4.39					
	3	0.88	4.74					
	8	0.79	3.70					
	15	0.34	0.93					
	21	0.34	0.88					

CRUISE NO. VI   DATE 16-18 February 1974

PHYTOPLANKTON FRACTIONATION: PRIMARY PRODUCTIVITY
TABLE VI.

		CHL A			PRIM PROD		ASSIM. RATIO	
STA.	Z	NANO	NET	%LD	NANO	NET	NANO	NET
A3	0	0.79	2.08	0.0	33.02	76.74	41.8	36.9
	2	0.88	2.77	0.4	40.02	107.27	50.7	51.6
	12	1.01	6.47	1.1	21.98	53.84	27.8	25.9
				1.7	18.24	49.95	23.1	24.0
				4.1	2.80	9.48	3.5	4.6
P1	0	0.79	7.86	0.0				
	4	0.71	7.86	1.0				
	10	0.97	9.71	2.4				
				3.8				
				9.4				
B4	0	1.10	0.97	0.0				
	4	1.01	0.93	1.0				
	11	1.19	1.50	2.4				
	15	0.97	1.10	3.8				
				9.4				
C3	0	0.88	4.62	0.0	54.48	200.28	61.9	43.4
	2	0.93	5.55	1.2	58.79	215.90	63.2	38.9
	4	1.06	3.70	2.8	35.14	130.23	37.8	23.5
	12	0.41	2.77	4.4	13.94	73.00	13.2	19.7
	23	0.31	1.10	10.7	1.14	3.69	2.8	1.3
C5	0	0.48	2.20	0.0	28.78	93.25	60.0	42.4
	3	0.57	1.96	2.2	29.01	100.91	50.9	51.5
	8	0.57	1.96	5.2	12.16	63.46	21.3	32.4
	21	0.40	2.08	8.2	7.98	31.56	14.0	16.1
	25	0.40	2.43	20.0	2.40	2.97	6.0	1.4
D3	0	0.88	4.39	0.0				
	3	0.66	4.86	1.7				
	7	0.66	5.78	4.0				
	12	0.57	5.78	6.3				
	20	0.34	1.73	15.3				
D5	0	0.57	4.05	0.0				
	3	0.57	4.16	1.7				
	6	0.57	4.39	4.0				
	16	0.30	1.96	6.3				
	22	0.31	1.50	15.3				

CRUISE NO. III DATE 13-19 Nov. 1973

PHYTOPLANKTON FRACTIONATION: NET/NANO RATIOS
TABLE VII.

STA.	P_{max}	ASSIM. NO.	CHL M^{-2}	PROD M^{-2}	ASSIM RATIO
A3	0.63	1.0	0.7		
C3	0.26	0.7	0.3		
C5	0.21	0.6	0.4		

CRUISE NO. IV   DATE 15-16 Dec. 1973

PHYTOPLANKTON FRACTIONATION: NET/NANO RATIOS
TABLE VII.

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

CRUISE NO. V DATE 26-28 January 1974

PHYTOPLANKTON FRACTIONATION: NET/NANO RATIOS
TABLE VII.

STA.	P_{max}	ASSIM. NO.	CHL M^{-2}	PROD M^{-2}	ASSIM. RATIO
A3	0.8	0.6	1.6		
P1	1.6	0.7	2.1		
C3	2.4	0.5	3.7		
C5	1.0	0.5	3.7		
D3	1.2	0.3	3.4		
D5	3.0	0.6	4.4		

CRUISE NO. VI DATE 16-18 February 1974

PHYTOPLANKTON FRACTIONATION: NET/NANO RATIOS
TABLE VII.

STA.	P_{max}	ASSIM. NO.	CHL M^{-2}	PROD M^{-2}	ASSIM. RATIO
A3	1.9	0.7	4.6	2.6	0.6
P1	6.1	0.6	10.5		
B4	0.6	0.7	0.9		
C3	3.8	0.7	4.9	4.0	0.8
C5	3.4	0.7	4.2	3.7	0.9
D3	4.6	0.9	8.1		
D5	5.2	0.7	7.0		

CRUISE NO. I DATE 28-30 Sept. 1973

NUMERICAL ABUNDANCE OF ZOOPLANKTON
TABLE IX.

TAXONOMIC GROUP	A1*	A3	A4	P1	C3	C5	D3	D5	B4
COPEPODA	672	6239	6494	3108	4815	1039	3969	2696	2741
CLADOCERA		14		259	10427	2827	4662	3116.0	2725
OSTRACODA	2	10	8		137				26
AMPHIPODA						34		18	
MYSIDACEA	4		8	11		9		3	
CHAETOGNATHA							9	3	2
POLYCHAETA							45	5	8
CUMACEA									
TUNICATA			8	4	4953	1140	95	85	22
MEDUSAE	41								
CTENOPHORA									
LARVAE									
GASTROPODA		7	25		41				9
POLYCHAETA								3	
LAMELLIBRANCH				15	41	28	351	54	260
ECHNIODERMATA									
FISH									
BRACHYURAN ZOEA			8		1				
NAUPLII									
BALANUS									
COPEPOD	15		8	1	14		9		
FISH EGGS	6	10	80						
UNKNOWN LARVAE		10	8		69	9		69	19
TOTAL	740	6290	6647	3398	20138	5086	9140	6325	5812

*Net clogged.

CRUISE NO. II DATE 27-28 Oct. 1973

NUMERICAN ABUNDANCE OF ZOOPLANKTON
TABLE IX.

TAXONOMIC GROUP	A1	A3	A4	P1	C3	C5	D3	D5	B4
COPEPODA	1260	9125	1935	850	988	1440	433	7993	
CLADOCERA		266	49	320	1718	706	502	6848	
OSTRACODA			3	2			3	10	
AMPHIPODA		12		4	42	15			
MYSIDACEA	2	6	4		5		2		
CHAETOGNATHA					4	11	3		
POLYCHAETA		1	3	16	2				
CUMACEA									
TUNICATA	29			113	34	41	53		
MEDUSAE									
CTENOPHORA									
LARVAE									
GASTROPODA	3			18	92	7	2	1	
POLYCHAETA	1		2	2			5		
LAMELLIBRANCH		17	9	76	126	88	57	2318	
ECHNIODERMATA				4	57				
FISH						36			
BRACHYURAN ZOEA								10	
NAUPLII									
BALANUS									
COPEPOD	2	85	19	100			21		
FISH EGGS	12					6			
UNKNOWN LARVAE					9	12			
TOTAL	1309	9512	2024	1505	3079	3162	1081	17,170	

CRUISE NO. III   DATE 17-19 Nov. 1973

NUMERICAL ABUNDANCE OF ZOOPLANKTON
TABLE IX.

TAXONOMIC GROUP	A1	A3	A4	P1	C3	C5	D3	D5	B4
COPEPODA	105	43	2426	2600	4510	3502	4516	7385	3323
CLADOCERA		1	6	13	35	163	36	38	30
OSTRACODA	1		5	2			7		3
AMPHIPODA						5	7	38	3
MYSIDACEA			6	4	11				
CHAETOGNATHA			8	5	88	40	18	17	11
POLYCHAETA			27	2					16
CUMACEA									
TUNICATA					3				
MEDUSAE				2	2				
CTENOPHORA									
LARVAE									
GASTROPODA				8	33	40	7	34	8
POLYCHAETA	88	1	8		6		17	26	6
LAMELLIBRANCH	3		51	261	291		259	350	431
ECHNIODERMATA									
FISH									
BRACHYURAN ZOEA									
NAUPLII									
BALANUS									
COPEPOD			27						6
FISH EGGS	1				2				
UNKNOWN LARVAE					23	12	105	42	
TOTAL	197	45	2564	2897	5804	3762	4972	7930	3831

CRUISE NO. IV DATE 15-16 Dec. 1973

NUMERICAL ABUNDANCE OF ZOOPLANKTON
TABLE IX.

TAXONOMIC GROUP	A1	A3	A4	P1	C3	C5	D3	D5	B4
COPEPODA	87.86	35.70	319.68	258.70	949.43	1622.85	685.88	266.51	
CLADOCERA		0.05							
OSTRACODA			0.48					0.48	
AMPHIPODA							0.85	0.24	
MYSIDACEA		0.10	0.50			1.16		0.24	
CHAETOGNATHA				0.75	11.97		12.20	4.21	
POLYCHAETA		0.10	1.92				0.30	0.24	
CUMACEA	0.30								
TUNICATA									
MEDUSAE									
CTENOPHORA									
LARVAE									
GASTROPODA	0.25					1.08	2.00		
POLYCHAETA	1.15	0.10			0.57				
LAMELLIBRANCH	0.20	0.35	17.75		40.57	653.66	33.30	14.05	
ECHNIODERMATA			0.25						
FISH	0.05				1.71	1.16			
BRACHYURAN ZOEA									
NAUPLII									
BALANUS									
COPEPOD									
UNKNOWN			0.24	18.6		4.06	6.20	0.97	
TOTAL	89.81	36.40	340.82	278.05	1604.35	2283.97	723.73	286.94	

CRUISE NO. V DATE 26-28 January 1974

NUMERICAL ABUNDANCE OF ZOOPLANKTON
TABLE IX.

TAXONOMIC GROUP	A1	A3	A4	P1	C3	C5	D3	D5	B
COPEPODA	49.95	54.52	117.30	395.0	251.32	293.78	599.61	2309.00	
CLADOCERA									
OSTRACODA									
AMPHIPODA	0.32	0.08							
MYSIDACEA	0.32		0.16	0.13	0.23		0.16	5.96	
CHAETOGNATHA	0.08	0.12	0.16	0.67	1.25	0.32	1.11		
POLYCHAETA		0.25	0.31						
CUMACEA		0.04							
TUNICATA									
MEDUSAE	0.08								
ctenophora									
LARVAE									
GASTROPODA							1.11		
POLYCHAETA		0.66	0.47	0.13					
LAMELLIBRANCH			0.31		0.34	0.32		98.34	
ECHNIODERMATA									
FISH						2.92	0.16	1.49	
BRACHYURAN ZOEA									
NAUPLII									
BALANUS		0.45	2.74	20.50	0.11	0.65	5.53		
COPEPOD		0.12		0.67	1.94	0.97	1.11	7.45	
UNIDENTIFIED LARVAE				3.62	1.49		5.21	11.92	
TOTAL	52.75	56.36	121.45	420.72	256.68	298.96	614.00	2434.16	

CRUISE NO. I   DATE 28-30 Sept. 1973

ZOOPLANKTON BIOMASS
TABLE X.

STA.	DRY WEIGHT					DISPLACEMENT VOLUME
	COPEPODA		CLADOCERA		WHOLE SAMPLE	
	WT/M^3	WT/ORG.	WT/M^3	WT/ORG.	WT/M^3	ML/M^3
A1					34.9	7.735*
A3	106.7	.0171				2.150
A4	97.4	.0150				1.040
P1	43.5	.0133	3.9	.0150		0.915
C3	139.7	.0290	198.1	.0190		5.360
C5	19.2	.0185	38.5	.0136		2.990
D3	57.2	.0144	36.4	.0078		3.520
D5	136.7	.0507	102.9	.0330		1.540
B4	69.4	.0252	48.3	.0227		3.040

* Net clogged.

CRUISE NO. II DATE 27-28 October 1973

ZOOPLANKTON BIOMASS
TABLE X.

STA.	DRY WEIGHT					DISPLACEMENT VOLUME ML/M³
	COPEPODA		CLADOCERA		WHOLE SAMPLE	
	WT/M³	WT/ORG.	WT/M³	WT/ORG.	WT/M³	
A1	18.2	.0144				0.560
A3	50.2	.0055	4.0	.0151		0.885
A4	21.7	.0112				0.370
P1	10.6	.0125	3.2	.0100		0.695
C3	11.9	.0121	24.2	.0145		0.640
C5	25.8	.0179	8.5	.0122		0.595
D3	7.9	.0183	3.6	.0083		0.810
D5	184.6	.0231	130.5	.0193		5.700
B4	ND					

CRUISE III DATE 17-19 Nov. 1973

ZOOPLANKTON BIOMASS
TABLE X.

STA.	DRY WEIGHT					DISPLACEMENT VOLUME ML/M³
	COPEPODA		CLADOCERA		WHOLE SAMPLE	
	WT/M³	WT/ORG.	WT/M³	WT/ORG.	WT/M³	
A1	1.5	.0144				0.085
A3					2.6	0.250
A4	69.9	.0288				0.604
P1	89.2	.0343				0.605
C3	65.0	.0144	17.5	.0301		0.990
C5	194.0	.0554	8.5	.0260		0.725
D3	303.0	.0671				0.520
D5	347.1	.0470				1.640
B4	92.4	.0278	30.2	.0350		0.525

CRUISE NO. IV DATE 15-16 Dec. 1973

ZOOPLANKTON BIOMASS
TABLE X.

STA.	DRY WEIGHT				DISPLACEMENT VOLUME ML/M³
	COPEPODA		WHOLE SAMPLE	OTHERS	
	Wt/M³	Wt/ORG.	Wt/M³	Wt/M³	
A1	0.76	0.00868	1.32	0.56	0.028
A3	0.80	0.0225	2.63	0.18	0.016
A4	?2.94	0.0092	2.15		0.019
P1	2.74	0.0106	3.80	0.11	0.058
C3	16.10	0.0170	27.50	11.40	0.200
C5	?51.93	0.0320	36.20		0.185
D3	16.46	0.0240	21.20	4.74	0.159
D5	8.41	0.0315	9.20	0.79	0.171
B4	ND				

CRUISE NO. V   DATE 26-28 Jan. 1974

ZOOPLANKTON BIOMASS
TABLE X.

STA.	DRY WEIGHT				DISPLACEMENT VOLUME ML/M^3
	COPEPODA		WHOLE SAMPLE	OTHERS	
	Wt/M^3	Wt/ORG.	Wt/M^3	Wt/M^3	
A1*	-	-	15.40	-	0.333
A3*	3.82	.0702	9.60	5.78	0.013
A4	2.12	.0181	4.51	2.39	0.058
P1	4.70	.0118	5.20	0.50	0.104
C3	0.69	.0028	3.35	2.66	0.085
C5	? 6.20	.0211	5.60		0.101
D3	14.50	.0243	23.50	9.00	0.187
D5	69.27	.0300	74.00	4.73	0.088
B4	ND				

* Large amount of debris present.

Figure 1. Station Locations in the New York Bight

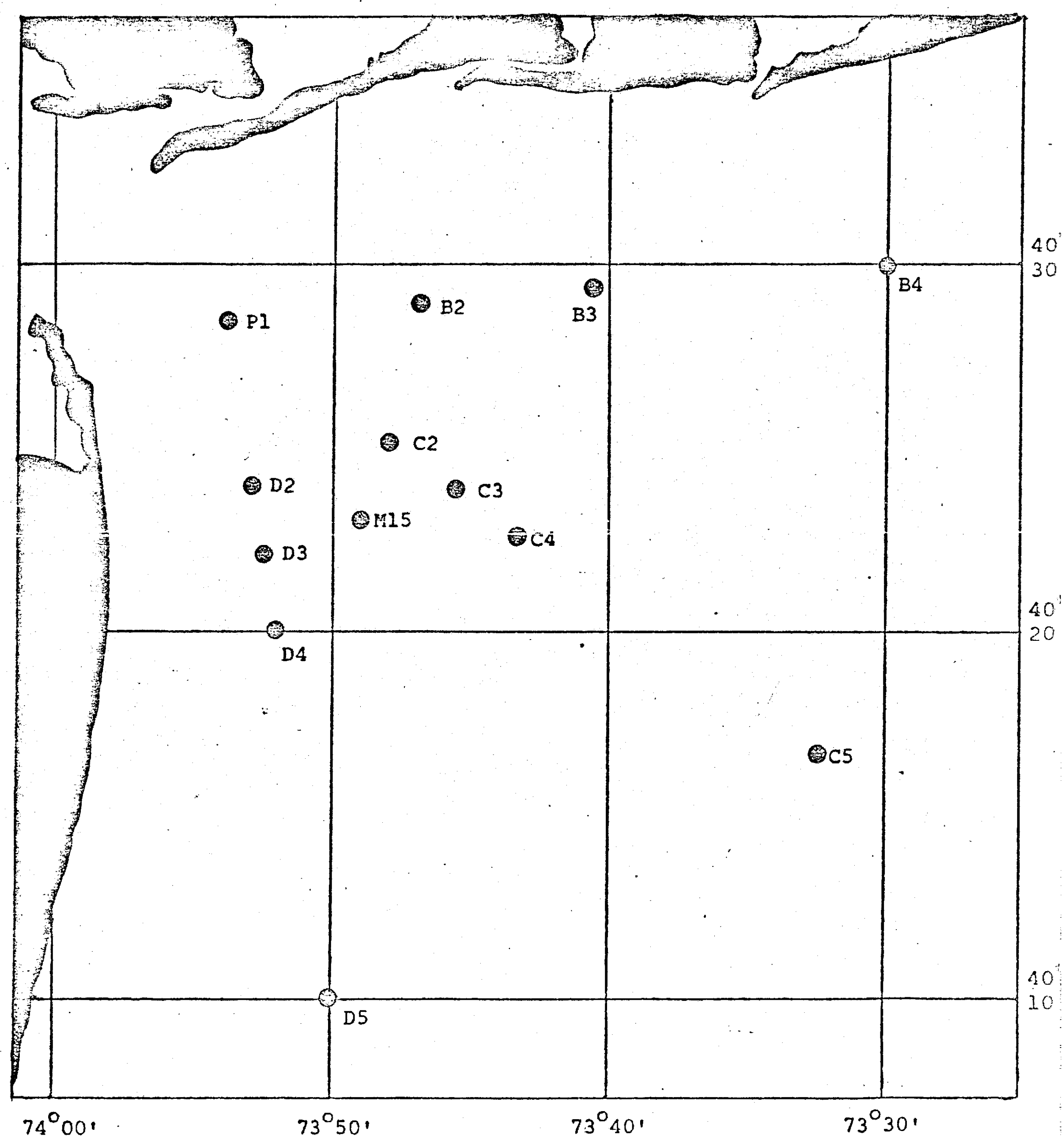

40
30
40
20
40
10
P1
B2
B3
B4
C2
D2
C3
M15
C4
D3
D4
C5
D5
74°00'
73°50'
73°40'
73°30'

Figure 2. Monthly variations in surface temperature and salinity at station C3.

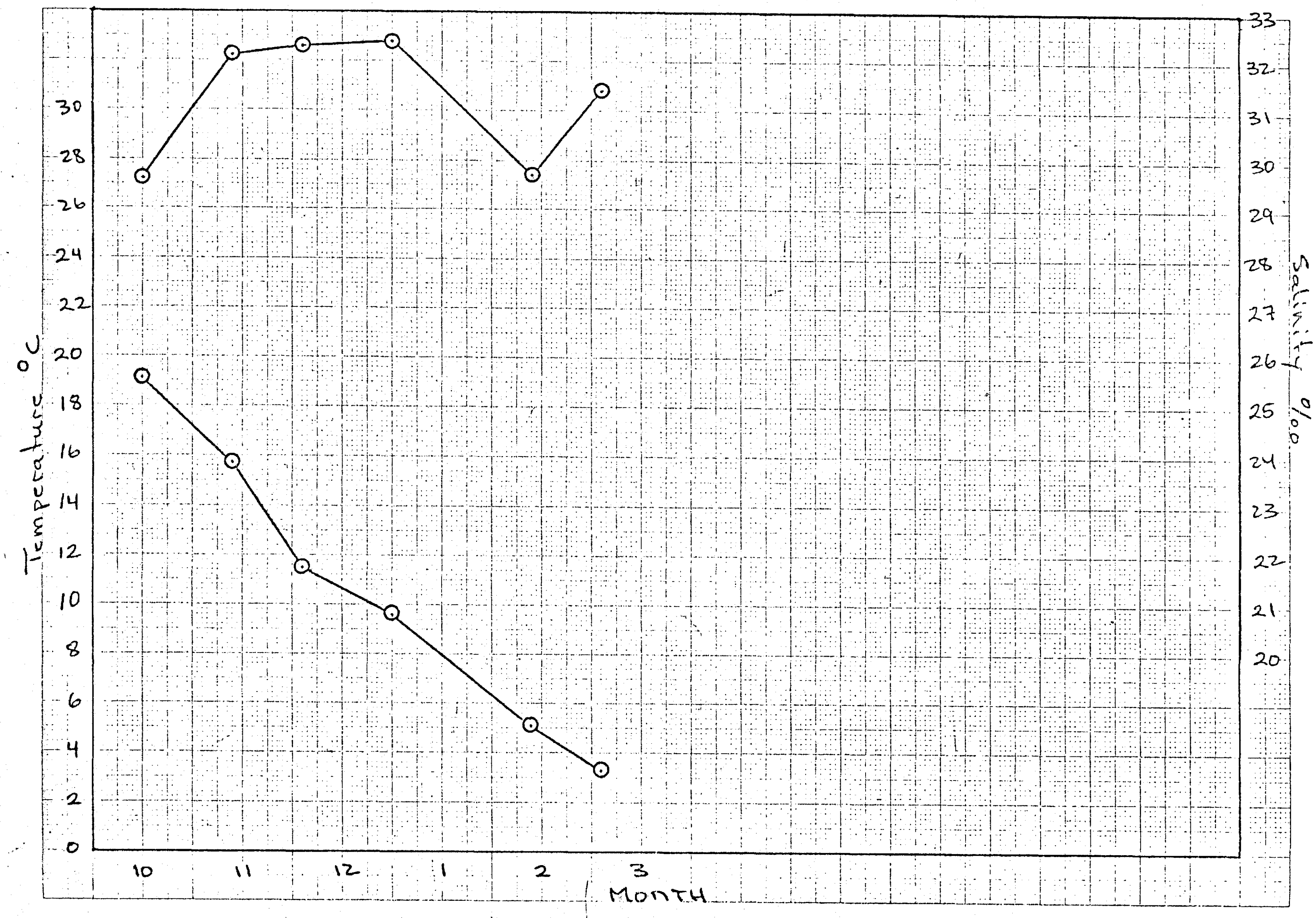
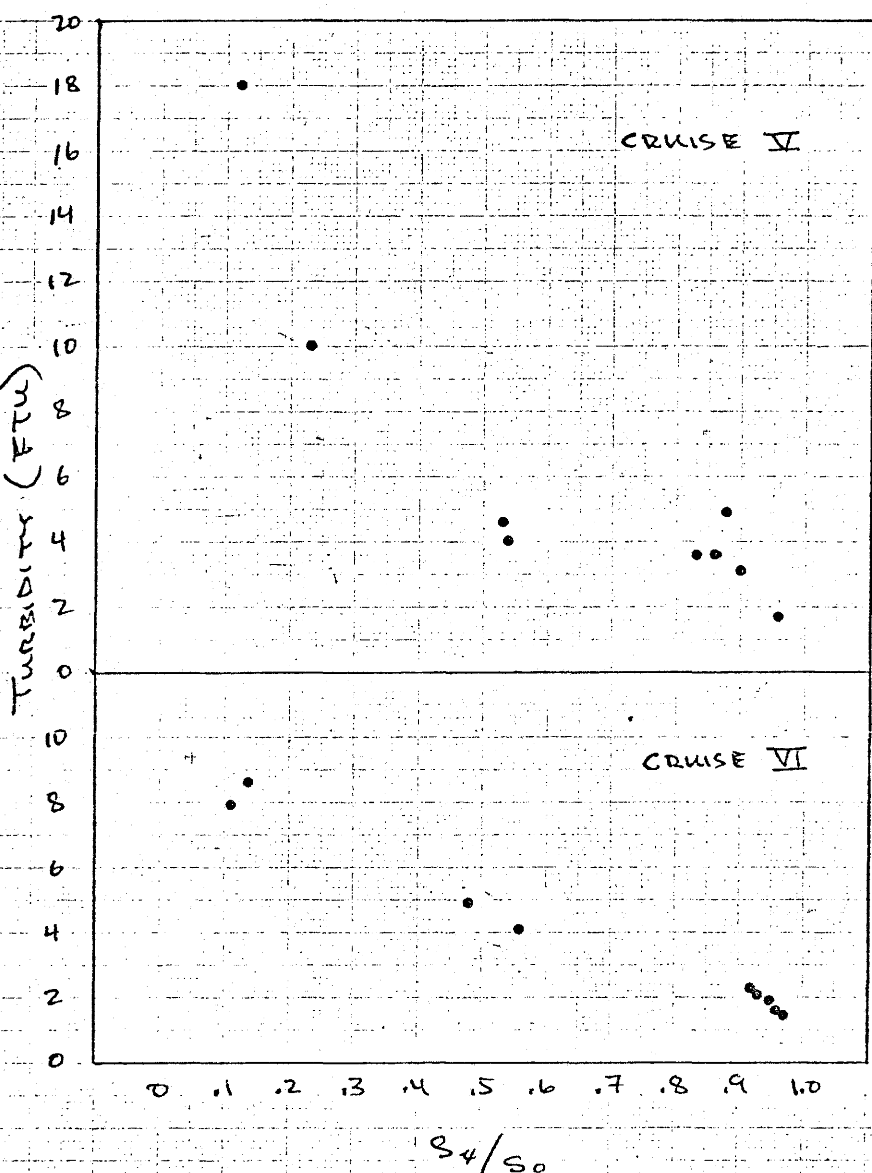

Temperature °C
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
Salinity ‰
20
21
22
23
24
25
26
27
28
29
30
31
32
33
10
11
12
1
2
3
MONTH

Fig 2

Figure 3. Surface turbidity as a function of the salinity ratio (S_x = salinity of the sample, S_o = salinity of the source sea water).

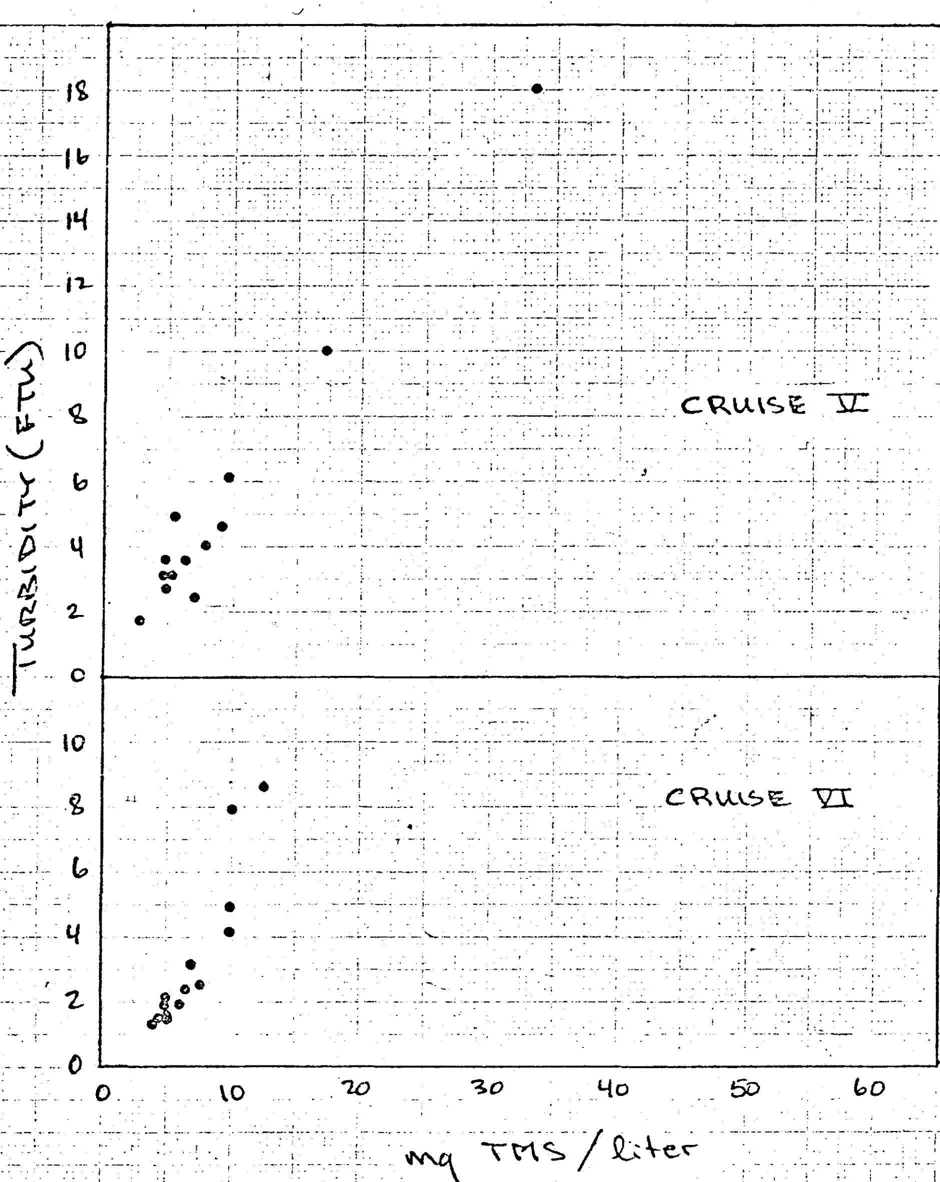
Fig 3



CRUISE V
CRUISE VI
TURBIDITY (FTU)
20
18
16
14
12
10
8
6
4
2
0
10
8
6
4
2
0
0
.1
.2
.3
.4
.5
.6
.7
.8
.9
1.0
S4/S0

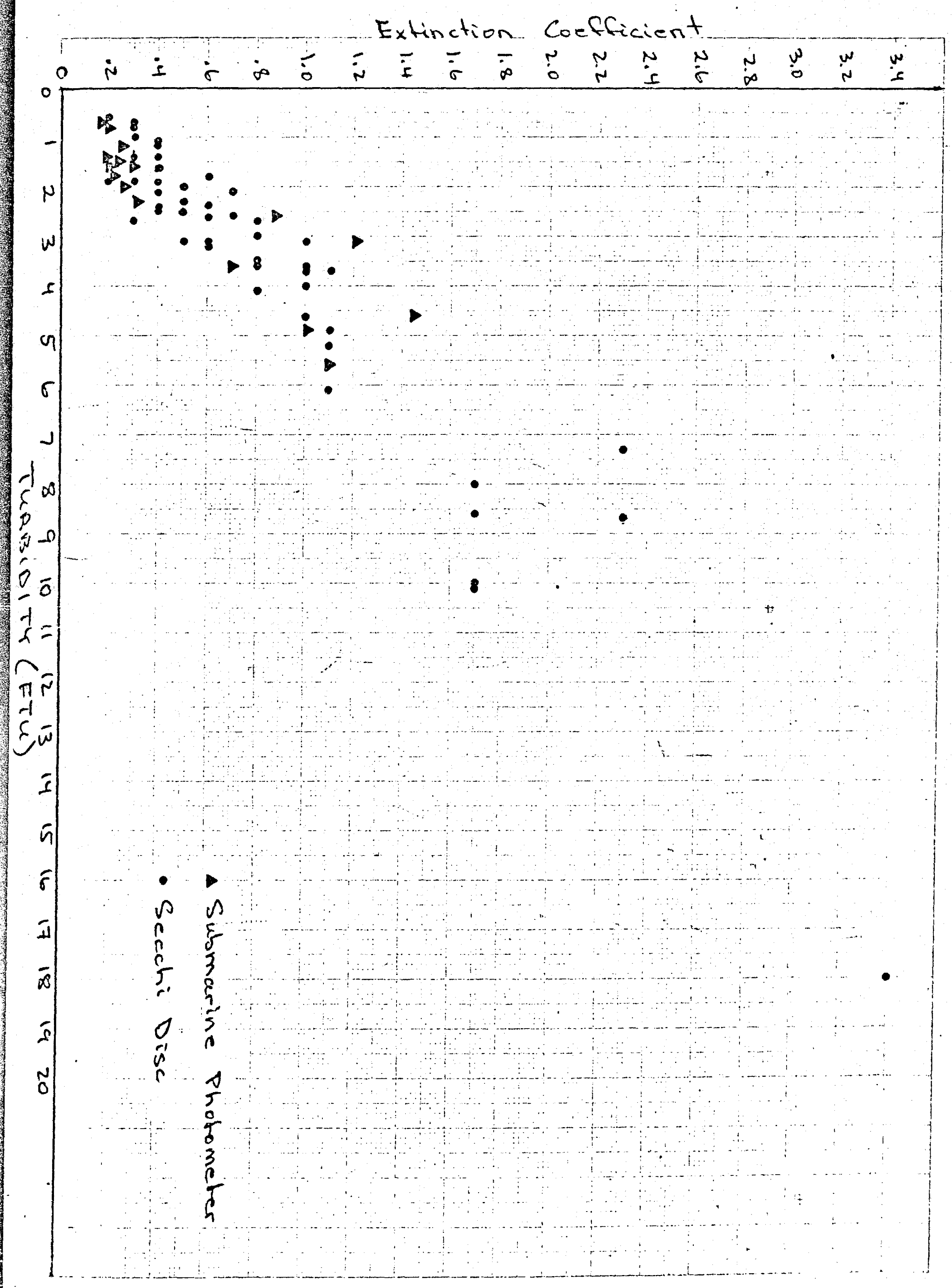
Figure 4. Surface turbidity as a function of the weight of total microseston.

Fig 4



TURBIDITY (FTU)
18
16
14
12
10
8
6
4
2
0
CRUISE V
10
8
6
4
2
0
CRUISE VI
0
10
20
30
40
50
60
mg TMS / liter

Figure 5. Extinction coefficients as a function of surface turbidity (pooled data for all cruises).



Extinction Coefficient
0 .2 .4 .6 .8 1.0 1.2 1.4 1.6 1.8 2.0 2.2 2.4 2.6 2.8 3.0 3.2 3.4
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
TURBIDITY (FTU)
▲ Submarine Photometer
• Secchi Disc

Figure 6. Monthly variations in the weight of suspended inorganic matter and the proportion of POC which is phytoplankton-bound at station C3 (vertical bars represent the range of values observed at all Bight Stations).

Fig 6

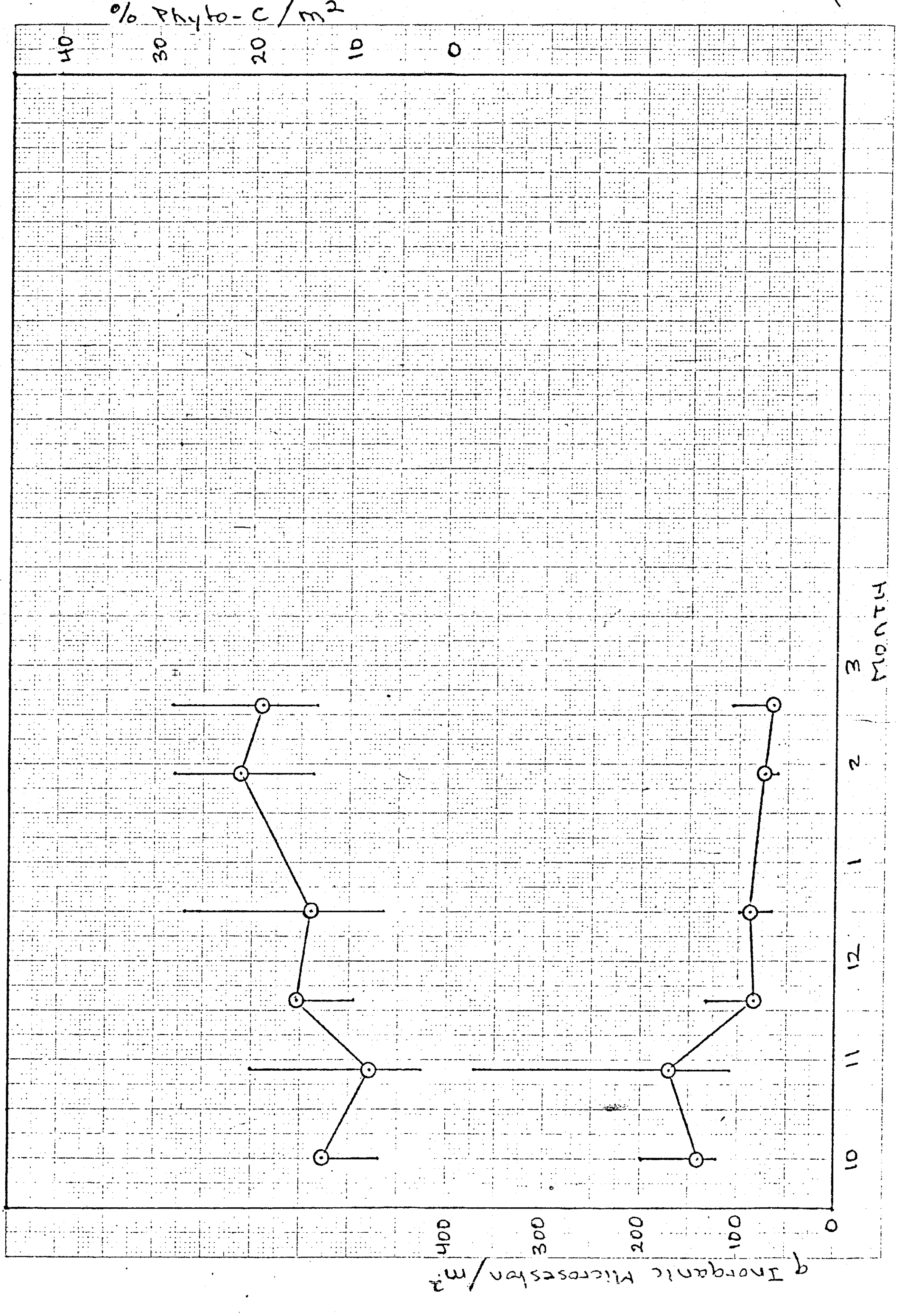
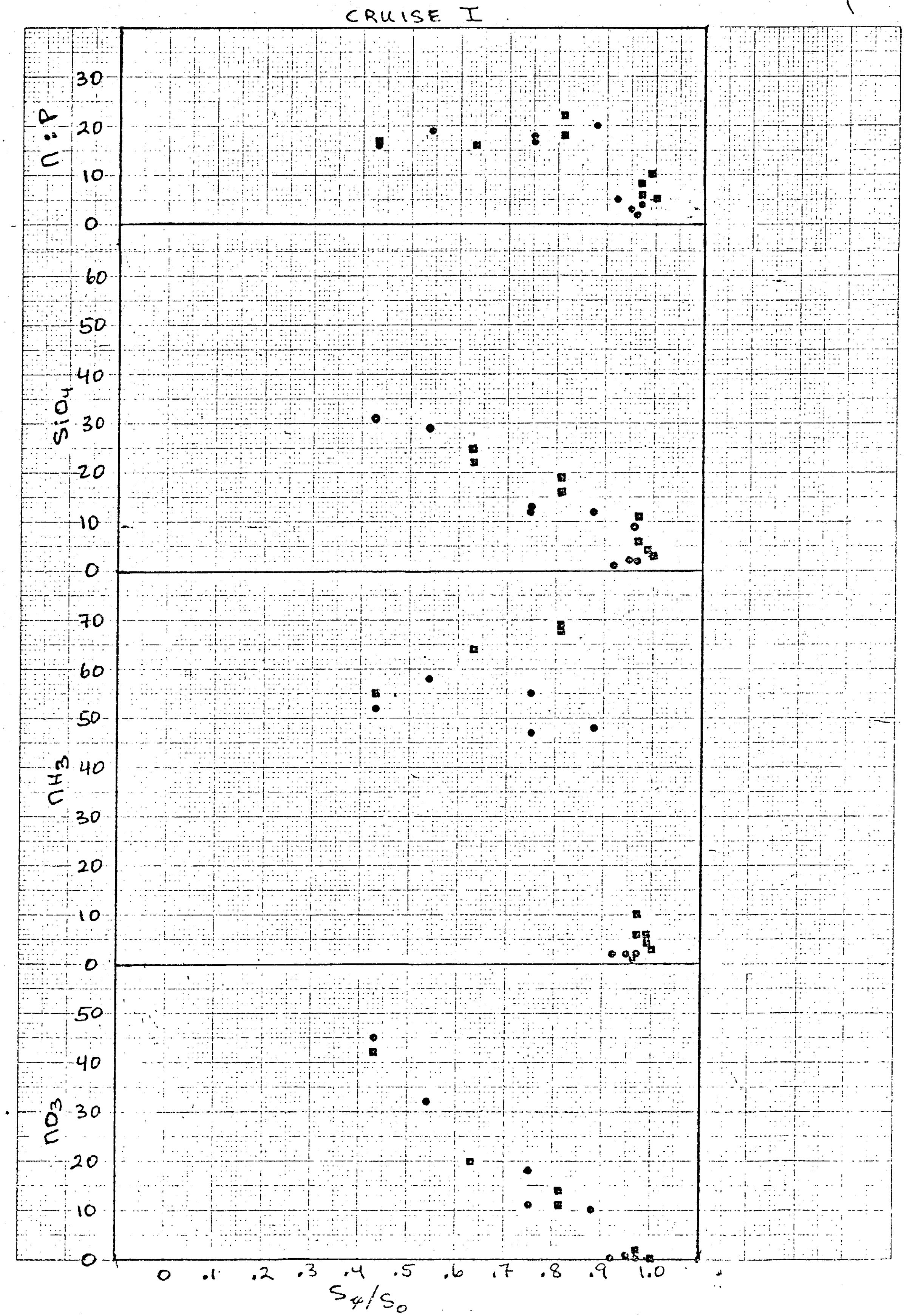
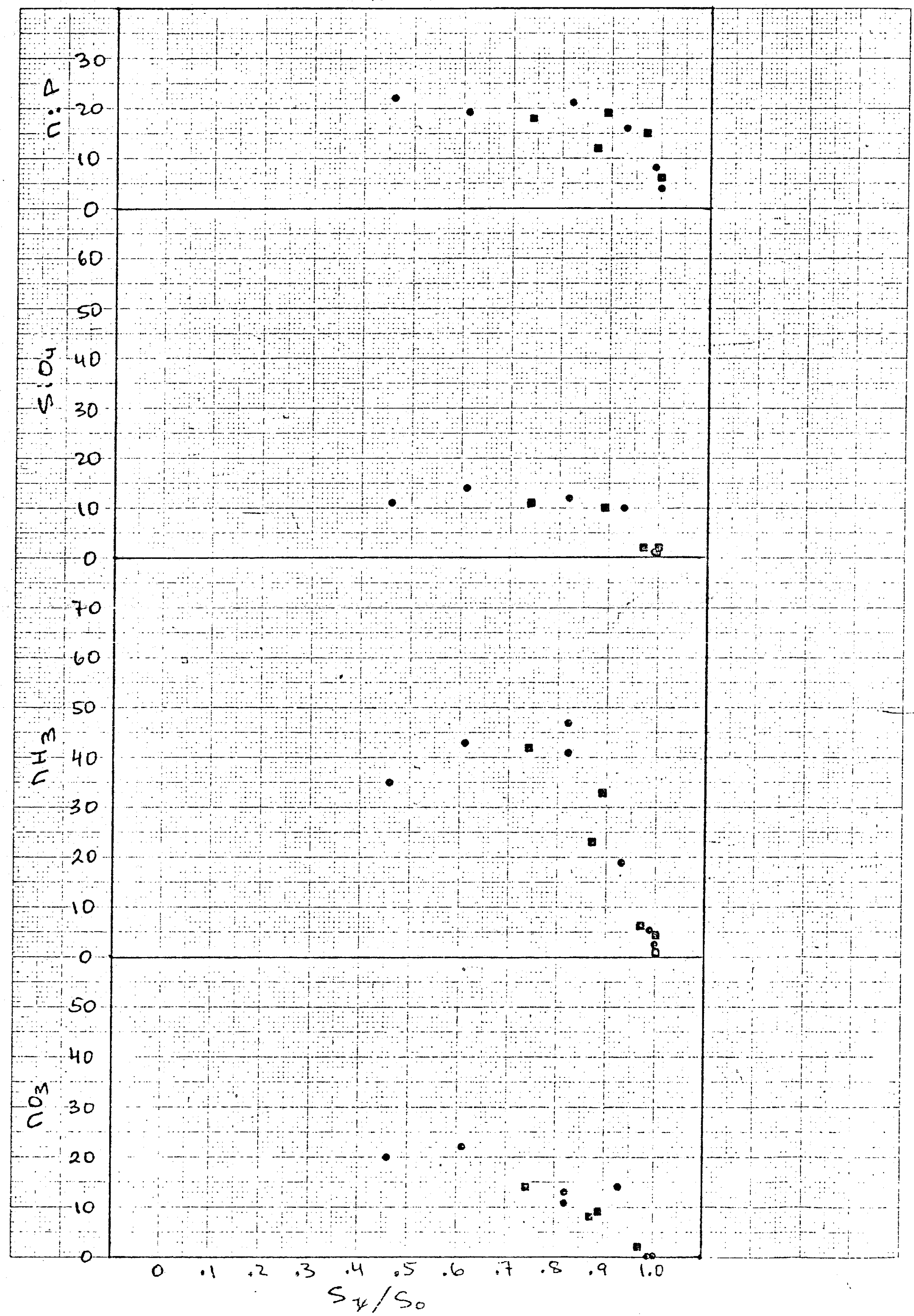

% Phyto-C/m2
40
30
20
10
0
MONTH
3
2
1
12
11
10
400
300
200
100
0
g Inorganic Microseston/m2

Figure 7. Surface nutrient concentrations (ug-gt/liter) and the N:P ratio as a function of the salinity ratio.

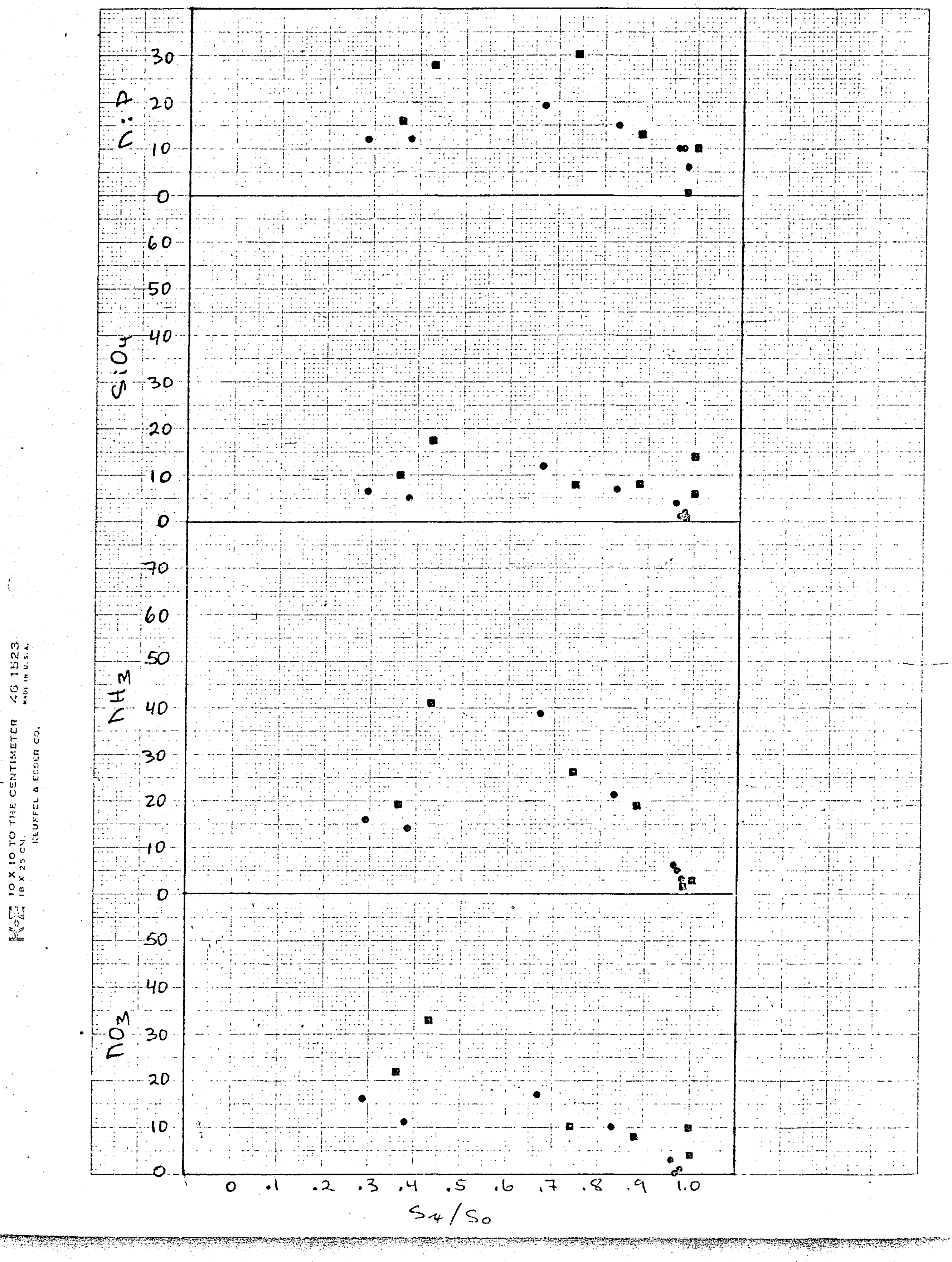
Fig 7

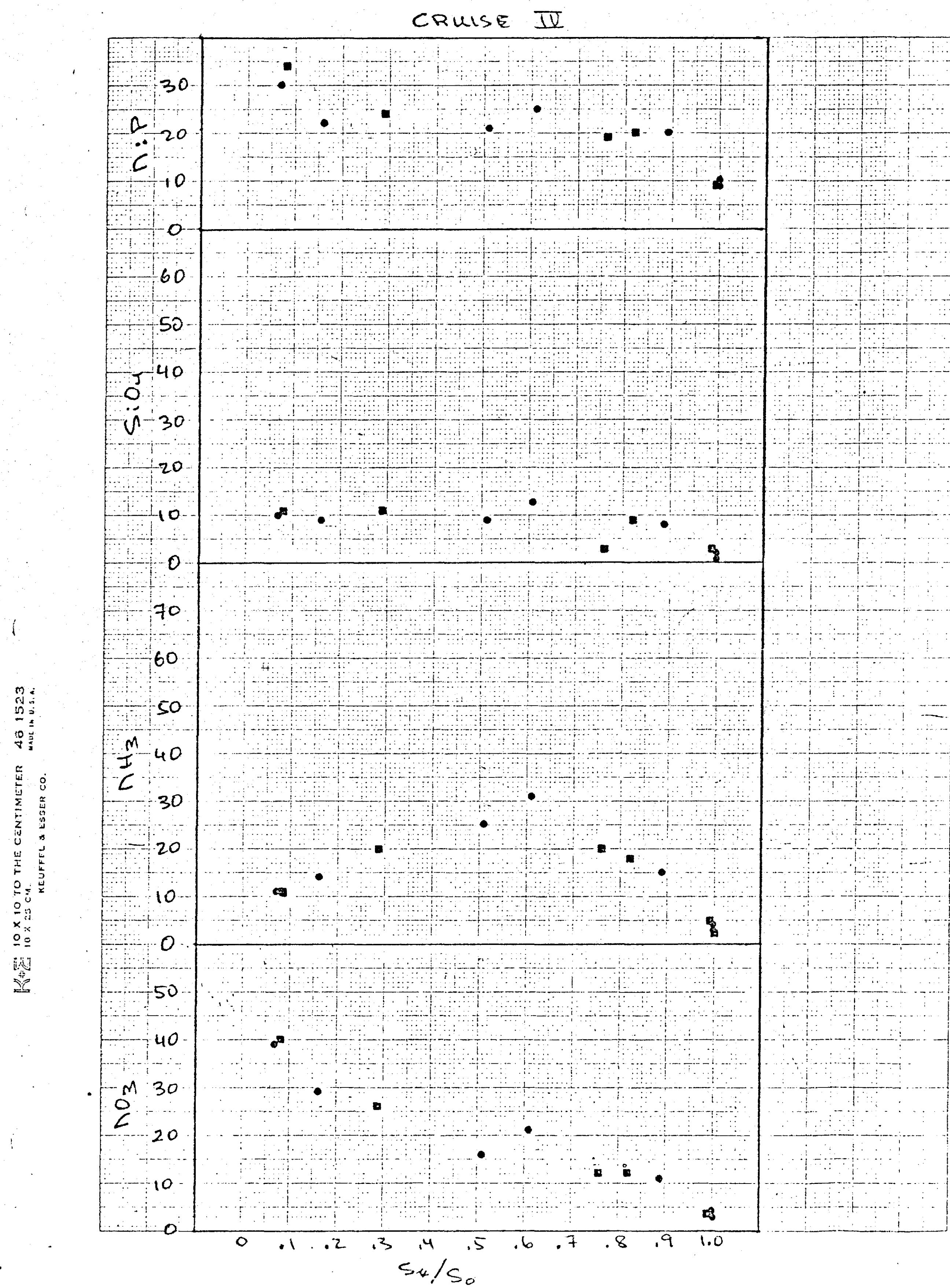

CRUISE I
N:P
30
20
10
0
SiO4
60
50
40
30
20
10
0
NH3
70
60
50
40
30
20
10
0
NO3
50
40
30
20
10
0
0 .1 .2 .3 .4 .5 .6 .7 .8 .9 1.0
S4/So

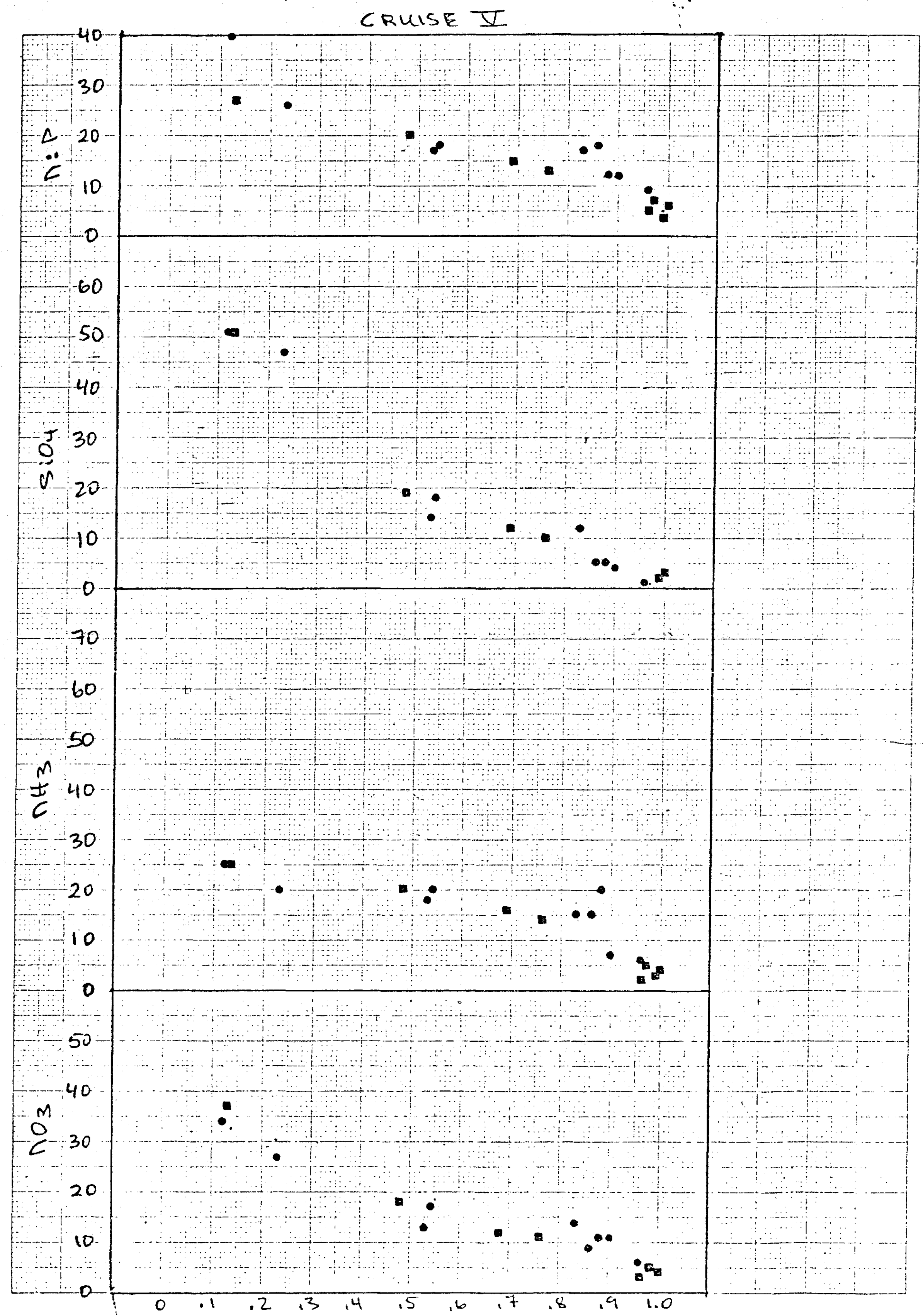
CRUISE II


C:P
0
10
20
30
SiO4
0
10
20
30
40
50
60
NH3
0
10
20
30
40
50
60
70
NO3
0
10
20
30
40
50
0 .1 .2 .3 .4 .5 .6 .7 .8 .9 1.0
Sψ/So

CRUISE III


C:P
30
20
10
0
SiO4
60
50
40
30
20
10
0
NH3
70
60
50
40
30
20
10
0
NO3
50
40
30
20
10
0
0 .1 .2 .3 .4 .5 .6 .7 .8 .9 1.0
S4/So
10 X 10 TO THE CENTIMETER 46 1523
18 X 25 CM. MADE IN U.S.A.
KEUFFEL & ESSER CO.


CRUISE IV
N:P
Si:OJ
NH3
NO3
30
20
10
0
60
50
40
30
20
10
0
70
60
50
40
30
20
10
0
50
40
30
20
10
0
0 .1 .2 .3 .4 .5 .6 .7 .8 .9 1.0
S4/So
K+E 10 X 10 TO THE CENTIMETER 46 1523
10 X 25 CM.
KEUFFEL & ESSER CO.
MADE IN U.S.A.


CRUISE V
N:P
SiO4
NH3
NO3
0 .1 .2 .3 .4 .5 .6 .7 .8 .9 1.0

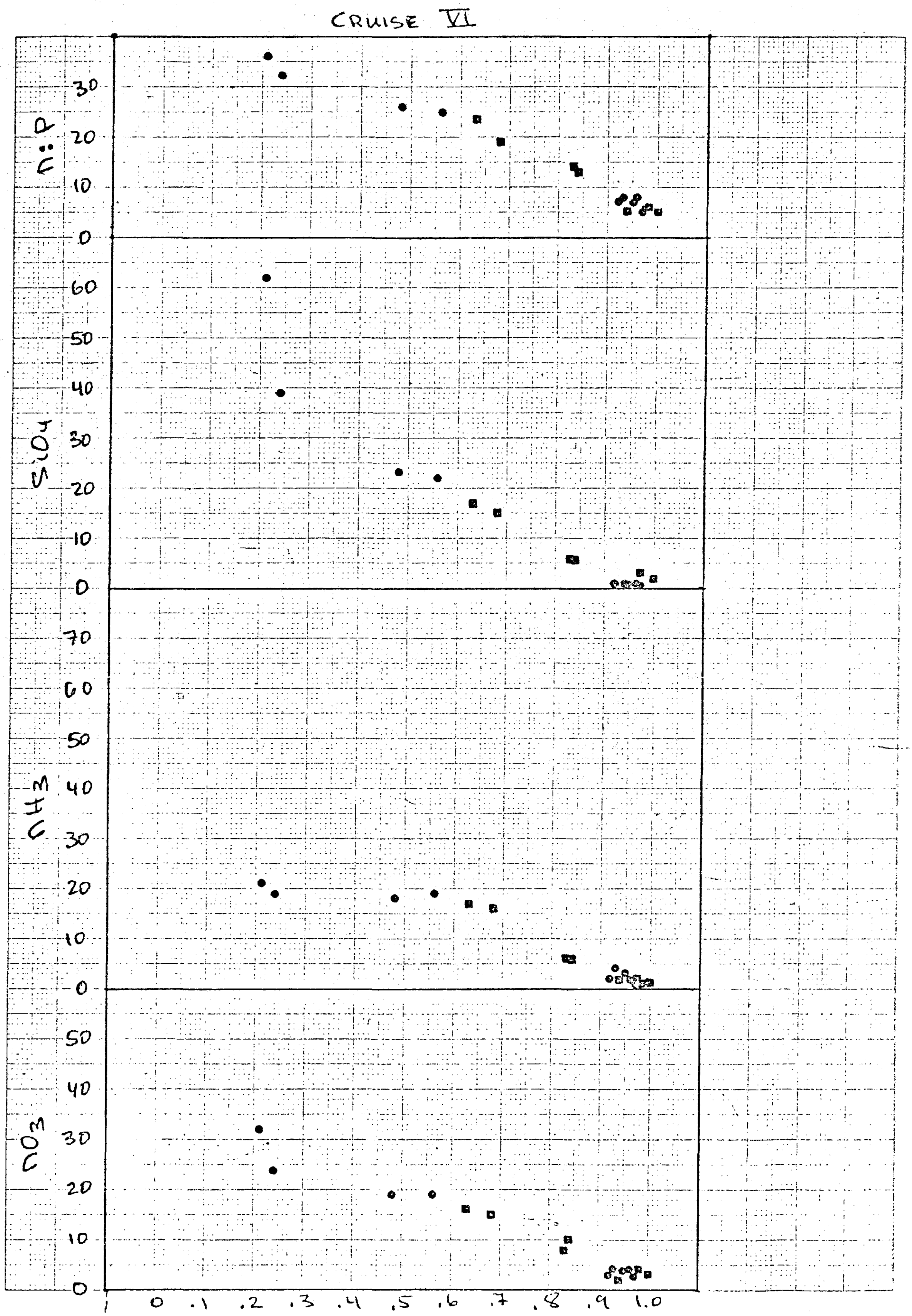

CRUISE VI
N:P
0
10
20
30
SiO4
0
10
20
30
40
50
60
NH3
0
10
20
30
40
50
60
70
NO3
0
10
20
30
40
50
0 .1 .2 .3 .4 .5 .6 .7 .8 .9 1.0

Figure 8. Monthly variations in surface nutrient concentrations and the N:P ratio at station C3 (vertical bars represent the range of values observed at all Bight stations).

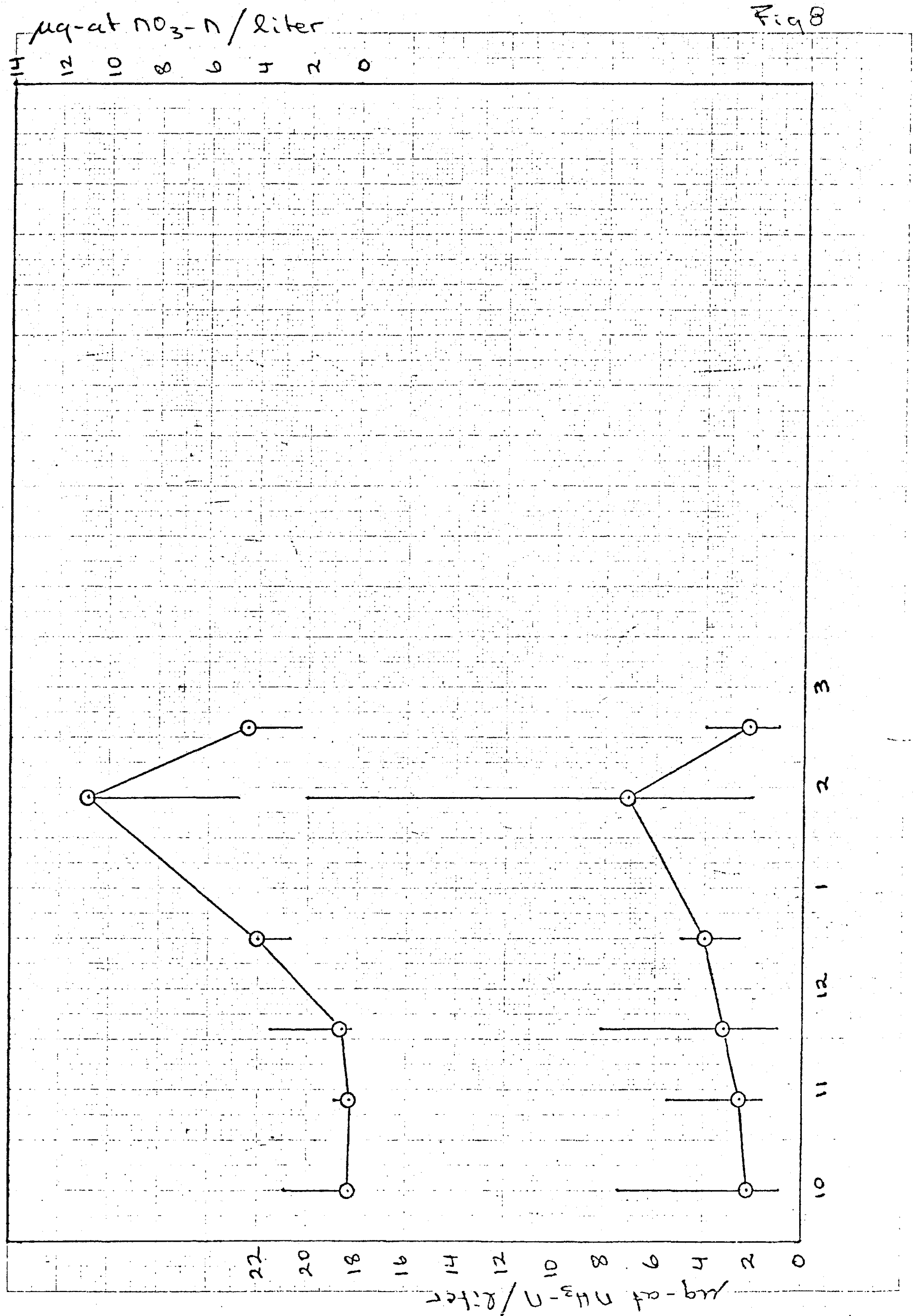
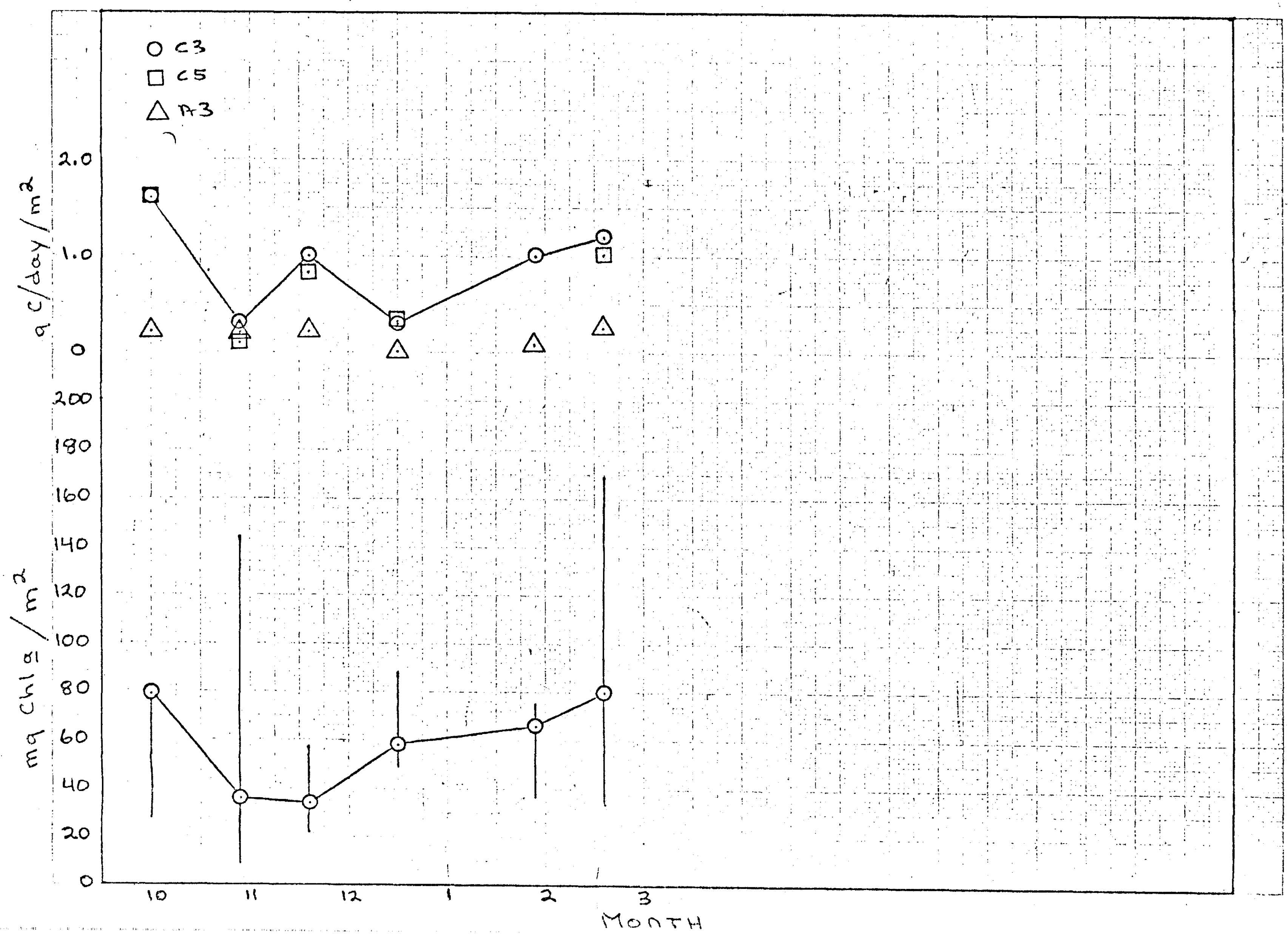

μg-at NO_3-N / liter
14 12 10 8 6 4 2 0
μg-at NH_3-N / liter
22 20 18 16 14 12 10 8 6 4 2 0
10 11 12 1 2 3

Fig 8

Figure 9. Monthly variations in water column chlorophyll a at station C3 (vertical bars represent the range of values observed at all Bight stations) and primary productivity at stations A3, C3 and C5.

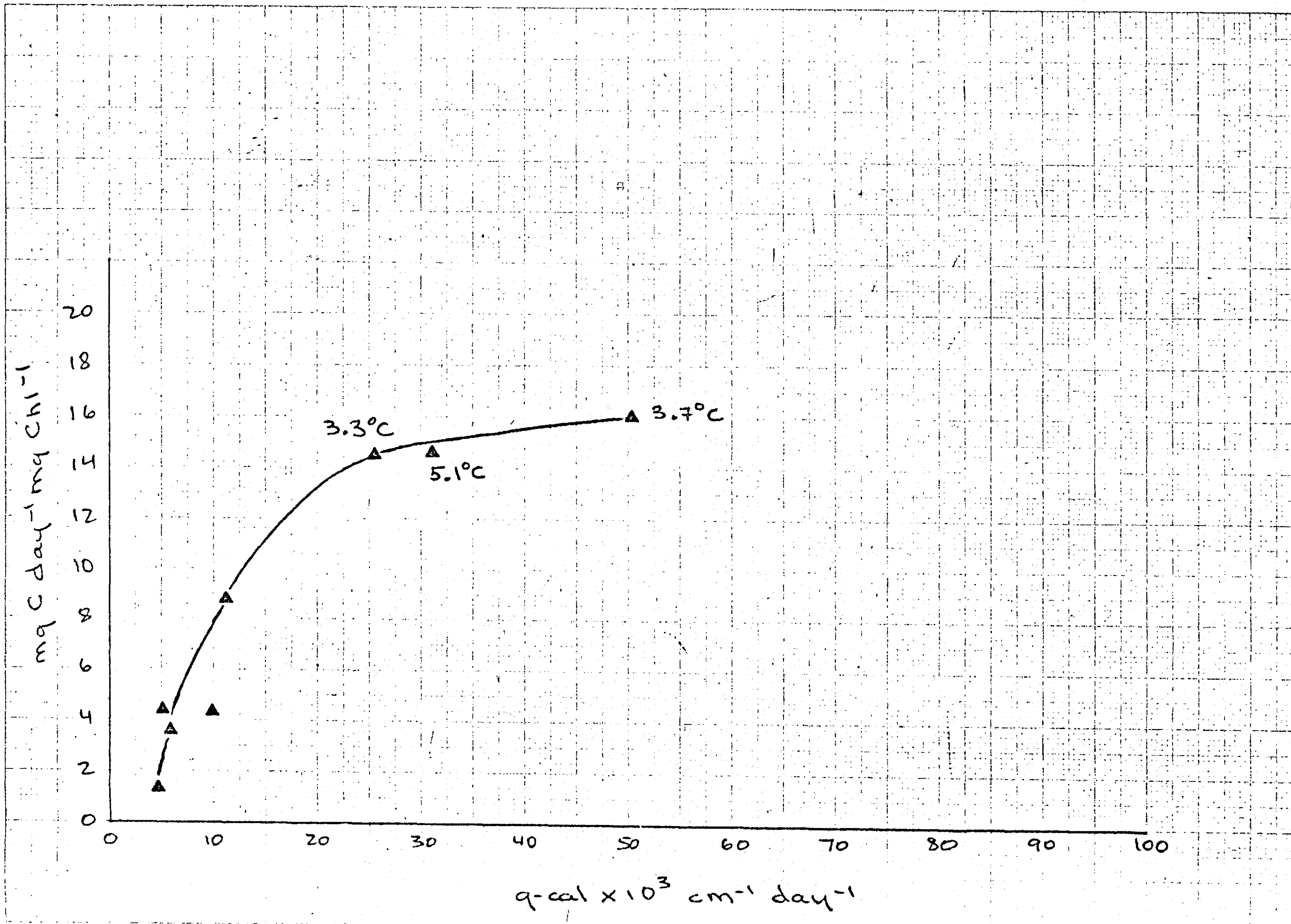


○ C3
□ C5
△ A3
2.0
1.0
0
g C/day/m2
200
180
160
140
120
100
80
60
40
20
0
mg Chl a / m2
10
11
12
1
2
3
MONTH

Fig 9

Figure 10. Primary production per unit water column chlorophyll *a* as a function of light energy flux in the photic zone.

Fig 10



mg C day⁻¹ mg Chl⁻¹
0
2
4
6
8
10
12
14
16
18
20
0
10
20
30
40
50
60
70
80
90
100
q-cal x 10³ cm⁻¹ day⁻¹
3.3°C
5.1°C
3.7°C

Figure 11. Monthly variations in the assimilation number at station C3 (vertical bars represent the range of values observed at all Bight stations).

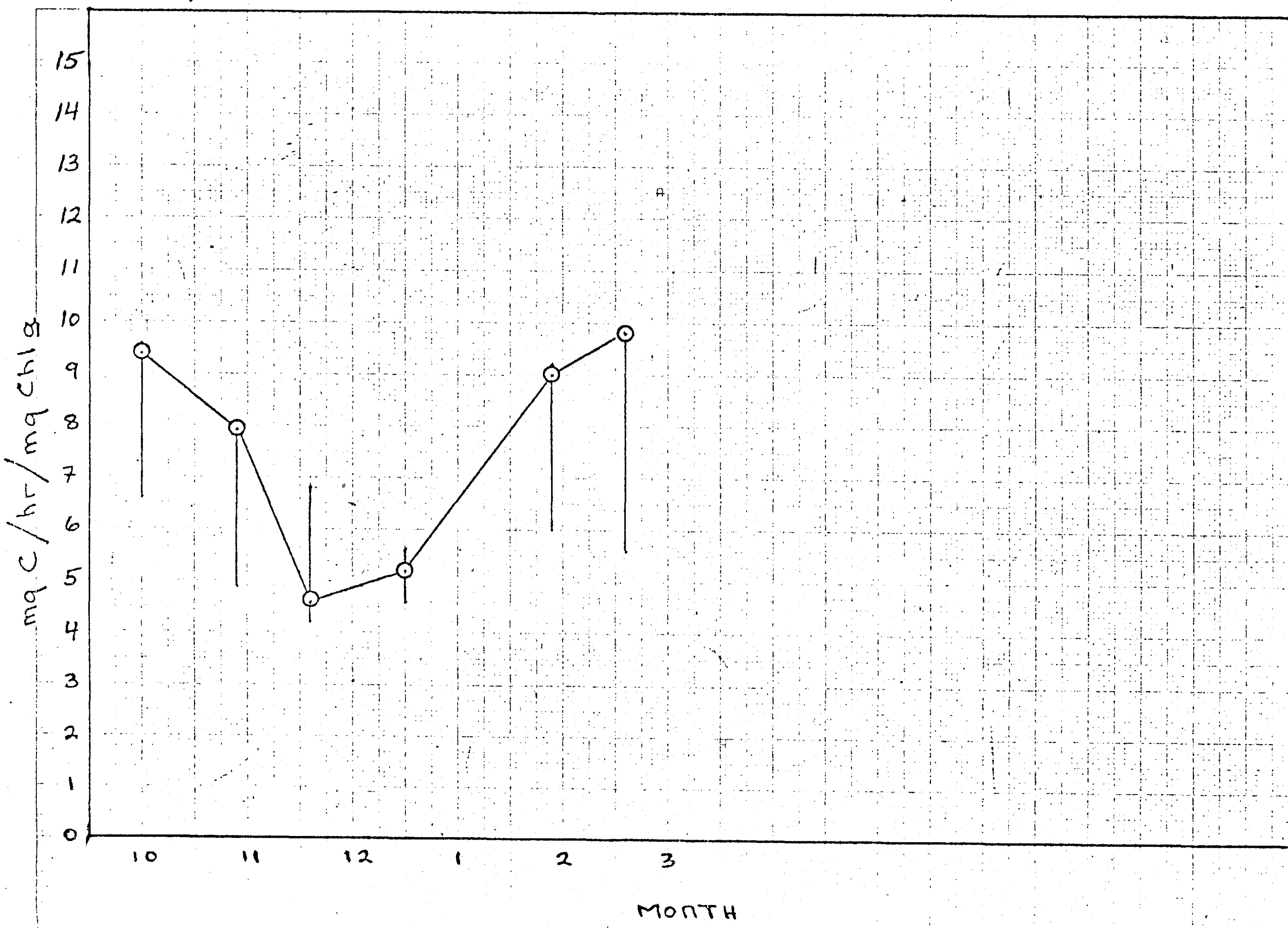
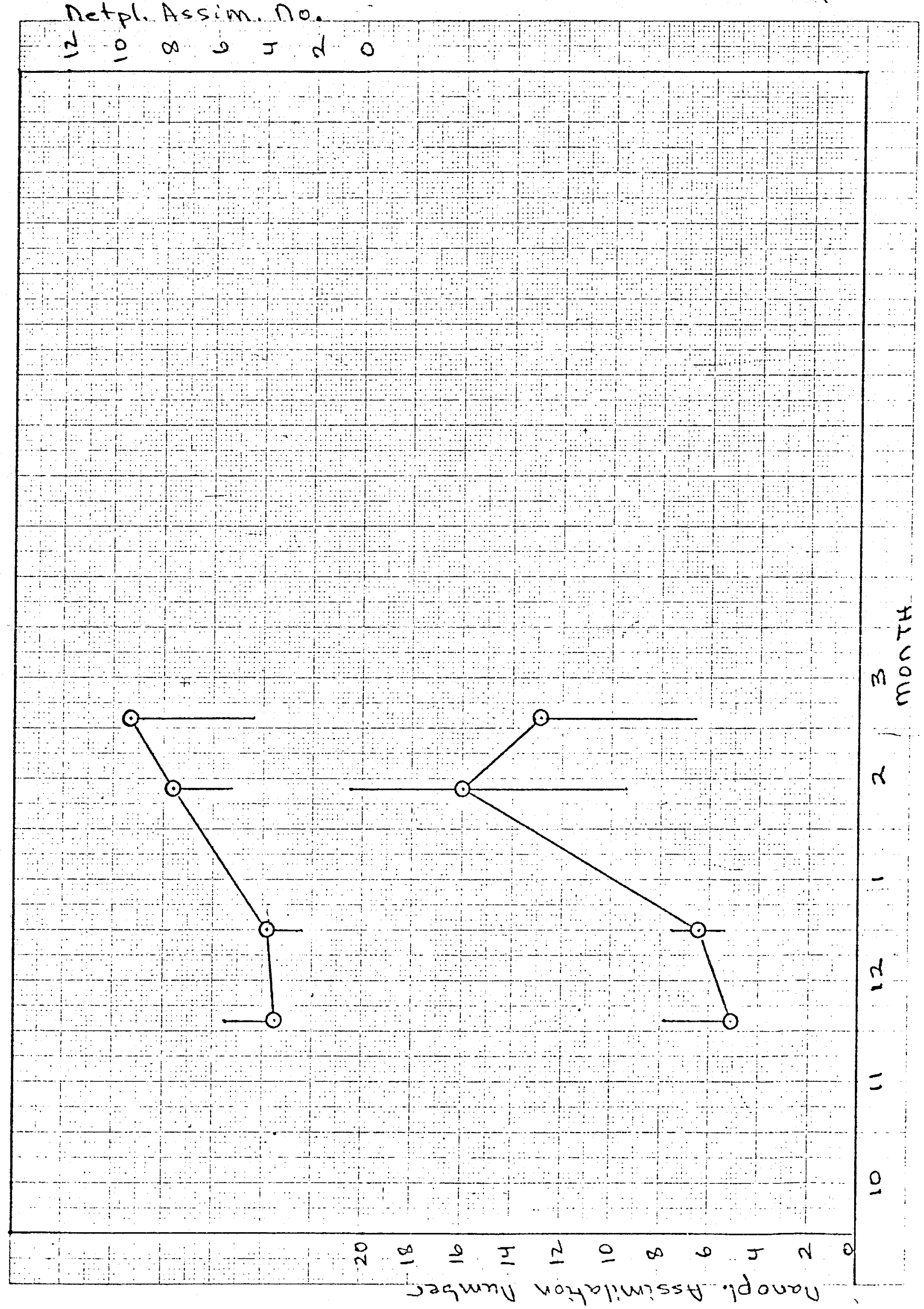


Fig. 11

Figure 12. Monthly variations in netplankton and nanoplankton assimilation numbers (vertical bars represent the range of values observed at all Bight stations).

Fig 12



Netpl. Assim. No.
12
10
8
6
4
2
0
Nanopl. Assimilation Number
20
18
16
14
12
10
8
6
4
2
0
MONTH
10
11
12
1
2
3

Figure 13. Monthly variations in the density of zooplankton in the photic zone (vertical bars represent the range of values observed al all Bight stations).

Fig 13

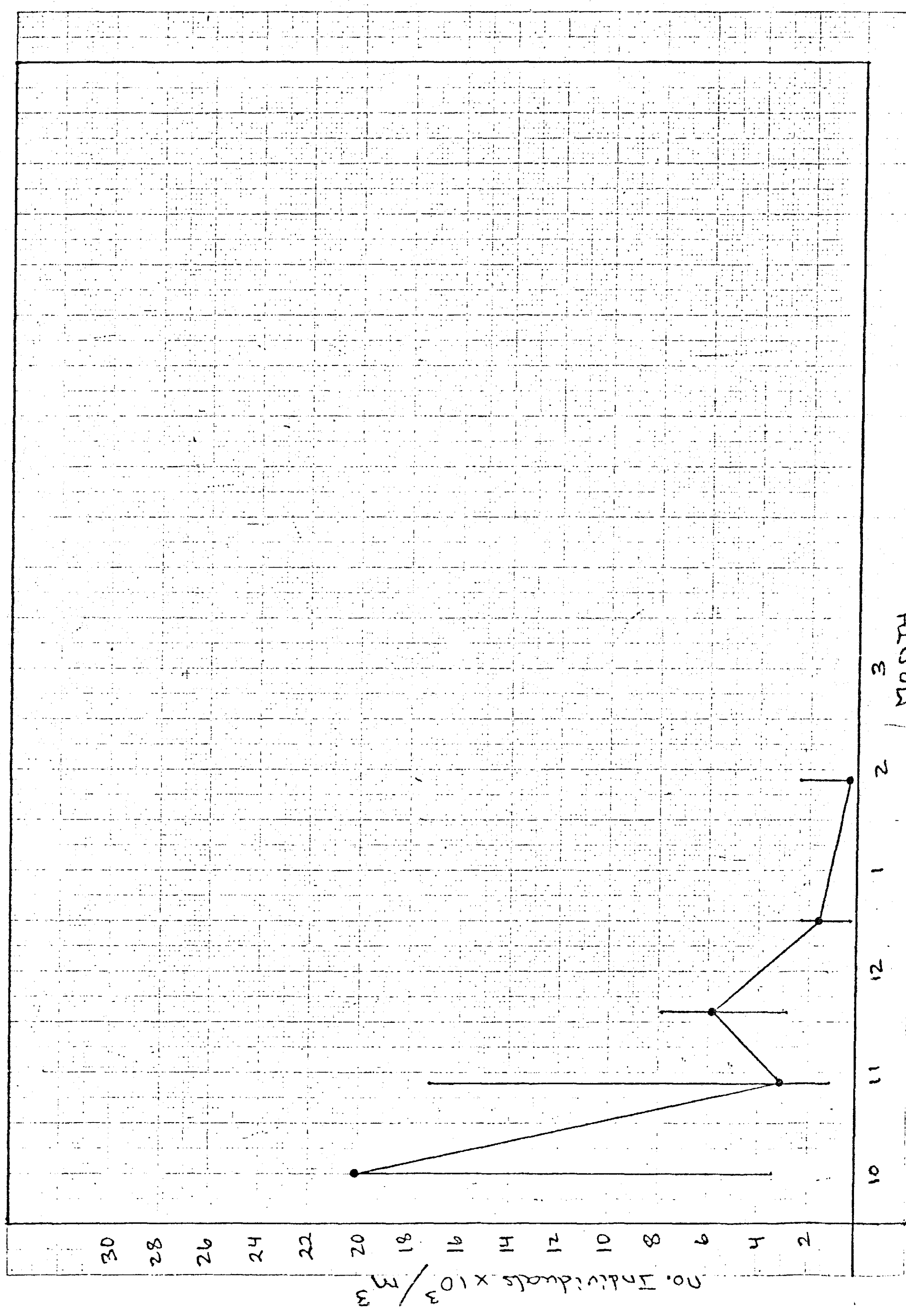
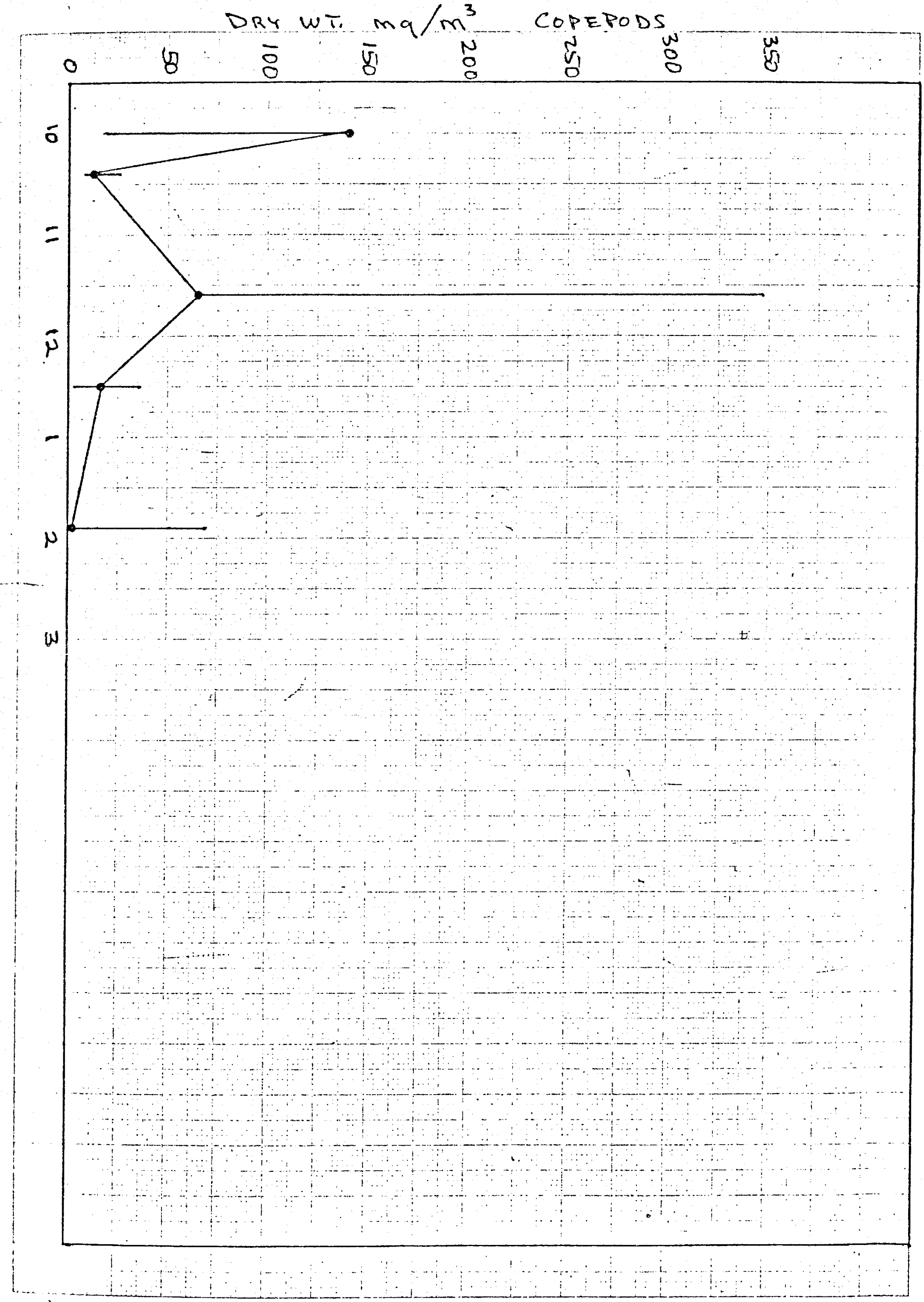

No. Individuals x 10^3/m^3
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
10
11
12
1
2
3
MONTH

Figure 14. Monthly variations in copepod dry weight (vertical bars represent the range of values observed at all Bight stations).


DRY WT. mg/m³ COPEPODS
0
50
100
150
200
250
300
350
10
11
12
1
2
3

APPENDIX E

Dr. Sindermann -
Mr. Holston

SUBLITTORAL MEIOBENTHOS OF THE NEW YORK BIGHT

John H. Tietjen

Quarterly Report - March 1974

Department of Biology, City College of
New York and Institute of Oceanography,
City University of New York
New York, New York 10031

INTRODUCTION

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

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

This report includes the information which has thus far been gathered 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 tween June 5 and June 11, 1973 for the purpose of obtaining replicate mples for statistical analyses to determine the within and between station riance in the mechanical properties of the sediments, heavy metal conntrations, meiofauna density and macrofauna density. The number of replicate mples per station was 20.

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

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

RESULTS

Analysis has thus far been completed for three stations. These are tation 4 (40° 25.15' No. Lat, 73°43.3' West Long), Station 6 (40°24.2' Lat., 3°52.6' Long.) and Station 8 (40°31.1' Lat., 73°46.9' Long.) Station 4 is ocated at the Northeast corner of the sewage sludge dump site, Station 6 ust north of the dredge spoil dump site and Station 8 south of Long Island. e numbers of meiofauna per 100 cm^3 of sediment are given in Tables 1 - 3.

At all three stations nematodes are the dominant taxon. Harpacticoid opepods are the next dominant taxon, although their densities are generally e to two orders of magnitude lower than the nematodes. At Station 4 ciliated rotozoans were encountered in especially high numbers. Our treatment of the mples, however, is not designed to efficiently separate the ciliates from e samples; the number of ciliates reported, therefore, must be regarded th extreme caution. We no doubt have lost most of them through the 0.074 mm sh sieve.

No conclusions regarding the distribution of the meiofauna at these three ations will be made; it was not the intent of this particular study to do so. wever, it may be seen that the numbers of meiofauna at Station 6, located ar the dredge spoil dump site, are clearly lower than at the other two stations.

The data are being forwarded to Dr. Saul B. Saila of the University of Rhode Island for statistical analysis of the within station variance. We are continuing in our analysis of the meiofauna sampled at the eight stations designated for intensive statistical study.

As a post-script, it will be noted that Grab # 1 has been omitted on all three stations. These samples are being retained for future analysis of the nematode species composition.

Table 1. [illegible]s of meiofauna per 100 cm^3 of sediment at station 4 in the New York Bight, 6 June 1973.

Meiofauna Group	GRAB NUMBER 2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Nematoda	932	1880	2538	2020	3375	1329	3463	1588	2435	1692	963	2570	2121	1830	2081	937	3088	1818	1145
Foraminifera	5	10		21	14	16		8		14	5	13	4	51	17	21	48	8	4
Harpacticoidea	27	10	79	143	122	21	25	289	48	94	24	34	29	25	4	42	12	104	8
Ciliated Protozoa	860	211	713	764	891	568	32	508	864	1069	192	466	134	970	258	602	844	860	217
Polychaeta	50	41	187	201	163	131	50	42	34	112	58	176	63	960	129	55	200	288	209
Nemertea	221		4	126	320	33		193	34	50	5	84			146		16	156	122
Turbellaria	14	3	4	17	18	8	14	4		25	62	17			9	4	8	20	19
Nauplii		7			5		4			4				5					
Lamellibranchiata		7		8	14	12				14	14	8	8		4		16		
Halacarid				4			4												
Total Meiofauna	2109	2169	3525	3384	4921	2618	3592	2632	3415	6489	1323	3368	2359	3841	2648	1711	4232	3254	1724

Table 2. Numbers of meiofauna per 100 cm^3 of sediment at station 6 in the New York Bight, 10 June 1973.

Meiofauna Group	GRAB NUMBER 2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Nematoda	152	622	126	340	2530	470	2551	339	615	84	723	1315	540	388	473	545	165	233	295
Foraminifera	19	406	13	11	17	17	281	57	26	40	166	137	26	17	24	9	65	79	40
Harpacticoidea	15	39	10	19	520	7	4	4	17		112	15	13	8		11	10	7	25
Nemertea	4		6	11		3					32		65	4	3	120			25
Polychaeta			10	7	4	3						23			10	14		3	15
Ciliated Protozoa					30				4										
Nauplii		23	3	19	264		7	4	4		10	4	4			3		3	
Lamellibranchiata	4	10		4	4	7	4				10	8	9						
Halacarid									4										
Turbellaria										4									5
Ostracoda											3								
Total Meiofauna	193	1100	163	411	3369	507	2847	404	670	128	1056	1502	657	417	510	702	240	320	405

Table 3. Numbers of meiofauna per 100 cm^3 of sediment at station 8 in the New York Bight, 11 June 1973.

Meiofauna Group	GRAB NUMBER 2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Nematoda	2684	3160	2355	2688	1625	1533	2660	2515	4283	3197	2235	2105	3767	2429	1312	962	2616	1616	2222
Foraminifera	50	5	30		76	32	25	19	63	57	34	22		22	47	11	112	15	19
Harpacticoidea	50	23	25	63	50		5	38	63	48	31	11	59	32	17	7		36	38
Polychaeta	30	77	15	34	13	28	20	101	104	293	44	78	50	51	17	7	44	23	43
Nauplii	4	5	5	8	4		15		5	48	20		4				12	5	5
Ciliated Protozoa	25	36	35	13	71			11	27	72			29	51			32		43
Lamellibranchiata	71	5	35	34	71	39	45	29	68	149	68	52	193	51	13		20	41	14
Turbellaria	71	5	15	26	17	7	120		36	67		4	34	22			36		38
Ostracoda	34	9	20	8	8	7	10	19	14	62	31	7	46	35	4	19	8	27	5
Halacarid		5					10												
Nemertea			25	8	21			10		5							4		10
Amphipoda			10																
Kinorhyncha			5	4					5				4	3					
Acanthuria									5				4	6					
Total Meiofauna	3019	3330	2575	2886	1956	1646	2910	2745	4678	3998	2463	2279	4190	2702	1410	1006	2884	1793	2447

APPENDIX F

QUARTERLY REPORT

to the

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

on the

FORAMINIFERA OF THE NEW YORK METROPOLITAN AREA

1 January 1974 - 31 March 1974

CONTRACT NO. 03-4-043-315

Dr. John J. Lee

INTRODUCTION

The initial 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. Methods and results of the research to date are presented in this report.

METHODS

Collections for benthic foraminifera in the New York Bight were taken in June 1973 at stations listed in Table 1 under the auspices of personnel of the National Oceanographic and Atmospheric Administration (NOAA) at the Sandy Hook Laboratory of the National Marine Fisheries Service. The samples were analyzed at the City College of the City University of New York (CUNY) concomitantly with analyses of other meiofauna conducted under the auspices of Dr. John Tietjen. The samples were taken with a Smith-McIntyre grab and subsampled with a 1.0 inch plastic tube to a depth of 2 inches. The resulting samples was placed in a jar with buffered formalin and rose bengal. Twenty replicate samples for each of the eight stations were obtained. Laboratory analysis of the samples was accomplished by microscopic examination of the entire sample after it was washed through a 500 μ mesh sieve and onto a 74 μ mesh sieve with tap water. Living (stained red) foraminifera were enumerated in all samples. The organisms were picked by micropipette and placed in small vials for future identification. In some samples dead organisms have also been counted. Identifications have been made using classical methods. Dry specimens are mounted on micropaleontological slides and studied using epi-illumination.

Collections of planktonic foraminifera in the lower Hudson River and New York Bight are made on a monthly basis in collaboration with

Dr. T. Malone on the R/V Commonwealth of CUNY Institute of Oceanography. Three types of samples are obtained at each of 16 stations (weather and other factors permitting) (Table 2 and Fig. 1). Twenty-five liter aliquots of surface water collected in a bucket is filtered through a 20 μ mesh piece of netting and the resultant sample placed in a jar with borax buffered formalin to a concentration of 10 %. Five minute surface net tows with a 1/2 meter 80 μ mesh plankton net are made and the volume filtered estimated using a TSK flowmeter. The sample collected in the cod end is also placed in a jar and similarly formalinized. Oblique net tows to a depth of 5 meters in the river and 10 in the bight with a 1/2 M 200 μ mesh plankton net are made at selected stations for zooplankton analysis by Ms. Mira Chervin, a graduate student working with Dr. Malone. The samples are then placed in jars and properly formalinized. Aliquots of these samples are used for foraminiferan analysis.

Treatment of the samples in the laboratory has presented unanticipated problems and thus initial, rather standard, methods for separating the foraminifera from the other plankton have been abandoned. At first, the samples were burned at 500° C according to the method described by Cifelli and Smith (1970). However, the presence of large amounts of chain-form diatoms formed compact chunks on drying and remained so even after burning (the silicon frustules would be expected to remain) entrapping the foraminifera. Separation of the foraminifera became too difficult to be practical. The tedious, but more accurate, method of hand separation by microscopic investigation of whole plankton samples has been adopted. The burning or any other suitable method may be employed for the 200 μ zooplankton samples when they are analyzed in the future. Planktonic foraminifera are counted and micropipetted from the samples and saved wet in plastic petri dishes for indentification and future reference.

RESULTS

Data for the benthic samples analyzed is presented in Table 3. Fourteen separate species of benthic foraminifera have been recognized, five of which have been found only as dead specimens. About five species were most common in the samples, but the Elphidium clavatum/incertum complex was found in the greatest abundance. It is too early in the study to identify patterns of distribution in the area of interest. However, the benthic foraminifera are patchy, and some have been found in the sludge dumping sites.

Planktonic foraminifera found in samples analyzed to date are presented as number/M^3 in Table 4. These specimens have been tentatively identified as juveniles of Globigerina bulloides. They are extremely delicate. Specimens initially identified as the progeny of adult forms and previously undescribed (Lee et al. 1965) are under further investigation. The planktonic foraminifera collected although not stained with rose bengal at the time of collection took up the stain in the laboratory and thus can be assumed to have been alive at the time of collection.

DISCUSSION

Despite the early stage of this research, the presence of live planktonic and benthic foraminifera in the river and bight is assured. The variable nature of the abundance of benthic foraminifera is noted and continuing analysis will hopefully reveal possible explanations. The presence of planktonic foraminifera is treated cautiously since they have been found previously in inshore waters only spasmodically and mainly as a result of inward movement of oceanic water (Phleger, 1960). However, the presence of juveniles is interesting.

Conclusions would be premature at this early stage. Comparisons with other research findings yet unavailable are necessary for a comprehensive analysis.

LITERATURE CITED

Cifelli, R. and R. K. Smith. 1970. Distribution of planktonic foraminifera in the vicinity of the North Atlantic Current. Smithsonian Contributions to Paleobiology. 4.

Lee, J. J., H. D. Freudenthal, V. Kossoy, and A. Be. 1965. Cytological observations on two planktonic foraminifera, Globigerina bulloides d'Orbigny 1826, and Globigerinoides ruber (d'Orbigny 1839) Cushman 1927. J. Protozool. 12:531-542.

Phleger, F. B. 1960. Ecology and distribution of recent foraminifera. 297 pp. Baltimore. The Johns Hopkins Press.

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

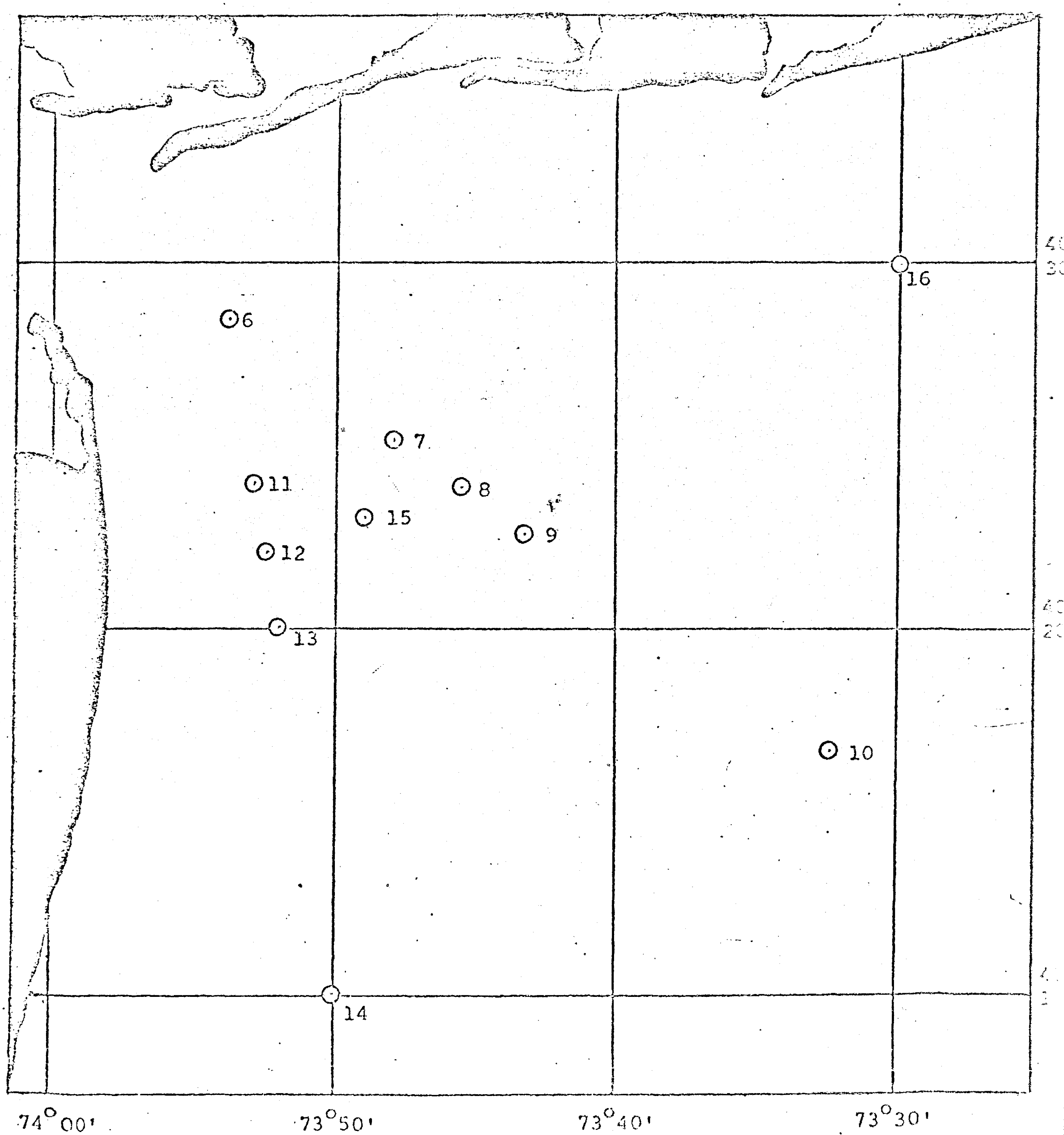


TABLE 1

Benthic stations sampled in New York Bight during June, 1973.

Station	Latitude	Longitude	Comments
1	40°24.9'	73°48'	sludge dump, fringe
2	40°22.3'	73°47.1'	sludge dump, fringe
3	40°19.5'	73°43.65'	south of sludge dump
4	40°25.15'	73°43.3'	sludge dump, fringe
5	40°28.6'	73°45.5'	north of sludge dump
6	40°24.2'	73°52.6'	near dredge dump
7	40°27.8'	73°38.1'	north east of sludge dump
8	40°31.1'	73°46.9'	towards N. Y. shore

TABLE 2

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

Station	Latitude	Longitude	Comments
1	40°52'53"	mid channel	river, above G. W. Bridge
2	40°49'31"	mid channel	river, below G. W. Bridge
3	40°40'18"	74°02'18"	upper bay
4	40°38'30"	74°02'18"	upper bay, above V. B.
5	40°35'18"	74°02'39"	lower bay, below V. B.
6	40°28.6'	73°54.0'	Sandy Hook
7	40°25.4'	73°48.0'	sludge dump, fringe
8	40°24.0'	73°45.5'	sludge dump, center
9	40°22.4'	73°42.0'	sludge dump, fringe
10	40°16.7'	73°32.4'	reference
11	40°24.0'	73°53.0'	dredge dump, fringe
12	40.22.0'	73°52.5'	dredge dump, center
13	40°20.0'	73°52.1'	dredge dump, fringe
14	40°10.0'	73°50.0'	reference
15	40°23.0'	73°49.0'	acid waste dump
16	40°30.0'	73°30.0'	reference

TABLE 3

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

Station	Grab	#/100 cm^3	Station	Grab	#/100 cm^3
1	4	46	6	2	19
	14	289		3	406
				4	13
2	4	22		5	11
	11	4,824		6	17
				7	17
3	7	90		8	281
				9	57
4	2	5		10	26
	3	10		11	40
	4	0		12	166
	5	21		13	137
	6	14		14	26
	7	16		15	17
	8	--		16	24
	9	8		17	9
	10	--		18	65
	11	14		19	79
	12	5		20	40
	13	13			
	14	4	7	3	7
	15	51			
	16	17	8	2	50
	17	21		3	5
	18	48		4	30
	19	8		5	--
	20	4		6	76
				7	32
5	9	3,890		8	25
	23	234		9	19
				10	63
				11	57
				12	34
				13	22
				14	--
				15	22
				16	47
				17	11
				18	112
				19	45
				20	19

TABLE 4

Number of planktonic foraminifera found in the Hudson River estuary and New York Bight (January 1974).

Station	20μ samples #/sample	estimated #/m^3
5	12	472
6	6	236
7	26	1,024
8	24	954
10	18	709
11	29	1,142

APPENDIX G

5 March 1974

Marine Fisheries of New Jersey

A progress report on studies
supported by the
Marine Ecosystems Analysis Program
of NOAA, U.S. Department of Commerce

J. L. McHugh

This preliminary review of the history of New Jersey fisheries is based on statistics on landings published annually by the federal government in "Fishery Statistics of the United States" and jointly with the New Jersey Division of Fish Game and Shellfisheries in "New Jersey Landings." The earliest records are for 1880, but surveys were made only occasionally until 1929, when regular annual surveys began.

Total landings. - Total landings of fish and shellfish in New Jersey (fig. 1) were relatively small until the early 1930s, fluctuating about an annual average of about 40,000 metric tons. Landings then rose rapidly to a maximum of over 240,000 metric tons in 1956, then fell even more abruptly to a low of about 41,000 metric tons in 1969. Total landings, however, do not reflect adequately the history of the fisheries of the state, for industrial species, especially menhaden (fig. 1), have always made up a large part of the catch. From the middle 1930s to the middle 1960s menhaden dominated, producing over 220,000 metric tons in 1956. Other industrial species were horseshoe crab, sea herring, and mixed trawl-caught fishes.

Food fishes and shellfish. - Landings of finfishes for human food in New Jersey (fig. 2) rose from about 7,500 metric tons to nearly 24,000 metric tons in the last two decades of the 19th century. Records were sparse in the following quarter-century, but from 1929 to 1949 landings fluctuated between about 15,000 and 23,000 metric tons. The subsequent decline in the 1950s and 1960s has brought landings in the last few years down to 7,000 to 9,000 metric tons. Changes in the importance of individual species have been much greater than this. The first six species by weight in the period 1880-1901, which accounted for more than 80 percent of the landings of food finfish, are now of minor importance in the catch. Some species, like weakfish, scup, and butterfish, which were important in later years, also have declined to minor rank. As in New York, the decline probably would have been much greater if the industry had not steadily shifted to other species as historic resources declined.

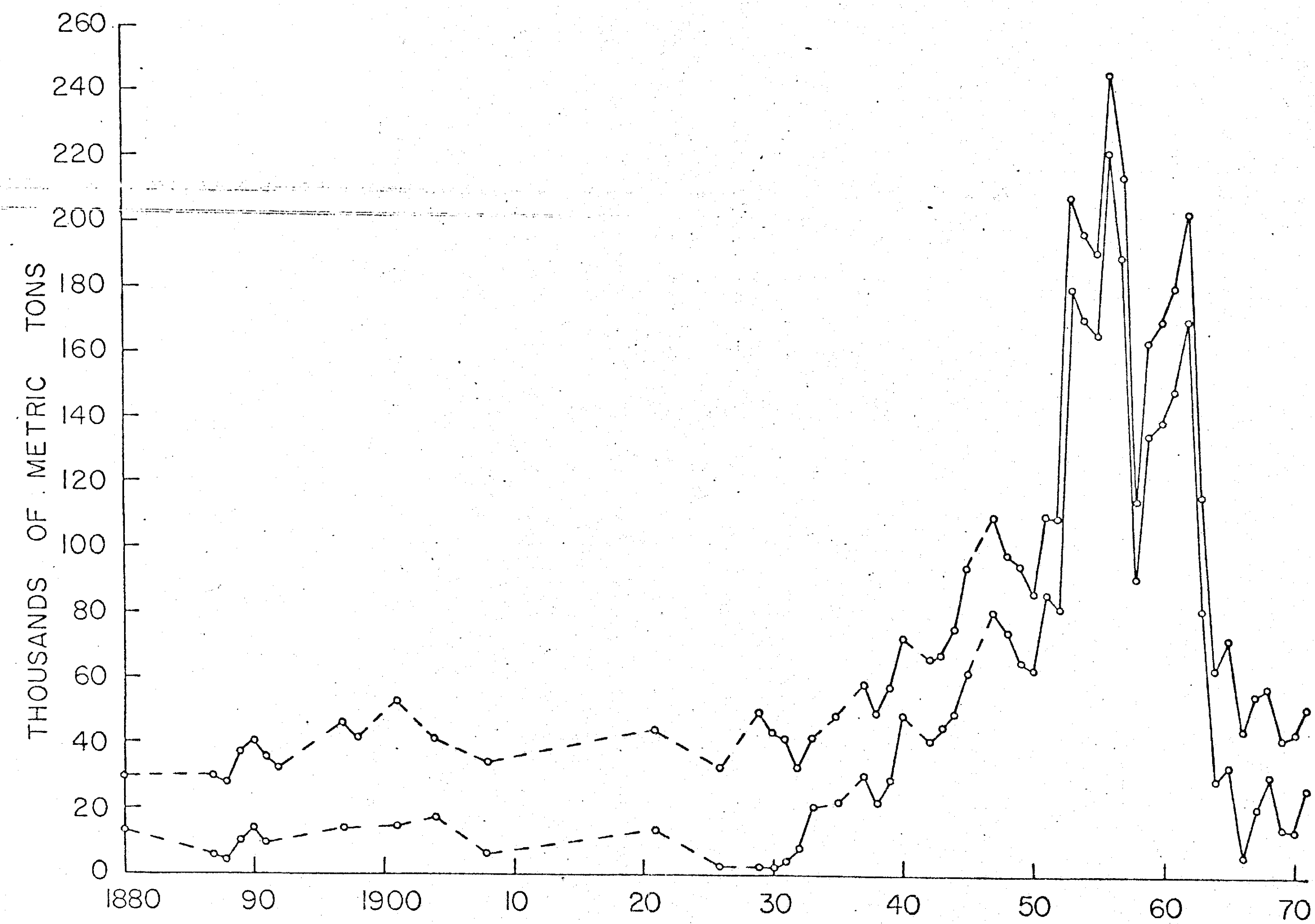


Figure 1. Total marine fish and shellfish landings in New Jersey 1880 to 1971. Lower polygon represents menhaden only.

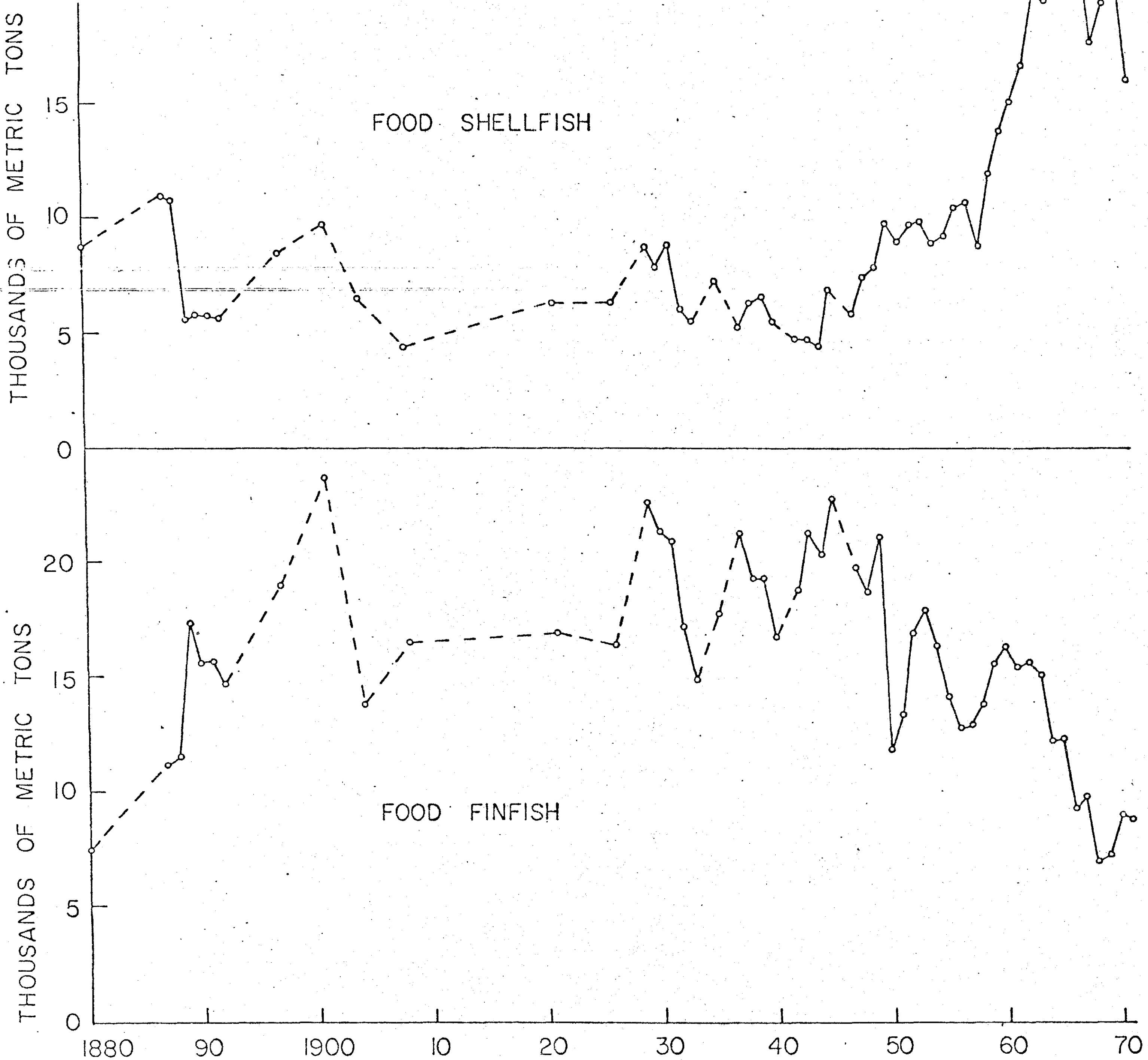


Figure 2. Food finfish and food shellfish landings in New Jersey 1880 to 1971.

Food shellfish landings in New Jersey (fig. 2) have risen substantially over the period of record. From 1880 to 1931 reported landings fluctuated between about 5 and 10 thousand metric tons. In the 1930s and early 1940s the trend was downward, but production rose sharply after 1949 as the surf clam fishery developed and reached its peak. Omitting the surf clam, total landings of other shellfish used as human food have trended downwards over the recorded history of the fishery. The oyster industry, which dominated shell-fish landings in New Jersey until the early 1930s, declined thereafter, but remained at a relatively steady level of production at an average of about 3,000 metric tons of meats per year from 1935 to 1953, then fell sharply to very low levels in the 1950s and 1960s, from which it has recovered only partially. The hard clam and blue crab fisheries have fluctuated over the years, but the downward trends in weight landed have not been great. Lobster landings in New Jersey, as in New York, have been rising for the last 15 years. The principal features of the history of New Jersey shellfish landings in the last 90 years or so have been the decline of the oyster industry and the relatively recent development of a major fishery for surf clams.

Present status of study. - Illustrations showing the history of landings in New Jersey, species by species, have been drawn for some 42 species once important or presently important in New Jersey landings With some major and interesting differences, the patterns are similar to those already demonstrated for New York (McHugh, 1972, reprint attached). The descriptive section of a draft manuscript is about half complete. The manuscript should be ready for publication in about 6 months.

Tentative conclusions. - The preliminary study described above will be a companion paper to the study of New York marine fisheries already cited (McHugh, 1972). Together the two papers will describe briefly the history of the fisheries of New York Bight. The conclusions from the New Jersey study will not be greatly different from those arrived at in the review of the marine fisheries of New York, namely, that the fisheries have risen to a maximum in the 1950s and early 1960s and subsequently declined to pre-war levels in terms of weight landed. The food fisheries maintained fairly steady levels of production until after the second world war, then declined steadily. The decline would have been much sharper had it not been for the amazing development of the surf clam fishery after the war. Historic levels of food fish and shellfish production have been maintained only by shifting from one species to another as the principal species of earlier times reached maximum levels of production, then declined. The industrial fisheries, based mainly on menhaden, reached their peak later, in the period 1956-1962, and now have dropped to about 10 percent of the maximum level. Intensive fishing in the Chesapeake Bay region has been responsible for the decline of the menhaden industry in the New York Bight area.

Data on saltwater sport fishing in the area are much less complete, but it appears that the total catch has been rising in the decade 1960-1970. Fluctuations in recreational catches species by species have been similar to fluctuations in domestic commercial catches. Recreational catches of some species, particularly bluefish and striped bass, appear to have been much larger than commercial catches, which casts doubt on prevailing views that commercial fishing for these species should be curtailed.

The causes of declining marine fisheries in the New York Bight area are complex, and they are mainly social-political. Economic conditions during and after the second world war certainly must have played an important role. Some of the declines clearly were the result of bad management or no effective management at all. Both states have accumulated substantial bodies of laws and regulations relating to fish and game but these have not been effective in maintaining the yield of the marine fisheries.

It is popular in both states to blame foreign fishing for the real and imagined ills of the coastal fisheries. Foreign fishing certainly has been an added aggravation, but it is a comparatively recent development, and not a root cause.

Subsequent studies will examine the history of New Jersey marine fisheries in greater detail and will attempt to identify and assess the causes of the changes observed.

Literature Cited

McHugh, J. L. 1972. Marine fisheries of New York State. U. S. Dept. Commerce, Natl. Marine Fish. Serv., Fish. Bull. 70(3):585-610. (Reprint attached).

APPENDIX H

To: Dr Carl Sindermann

UNIVERSITY OF RHODE ISLAND
KINGSTON • R. I. 02881

Graduate School of Oceanography • Narragansett Bay Campus

7 January 1974

Dr. John B. Pearce
Officer-in-Charge
National Marine Fisheries Service
Sandy Hook Marine Laboratory
Highlands, New Jersey 07732

Dear Jack:

We have briefly examined the first samples of heavy metal data you sent to us. They are remarkably consistent as far as the replicate analyses are concerned.

We believe that the heavy metal data will be extremely useful to us for purposes of defining and classifying communities and environments. Therefore we urge you to provide heavy metal data for as many stations as possible.

We are especially desirous of obtaining data on the following elements, which seem to be the most useful to us on the basis of these preliminary analysis. They include Cu, Ni, Pb and Zn.

Our plans for developing methods to classify environments are progressing, but we have not as yet made any final commitments to methodology.

Sincerely,

Saul B. Saila
Professor of Oceanography

SBS:bg

APPENDIX I

COLIFORM AND METAL CONCENTRATIONS IN SEDIMENTS FROM THE ATLANTIC AND LONG BEACH AREA - NEW YORK BIGHT, JANUARY 15-17, 1974

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

MIDDLE ATLANTIC COASTAL FISHERIES CENTER

Coastal
SANDY HOOK
MILFORD
CENTER DIRECTORATE SANDY HOOK
The Middle Atlantic
Fisheries Center
OXFORD

Informal Report No. 22

March 15, 1974

Middle Atlantic Coastal Fisheries Center

National Marine Fisheries Service

NOAA

Coliform and Metal Concentrations in Sediments from the Atlantic and Long Beach Area - New York Bight, January 15-17, 1974.

John T. Graikoski, Chief, EMCI

Richard A. Greig, Chemist

John A. Babinchak, Microbiologist

Assisted by: Shearon Dudley, Maureen Nitkowski, Betty Nelson, Albert Adams, and Cindy Abram

Informal Report Number 22

March 15, 1974

Coliform and Heavy Metal Concentrations in Sediments from Atlantic and Long Beach Area - New York Bight.

INTRODUCTION

The following account represents the information obtained on coliform counts and heavy metal burdens in sediments by the Environmental Microbiology and Chemistry Investigation of the Middle Atlantic Coastal Fisheries Center (NMFS). The study was a collaborative effort of several agencies to assess the status of water and sediment quality near the shores of Atlantic and Long Beach (Long Island) New York on January 15, 16, 17, 1974. A major objective of this study was to determine if sewer sludge was indeed migrating from the existing dumping site in the New York Bight.

MATERIALS AND METHODS

1. Collection and Handling of Samples

The bottom sediments were obtained using a Smith-McIntyre dredge. For bacterial studies the top centimeter was removed with a sterile tongue depressor and placed in a sterile 8 oz. French square bottle. The sample represented approximately 100 cm^2 of the surface area of the sediment. The samples were refrigerated and examined within 24 hours for this study. However, some previous studies showed that sediments for coliform counts could be refrigerated for several days at 4^oC without any appreciable effect on the coliform count.

For the chemical analysis a core was extruded from an undistributed portion of the grab by means of a 35 mm diameter polyethylene plastic tube, capped, refrigerated and then frozen until time for chemical analysis.

Sediment samples were obtained from all stations for chemical analysis. Samples were not obtained at all stations for bacterial analysis because of limitations on the number of samples that could be effectively analyzed in this short period of time by the Microbiology team.

II. Analysis for Coliform Bacteria

The procedure used for determining total coliform (confirmed) and fecal coliform MPN follows the procedures as outlined in Standard Methods of the Examination of Water and Waste Water, 13th edition, except for changes to make them applicable to the examination of bottom sediments.

The initial dilution of sediment is made by adding the sample to 100 ml of 0.5% sterile peptone contained in an 8 oz. French square bottle until it reaches a precalibration mark of 200 ml. The bottle is weighed in order to approximate the specific gravity of the sediment as a reference point in identifying the sediment type. After thoroughly shaking, appropriate dilutions are made for inoculation of the media. For this study the 5 tube MPN technique was employed. The results by this procedure are expressed as the number of coliforms per 100 ml of sediment.

III. Analysis for Metals in Sediments

The analysis of metals in sediments was a procedure developed and employed by the Environmental Protection Agency (Great Lake Region, Committee on Analytical Methods). The method is briefly outlined as follows: A 1-1/2 inch section is obtained from the top of the core. The sediment is dried at 60°C for 48 hours. Nitric acid and hydrogen peroxide are added to the sample followed by heating at 200-250°C until a dry residue is obtained.

The residue is then taken up with a mixture of nitric and hydrochloric acid, ammonium chloride and calcium nitrate. The solution is filtered, diluted to the desired volume and analyzed by means of a Perkin Elmer 403 atomic absorption spectrophotometer. The results are expressed as ppm of the metal per dry weight of sediment.

RESULTS

Sediment Types

The station numbers sampled for this study appear in Figure 1 and the coordinates are listed in Table 1. Samplings were obtained by a member of the Investigation aboard the R/V RORQUAL.

Except for the samples from station 24, 25, and 19 the bottom sediments were of a sandy type. Sediments from station 24 and 25 were of a sandy type with a small amount of black sediment intermixed. The sediment from station 19 was uniformly black but did not appear to be sewage sludge.

Coliform Counts

The data, both on the total and fecal MPN counts in the top layer of the sediments,are tabulated in Table 2. The distribution as related to station numbers for total coliform counts and fecal coliform counts are present in Figures 2 and 3, respectively.

As can be seen, the distribution of total coliform counts does not correlate with the fecal coliform count, with one possible exception at station 19. Here both the total and fecal coliform counts were high. The total coliform count increased in the sediments obtained on the transects away from the beach area. However, the fecal coliform MPN count did not show a similar tendency. The fecal coliform count in the sediments from both the in-shore and off-shore stations were quite similar. The significance of the total coliform count in the sediments is unknown. The relationship between total coliform and fecal contamination in marine sediments has not been established.

The distribution of the fecal coliforms in the sediments as presented in Figure 3 does not indicate that the wastes from the sewage sludge disposal site are causing fecal contamination of the area surveyed. Previous studies have shown the specificity of the fecal coliform MPN procedure for detecting coliforms of fecal origin in marine sediments.

Metal Concentrations in the Sediments

The results of the analysis for the seven heavy metals, silver, cadmium, chromium, copper, nickel, lead, and zinc, in sediments from the 31 stations are presented in Table 3. The concentrations of zinc and chromium in sediments from each station are presented as isopleths in Figures 4 and 5, respectively. The concentrations of the other heavy metals were not of sufficient magnitude or were below our levels of detection for this type of presentation.

The highest levels of metals were found in the sediment from station 19. Copper, chromium, lead, and zinc concentrations in the sediments from this station ranged from 100-155 ppm. The level of nickel was 27 ppm. Silver and cadmium were at 3-4 ppm. The next highest level of metal concentration was in the sediment obtained from station 24. However, the concentrations were much lower, being one-fourth to one-sixth that observed in the sediment from station 19.

The distribution of zinc and chromium in the sediments from all stations as evident from the figures was similar. The lowest concentration of the metals appears to be in sediments from station sampled nearest the coast. The concentrations of the other heavy metals were in most cases below detectable levels by our techniques so distribution patterns could not be attempted.

For comparative purposes of a proximate geographical area, the levels of metals found in the sediments from all stations with the exception of station 19, were of the same order of magnitude as we observed in sediments obtained in a previous study from Gardner's Bay, Long Island.

The data, both on coliform numbers and metal concentrations, were observed to be highest from station 19. The sediment was unique in that it differed from that obtained from the other stations. Unfortunately, other stations were not sampled peripheral to this station so that a distribution pattern of coliforms and heavy metals for this sediment type could not be established for this area.

FUTURE CONSIDERATIONS

The limited information demonstrates the need for a more comprehensive survey to definitely locate the sources of fecal contamination and heavy metal concentrations especially on radial transects to peripheral areas from the center of dumping and in-shore-bay areas. It would again need to be a cooperative effort to examine both the water column and sediment for coliforms and for select heavy metals.

Table I. Station Coordinates

Station Number	
	West to East
1.	40°34.75'N, 73°46.00'W
2.	40°34.75'N, 73°45.00'W
3.	40°34.75'N, 73°44.00'W
4.	40°34.75'N, 73°43.00'W
5.	40°34.75'N, 73°42.00'W
6.	40°34.75'N, 73°41.00'W
7.	40°34.75'N, 73°40.00'W
	South and then West
8.	40°34.50'N, 73°40.00'W
9.	40°34.50'N, 73°41.00'W
10.	40°34.50'N, 73°42.00'W
11.	40°34.50'N, 73°43.00'W
12.	40°34.50'N, 73°44.00'W
13.	40°34.50'N, 73°45.00'W
14.	40°34.50'N, 73°46.00'W
	South and then East
15.	40°34.00'N, 73°46.00'W
16.	40°34.00'N, 73°44.00'W
17.	40°34.00'N, 73°42.00'W
18.	40°34.00'N, 73°40.00'W
19.	40°34.00'N, 73°38.00'W
	South and then West
23.	40°33.00'N, 73°40.00'W
22.	40°33.00'N, 73°42.00'W
21.	40°33.00'N, 73°44.00'W
20.	40°33.00'N, 73°46.00'W
	South and then East
24.	40°32.00'N, 73°46.00'W
25.	40°32.00'N, 73°44.00'W
26.	40°32.00'N, 73°42.00'W
27.	40°32.00'N, 73°40.00'W
	South and then West
31.	40°31.00'N, 73°40.00'W
30.	40°31.00'N, 73°42.00'W
29.	40°31.00'N, 73°44.00'W
28.	40°31.00'N, 73°46.00'W

Table 2. Distribution of coliforms in top layer of sediments - Long Beach Area, New York Bight

	Coliforms/100 ml Sediment	
Stations	Total	Fecal
1	460	79
3	240	8
5	240	2
8	330	79
9	330	33
10	330	17
12	270	33
15	130	13
16	490	16
17	790	17
19	3,330	330
20	790	11
21	790	11
22	790	13
24	330	13
25	4,900	8
26	1,090	7
28	4,900	79
29	7,900	33
30	1,090	13

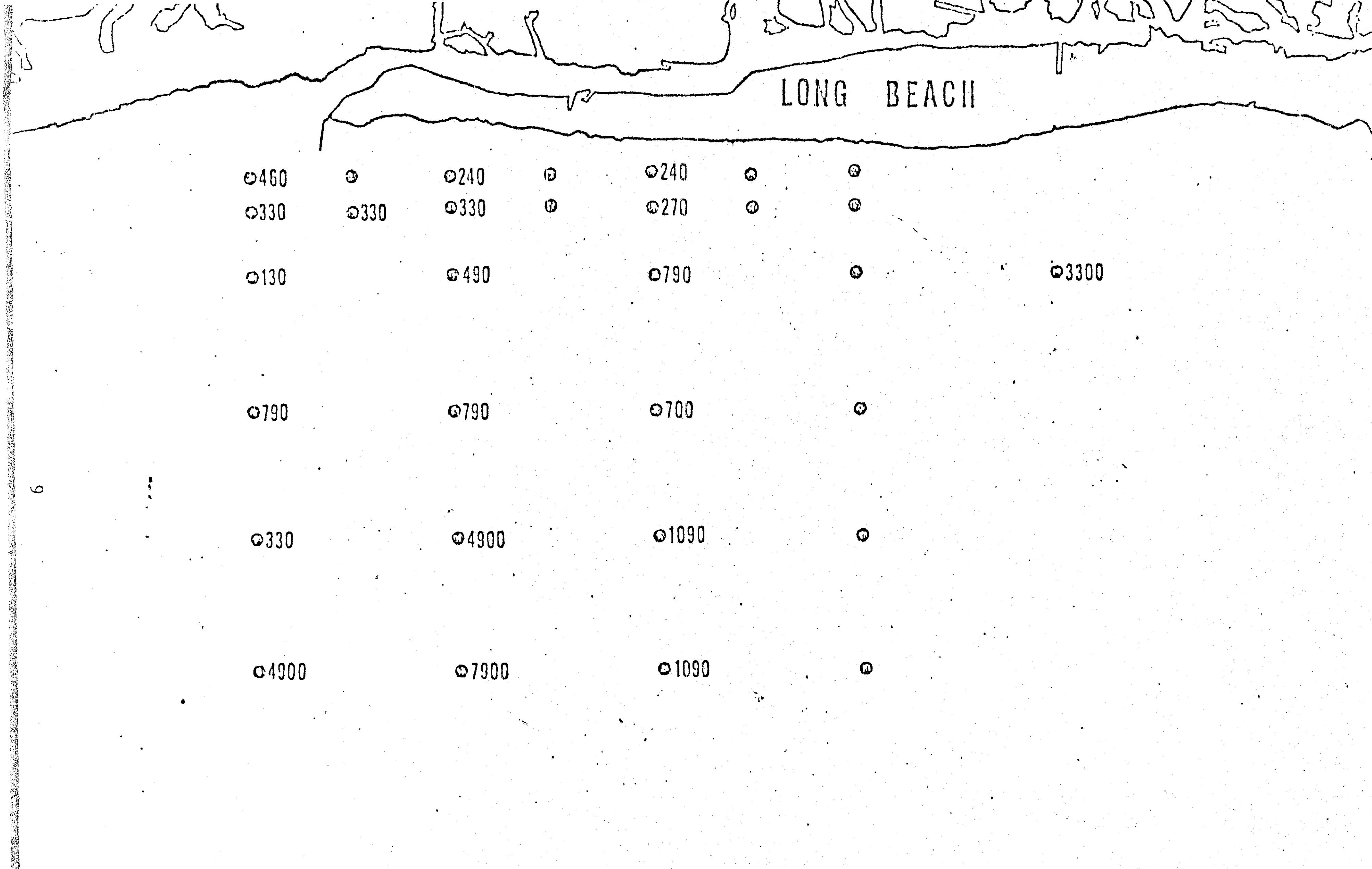


Figure 2. Distribution of Total Coliforms/100 ml Sediment

Table 3. Trace Metal Concentrations in Top Layer of Sediments from Long Beach Area--New York Bight

Concentration of Metal*
ppm dry weight

Station	Ag	Cd	Cr	Cu	Ni	Pb	Zn
1	< 1	< 1	4.1	< 4	< 2	< 6	7.6
2	< 1	< 1	7.0	< 4	< 2	7.0	15.1
3	< 1	< 1	2.7	< 4	< 2	< 6	10.2
4	"	"	5.8	"	"	8.0	16.0
5	"	"	6.5	"	"	6.0	14.0
6	"	"	2.9	"	"	< 6	9.7
7	"	"	1.0	"	"	< 6	3.2
8	"	"	2.8	"	"	< 6	9.8
9	"	"	16.1	12.1	4.5	17.3	29.3
10	"	"	3.1	< 4	< 2	< 6	13.8
11	"	"	2.2	< 4	2.9	< 6	7.5
12	"	"	6.9	< 4	3.7	8.0	19.6
13	"	"	6.0	"	2.4	< 6	14.3
14	"	"	3.7	"	< 2	< 6	6.7
15	"	"	6.7	"	3.4	8.0	19.3
16	"	"	3.9	"	< 2	< 6	12.7
17	"	"	4.3	"	2.8	< 7	18.0
18	"	"	4.7	"	2.6	< 6	15.6
19	3.7	3.0	102.	108.	26.7	130.	155.
20	< 1	< 1	7.7	< 4	3.0	11.0	28.7
21	< 1	< 1	4.9	< 4	2.0	< 6	11.2
22	< 1	< 1	11.8	< 4	4.5	17.0	32.0
23	"	"	8.2	"	2.9	11.0	27.0
24	"	"	17.1	8.5	4.9	25.0	43.5
25	"	"	11.2	4.9	4.0	12.0	30.0
26	"	"	7.5	< 4	3.3	8.0	25.0
27	"	"	4.0	< 4	< 2	6.0	13.0
28	"	"	14.0	9.1	5.7	15.0	29.5
29	"	"	10.7	4.6	2.8	14.0	28.7
30	"	"	9.5	< 4	3.4	13.0	27.0
31	"	"	4.6	< 4	3.2	< 7	20.0

*Average of duplicate analyses.

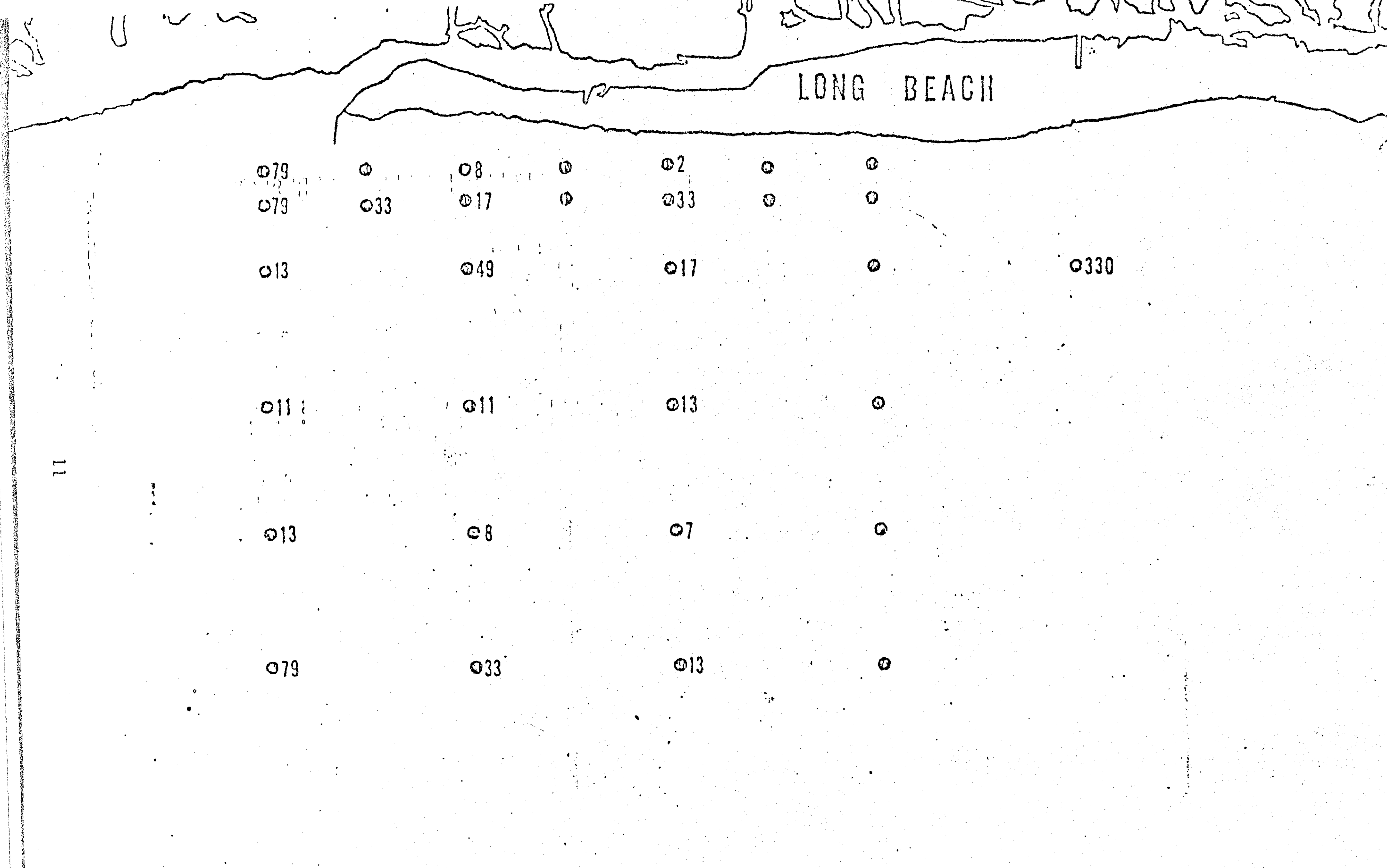
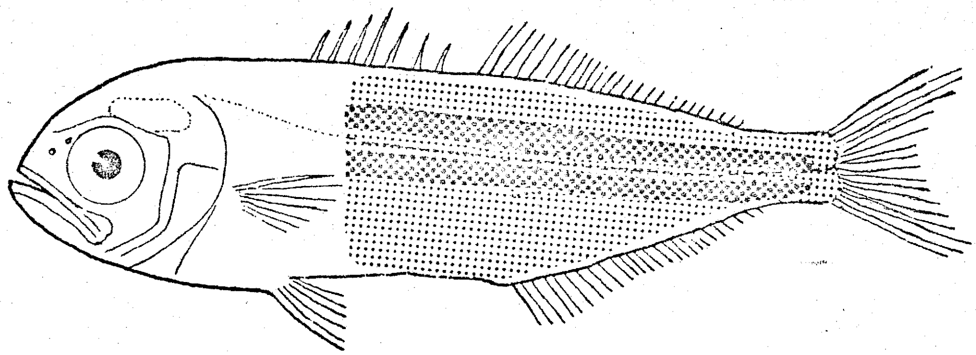
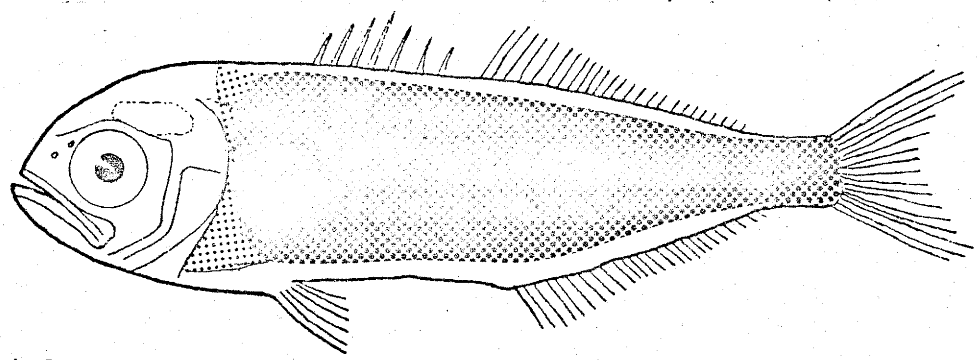


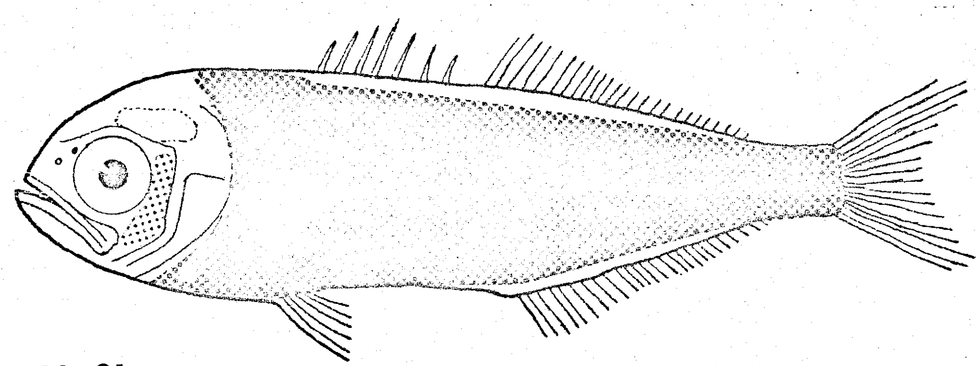
Figure 3. Distribution of Fecal Coliforms/100 ml Sediment



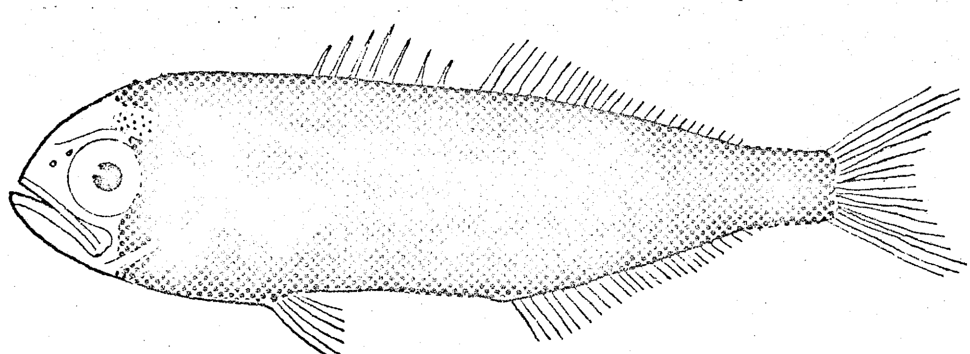
a. 12.5-14.0mm



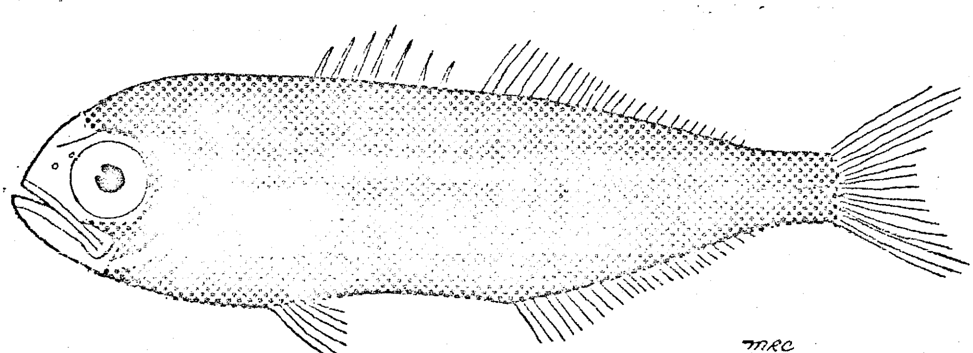
b. 15-17mm



c. 18-21mm



d. 22-27mm



e. 34-37mm

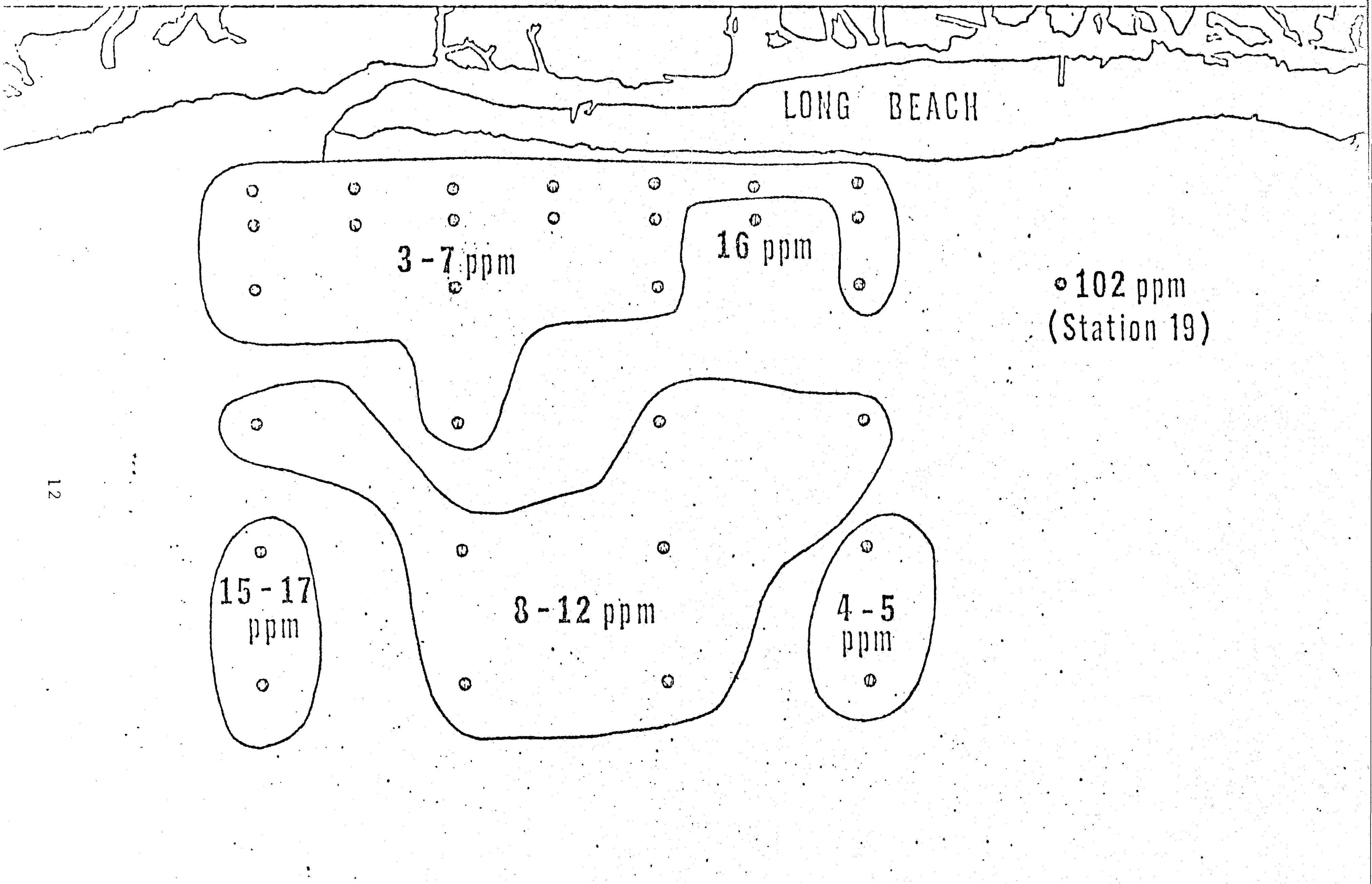
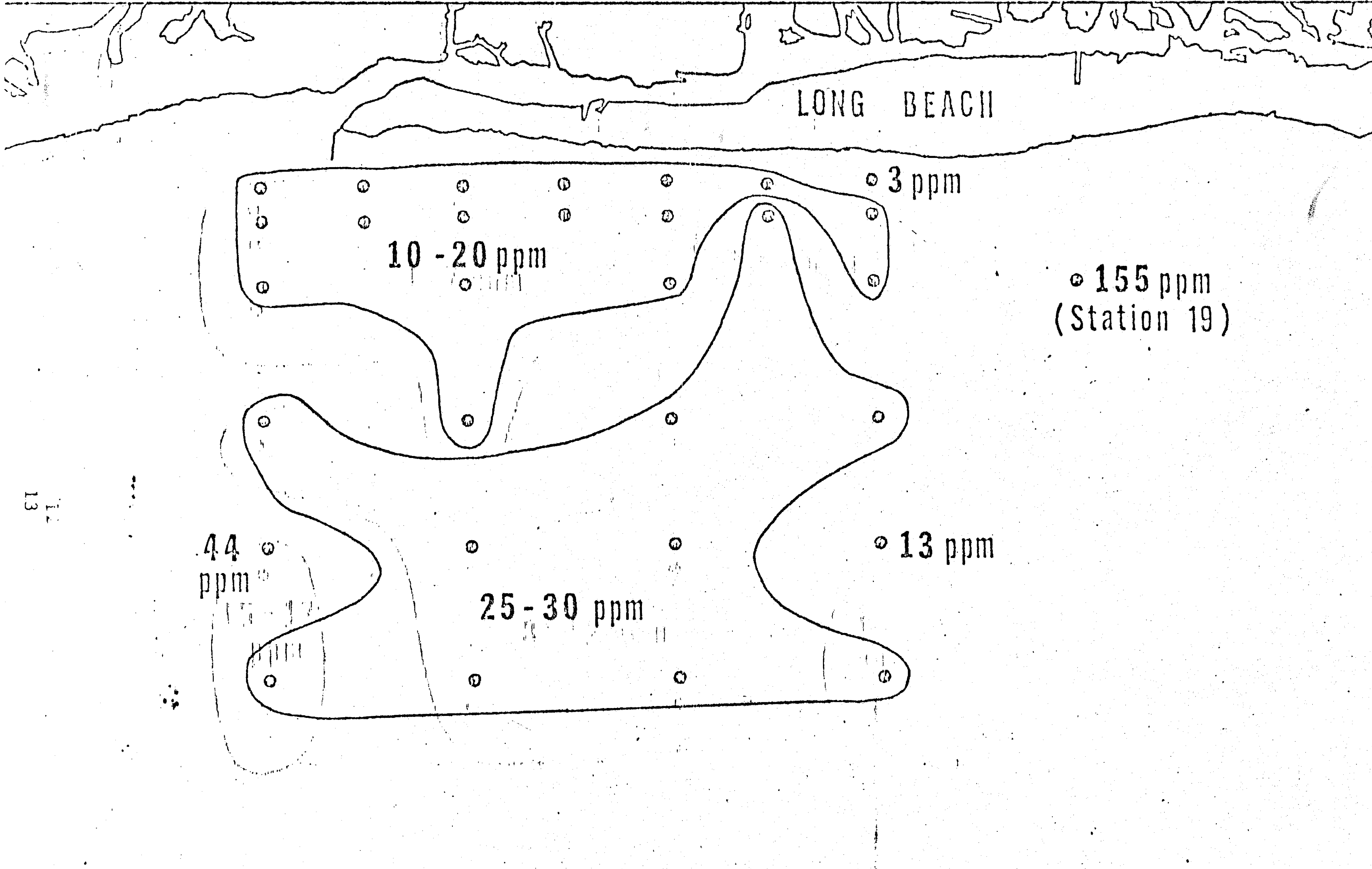


Figure 4. Levels of chromium in top layers of sediments (dry weight) from Long Beach Area--New York Bight.



igure 5. Levels of zinc in top layer of sediments (dry weight) from Long Beach Area --New York Bight.

APPENDIX J

SHELL DISEASE IN CRABS AND LOBSTERS COLLECTED FROM THE NEW YORK BIGHT

James S. Young and John B. Pearce[1]

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

ABSTRACT

Individuals of *Homarus americanus* and *Cancer irroratus* with the shell disease syndrome were collected from the New York Bight. Histopathology of the disease, causative agents, its effects on respiration, and its possible association with the disposal of solid waste in the ocean are discussed.

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Murchelano Robert A.	Supervisory Fishery Biologist (Res.)	226-5193

TITLE OF TALK AND AUTHORS

A Fin Rot Disease of Winter Flounder

ABSTRACT *(or resume of talk in lieu of abstract)*

The New York Bight has been the recipient of sewage sludge, dredge spoils and industrial acid wastes from the New York/New Jersey metropolitan area for the past 50 years. An approximate 25 square mile area of the Bight has been altered severely ecologically and has been the subject of extensive biological study. Trawl surveys for demersal fish have shown that substantial numbers of winter flounder, Pseudopleuronectes americanus, from this area exhibit necrotic lesions of the anal, dorsal, and caudal fins. Histopathological studies of these lesions reveal epidermal hyperplasia and extensive hemhorrage in underlying connective tissue. Examination of tissues from kidney, liver, and spleen has not revealed any consistent histopathology. Taxonomic studies of bacteria isolated from fin lesions have yielded an assorted group of ubiquitous marine bacteria. No particular bacterial species has been consistently isolated from the fin lesions cultured and tissue gram stains have failed to demonstrate in situ bacteria. Ecological, histological and microbiological studies presently are being conducted to establish the etiology of the disease.

MEETING AT WHICH TALK WILL BE PRESENTED

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DATE OF TALK: 4/30/74

NAME OF MEETING

International Association of Aquatic Animal Medicine

LOCATION OF MEETING

Orlando, Florida

SPONSORING ORGANIZATION

International Association of Aquatic Animal Medicine

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