Woods Hole Oceanographic Institution

BIOLOGICAL AND HYDROGRAPHIC STATION DATA OBTAINED IN THE VICINITY OF NANTUCKET SHOALS, MAY 1978 - MAY 1979

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January 1980

TECHNICAL REPORT

Prepared for the Department of Commerce, NOAA Office of Sea Grant under Grant 04-7-158-44104 and 04-9-MO1-149, EG&G Environmental Consultants Contract #54779 and Brookhaven National Laboratory Contract #424422-S.

WOODS HOLE, MASSACHUSETTS 02543

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Approved for Distribution _____
Valentine Worthington, Chairman
Department of Physical Oceanography

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Abstract

Six cruises were made from May, 1978 to May, 1979 to measure the regional distributions of chlorophyll, silicate, nitrate and nitrite, phosphate, temperature, and salinity in the vicinity of Nantucket Shoals on the New England continental shelf. A summary of the hydrographic observations made on the first three cruises has already been presented in Limeburner and Beardsley (1979). A summary of the biological data obtained on five of the six cruises and the hydrographic observations made during the last three cruises is presented here in graphic form.

1. Introduction

This report presents preliminary results of six hydrographic cruises made in the Nantucket Shoals region of the New England continental shelf. These cruises are part of a Sea Grant-supported research program designed to: a) measure and document the spatial and temporal structure and variability of the water properties in the Nantucket Shoals/Great South Channel region over one annual cycle; b) conduct a pilot moored current meter array experiment to obtain direct measurements of wind-driven and other subtidal transient currents; and c) synthesize the new hydrographic and current data into an improved circulation scheme for Nantucket Shoals. In addition, surface chlorophyll and nutrient data were obtained during the hydrographic cruises. A total of six surveys were completed at approximate intervals of one cruise every two months. The first hydrographic survey, Cruise NS1, was conducted May 28-June 2, 1978; the second survey, Cruise NS2, on July 15-20, 1978; the third survey, Cruise NS3, on September 14-19, 1978; the fourth survey, Cruise NS4, on January 23-29, 1979; the fifth survey, Cruise NS5, on March 22-26, 1979; and the sixth survey, Cruise NS6, on May 19-23, 1979. All six cruises were completed on the MIT 65-foot converted T-boat, the R/V EDGERTON. CTD stations were taken approximately every five nautical miles along a cruise track which

covered the coastal zone between one and fifty nautical miles offshore, and in the general area to the east and south of Cape Cod, Nantucket, and Marthas Vineyard. A summary of the hydrographic station data obtained during the first three cruises is given by Limeburner and Beardsley (1979) in WHOI Technical Report 79-30. The hydrographic data obtained during the last three cruises is presented in this report as well as maps of the surface hydrographic data from all of the cruises. Biological data obtained on five of the cruises is also presented here. The cruise tracks for all six cruises are shown with station locations, the station numbering scheme, and the regional topography. At station locations where strong tidal currents produced a vertically mixed water column, only a surface water sample was taken. A total of 10 CTD stations were taken on Cruise NS4, 24 CTD stations on Cruise NS5, and 29 CTD stations on Cruise NS6. The CTD data has been edited and analyzed at WHOI and 2 decibar averaged profile data has been submitted in GATE format to the National Oceanographic Data Center, Washington, D. C. 20235.

2. Instrumentation

A. CTD

A Plessy model 9040 CTD fish with a Plessy model 8400 digital data logger was used as the profiling instrument on all six cruises.

B. Calibration Samples

Surface nutrient and salinity samples were obtained at each station. Deep calibration samples were obtained using standard Nansen bottles at stations where the vertical salinity and temperature gradients were minimal. Surface temperature was measured with a Hewlett-Packard model 2850c quartz crystal temperature sensor. Normally, the CTD profile was begun at a depth of 2 meters, but frequently heavy seas required lowering the CTD fish to a depth of 4 meters before the profile was begun. The procedure was to attach the Nansen bottle 4 m above the CTD fish and lower the instrument to within 5 m of the bottom for a continuous down profile. The CTD fish was then raised until the Nansen bottle was

located in a zone of minimal temperature and salinity gradients as estimated from the analog temperature and conductivity downtraces. The winch was stopped and 5 minutes were allowed for the reversing thermometers to equilibrate before the bottle was tripped. The fish was then raised 4 m, the three instrument output frequencies logged, and then the fish was brought back to the surface. The Nansen bottle temperature represents the average of two protected thermometer measurements and has an estimated accuracy of ±.005°C. The salinity of the surface and deep water samples were measured at Woods Hole within a week after each cruise.

C. Biological Sampling

Continuous underway chlorophyll fluorescence was measured with a Turner Design 10-005R fluorometer equipped with a blue lamp, and Corning 5-60 and 2-64 excitation and emission filters. Analogue outputs were recorded on a dual pen strip chart recorder. Water was supplied by a Jabsco impeller pump and opaque rubber hose from the ship's cooling intake sea chest (nominal depth about 1.5 meters). The cuvette was cleaned and the instrument blanked with distilled, deionized water when necessary. Calibration samples were taken from the outflow every 30 minutes or upon arrival on stations, whichever was less. The sample (135 ml) was filtered onto Reeve Angel 984H glass fiber filters under 20 cm Hg vacuum, and the filter immediately frozen over dissicant at -20°C. Surface (1.5 m) phytoplankton samples (125 ml) and nutrient samples (60 ml) were also taken from the fluorometer outflow and were preserved with Lugol's iodine or frozen in aged plastic bottles, respectively.

Discrete chlorophyll and nutrient samples were taken from the Nansen bottles used in conjunction with the CTD (section 2B) and were treated as described above.

Chlorophyll and nutrient samples remained frozen until analyzed at MSRC or Brookhaven National Laboratory, respectively. This took place within two weeks for chlorophyll, and within one month for

nutrients except that the March nutrient samples from NS5 were analyzed in July. Chlorophyll and pheophytin were determined fluorometrically following grinding in 90% acetone and filtration, using a Turner Designs fluorometer. This instrument was calibrated using freshly chromatographed chlorophyll a obtained from spinach (courtesy T. Owens, BNL). Concentrations of this stock were determined using extinction coefficient of 91.0 l/gm cm at the red peak measured on an Aminco DW-2 spectrophotometer. The calibration was checked periodically with coproporphyrin standards, and is considered accurate to within ±10%. The coefficient of variation for triplicate samples is approximately 5% for the technique.

Nutrients were analyzed on an Autoanalyzer Technicon couple interfaced with a Hewlett-Packard 9845 computer. Methods and precisions are given in Strickland and Parsons (1972).

D. Navigation

A Northstar 6000 Loran-C instrument was used on each cruise for an estimated position error of ±.1 nautical miles at each station.

3. Data Analysis

The raw data tapes were first edited for proper header information and file structure using the WHOI computer program "TIDE". A second test of the structural integrity of the data files was made with program "PLSSY" (written by W. Sass) which transcribes the raw data into CTD format and detects any bad scans which are located in the data files. The data was then processed with program "AAA", a multi-level general CTD processing program written by J. Vermersch. This program can be used to: (1) apply user-specified calibration constants; (2) correct for sensor time lag; (3) compute salinity, sigma-t, and other derived variables; (4) edit up to four variables via first-difference or acceptable range methods; and (5) sort the data by pressure to provide a uniform pressure series. The linear corrections determined from

the calibration temperature and salinity measurements were not applied to the instrument temperature and conductivity data since the corrections were not significant in relation to the mode of presentation of the data. (The calibration results are discussed in the next section and the mean offsets of the CTD data listed in Table 1.) A time lag of 2.5 scans (.625 sec) was used on all station data from the six cruises. Previous hydrographic data analysis with the Plessy system experienced "spiking" of the salinity data in areas of strong temperature gradients due to the different time constants associated with the conductivity and temperature sensors of the fish. The spiking effects were minimized by the choice of time-lag given above, first difference editing of the data, and by pressure sorting at two decibar intervals with a least-square technique which gives the "best" value of each measured or computed variable at the center of each two-decibar interval. The two-decibar pressure-sorted data has been submitted in GATE format to NODC and has been used on all subsequent analysis and graphical presentations.

4. Error Analysis of the Hydrographic Data

Instrumental error in the hydrographic data is related to two possible sources: (a) an offset associated with the instrument calibration and obtained by comparison with the Nansen bottle data, and (b) the differential response time associated with the temperature and conductivity sensors in regions of strong vertical gradients. Table 1 summarizes the mean offset and standard deviations computed between the Nansen bottle and CTD calibration data. The offsets were calculated at CTD stations where no vertical temperature or salinity gradient was observed when the Nansen bottle was tripped. Plots of offset versus station number showed no recognizable calibration drift. The offsets given in Table 1 are small relative to the mode of presentation of the data, and thus the corrections were not applied to the data.

Vertical profiles and T/S diagrams indicated "spiking" of the salinity data in areas of strong, mid-level temperature gradients due to the

Table 1. CTD Calibration Results

Cruise	Number of CTD Stations	Variable	Average Offset	Standard Deviation
NS1	108	Temp	+.006°C	.016°C
		Salinity	-.001 ‰	.015 ‰
NS2	120	Temp	.010°C	.021°C
		Salinity	-.015 ‰	.014 ‰
NS3	100	Temp	.001°C	.011°C
		Salinity	-.004 ‰	.014 ‰
NS4	10	Temp	-	-
		Salinity	-	-
NS5	24	Temp	-.004°C	.014°C
		Salinity	-.007 ‰	.006 ‰
NS6	29	Temp	.009°C	.011°C
		Salinity	-.009 ‰	.009 ‰

different time constants associated with the conductivity and temperature sensors. The spiking effects were minimized by first difference editing of the data and by pressure sorting at two-decibar intervals, but unstable density stratification associated with a salinity spike is still apparent in approximately 1% of the edited data. When these apparent salinity and density errors were observed in the edited data a new salinity was calculated such as to give minimum stability to the density structure. These calculations were applied to the graphical data included in this report and were not applied to the edited data. Spiking in the hydrographic data was not evident during the two winter cruises when the water column was vertically well mixed in the top 100 m.

Each cruise lasted approximately five days so the data should be fairly synoptic in time. However, strong tidal currents essentially advect the hydrographic structure about the shoals in an elliptical pattern so there is an inherent noise level in the horizontal structure on the order of the M_2 tidal excursion, or 15 km.

5. Data Presentation

A. Biological

The chlorophyll and nutrient data for all cruises are presented in tabular form by cruise, station, and depth in Appendix A and as hand contoured surface distributions. One vertical section of all variables, taken 21 May 1979 eastward from Pollock Rip, is presented separately. Surface (1.5 m) chlorophyll distributions were contoured using primarily discrete calibration and station values, and interpolated with the aid of the continuous fluorometric record.

B. Hydrographic

The hydrographic data are presented in three formats: Surface distributions, vertical sections, and T/S correlations. Surface distributions of temperature, salinity, and density are presented for each of the six cruises. In winter during Cruises NS4 and NS5, the upper 100 m

of the water column was well mixed over the survey area and the surface distribution of temperature, salinity, and density reflect the distribution at depth. Vertical sections are given for Cruise NS6 to show the cross sectional hydrographic structure over the eastern edge of Nantucket Shoals. In general, the profiling instrument was lowered to within 5 m of the bottom and the deepest hydrographic parameters were considered to be equivalent to those at the bottom. Bottom boundary layers in excess of 5 m were frequently observed. The horizontal and vertical cross-sections are drawn with contour intervals of 1°C, 2 ‰, and .2 in sigma-t. T/S diagrams are shown next for Cruises NS4, NS5, and NS6. The data begins at 2 m and the symbols are plotted along each line with a frequency of 10 m in depth. At stations over Nantucket Shoals, symbols may be overprinted on each other indicating a vertically well-mixed structure and minimal instrumental noise.

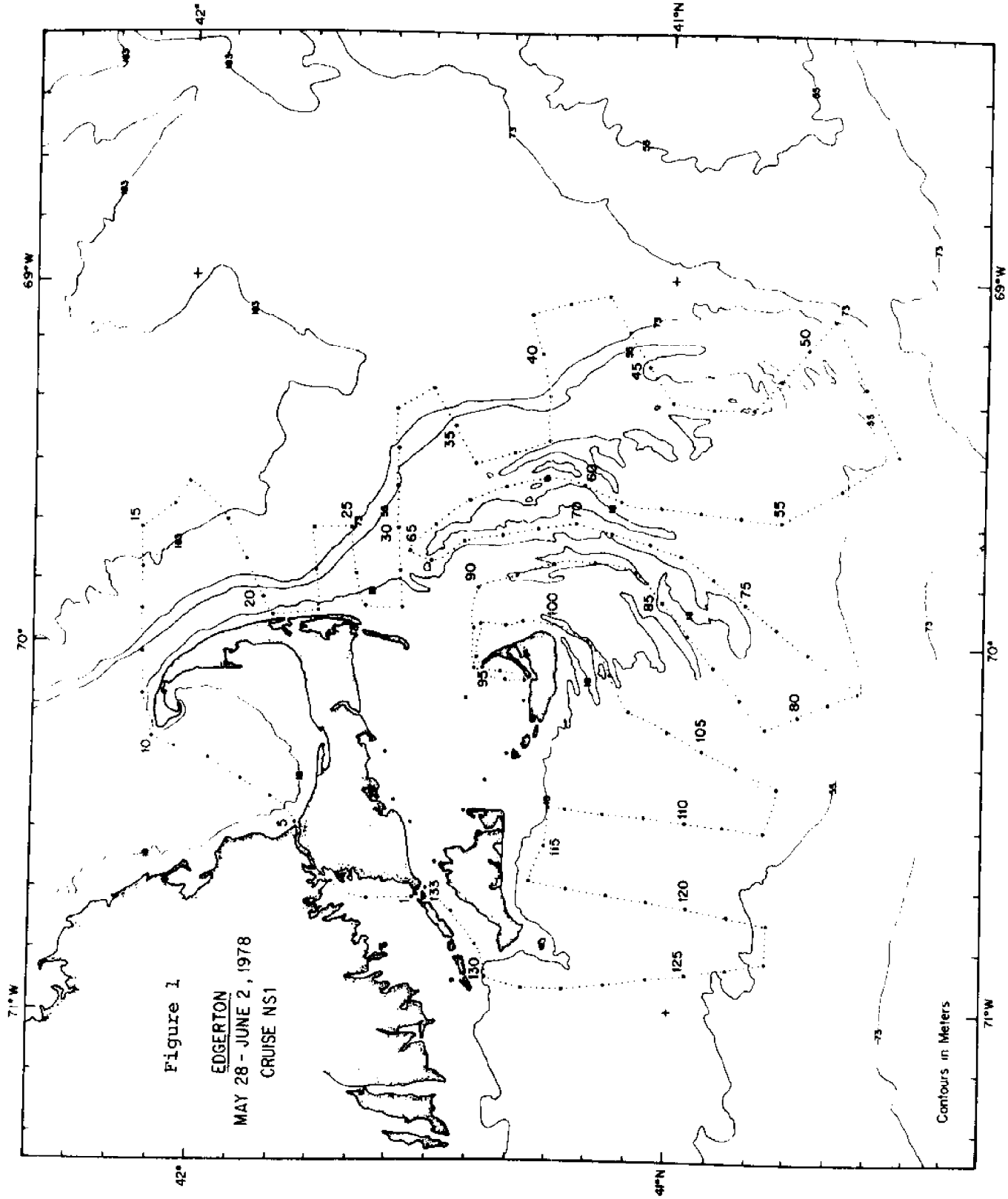
6. Acknowledgments

The six hydrographic cruises were supported by the Department of Commerce, NOAA Office of Sea Grant under Grant #04-7-158-44104 and #04-8-M01-149, and under EG&G Environmental Consultants Contract #1554779. R. Limeburner and R. Beardsly from WHOI served as co-chief scientists. Other scientific personnel included J. Vermersch, A. Jessup, and P. Daifuku from WHOI. B. Butman of the USGS graciously supplied the CTD fish, hydrowinch, and deck unit. V. Worthington piloted the July, 1978 inshore hydrographic survey.

The biological sampling was supported in part by Brookhaven National Laboratory contract #4233225S under DOE contract No. EY-76-C-02-0016, as part of the BNL Atlantic Coastal Ecosystem program. Scientific personnel included P. Kaneta, G. Garland, and R. Beck (MSRC), and T. Owens and J. Tokos (BNL). Nutrients were analyzed by S. Malloy (BNL).

The skill and competence of Howard Ossinger, Captain of the R/V EDGERTON, contributed significantly to the success of the six cruises.

Wayne Esaias present address: Mail Stop 272, NASA
Langley Research Center
Hampton, VA 23665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MAY 28 - JUNE 2, 1978
CRUISE NS1
Contours in Meters
71°W
70°
69°W
42°
41°N

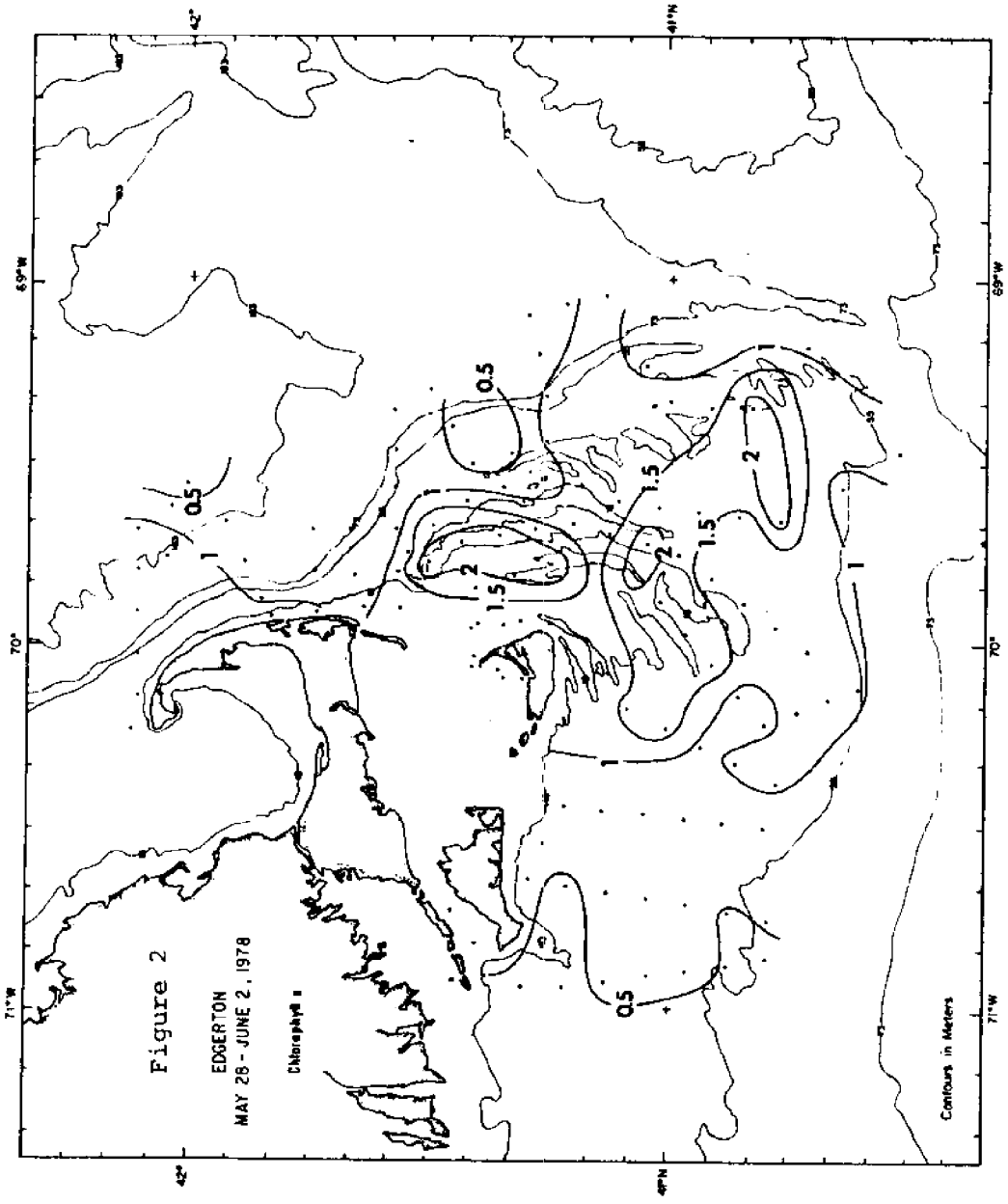
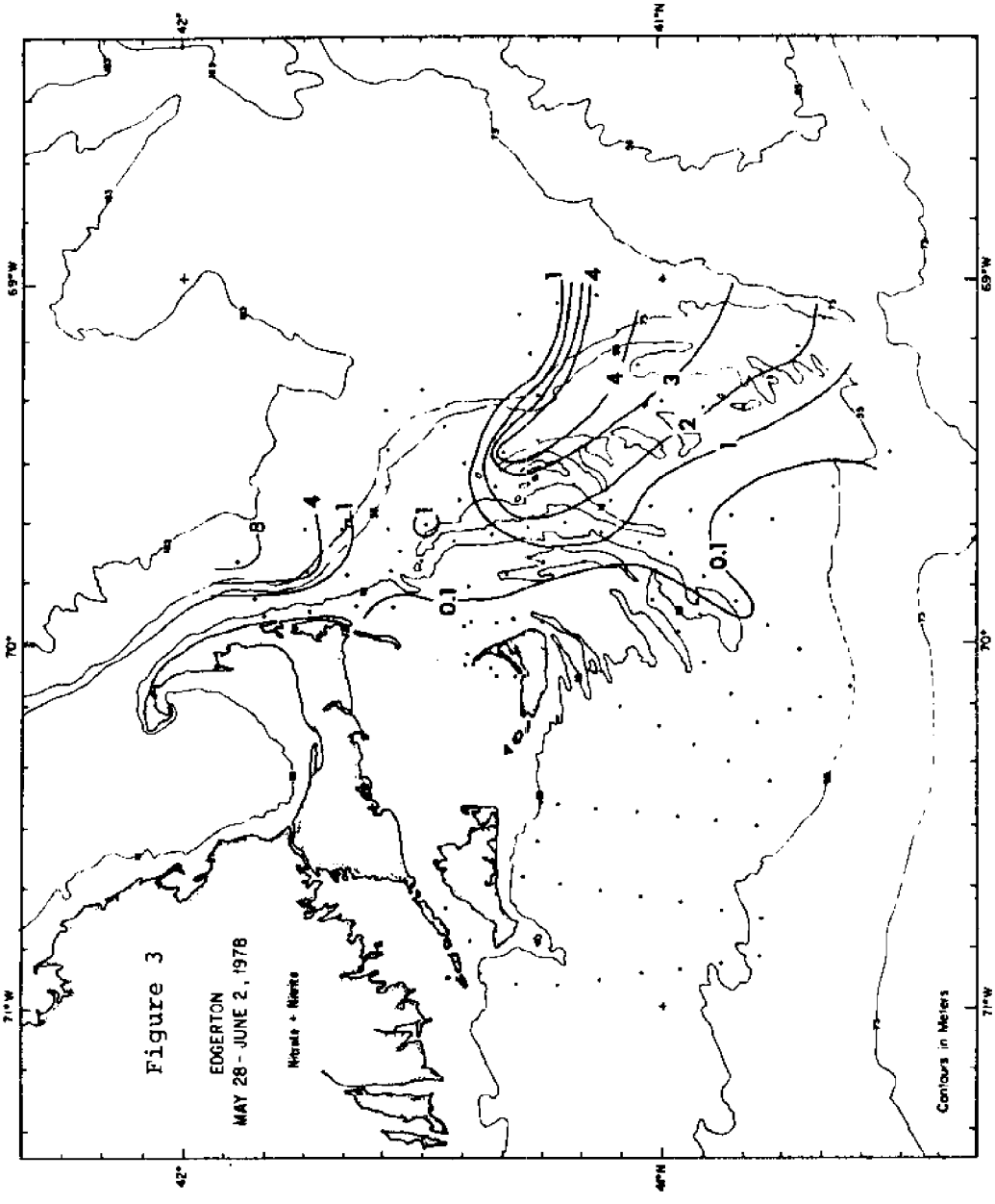


Figure 2
EDGERTON
MAY 28 - JUNE 2, 1978
Chlorophyll a
Contours in Meters
0.5
1
1.5
2
42°
41°N
71°W
70°
69°W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EDGERTON
MAY 28 - JUNE 2, 1978
Contours in Meters

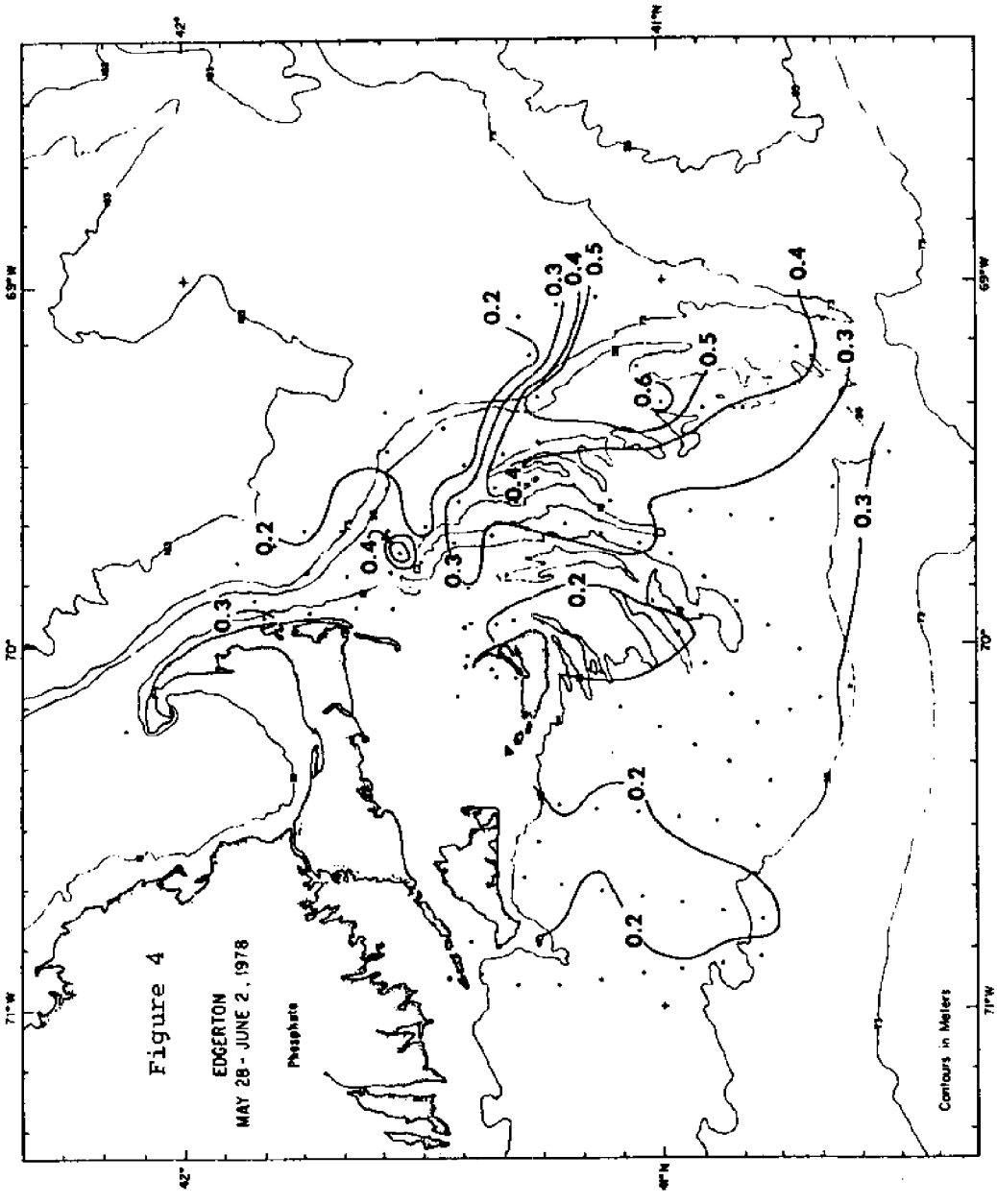
Figure 4
EDGERTON
MAY 28 - JUNE 2, 1978
Phosphate
Contours in Meters
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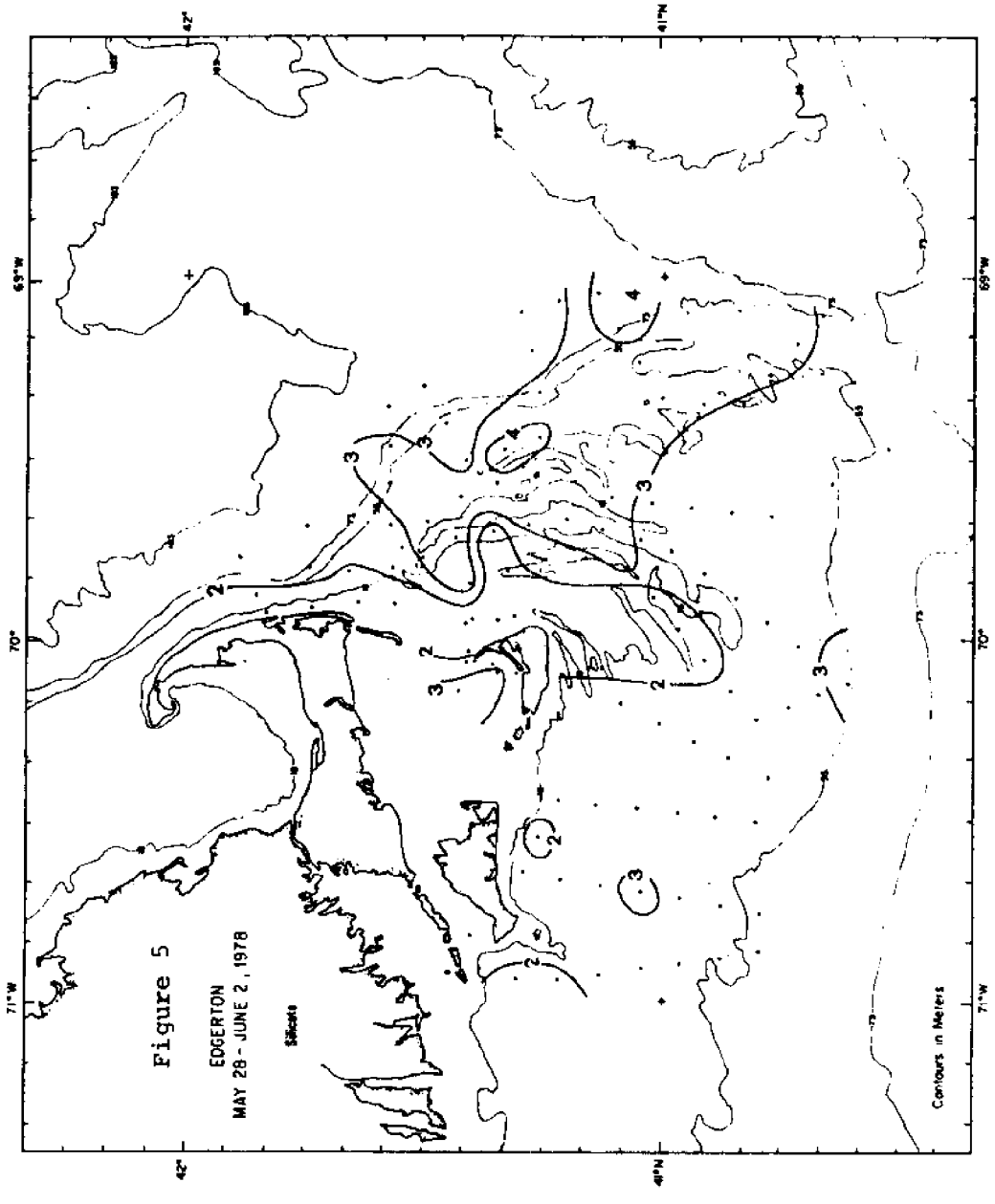
0.3
0.4
0.5
0.6
71°W
70°
69°W
42°
41°N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MAY 28 - JUNE 2, 1978
Silicate
Contours in Meters
42°
41°N
69°W
70°
71°W

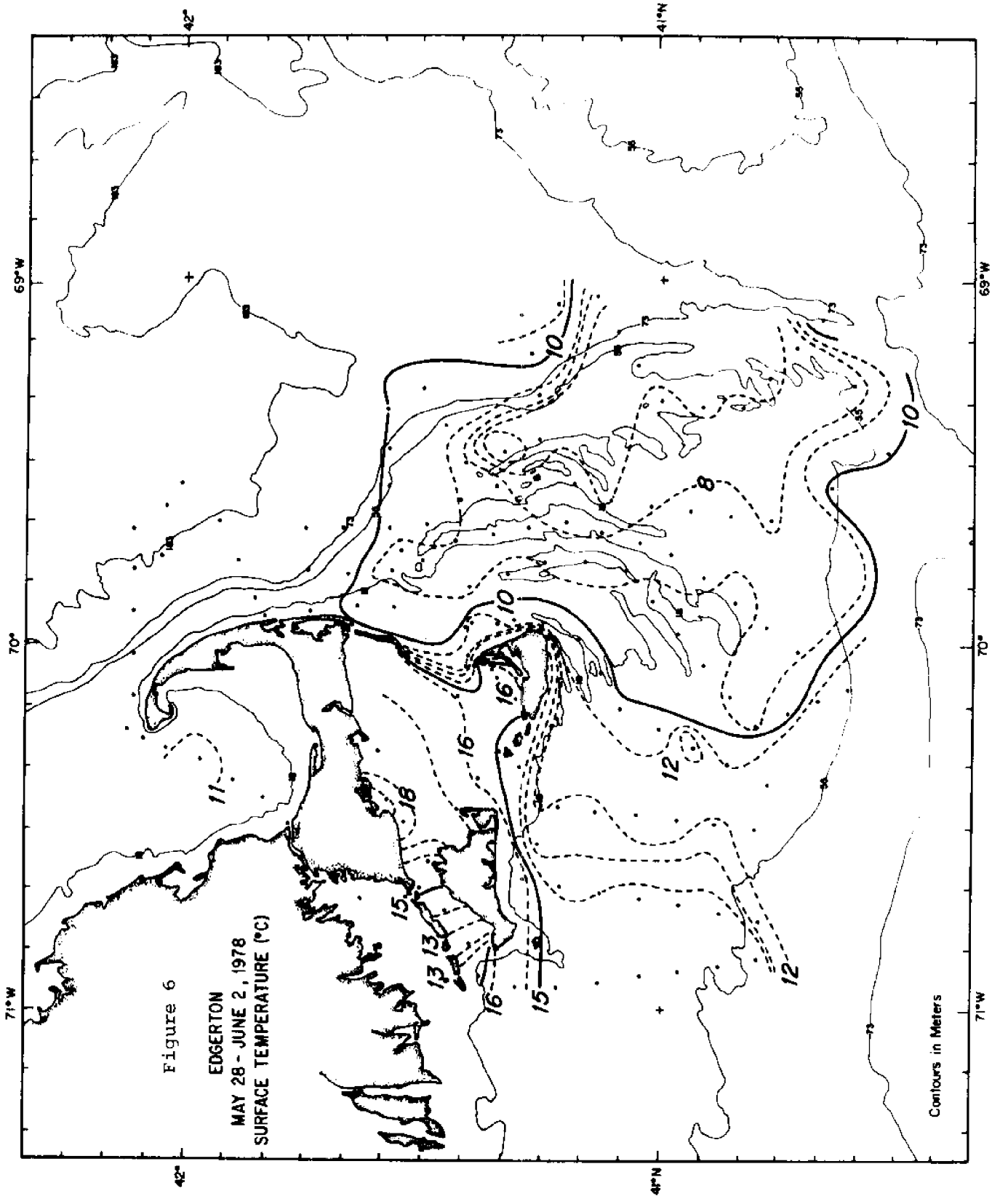

71°W
70°
69°W
42°
41°N
42°
41°N
EDGERTON
MAY 28 - JUNE 2, 1978
SURFACE TEMPERATURE (°C)
Contours in Meters
10
8
12
11
16
15
13

Figure 6

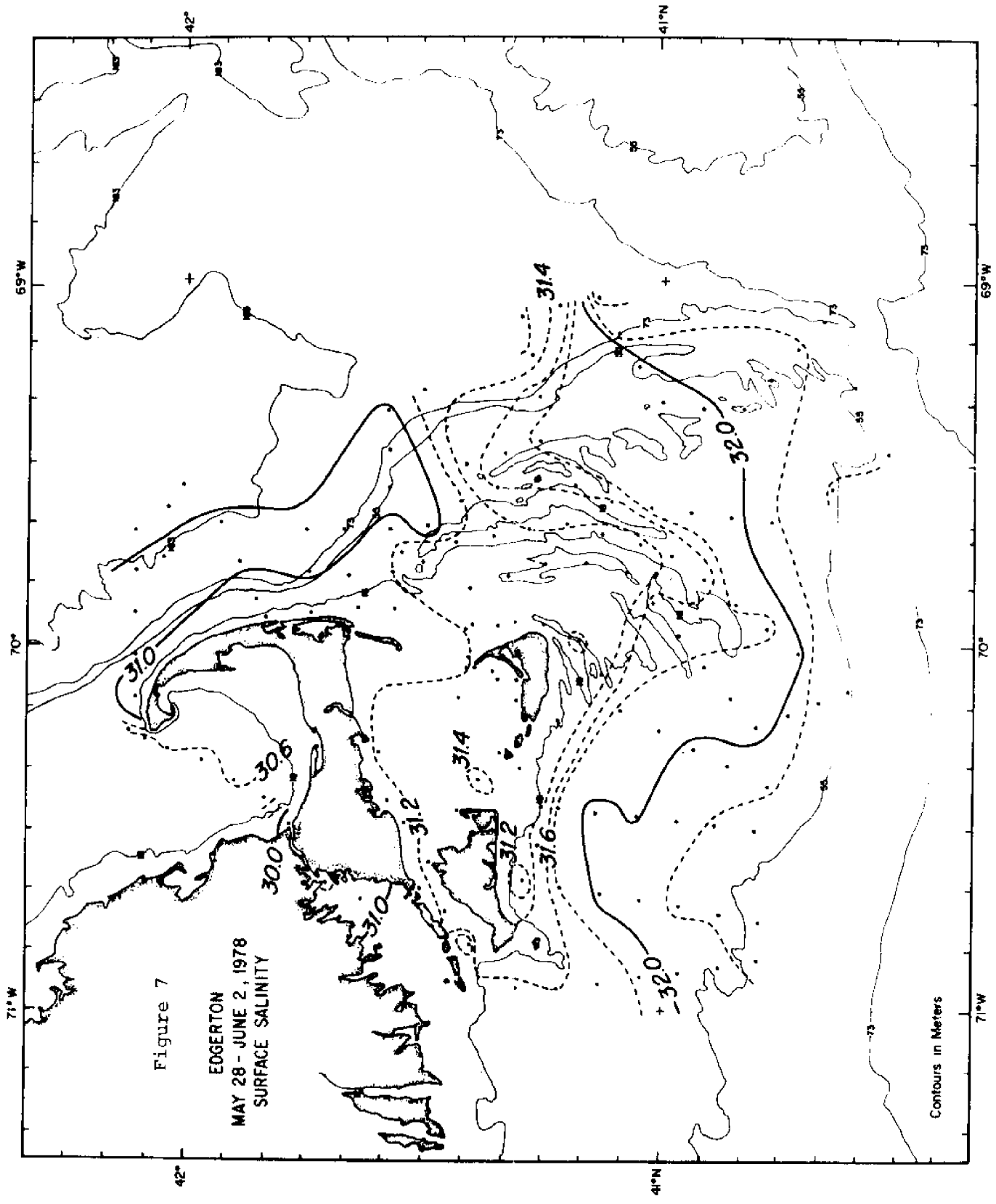


Figure 7

EDGERTON
MAY 28 - JUNE 2, 1978
SURFACE SALINITY

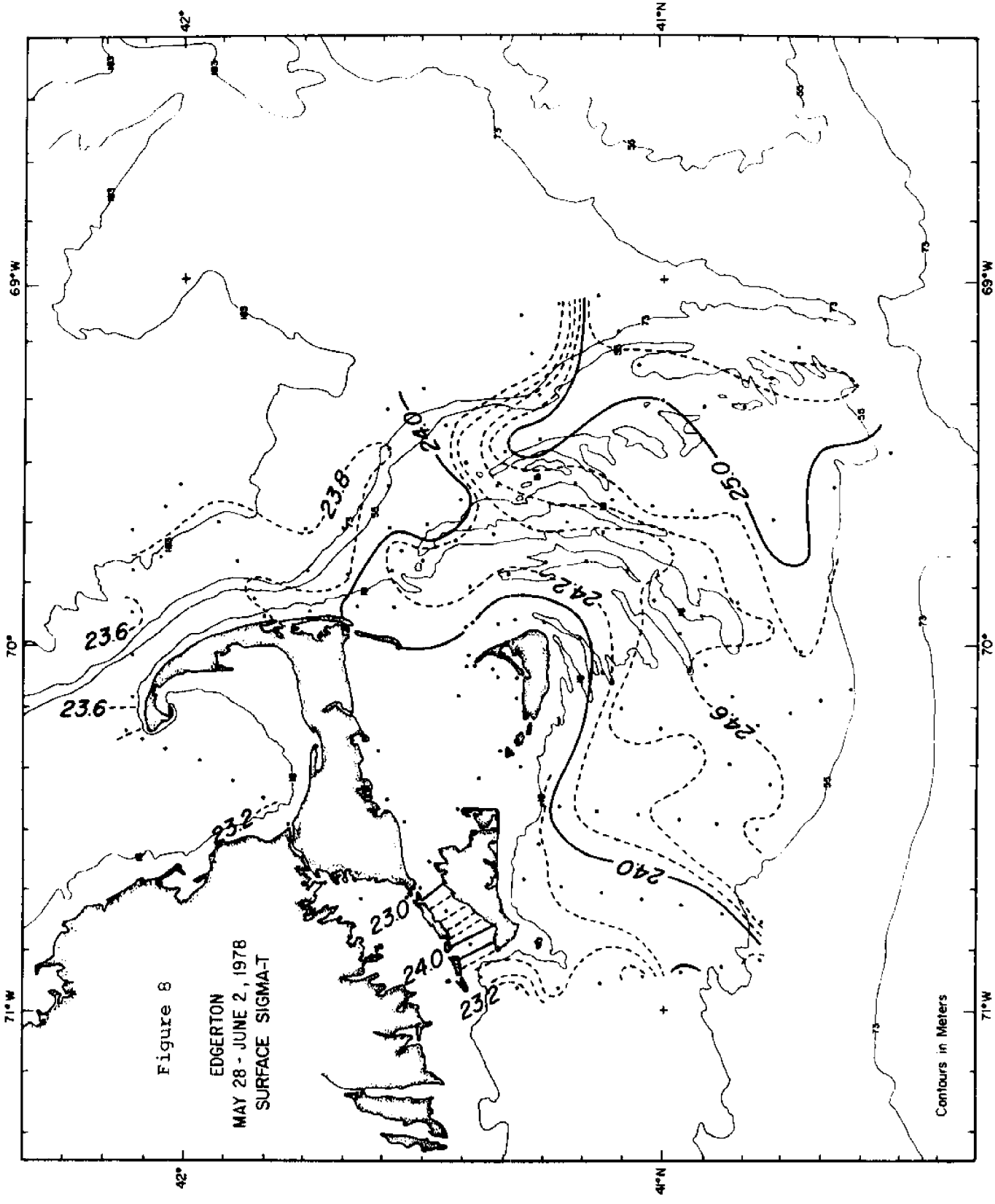
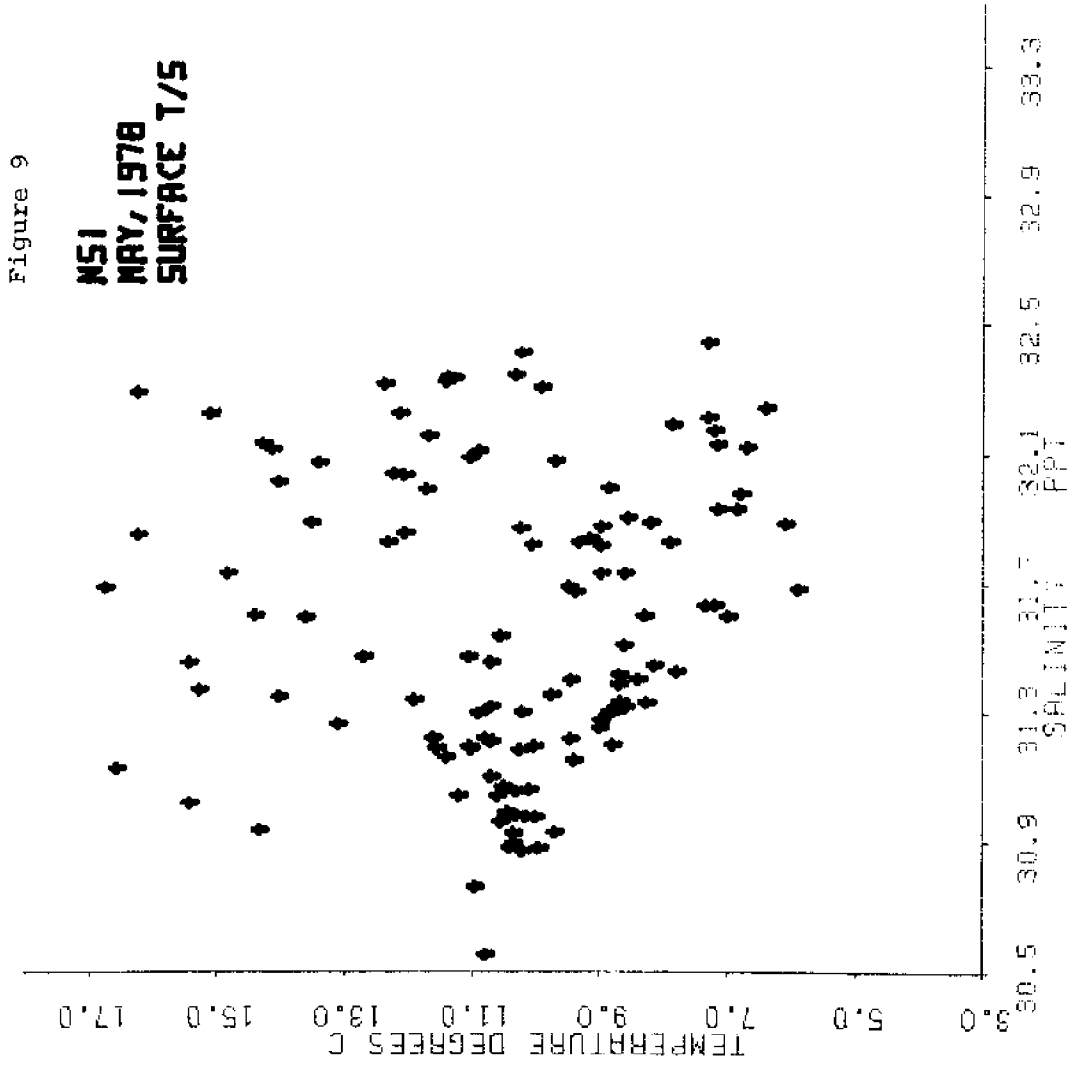


Figure 8

EDGERTON
MAY 28 - JUNE 2, 1978
SURFACE SIGMA-T

Figure 9


NS1
MAY, 1978
SURFACE T/S
TEMPERATURE DEGREES C
3.0
5.0
7.0
9.0
11.0
13.0
15.0
17.0
SALINITY
PPT
30.5
30.9
31.2
31.7
32.1
32.5
32.9
33.3

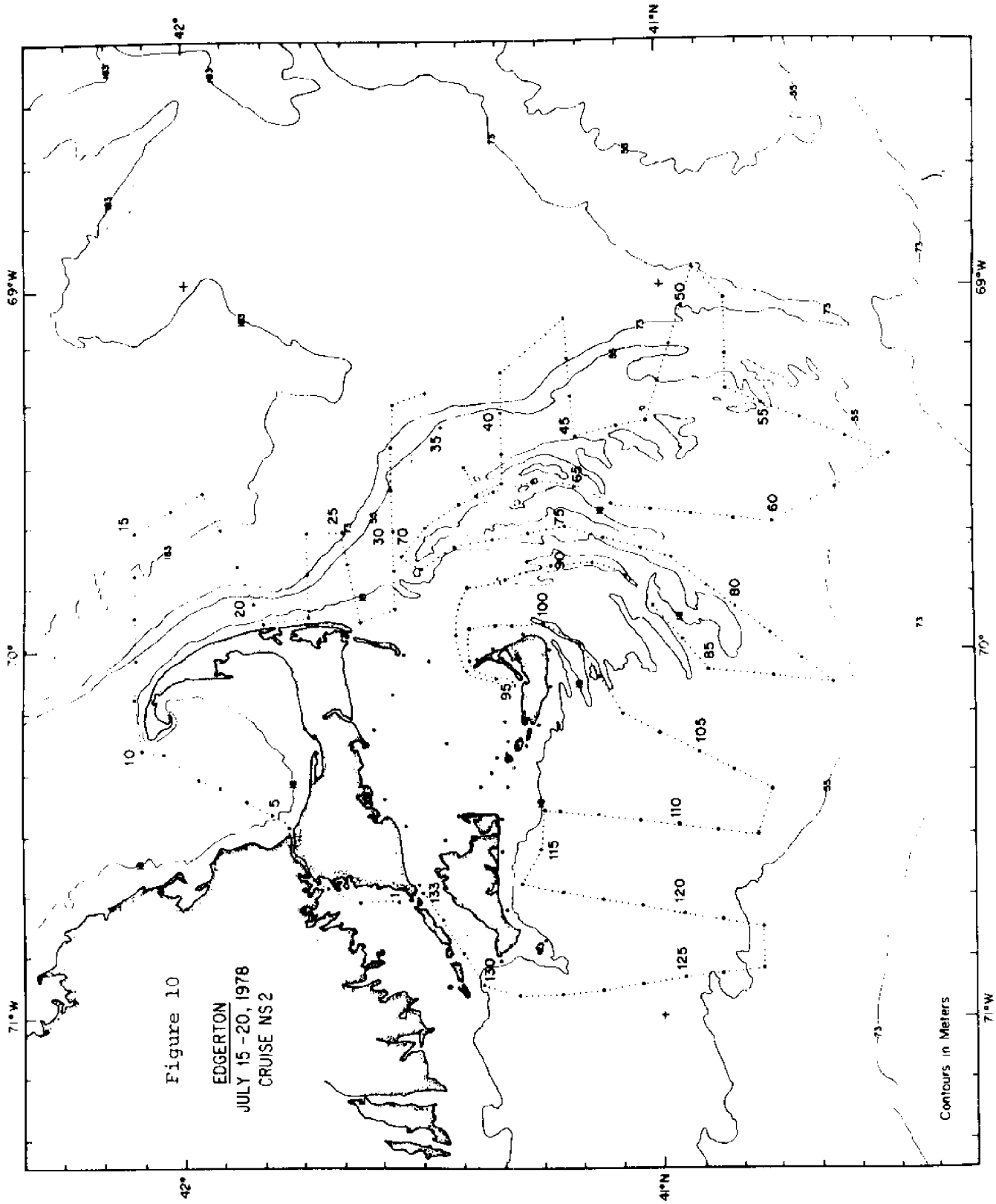

42°
41°N
69°W
70°
71°W
Contours in Meters
EDGERTON
JULY 15 - 20, 1978
CRUISE NS 2

Figure 10

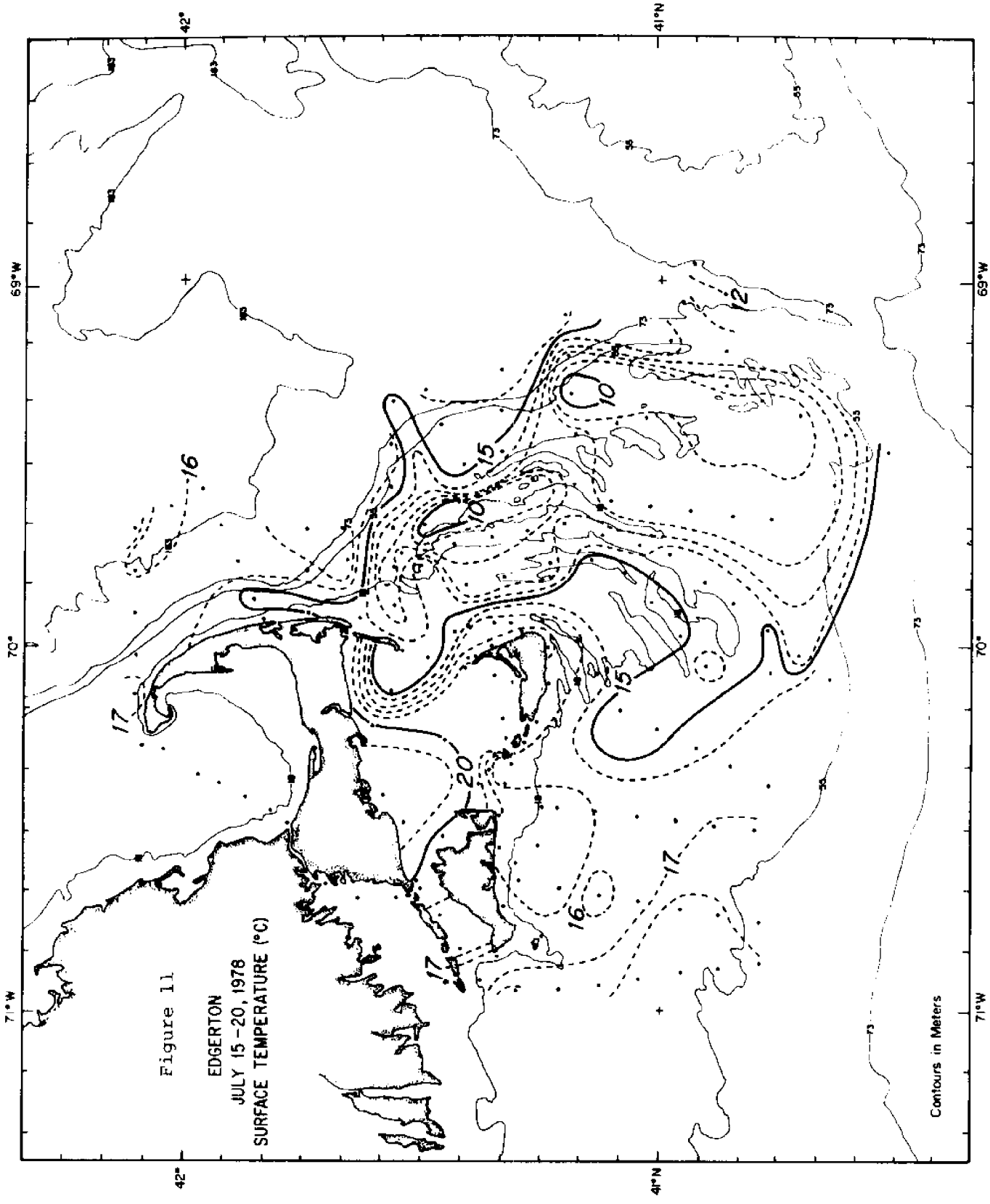

42°
41°N
69°W
70°
71°W
42°
41°N
69°W
70°
71°W
EDGERTON
JULY 15-20, 1978
SURFACE TEMPERATURE (°C)
Contours in Meters
10
12
15
16
17
20

Figure 11

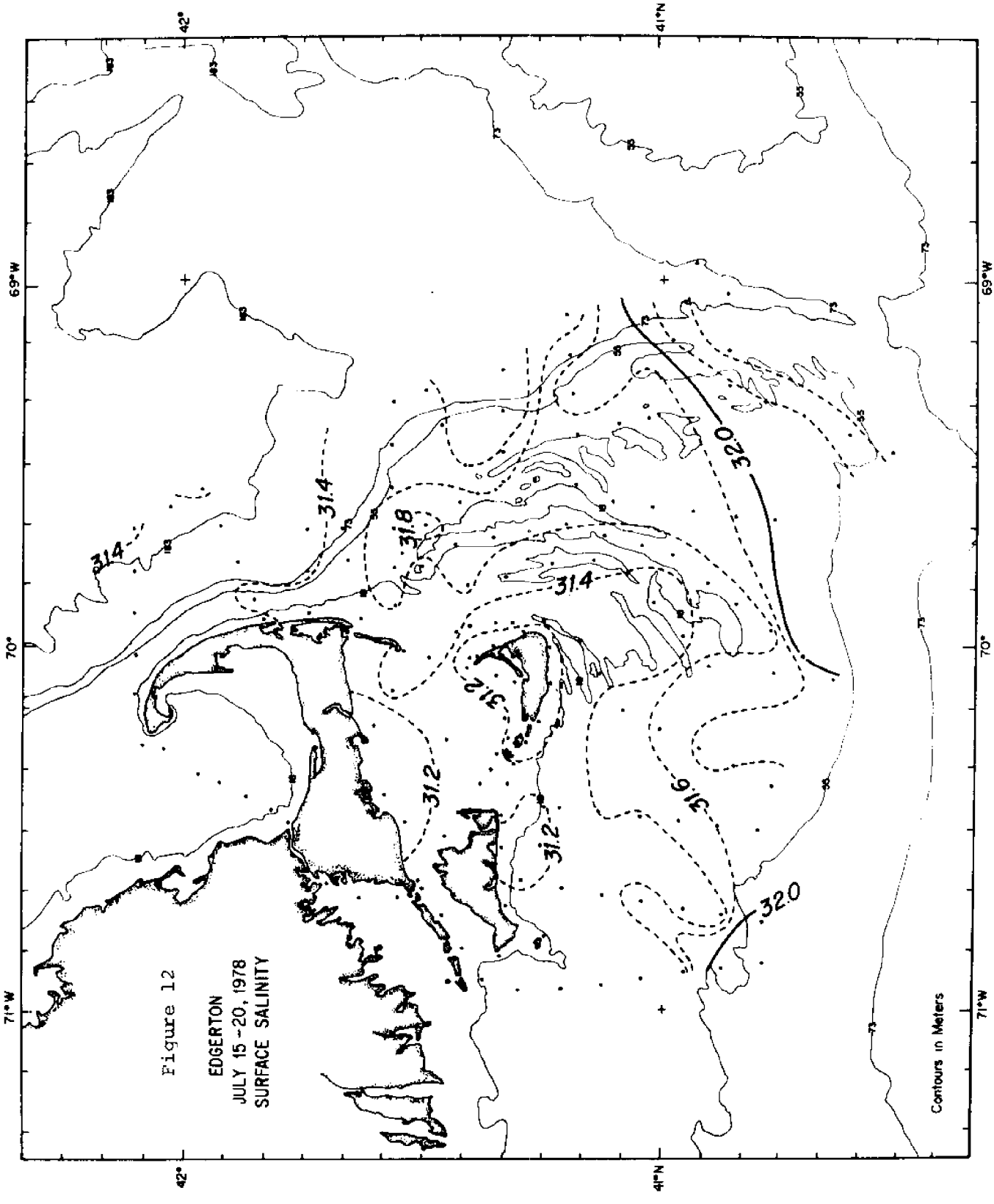


Figure 12

EDGERTON
JULY 15-20, 1978
SURFACE SALINITY

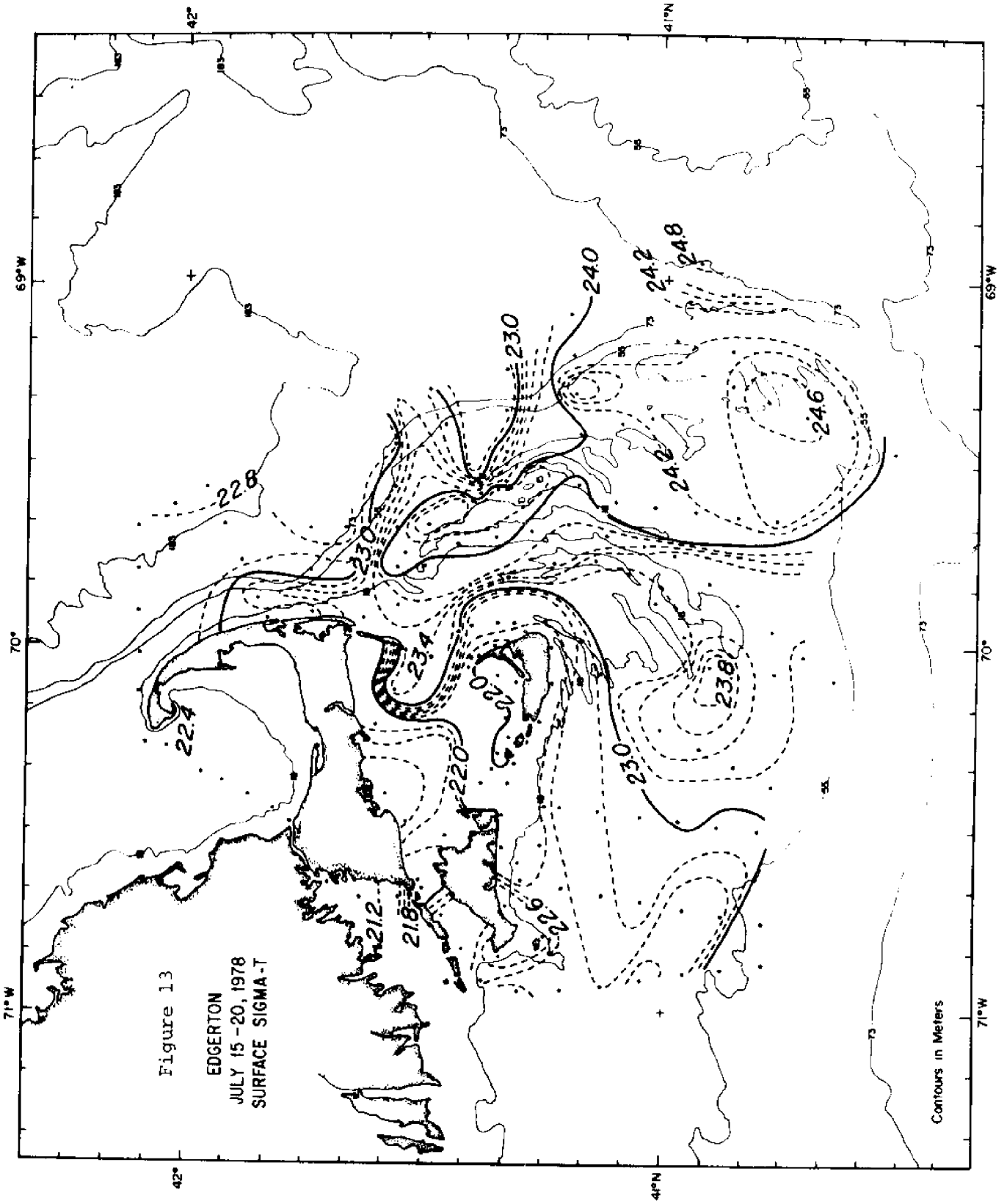
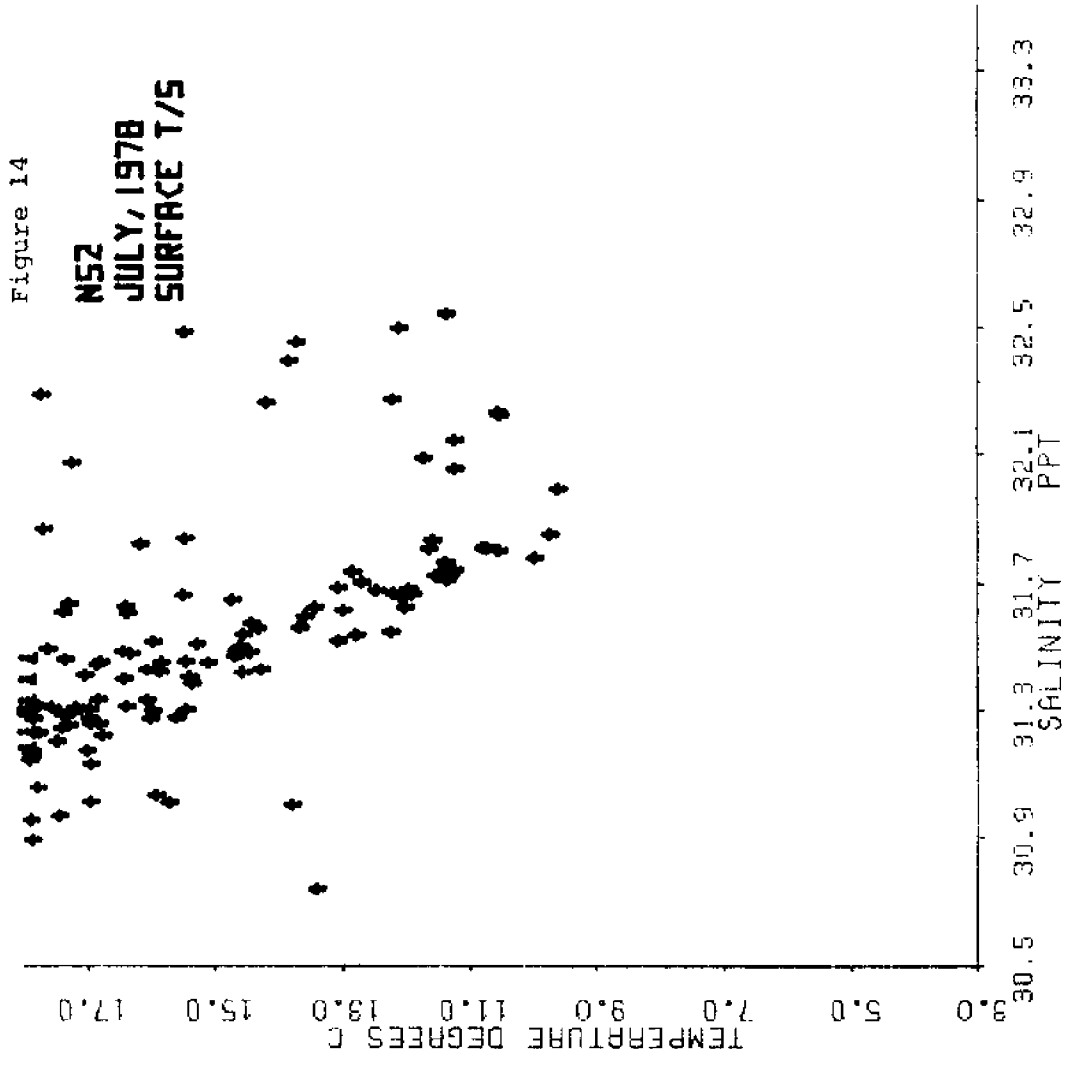


Figure 13

EDGERTON
JULY 15 -20, 1978
SURFACE SIGMA-T

Figure 14


N52
JULY/1978
SURFACE T/S
TEMPERATURE DEGREES C
5.0
7.0
9.0
11.0
13.0
15.0
17.0
30.5
30.9
31.3
31.7
32.1
32.5
32.9
33.3
SALINITY
PPT

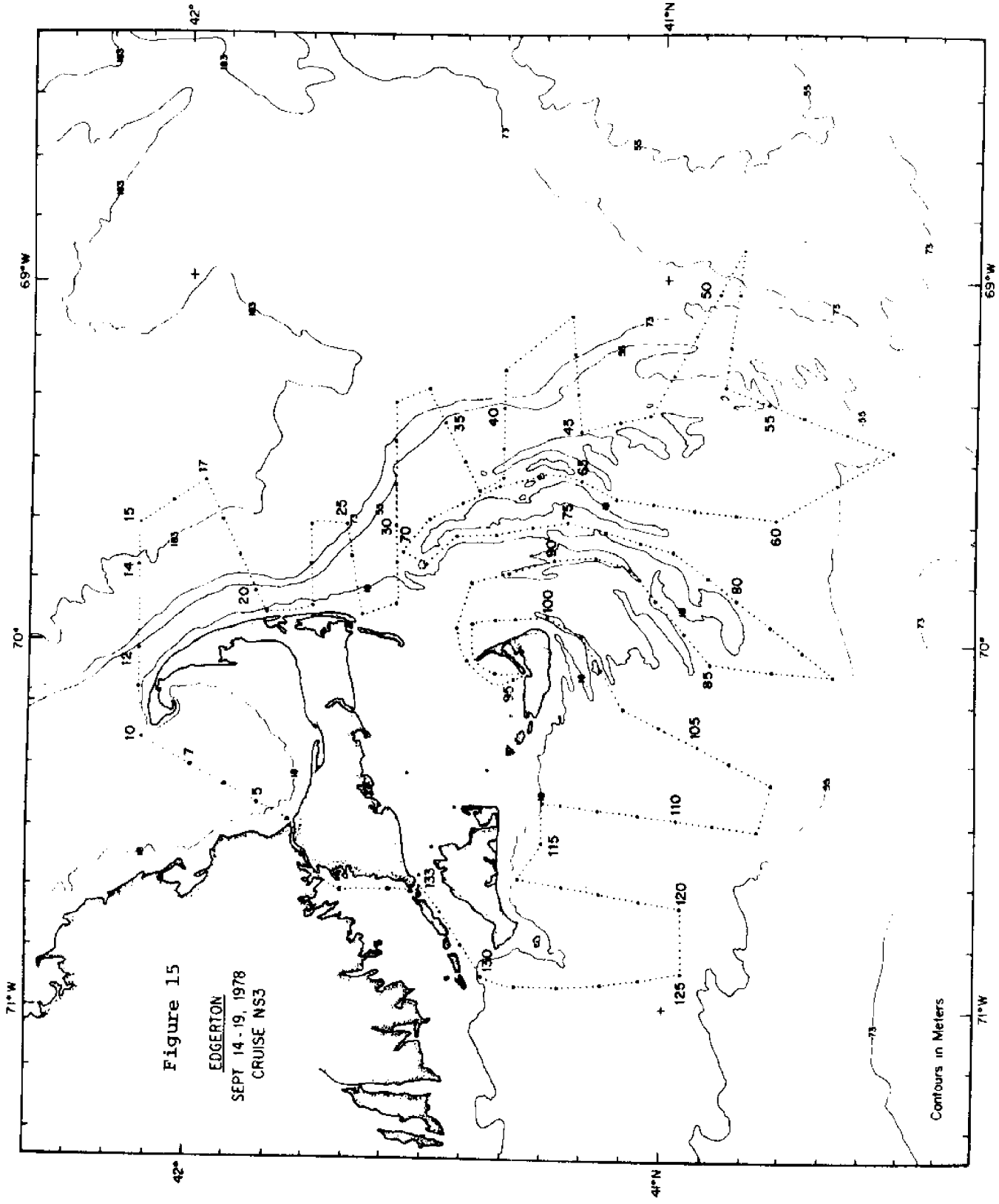

42°
41°N
69°W
70°
71°W
42°
41°N
Contours in Meters
EDGERTON
SEPT 14-19, 1978
CRUISE NS3

Figure 15

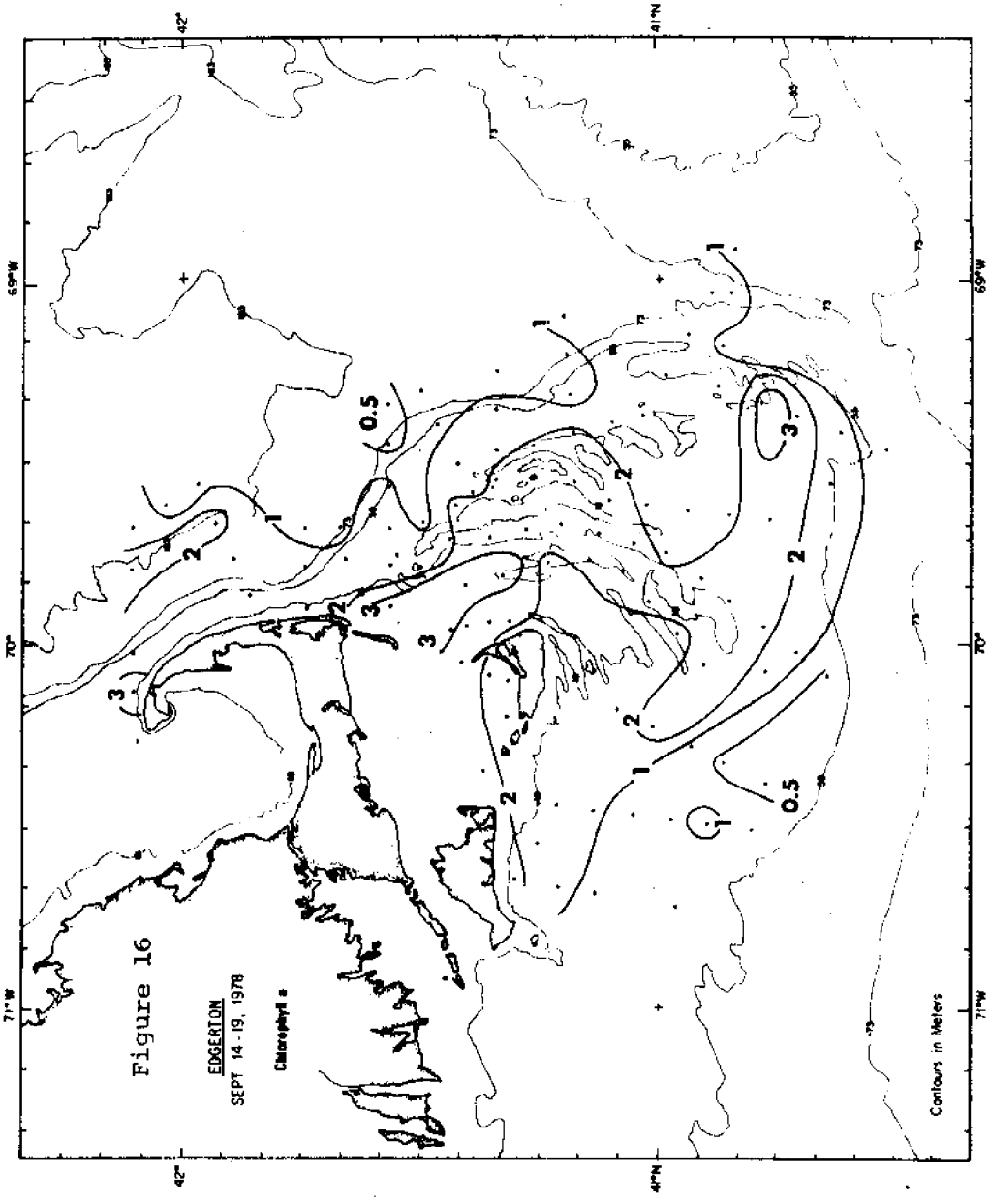


Figure 16
EDGERTON
SEPT 14-19, 1978
Chlorophyll a
Contours in Meters
42°
41°N
69°W
70°
70°W
71°W
42°
41°N
71°W

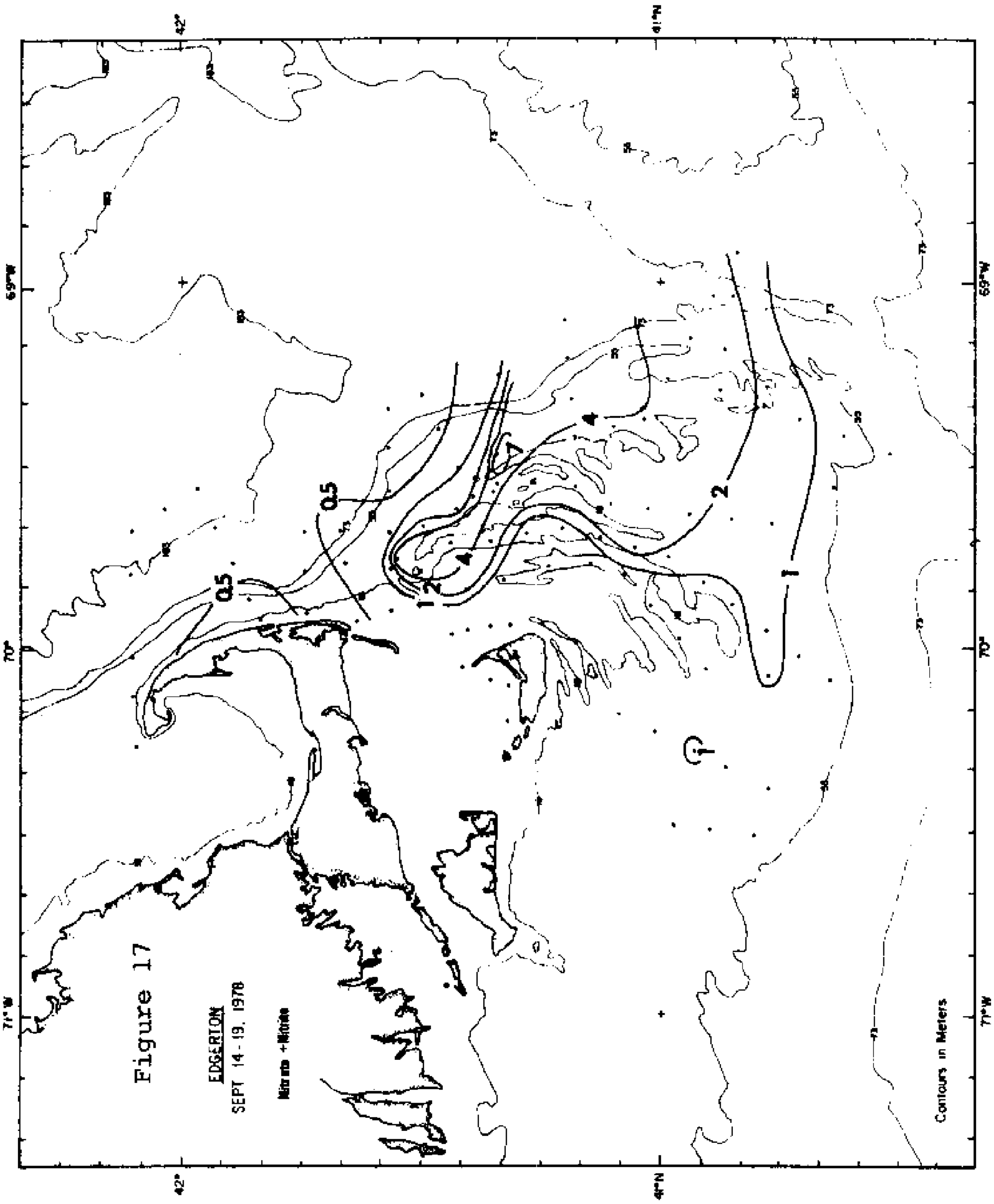

EDGERTON
SEPT 14-19, 1978
Nitrate + Nitrite
Contours in Meters
42°
41°N
69°W
70°
71°W
0.5
1
2
4

Figure 17

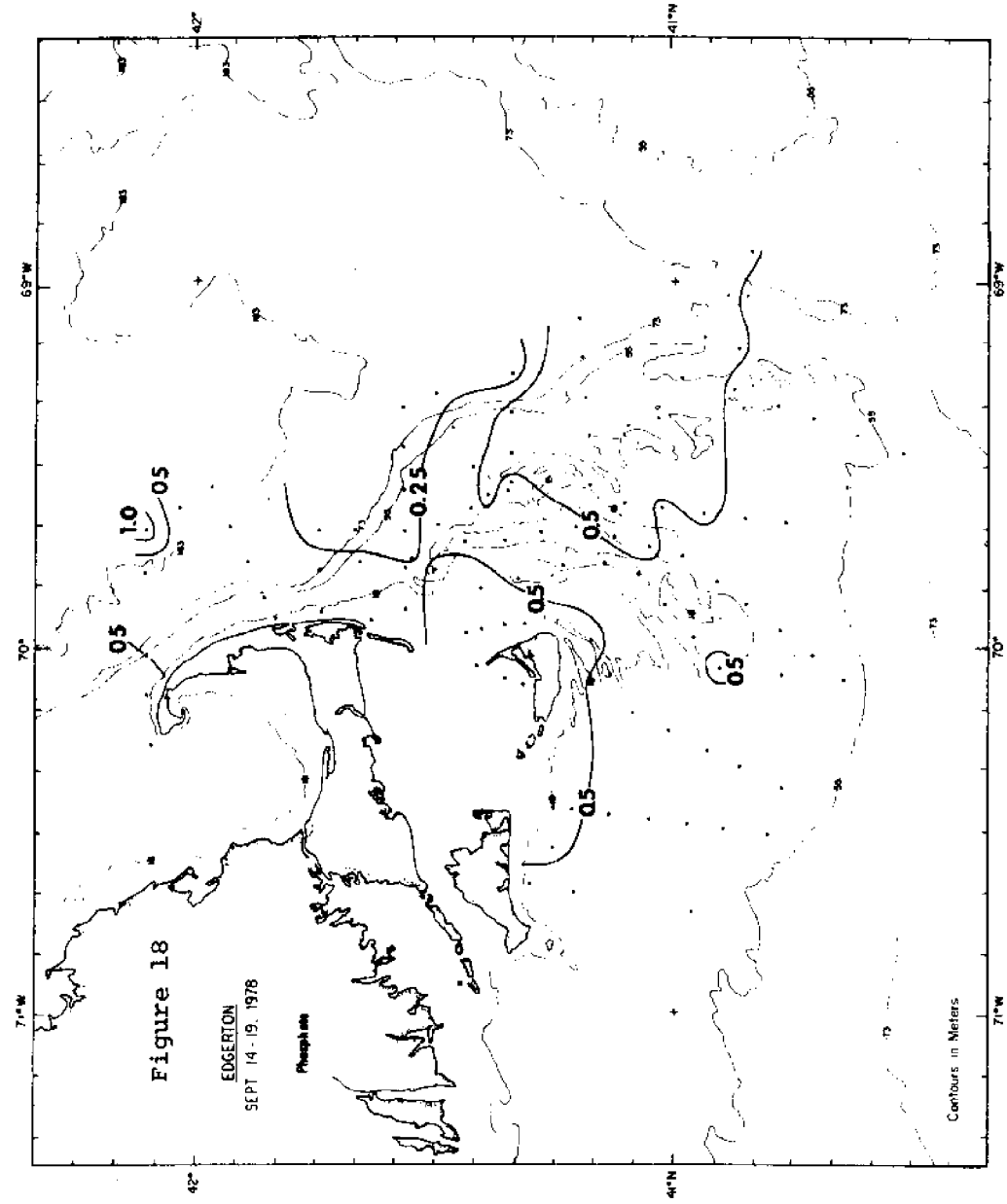
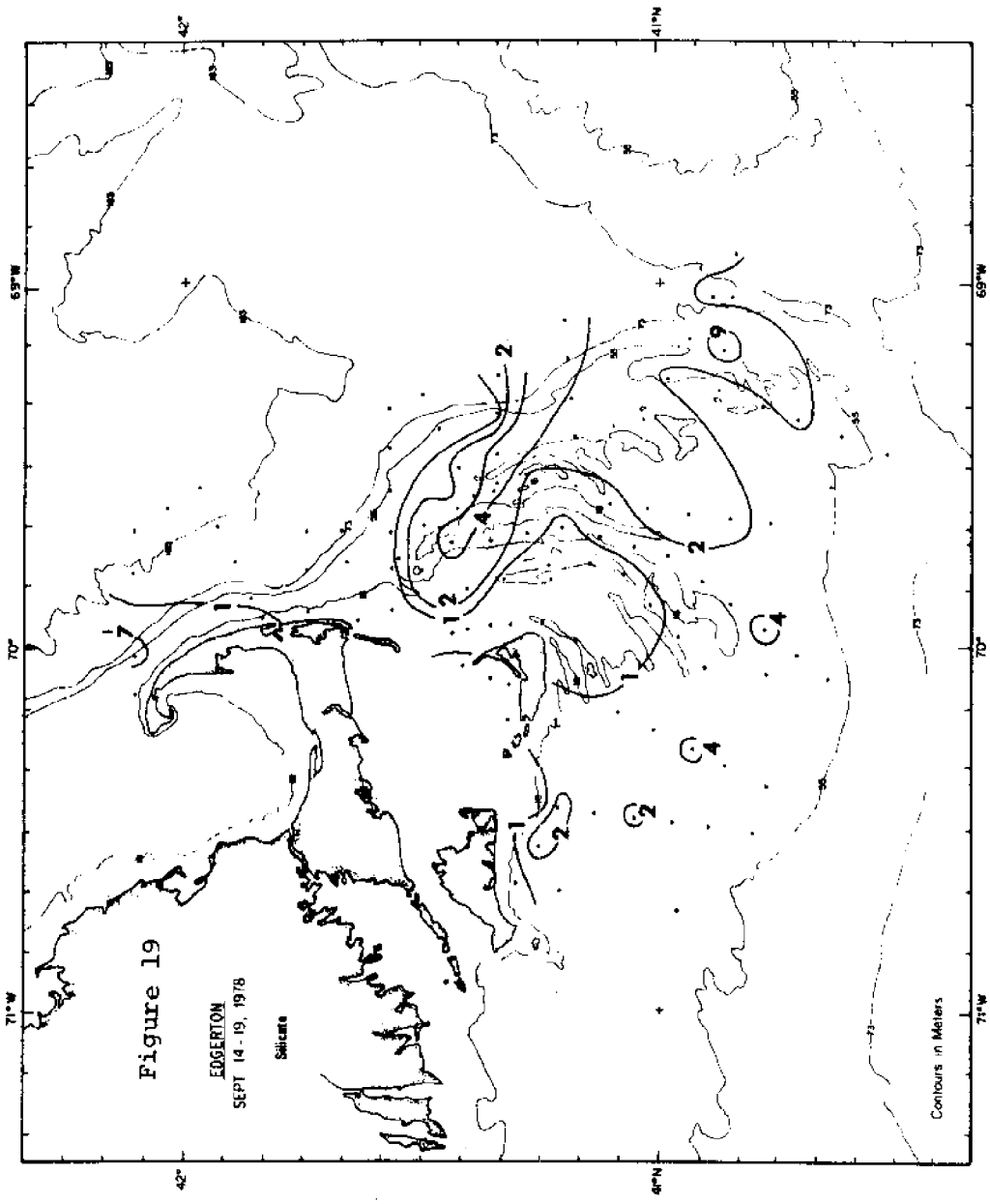


Figure 18
EDGERTON
SEPT 14-19, 1978
Phosphate
Contours in Meters
1.0
0.5
0.25
0.5
0.5
0.5
0.5
0.5
42°
41°N
69°W
70°
71°W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EDGERTON
SEPT 14 - 19, 1978
Silicate
Contours in Meters
42°
41°N
71°W
70°
69°W

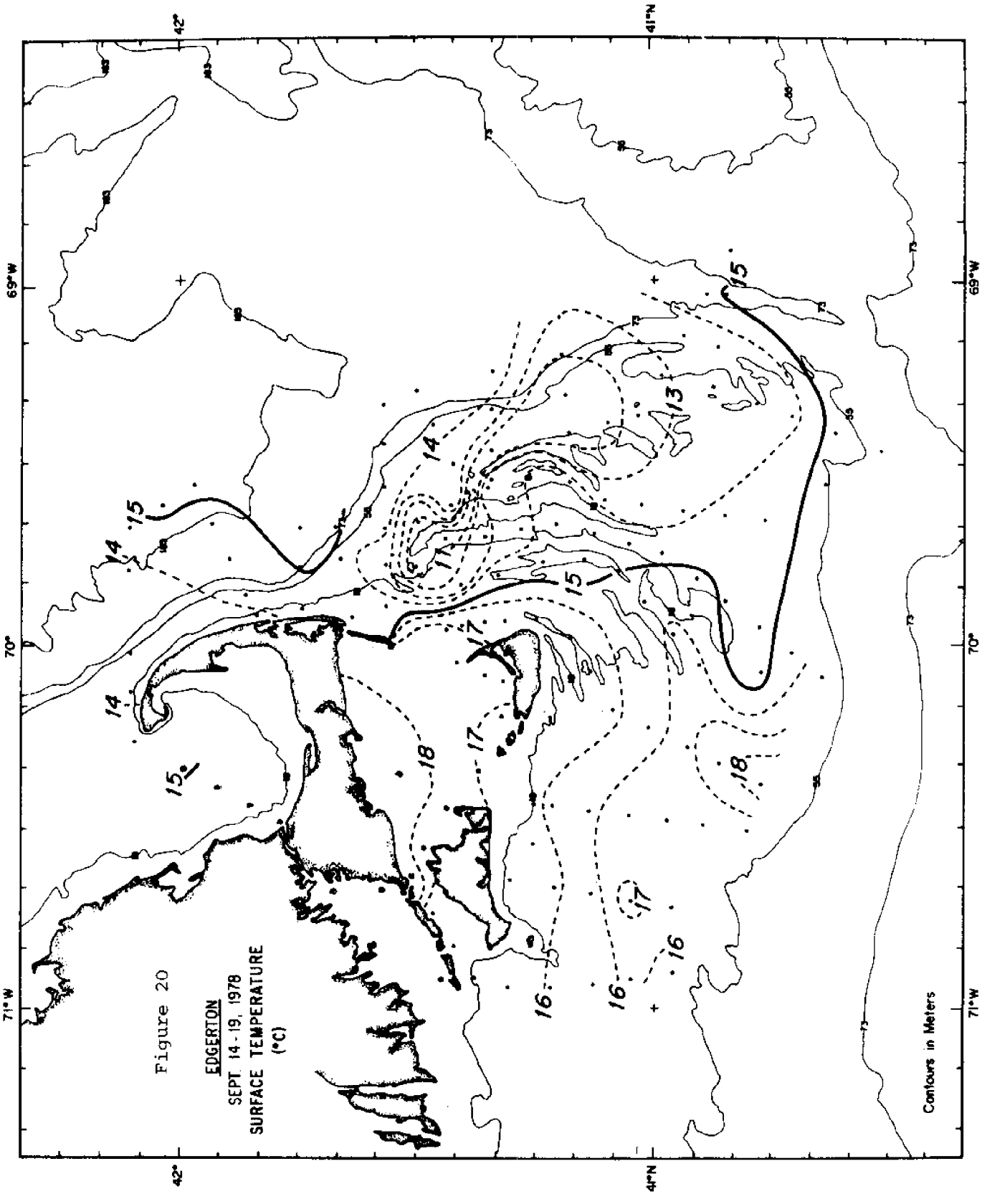

71°W
70°
69°W
42°
41°N
EDGERTON
SEPT 14-19, 1978
SURFACE TEMPERATURE
(°C)
Contours in Meters

Figure 20

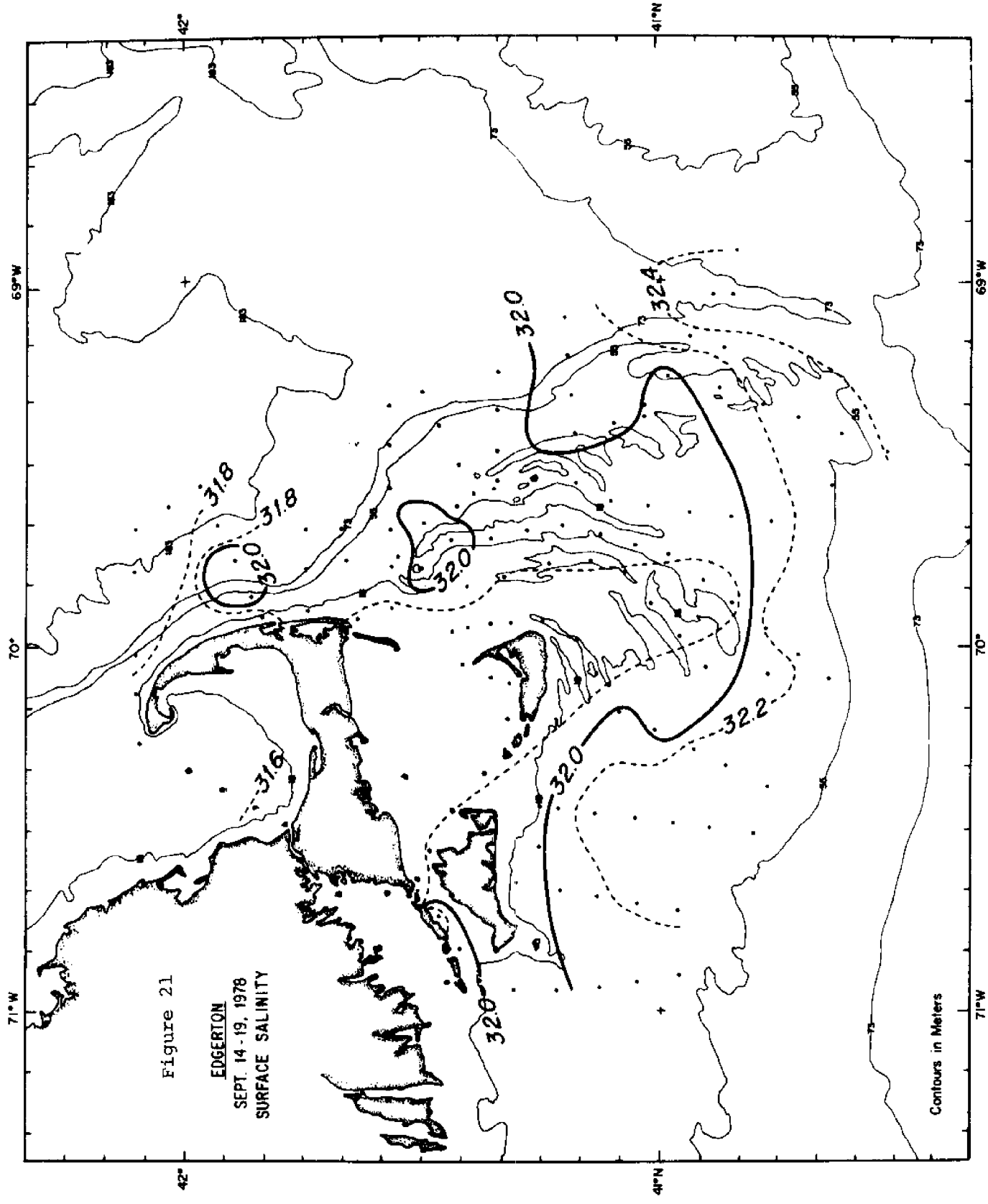


Figure 21

EDGERTON
SEPT. 14-19, 1978
SURFACE SALINITY

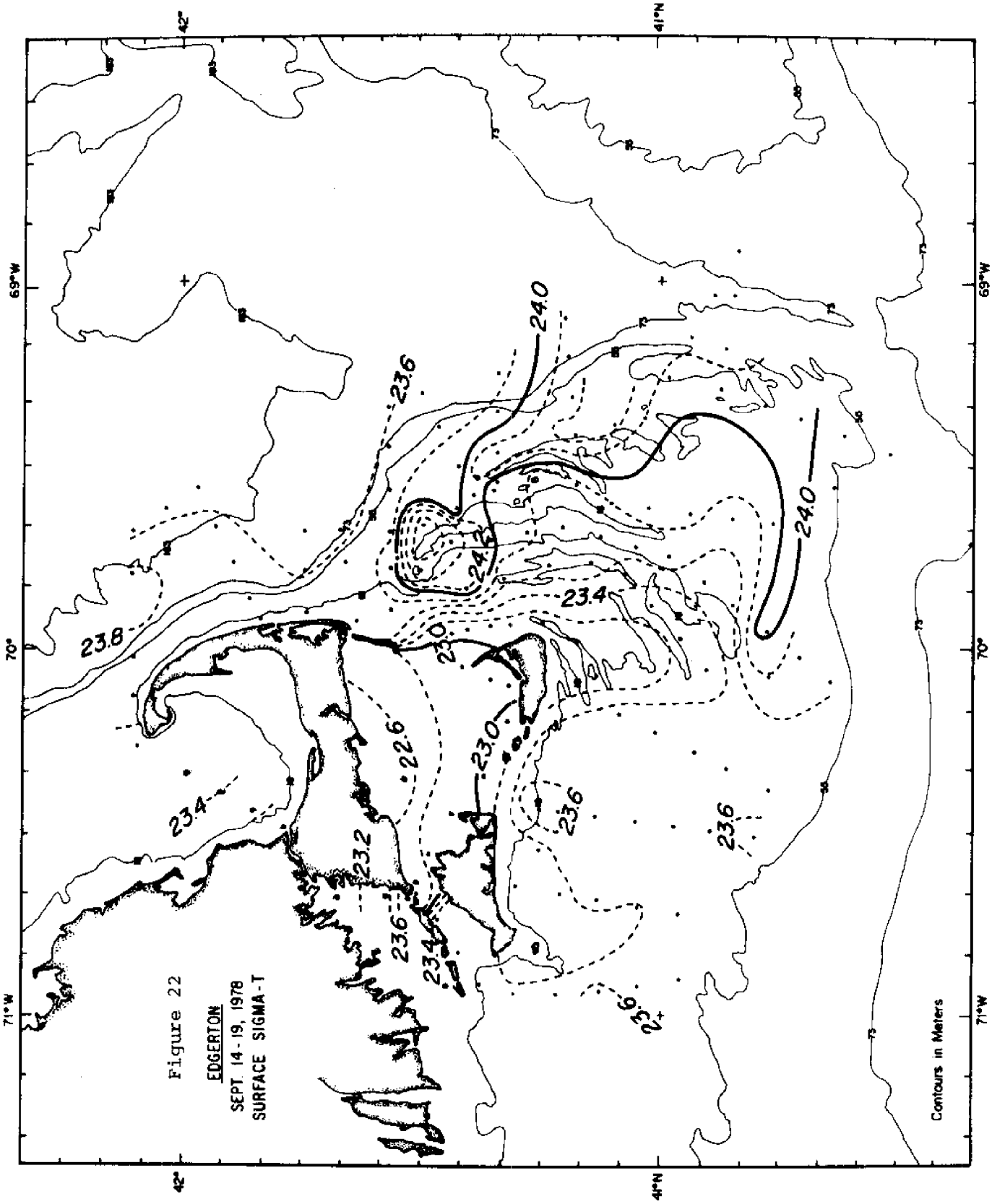
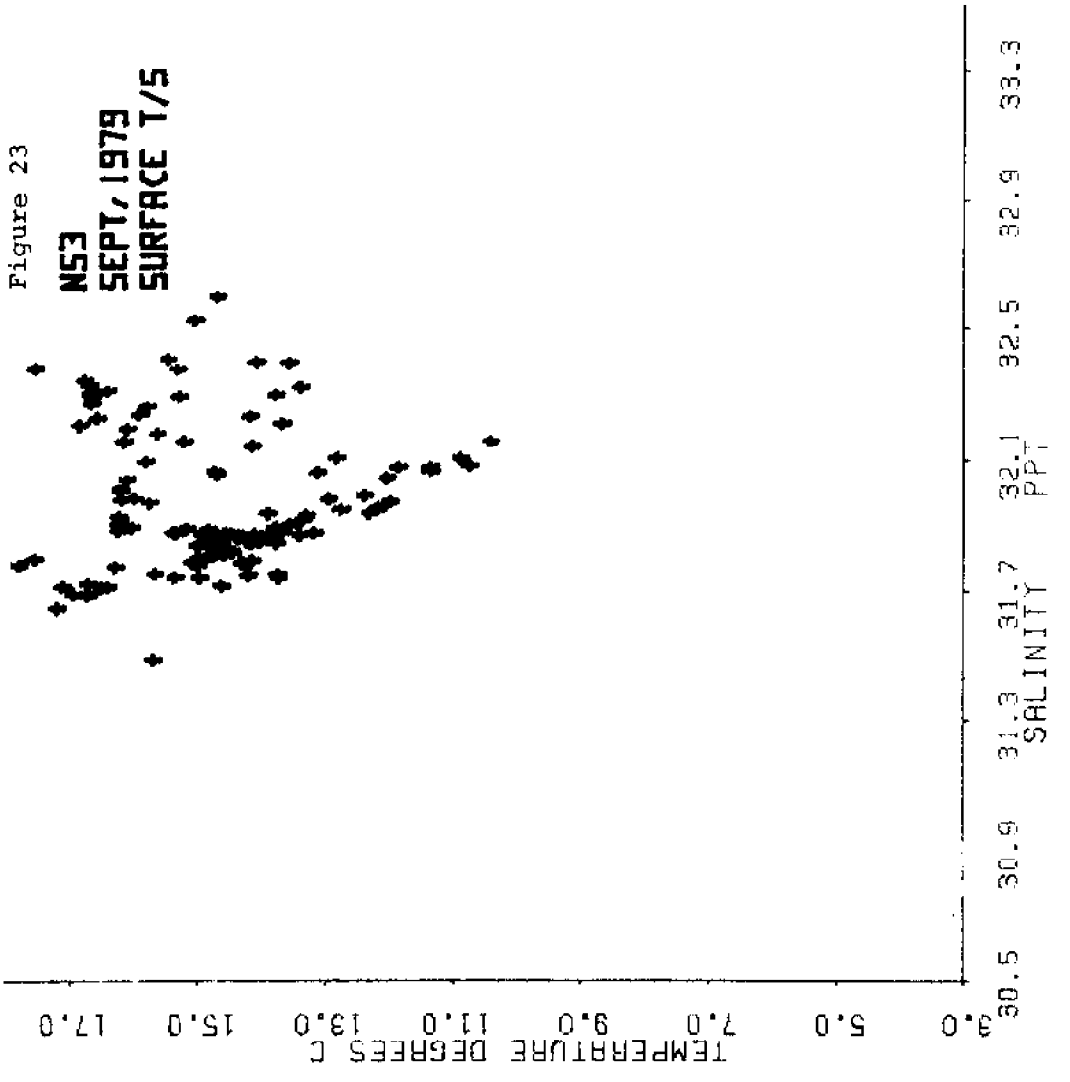


Figure 22

EDGERTON
SEPT 14-19, 1978
SURFACE SIGMA-T

Figure 23


NS3
SEPT, 1979
SURFACE T/S
TEMPERATURE DEGREES C
3.0
5.0
7.0
9.0
11.0
13.0
15.0
17.0
30.5
30.9
31.3
31.7
32.1
32.5
32.9
33.3
SALINITY PPT

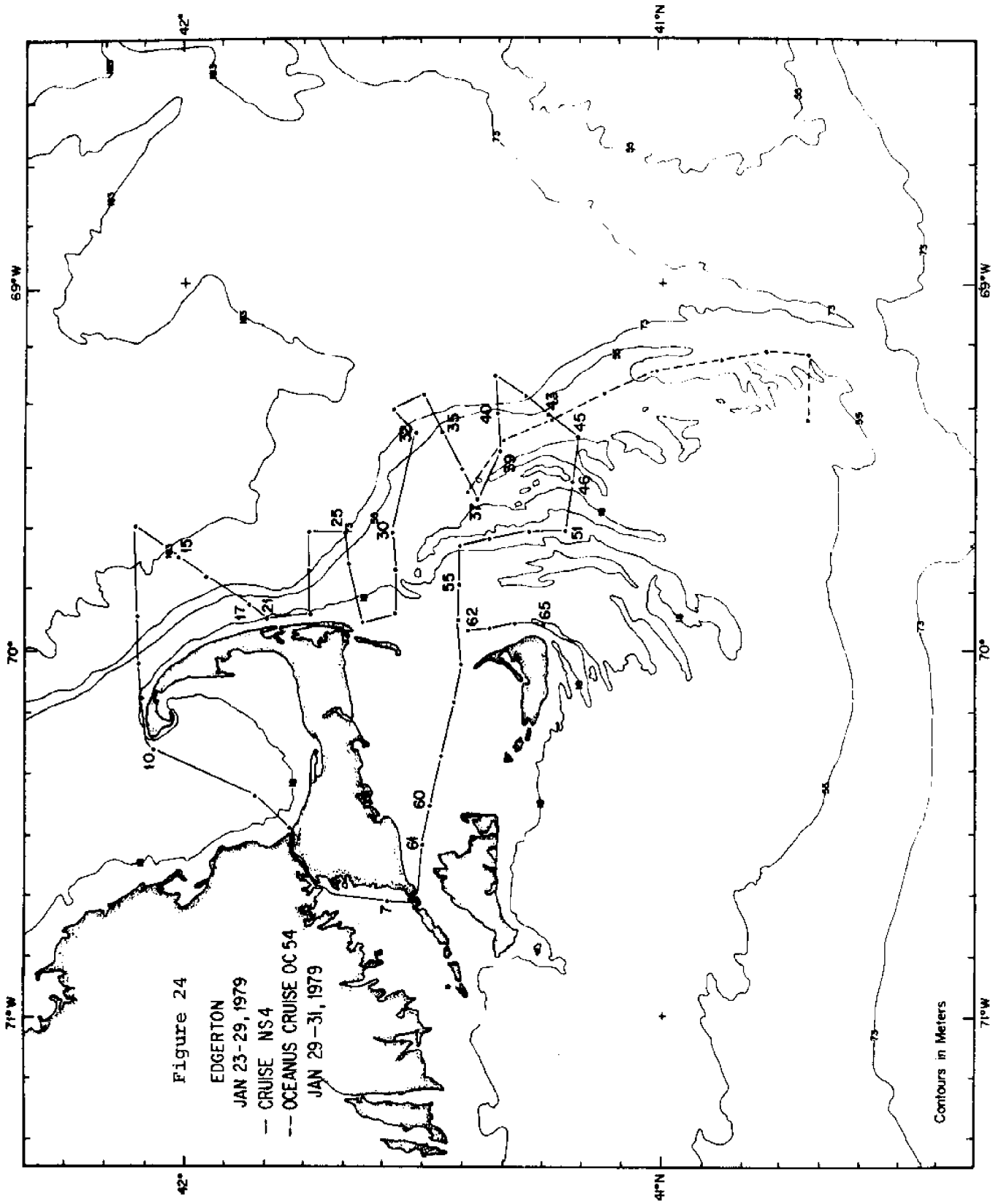


Figure 24
EDGERTON
JAN 23-29, 1979
— CRUISE NS4
-- OCEANUS CRUISE OC 54
JAN 29—31, 1979
Contours in Meters
42°
41°N
71°W
70°
69°W
10
15
17
21
25
30
35
39
40
43
45
46
51
55
60
61
62
65
7

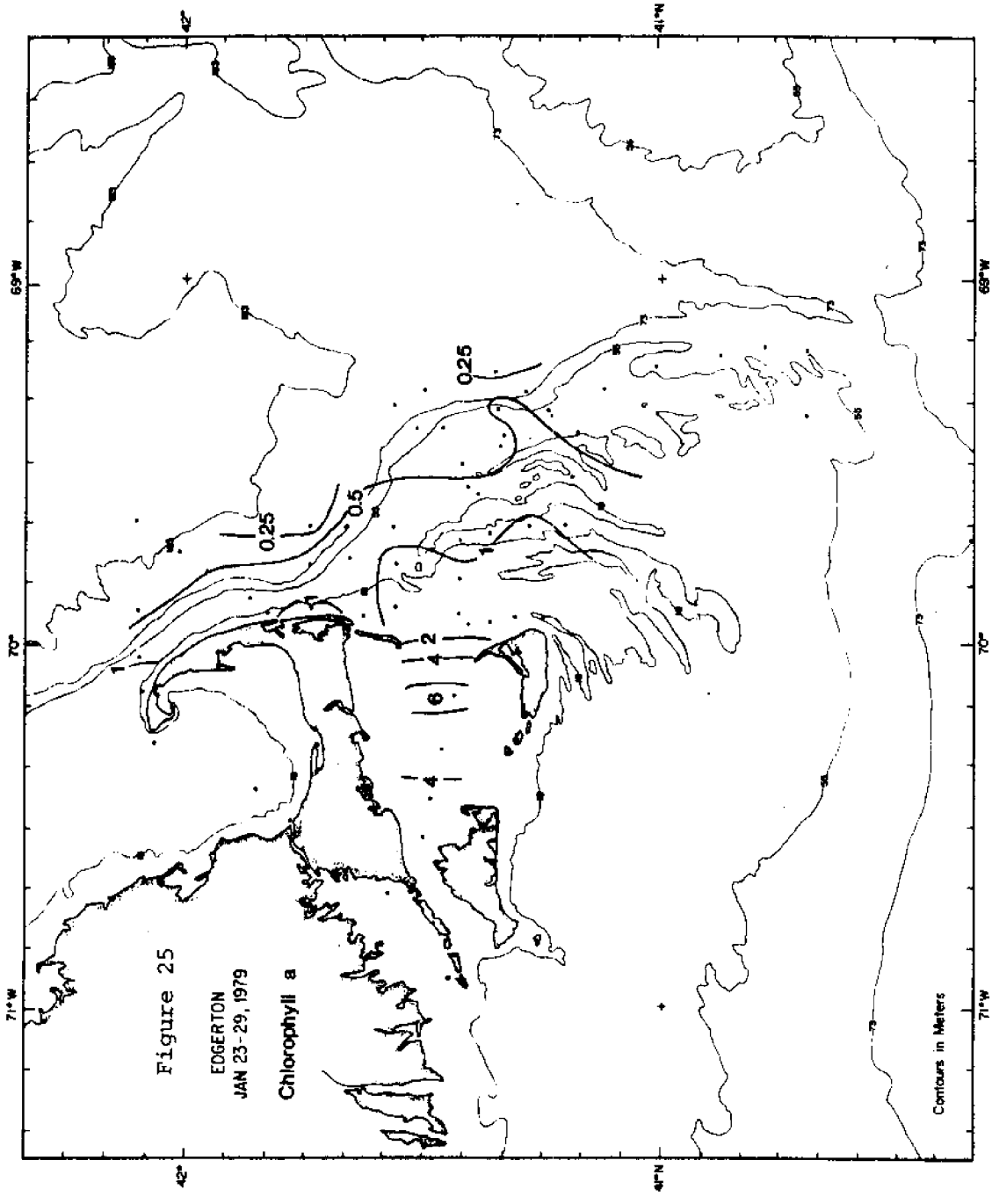


Figure 25
EDGERTON
JAN 23-29, 1979
Chlorophyll a
Contours in Meters
0.25
0.5
2
6
0.25
42°
41°N
69°W
70°
71°W

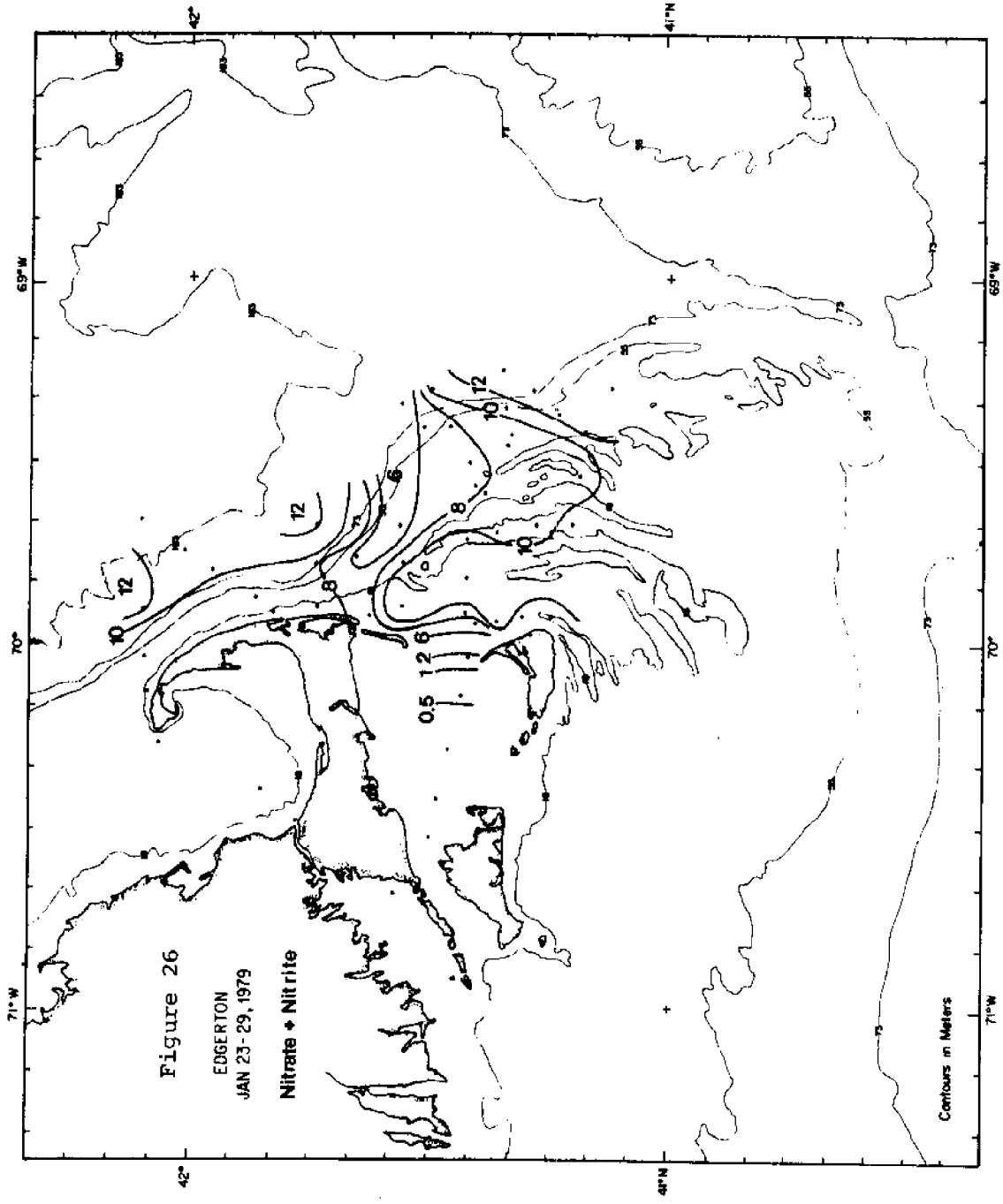


Figure 26
EDGERTON
JAN 23-29, 1979
Nitrate + Nitrite
Contours in Meters
42°
41°N
69°W
70°
71°W
0.5
1
2
6
8
10
12

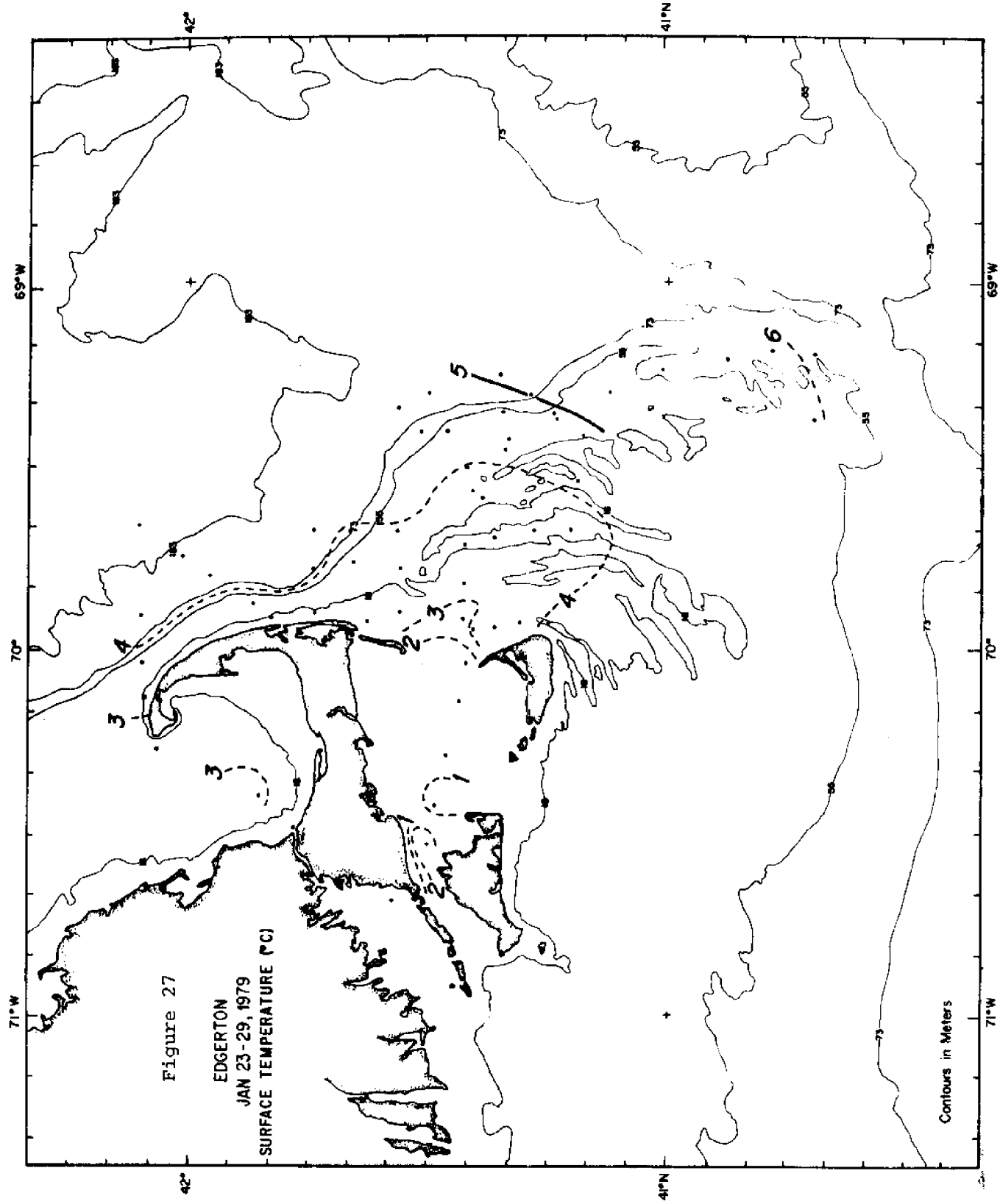

42°
41°N
69°W
70°
71°W
Contours in Meters
EDGERTON
JAN 23-29, 1979
SURFACE TEMPERATURE (°C)

Figure 27

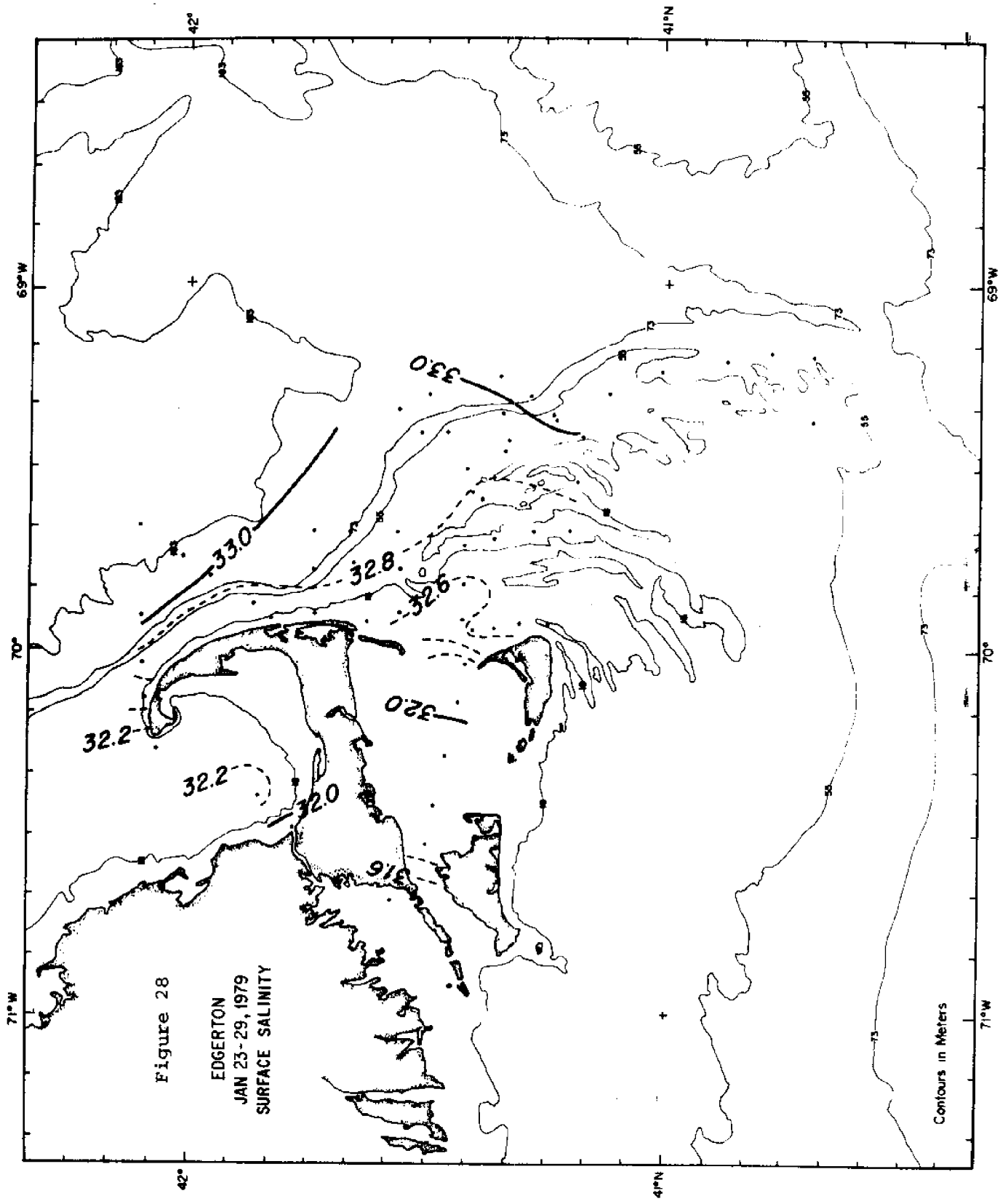


Figure 28

EDGERTON
JAN 23-29, 1979
SURFACE SALINITY

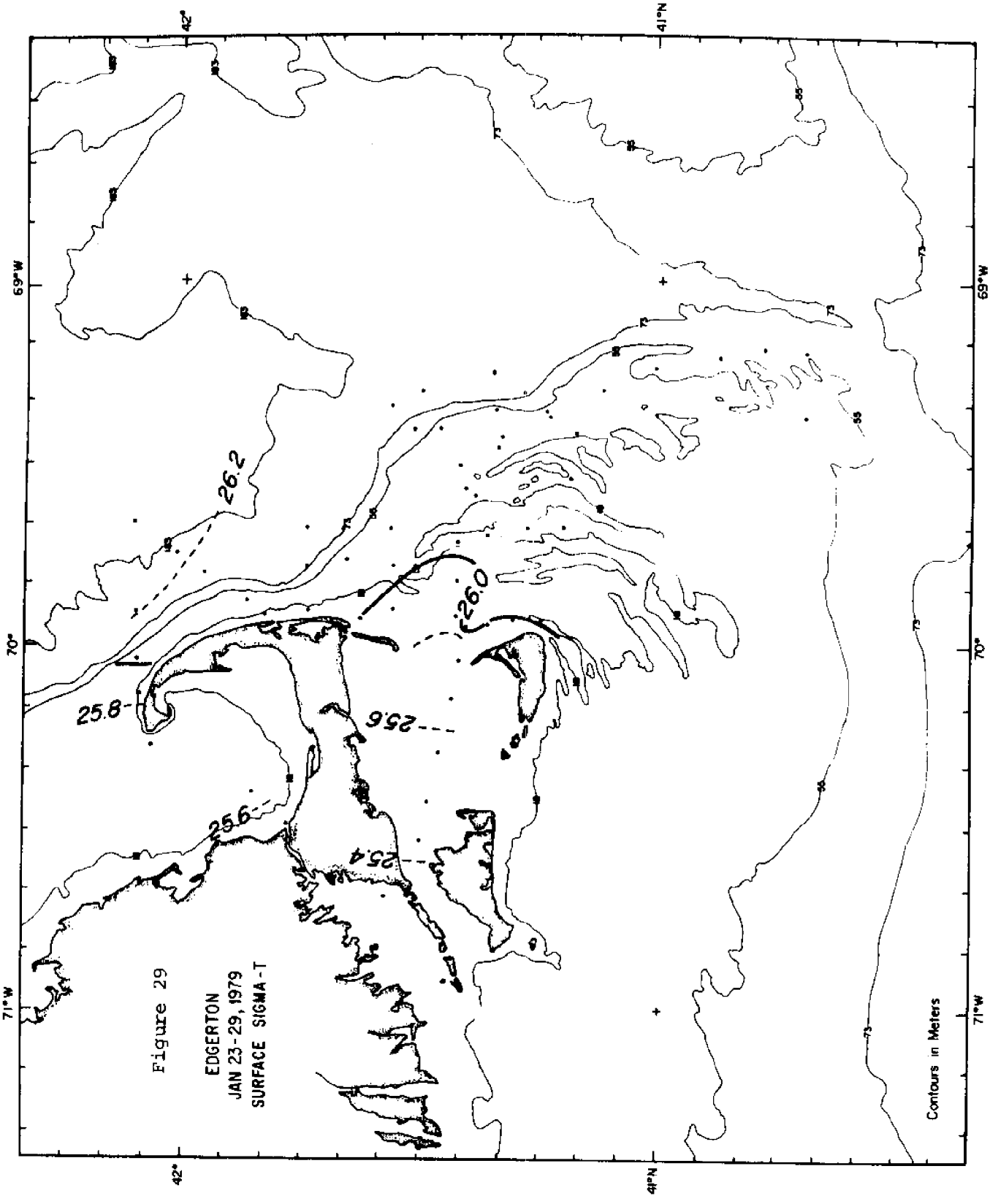


Figure 29

EDGERTON
JAN 23-29, 1979
SURFACE SIGMA-T

Figure 30

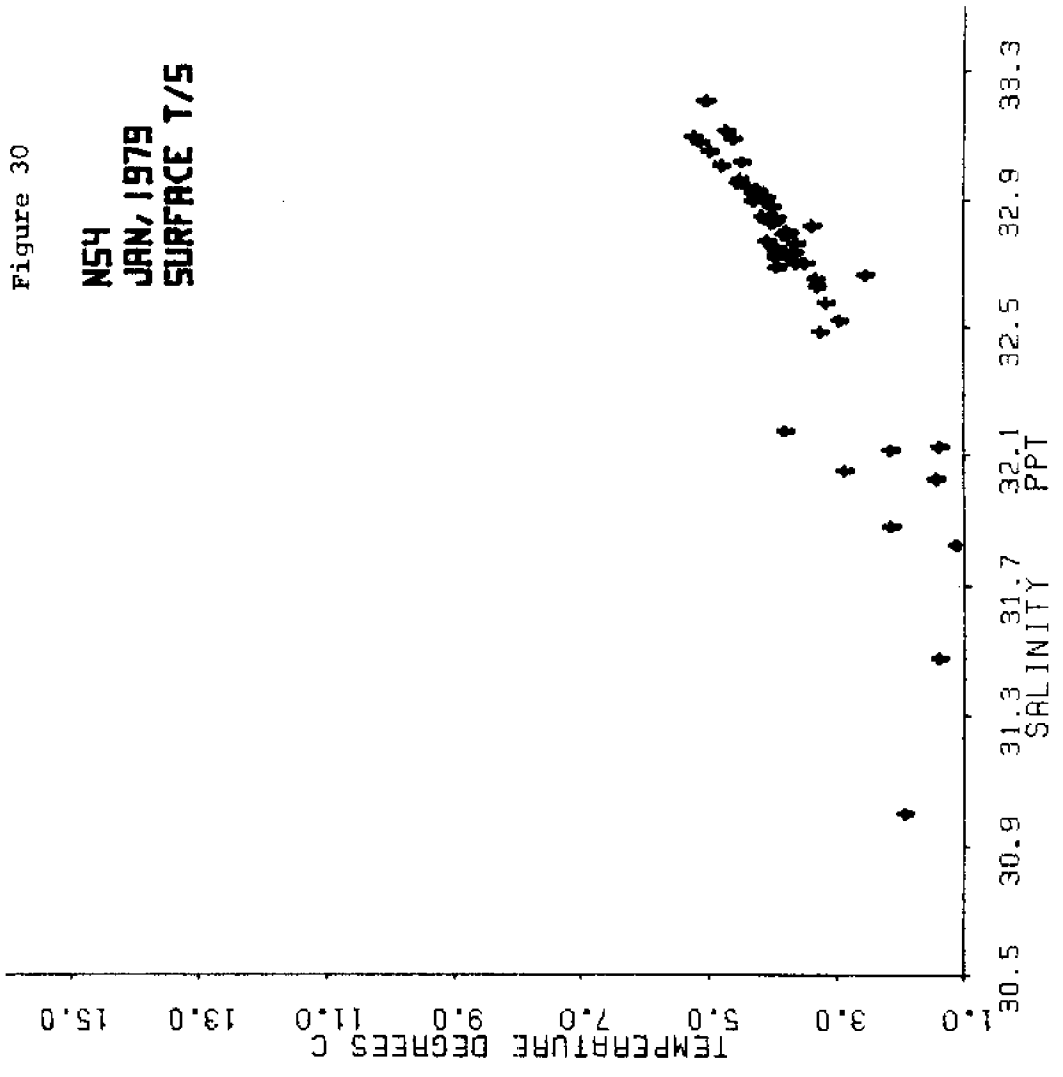
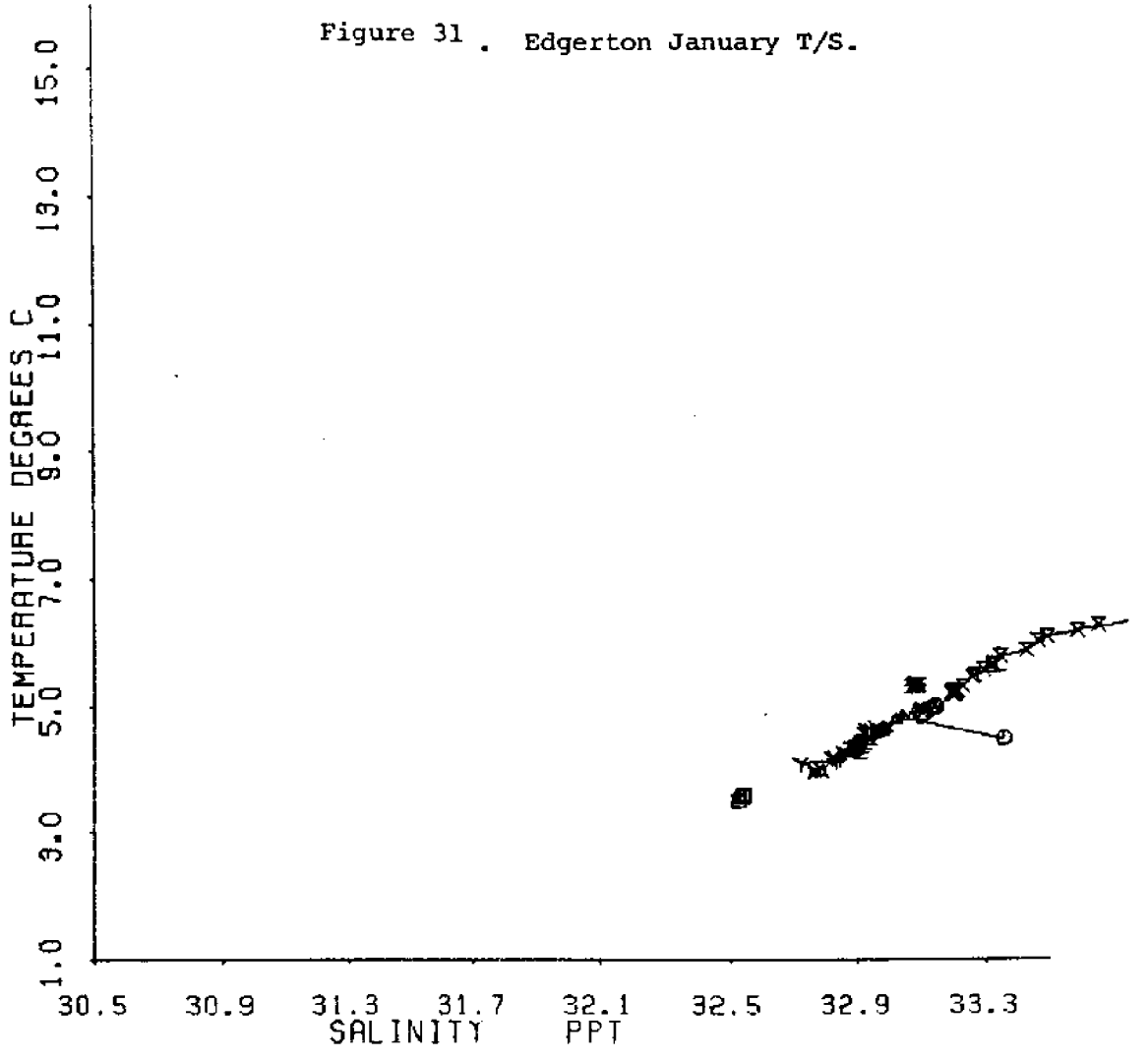
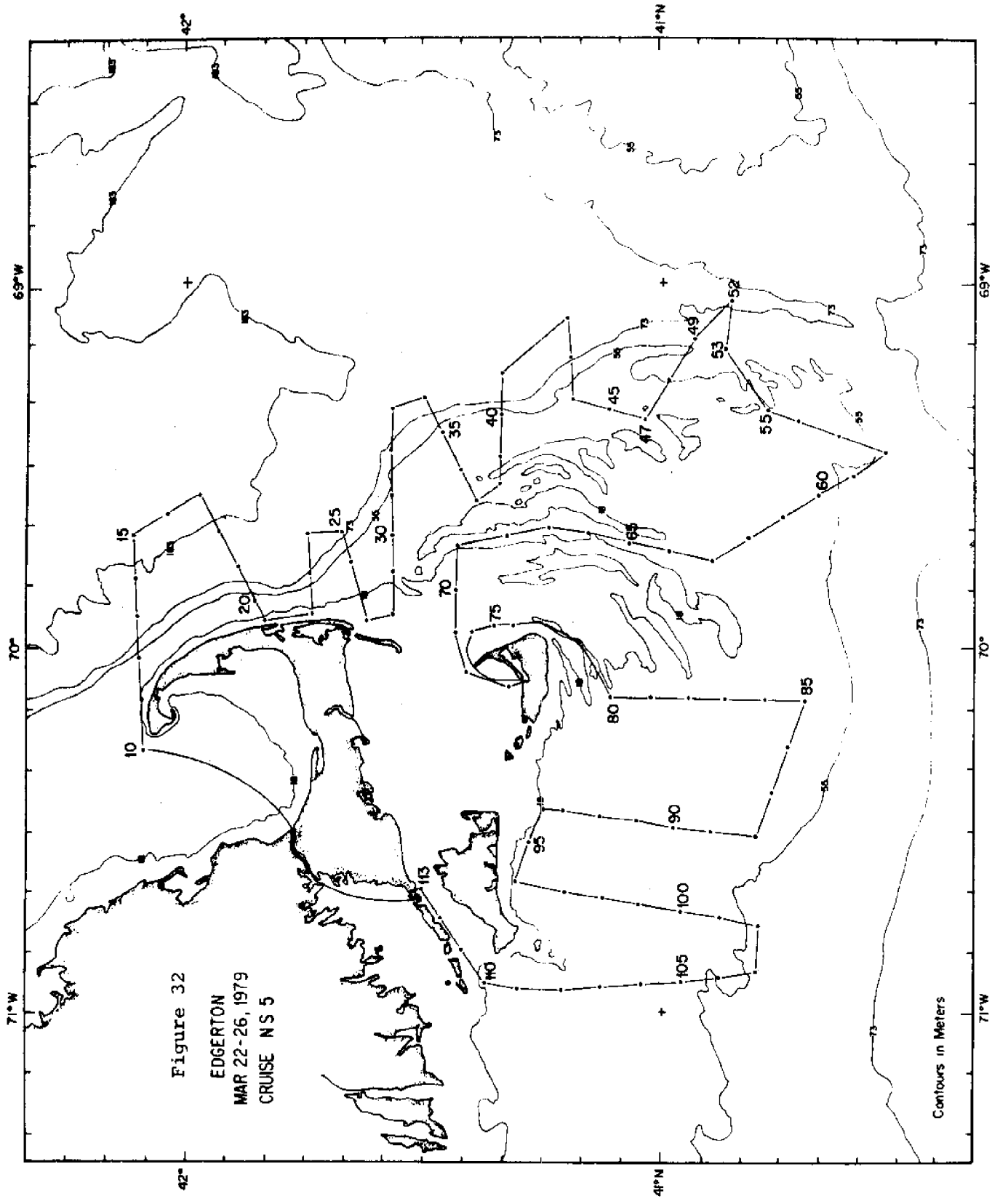

N54
JAN, 1979
SURFACE T/S
TEMPERATURE DEGREES C
1.0
3.0
5.0
7.0
9.0
11.0
13.0
15.0
30.5
30.9
31.3
31.7
32.1
32.5
32.9
33.3
SALINITY
PPT

Figure 31 . Edgerton January T/S.



NS4011T2.5	□	0.0	22.0
NS4013T2.5	○	2.0	84.0
NS4014T2.5	⧖	2.0	200.0
NS4023T2.5	Z	2.0	56.0
NS4024T2.5	△	4.0	112.0
NS4025T2.5	Y	2.0	56.0
NS4026T2.5	+	2.0	30.0
NS4029T2.5	⋈	4.0	16.0
NS4033T2.5	X	2.0	70.0
NS4041T2.5	✳	4.0	94.0


42°
41°N
69°W
70°
71°W
Contours in Meters
Figure 32
EDGERTON
MAR 22-26, 1979
CRUISE NS 5

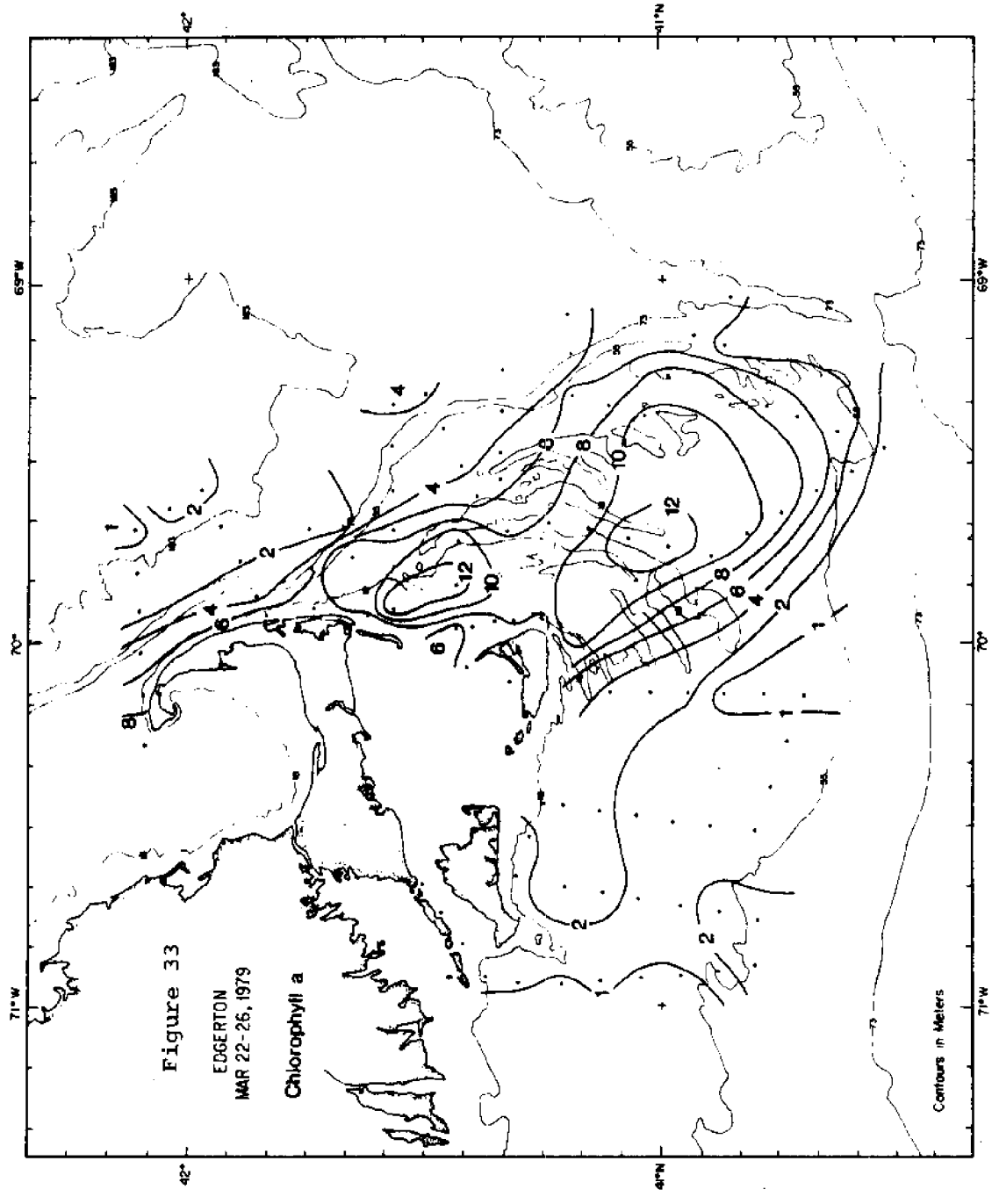


Figure 33
EDGERTON
MAR 22-26, 1979
Chlorophyll a
Contours in Meters
42°
41°N
71°W
70°
69°W

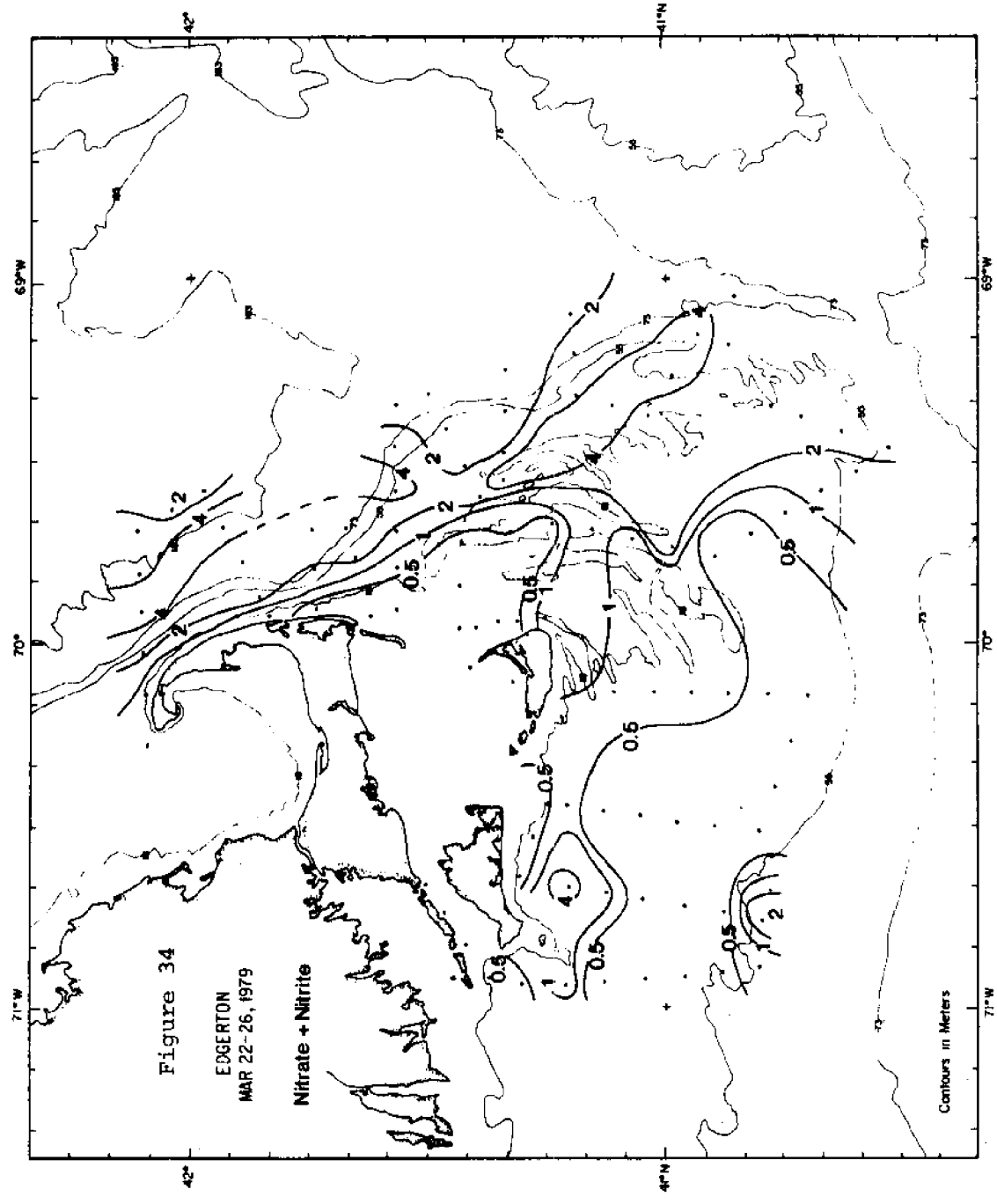


Figure 34
EDGERTON
MAR 22-26, 1979
Nitrate + Nitrite
Contours in Meters
42°
41°N
69°W
70°
71°W
0.5
1
2
4

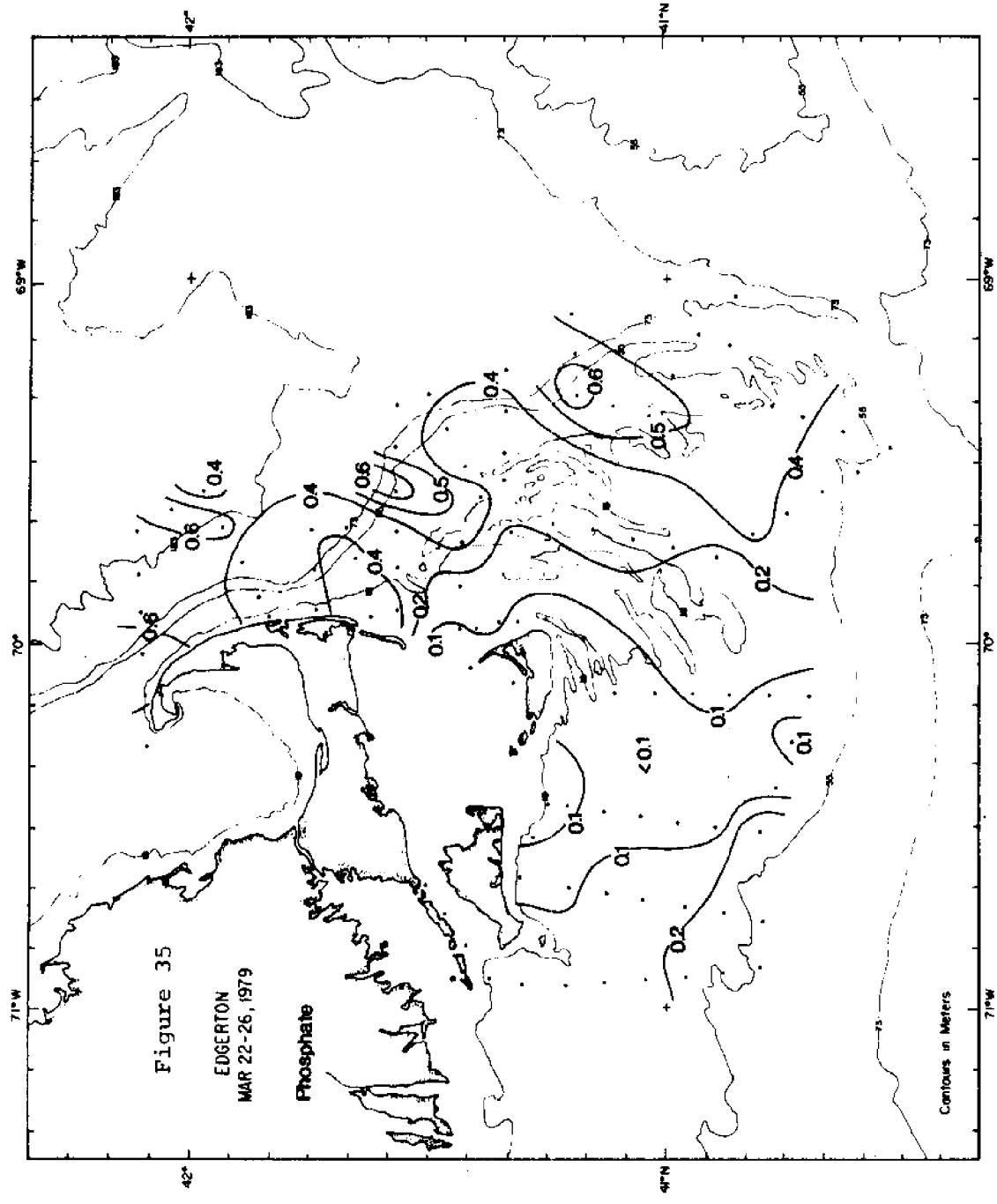


Figure 35
EDGERTON
MAR 22-26, 1979
Phosphate
Contours in Meters
42°
41°N
69°W
70°
71°W
0.1
0.2
0.4
0.5
0.6
<0.1

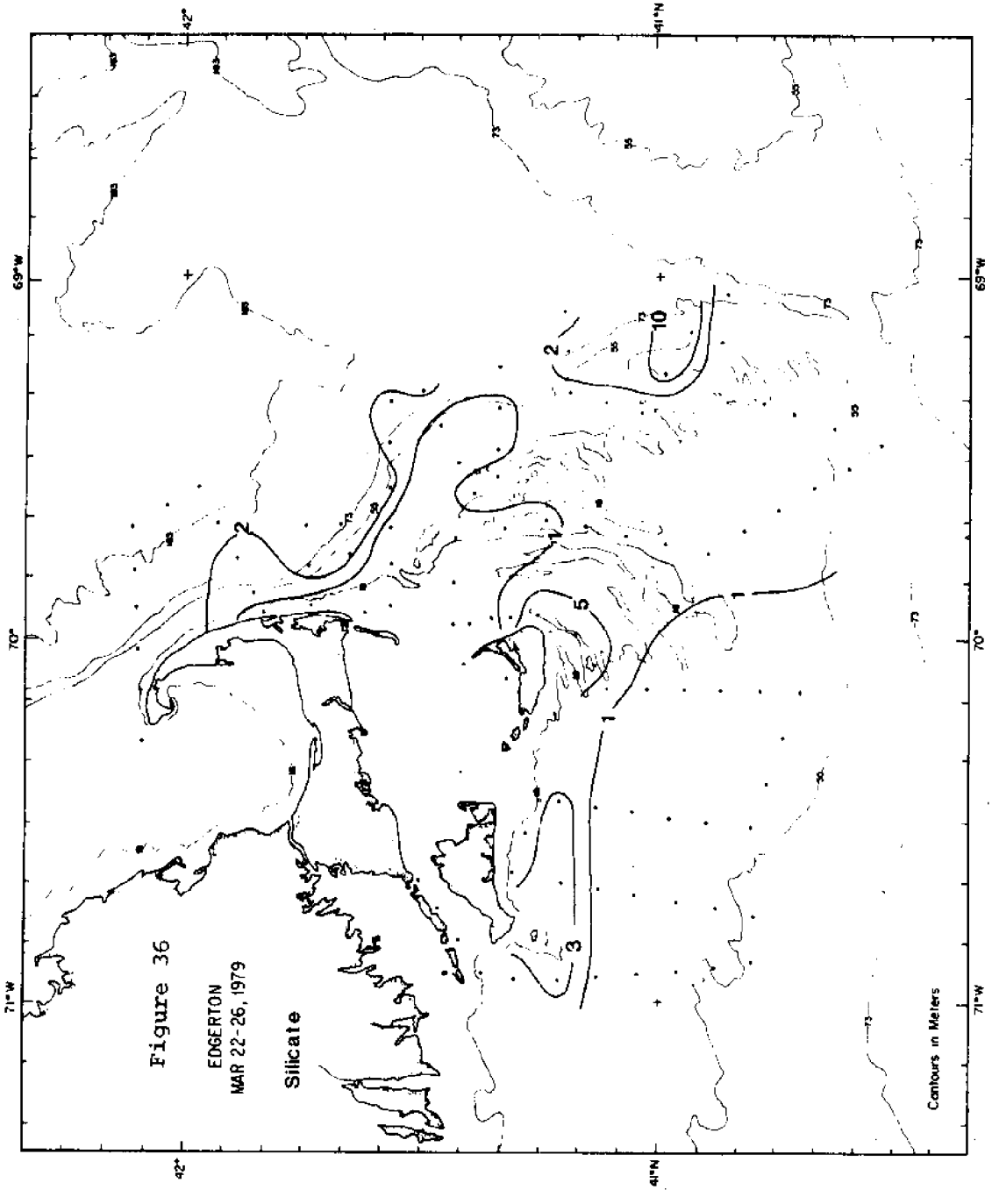


Figure 36
EDGERTON
MAR 22-26, 1979
Silicate
Contours in Meters
42°
41°N
71°W
70°
69°W

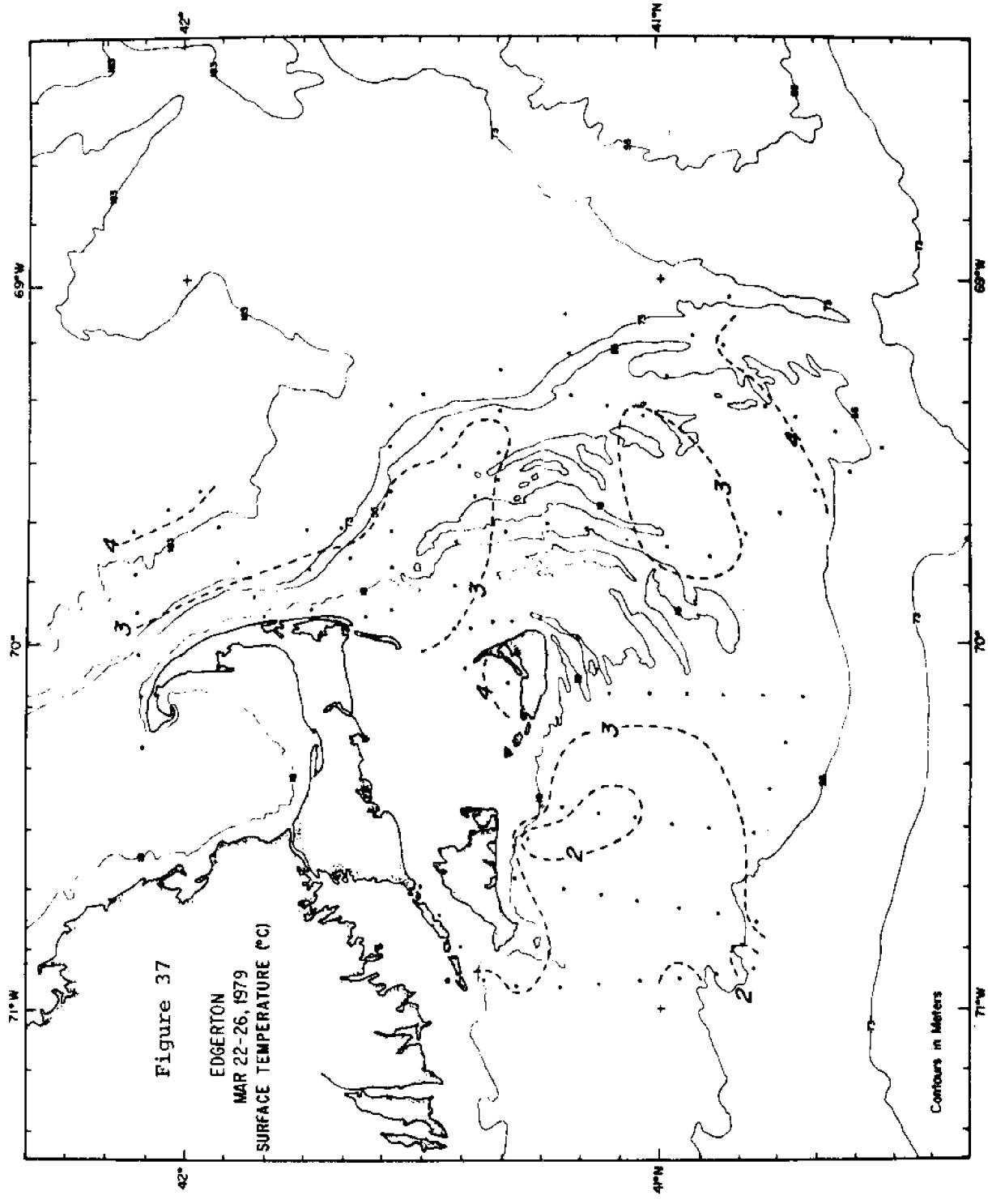

42°
41°N
69°W
70°
71°W
42°
41°N
Contours in Meters
EDGERTON
MAR 22-26, 1979
SURFACE TEMPERATURE (°C)

Figure 37

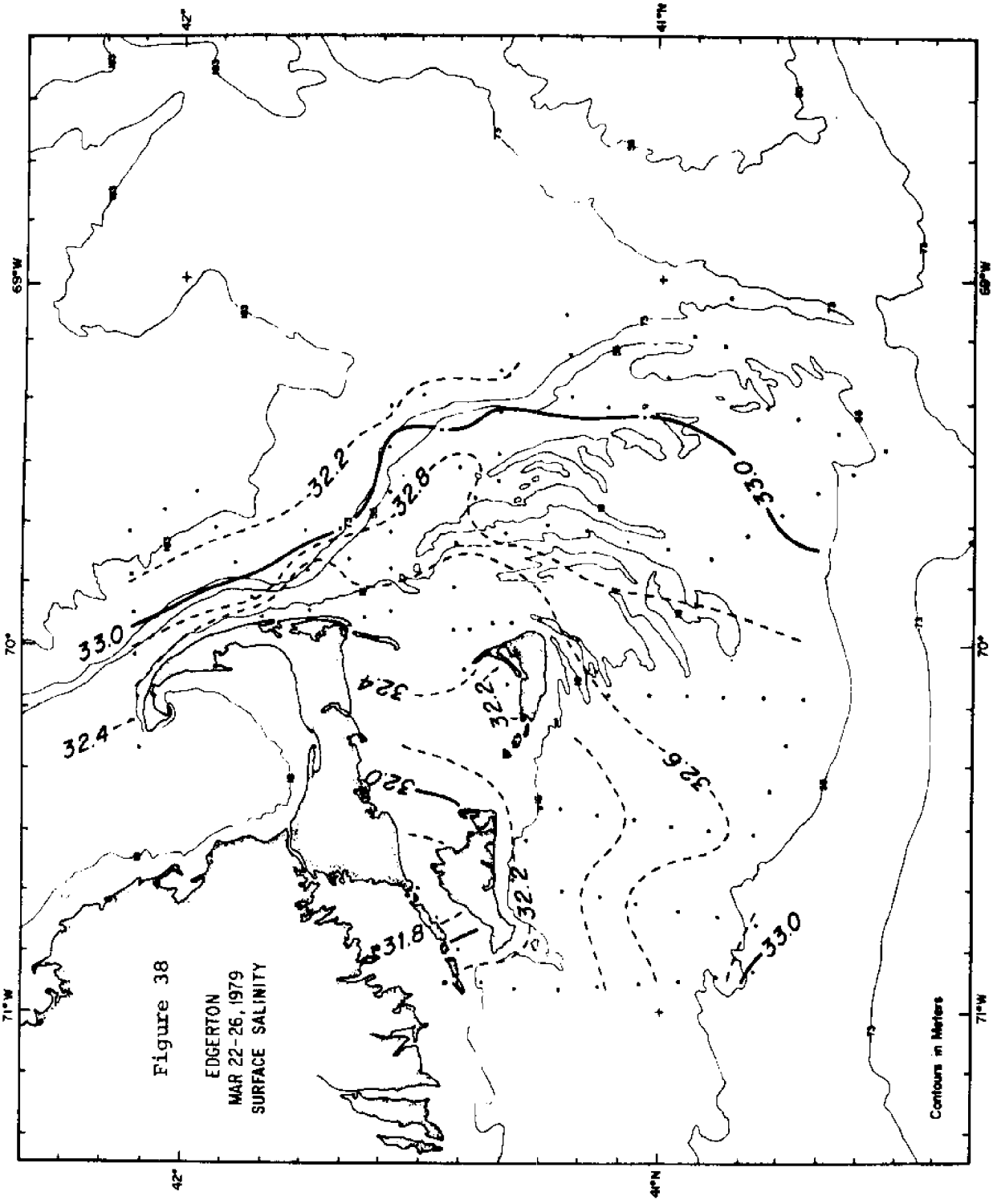


Figure 38
EDGERTON
MAR 22-26, 1979
SURFACE SALINITY

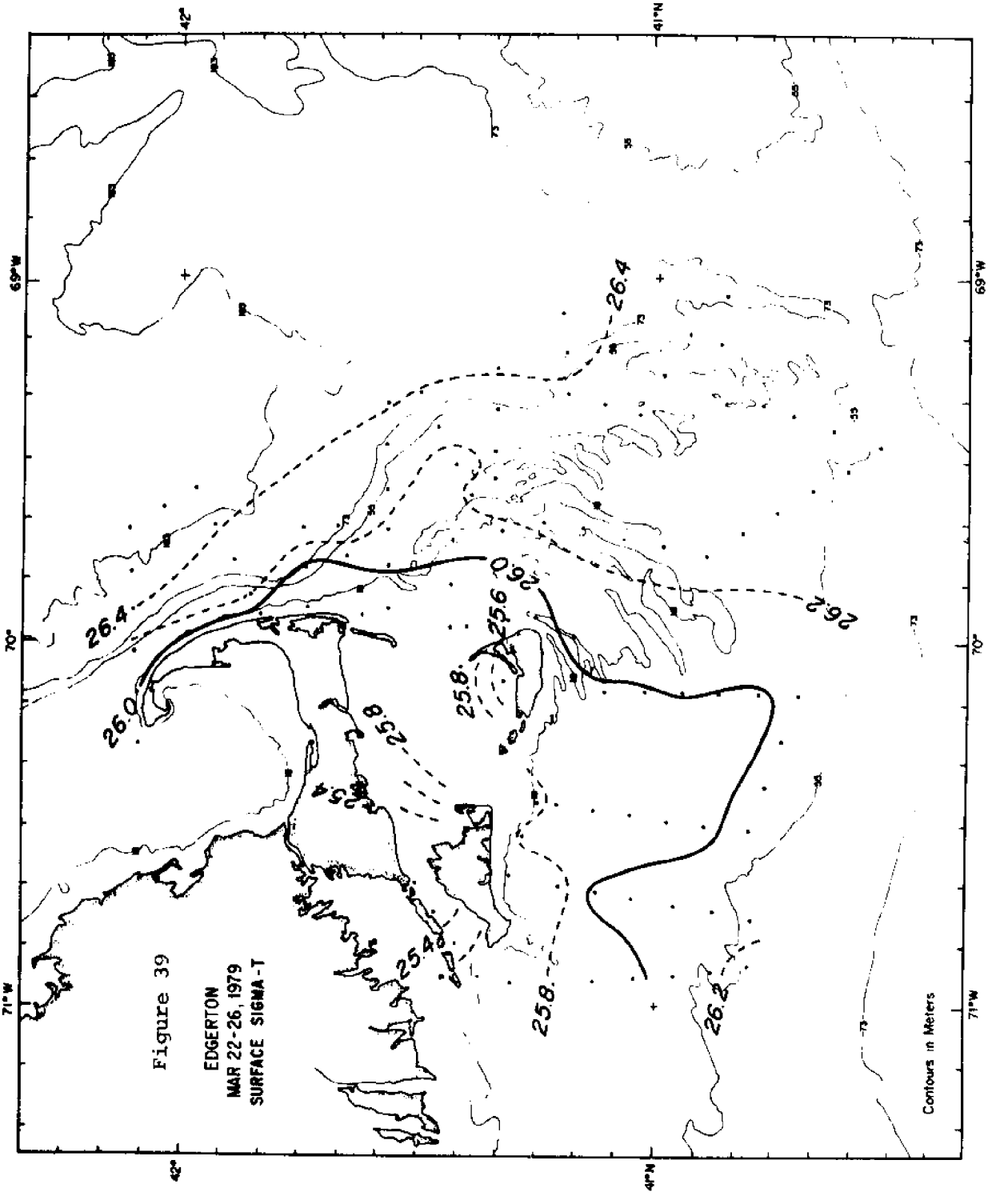


Figure 39
EDGERTON
MAR 22-26, 1979
SURFACE SIGMA-T

Figure 40

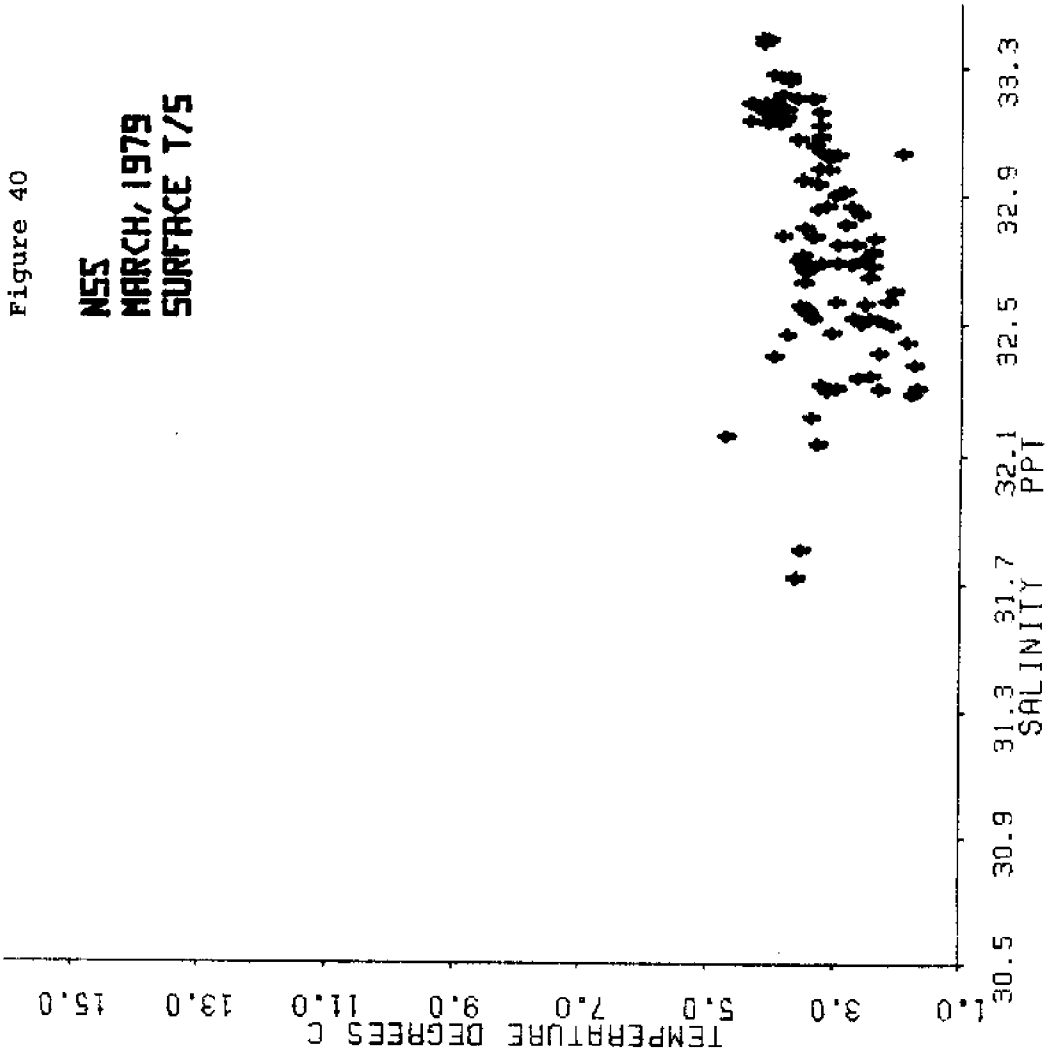
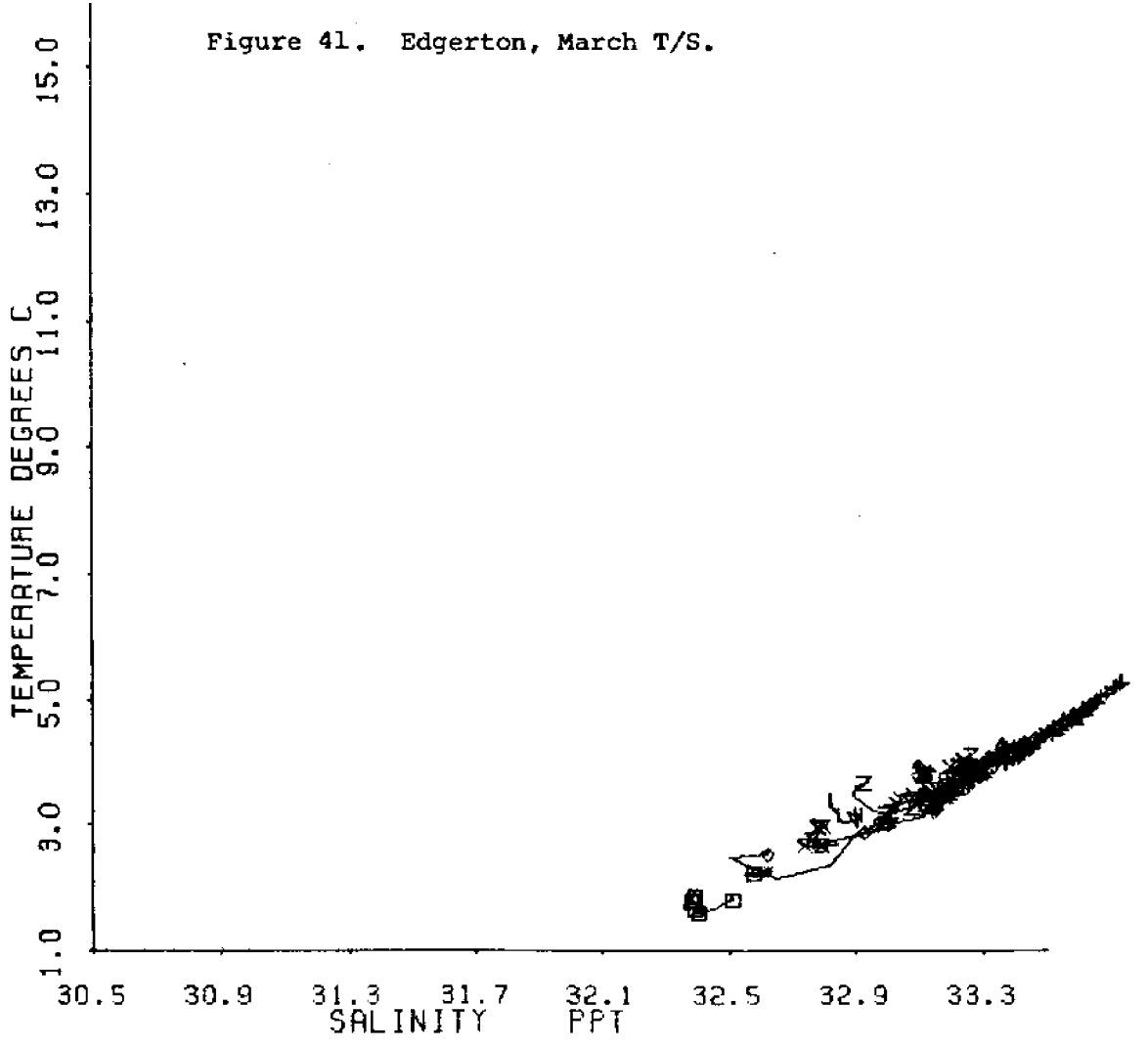

NSS
MARCH, 1979
SURFACE T/S
TEMPERATURE DEGREES C
1.0
3.0
5.0
7.0
9.0
11.0
13.0
15.0
30.5
30.9
31.3
31.7
32.1
32.5
32.9
33.3
SALINITY
PPT

Figure 41. Edgerton, March T/S.



NS5010T2.5	□	2.0	56.0
NS5011T2.5	□	0.0	10.0
NS5012T2.5	○	2.0	38.0
NS5013T2.5	○	2.0	94.0
NS5014T2.5	△	2.0	172.0
NS5015T2.5	△	2.0	208.0
NS5016T2.5	+	2.0	208.0
NS5017T2.5	+	2.0	194.0
NS5018T2.5	×	2.0	136.0
NS5019T2.5	×	2.0	112.0
NS5023T2.5	◇	2.0	66.0
NS5024T2.5	◇	2.0	114.0
NS5025T2.5	◇	2.0	64.0
NS5026T2.5	⋈	2.0	28.0
NS5030T2.5	⋈	2.0	24.0
NS5032T2.5	Z	2.0	62.0
NS5033T2.5	Z	2.0	106.0
NS5034T2.5	Y	2.0	86.0
NS5035T2.5	Y	2.0	38.0
NS5041T2.5	⋈	2.0	90.0
NS5042T2.5	✳	2.0	94.0
NS5052T2.5	⧖	2.0	78.0
NS5102T2.5	I	2.0	56.0

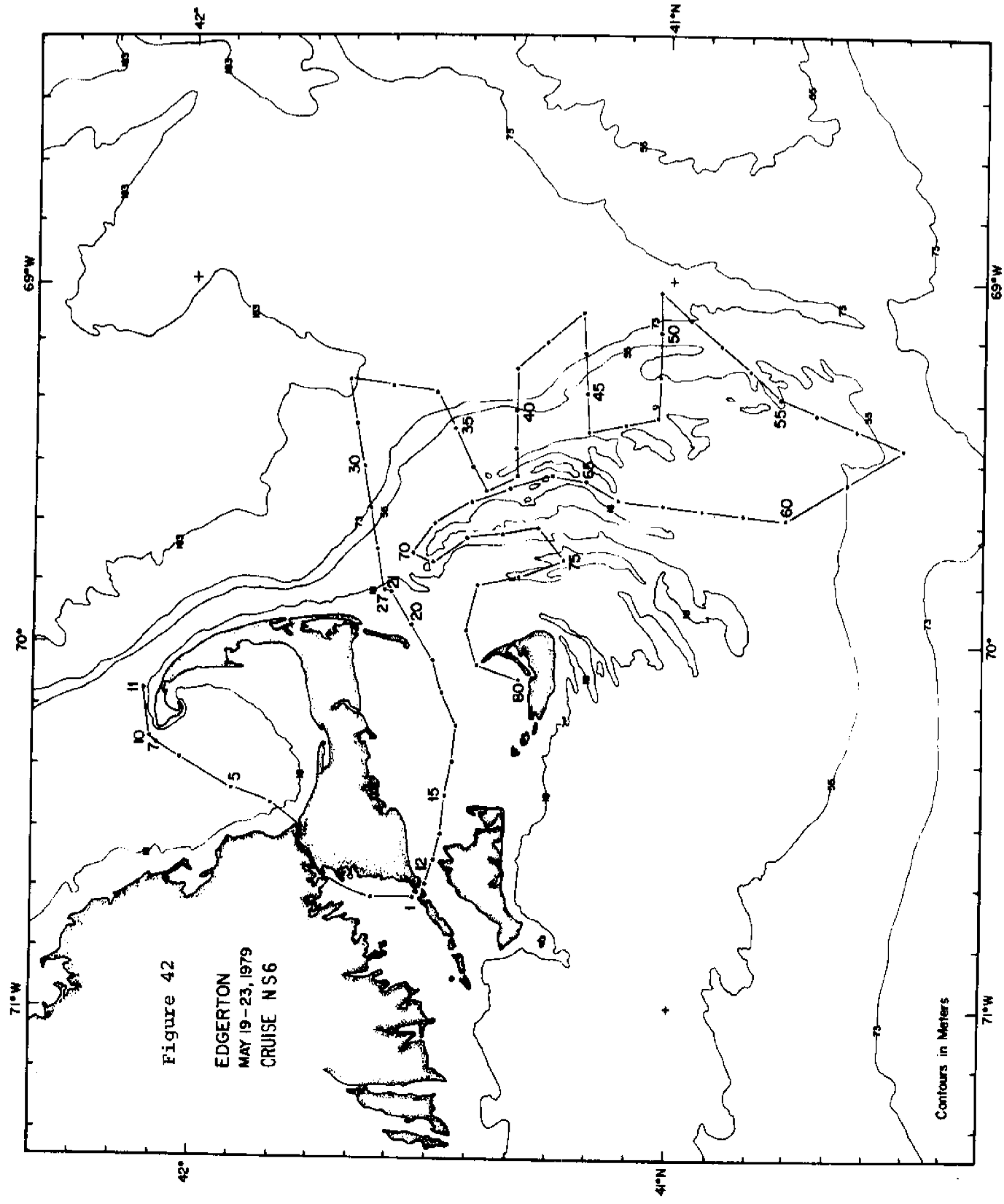

42°
41°N
69°W
70°
71°W
Contours in Meters
EDGERTON
MAY 19-23, 1979
CRUISE NS6

Figure 42

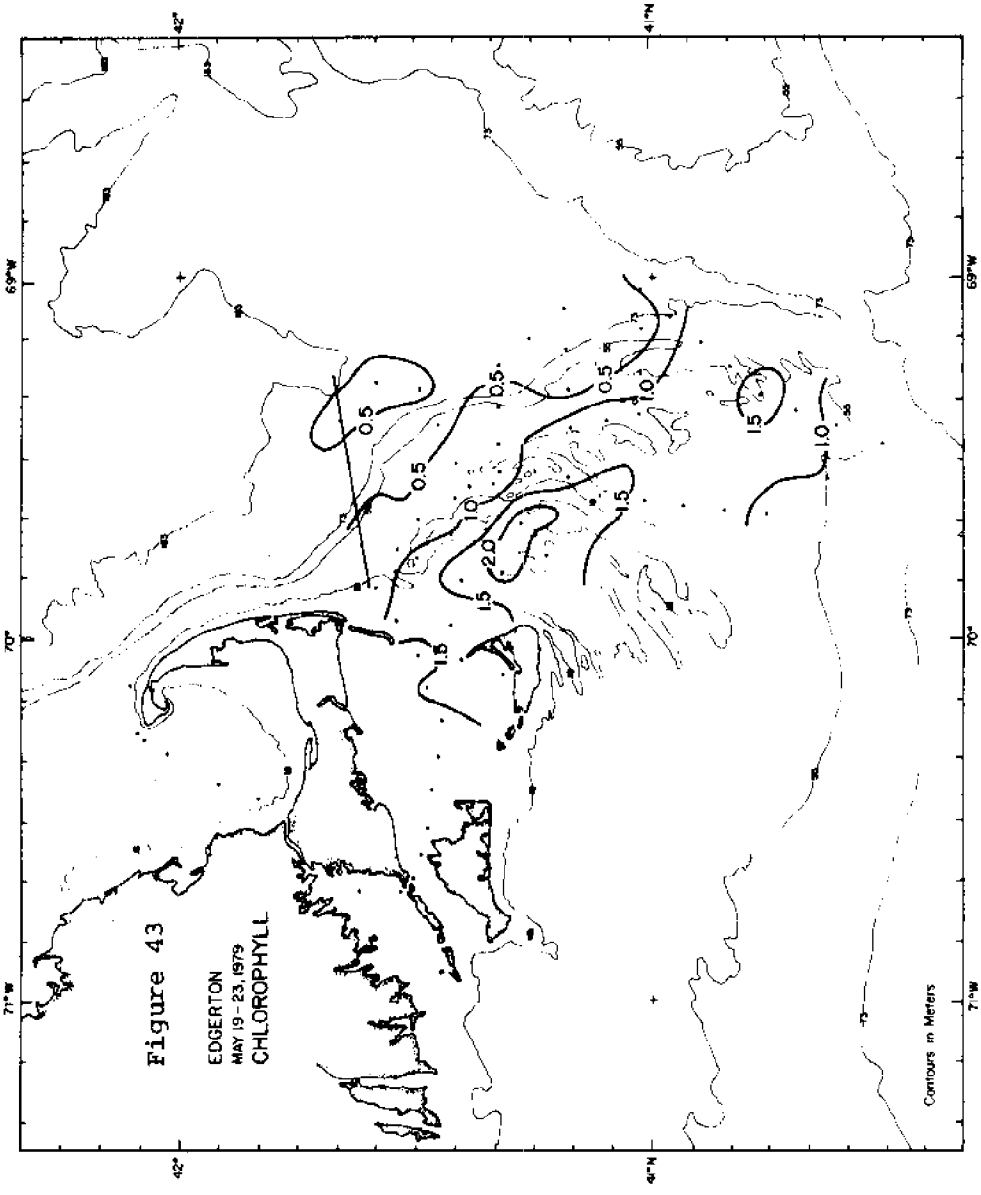


Figure 43
EDGERTON
MAY 19 - 23, 1979
CHLOROPHYLL
Contours in Meters
0.5
1.0
1.5
2.0
42°
41°N
71°W
70°
69°W

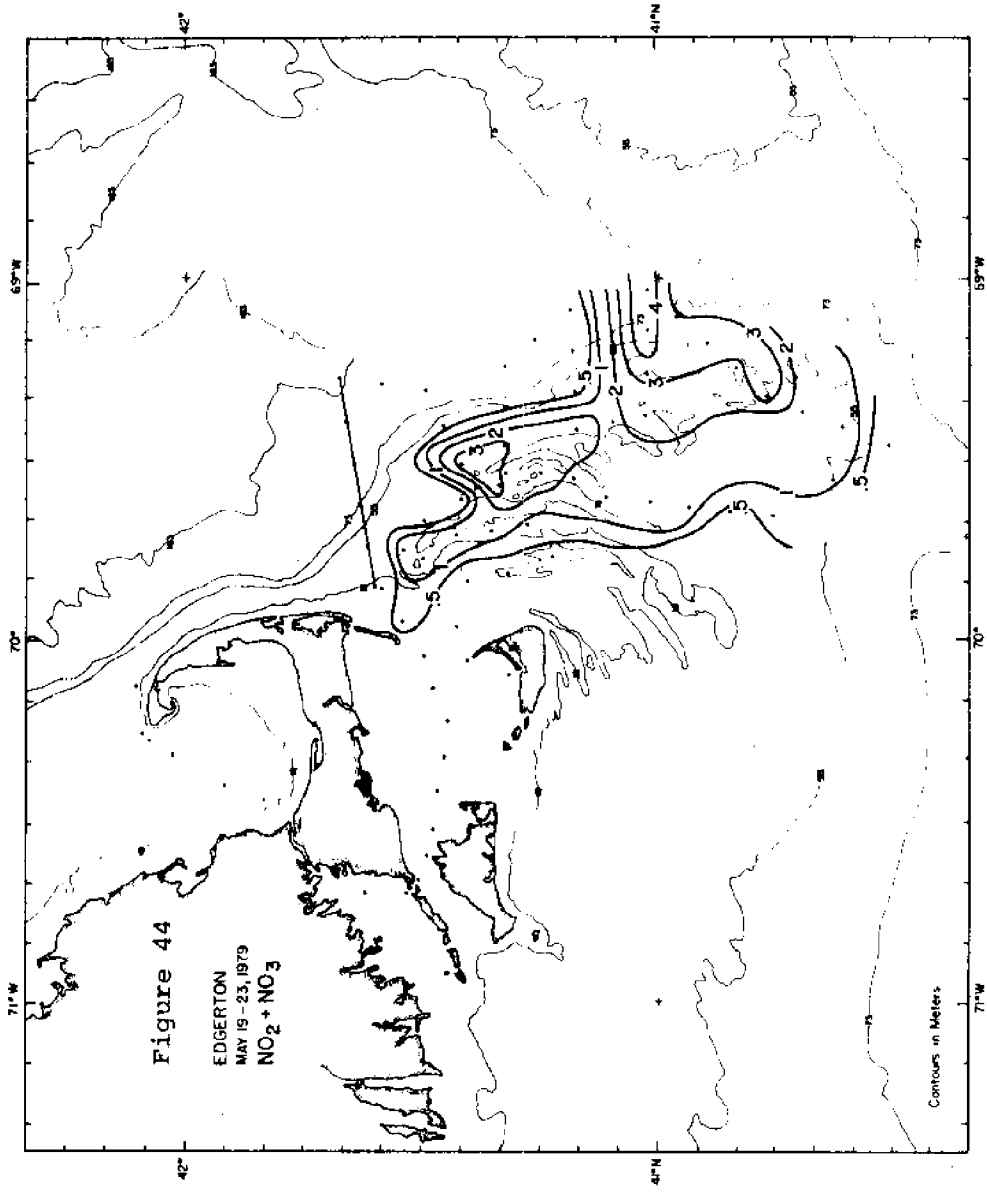


Figure 44
EDGERTON
MAY 19-23, 1979
$NO_2 + NO_3$
Contours in Meters
42°
41°N
71°W
70°
69°W

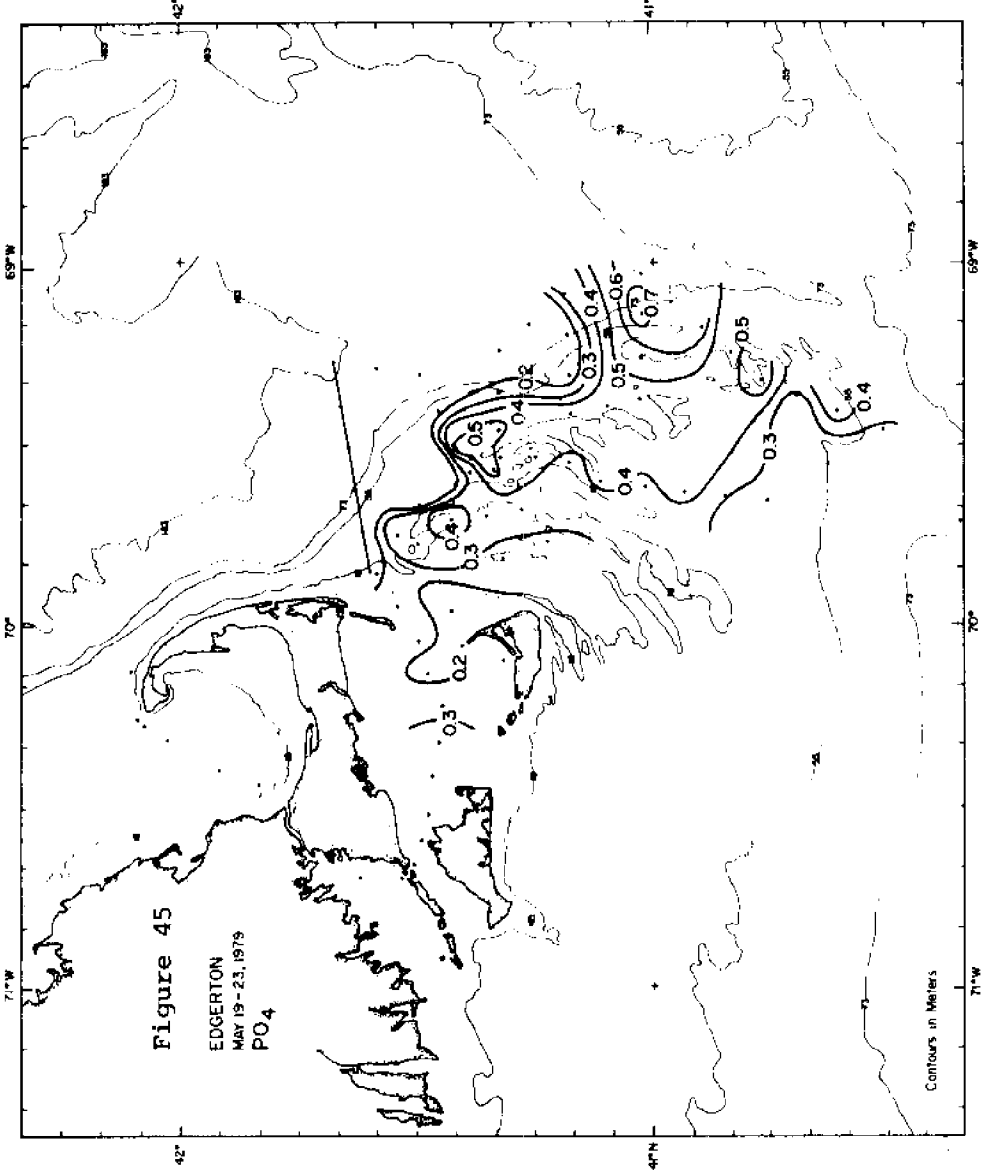
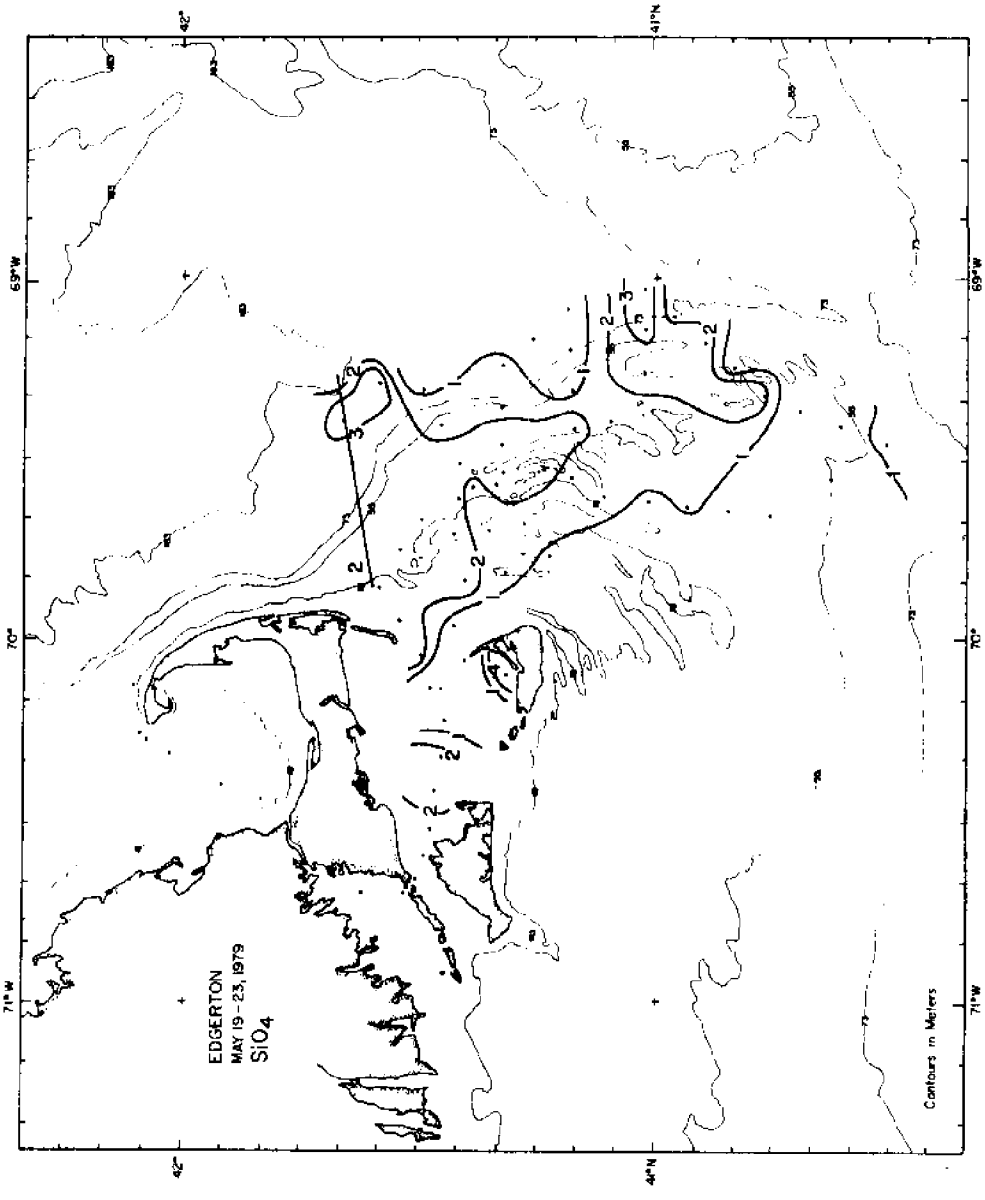


Figure 45
EDGERTON
May 19 - 23, 1979
PO_4
Contours in Meters
42°
41°N
69°W
70°
71°W
0.2
0.3
0.4
0.5
0.6
0.7


EDGERTON
MAY 19 - 23, 1979
SiO4
Contours in Meters
42°
41°N
69°W
70°
71°W
40°N

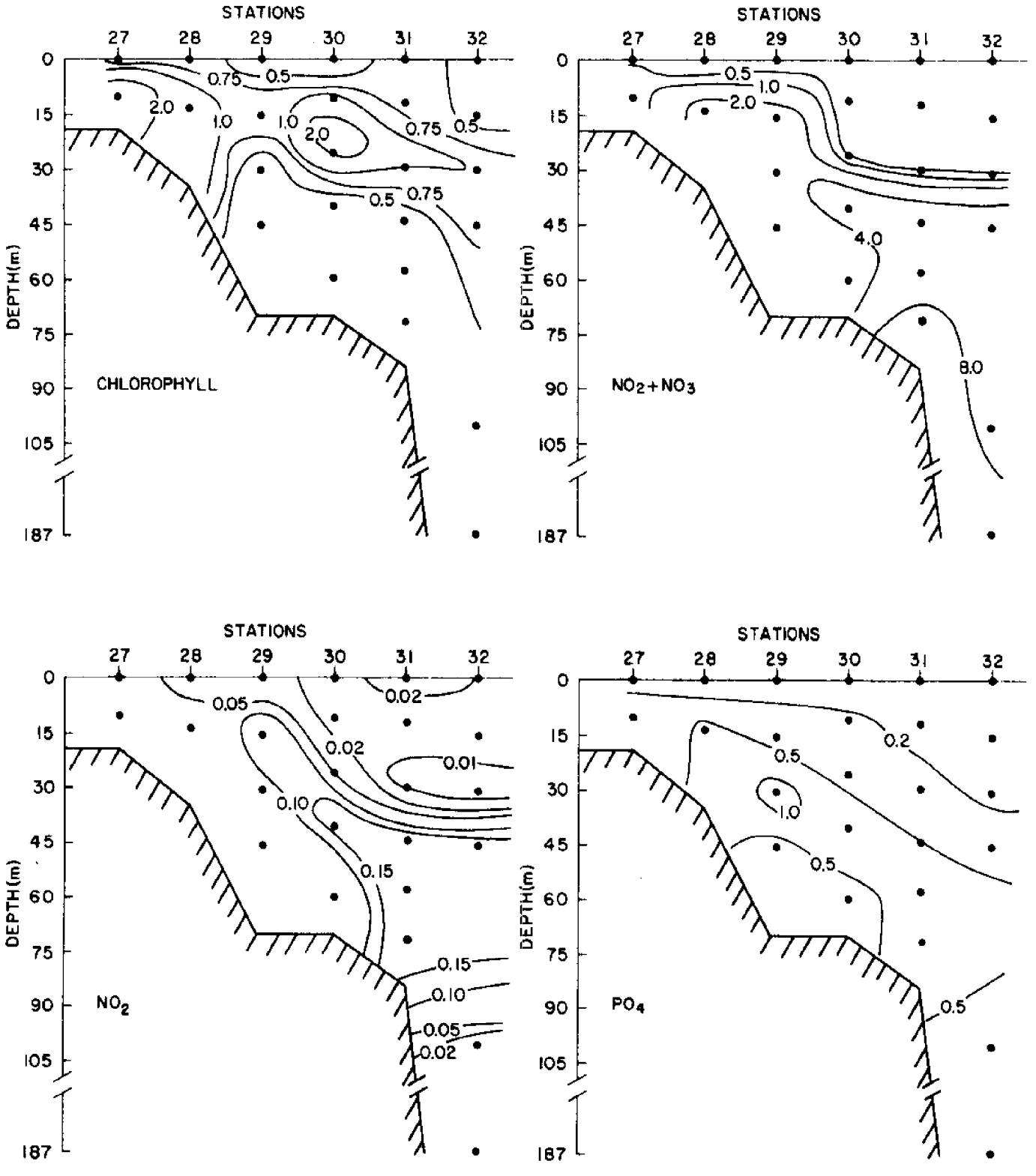


Figure 47. EDGERTON May 21, 1979. Vertical chlorophyll and nutrient distribution east of Monomoy Island.

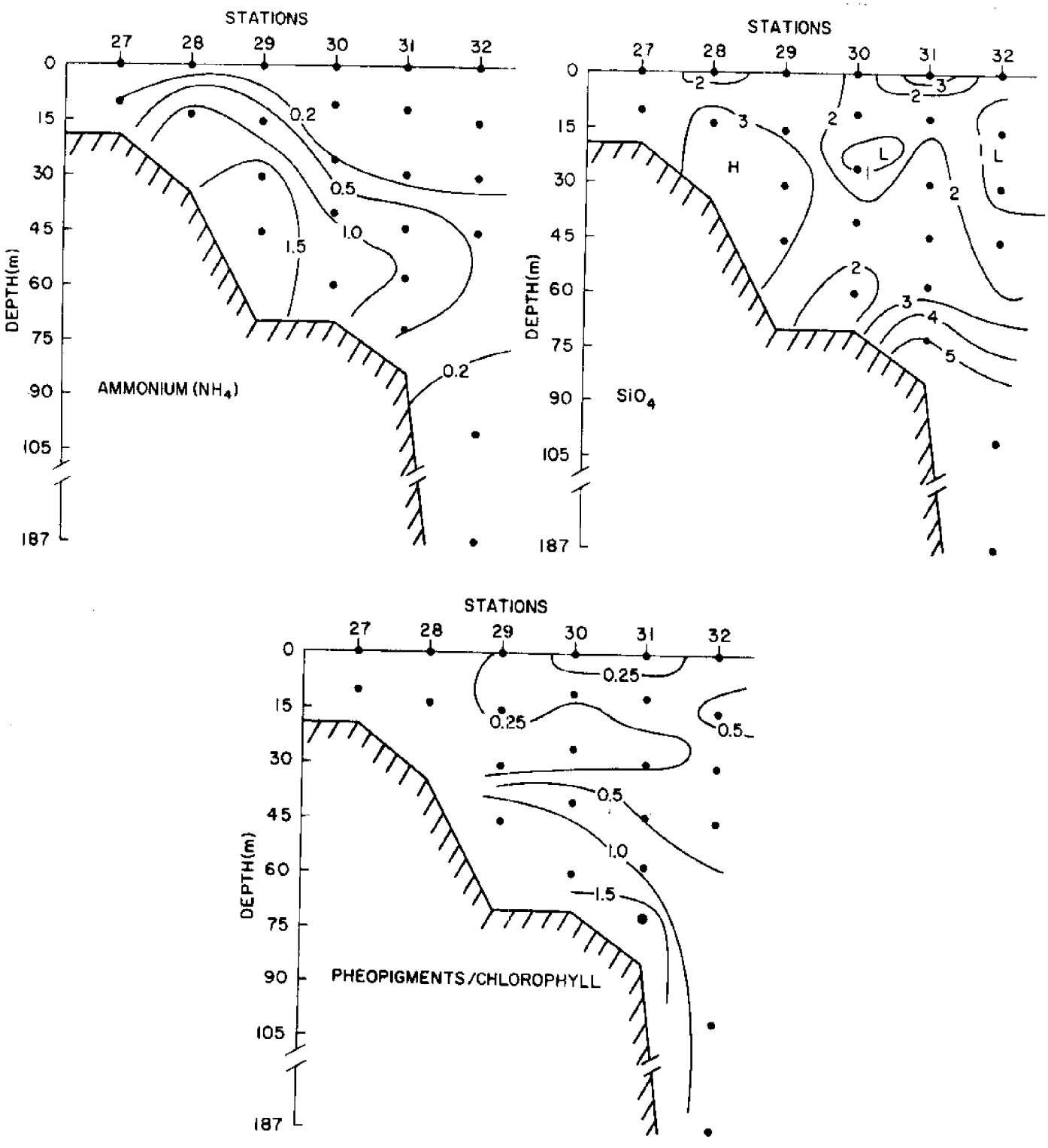


Figure 48. EDGERTON May 21, 1979. Vertical chlorophyll and nutrient distribution east of Monomoy Island

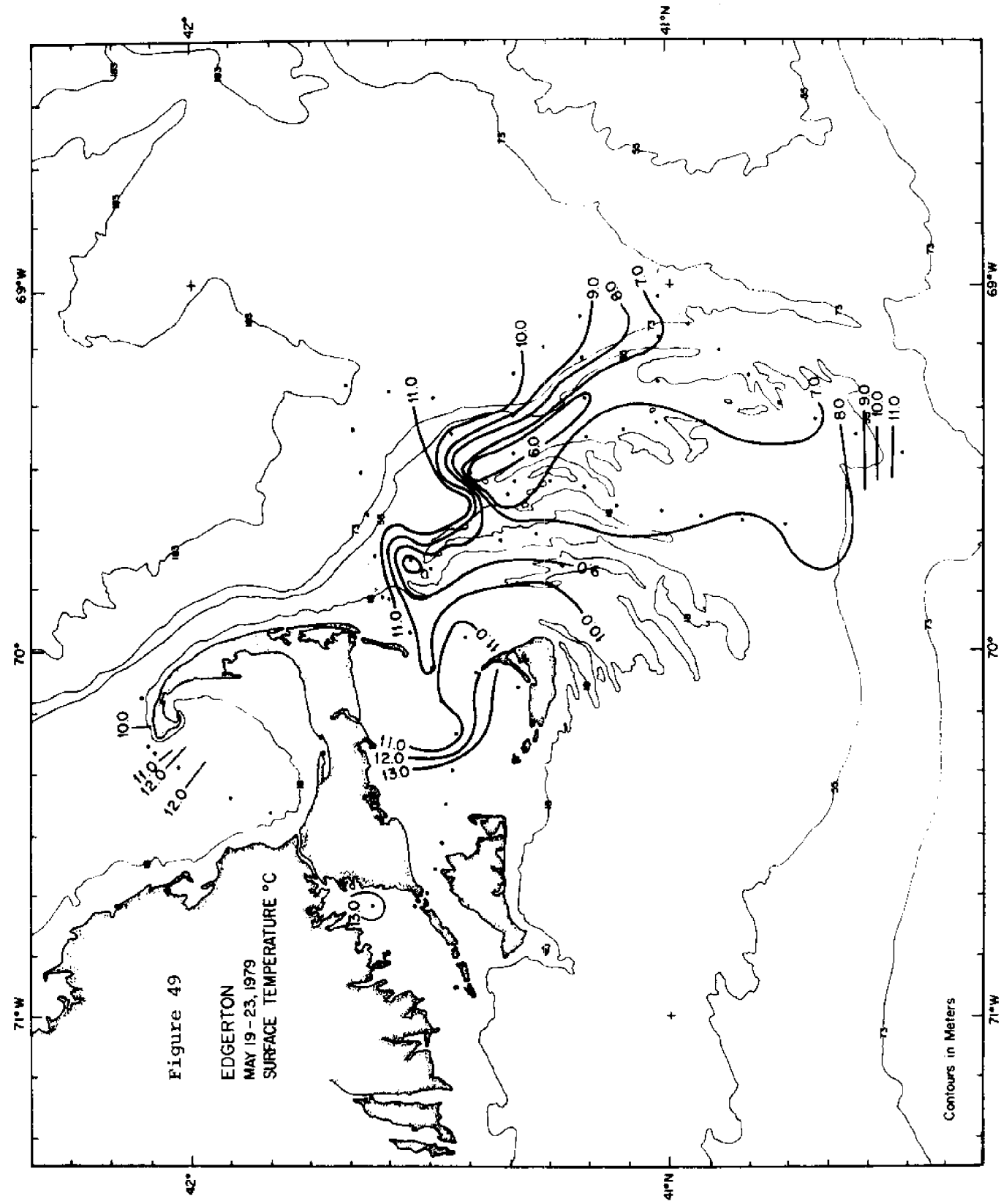


Figure 49

EDGERTON
MAY 19 - 23, 1979
SURFACE TEMPERATURE °C

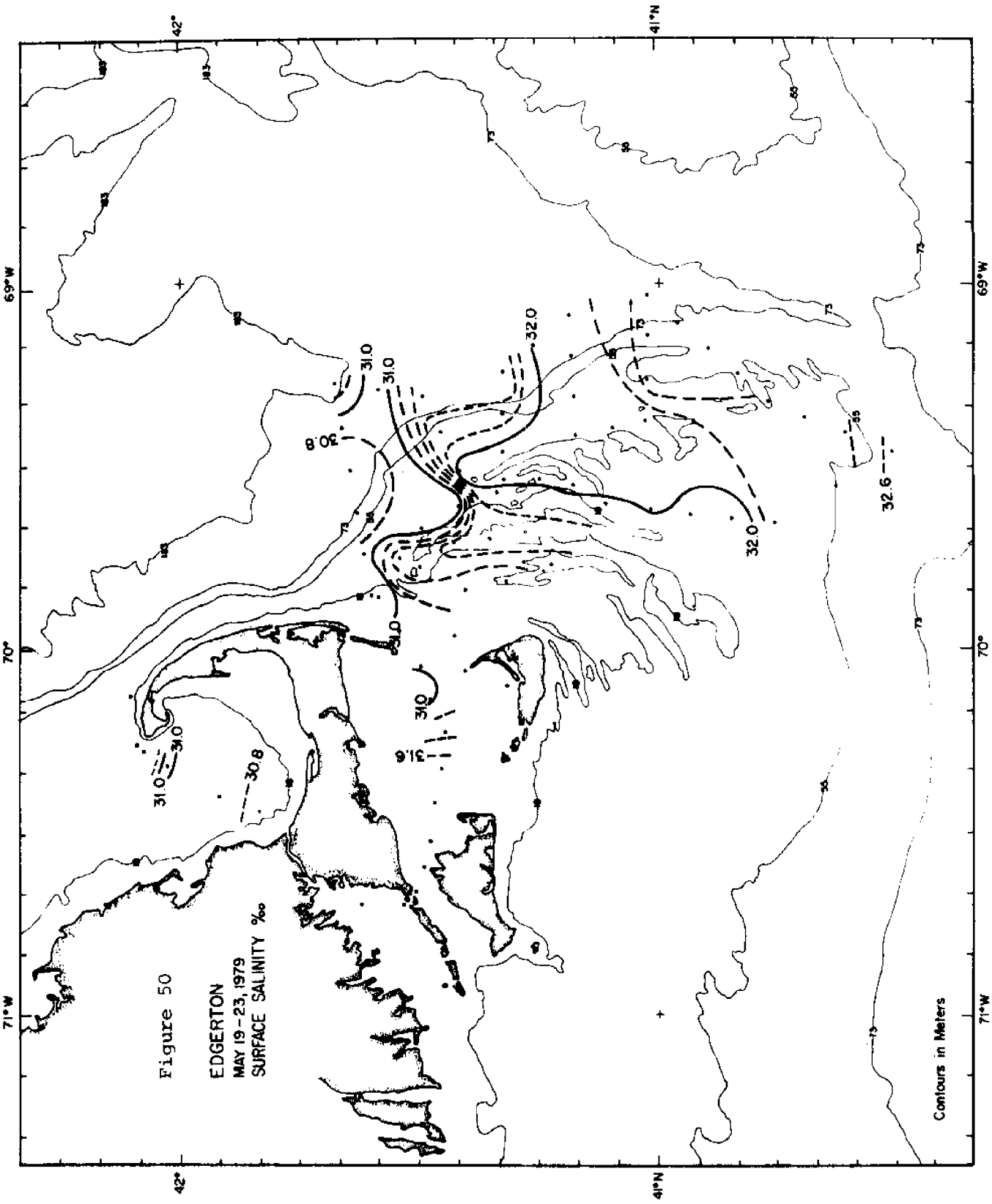


Figure 50

EDGERTON
MAY 19-23, 1979
SURFACE SALINITY ‰

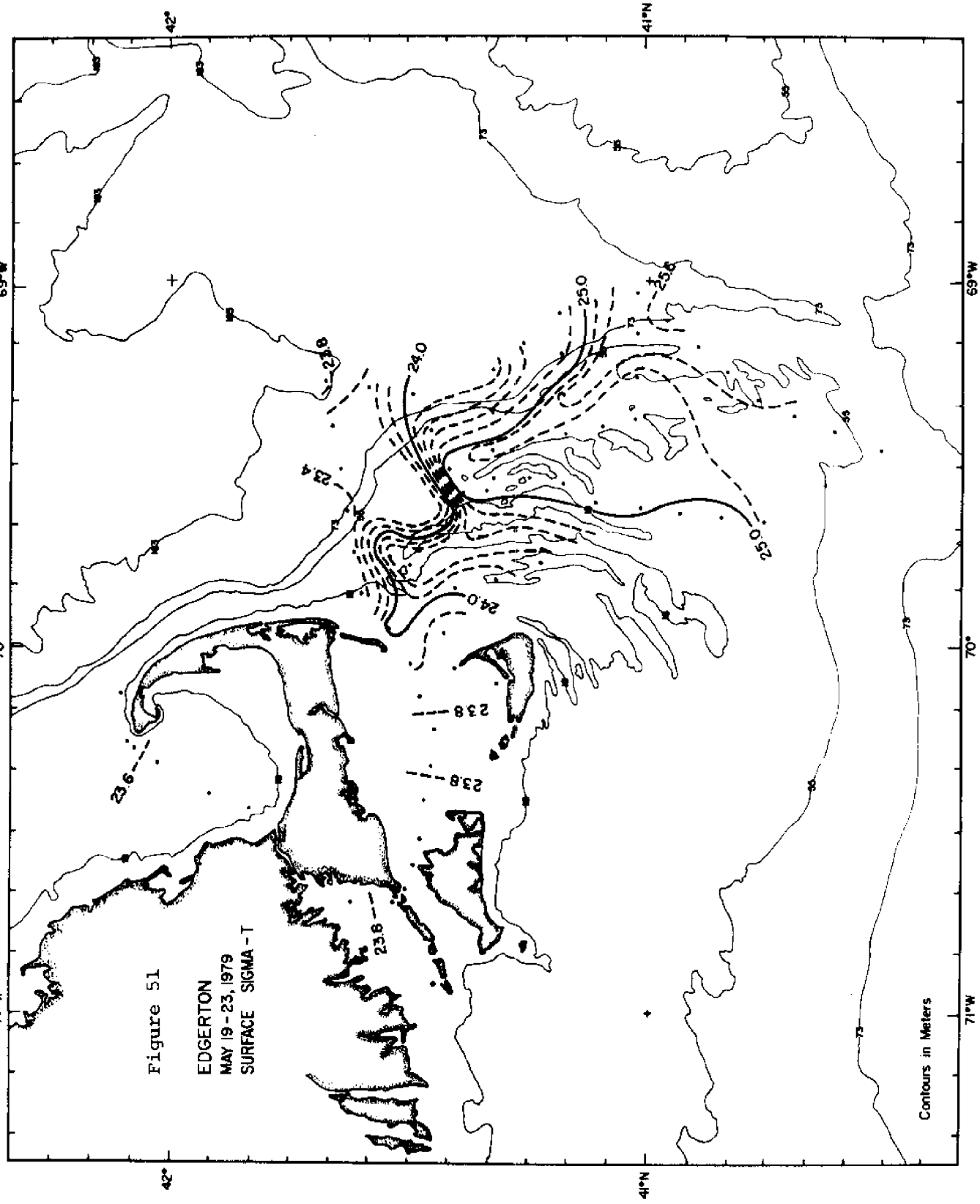
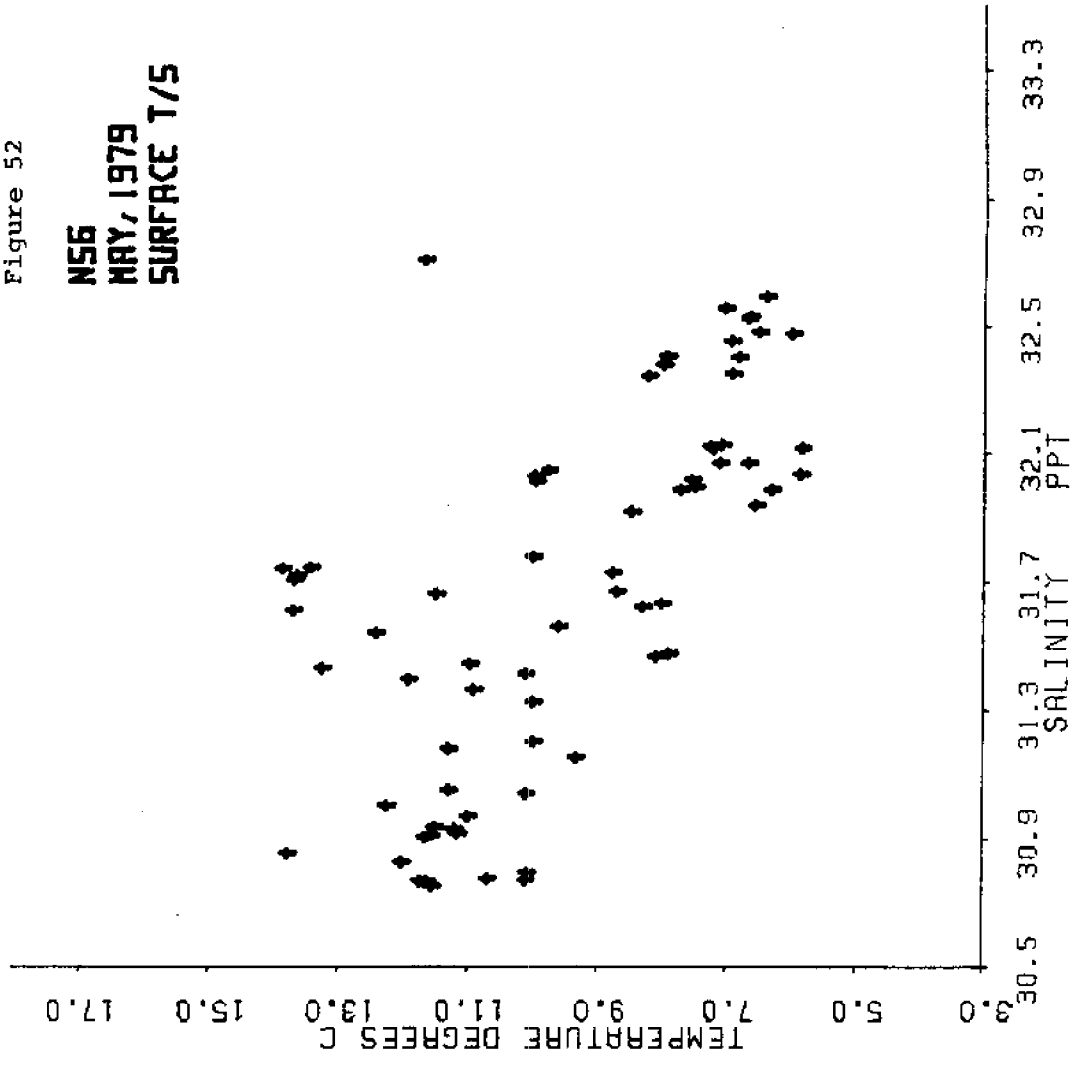


Figure 51

EDGERTON
MAY 19-23, 1979
SURFACE SIGMA-T

Figure 52


NS6
MAY, 1979
SURFACE T/S
TEMPERATURE DEGREES C
3.0
5.0
7.0
9.0
11.0
13.0
15.0
17.0
30.5
30.9
31.3
31.7
32.1
32.5
32.9
33.3
SALINITY PPT

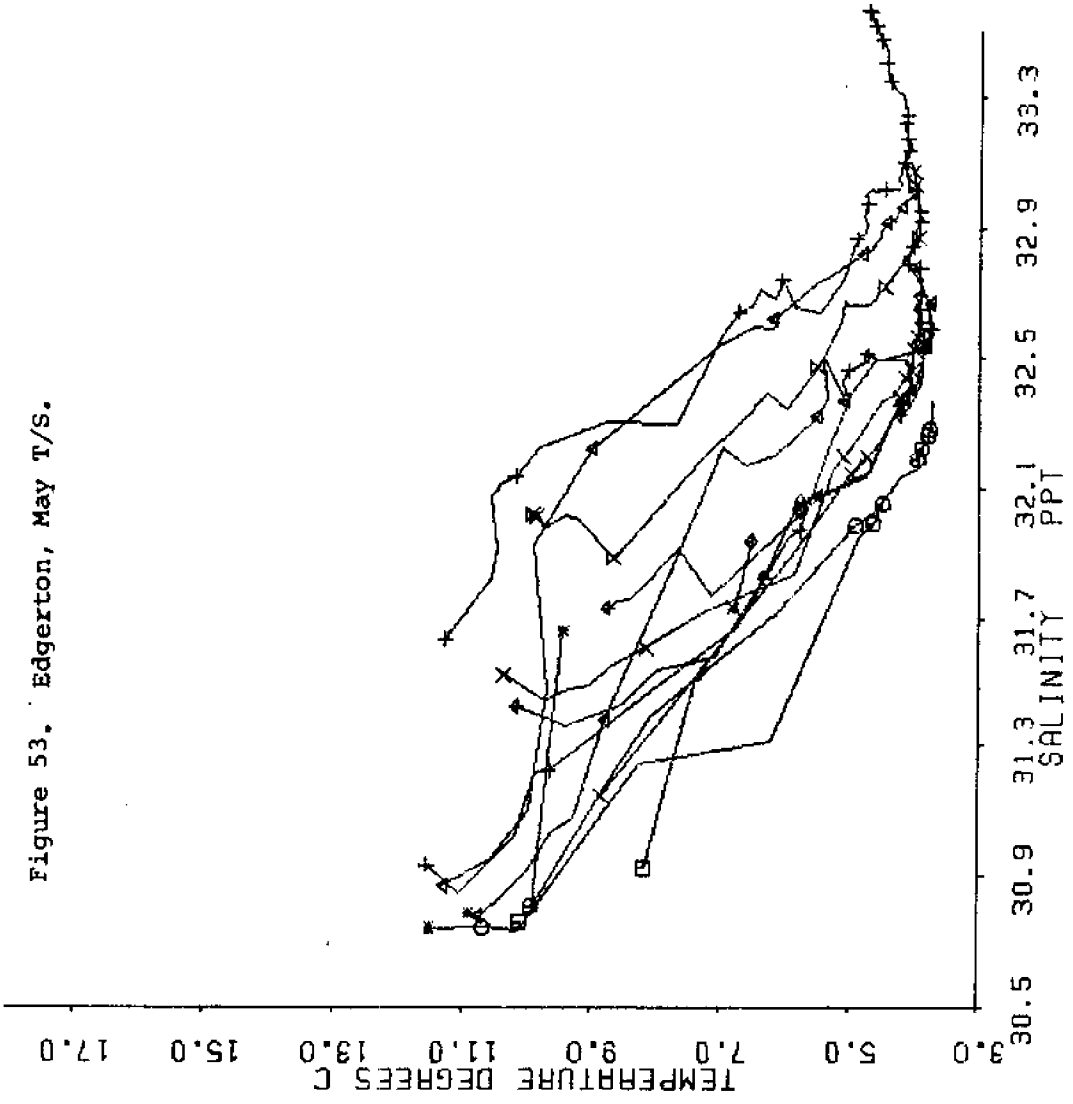


Figure 53. Edgerton, May T/S.

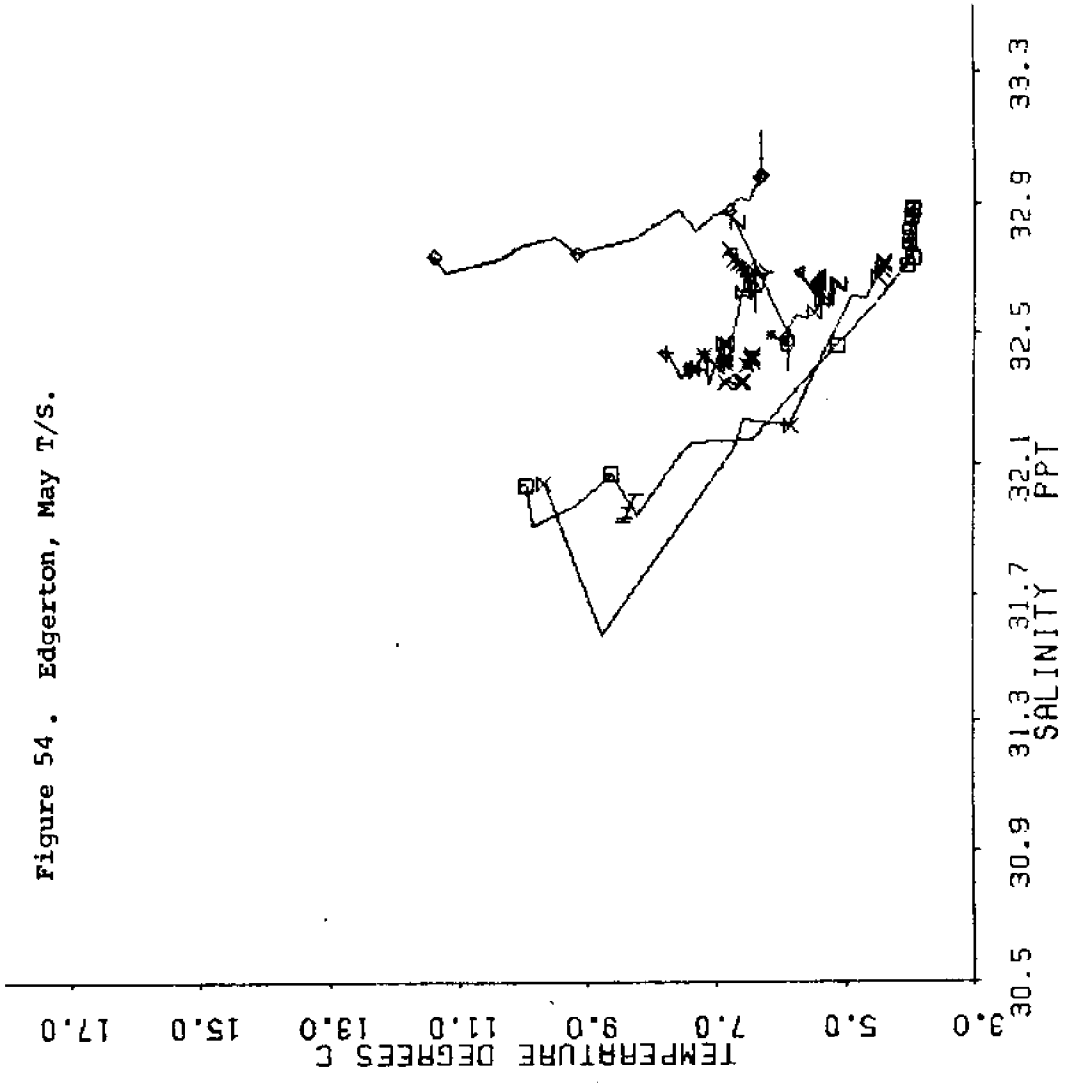
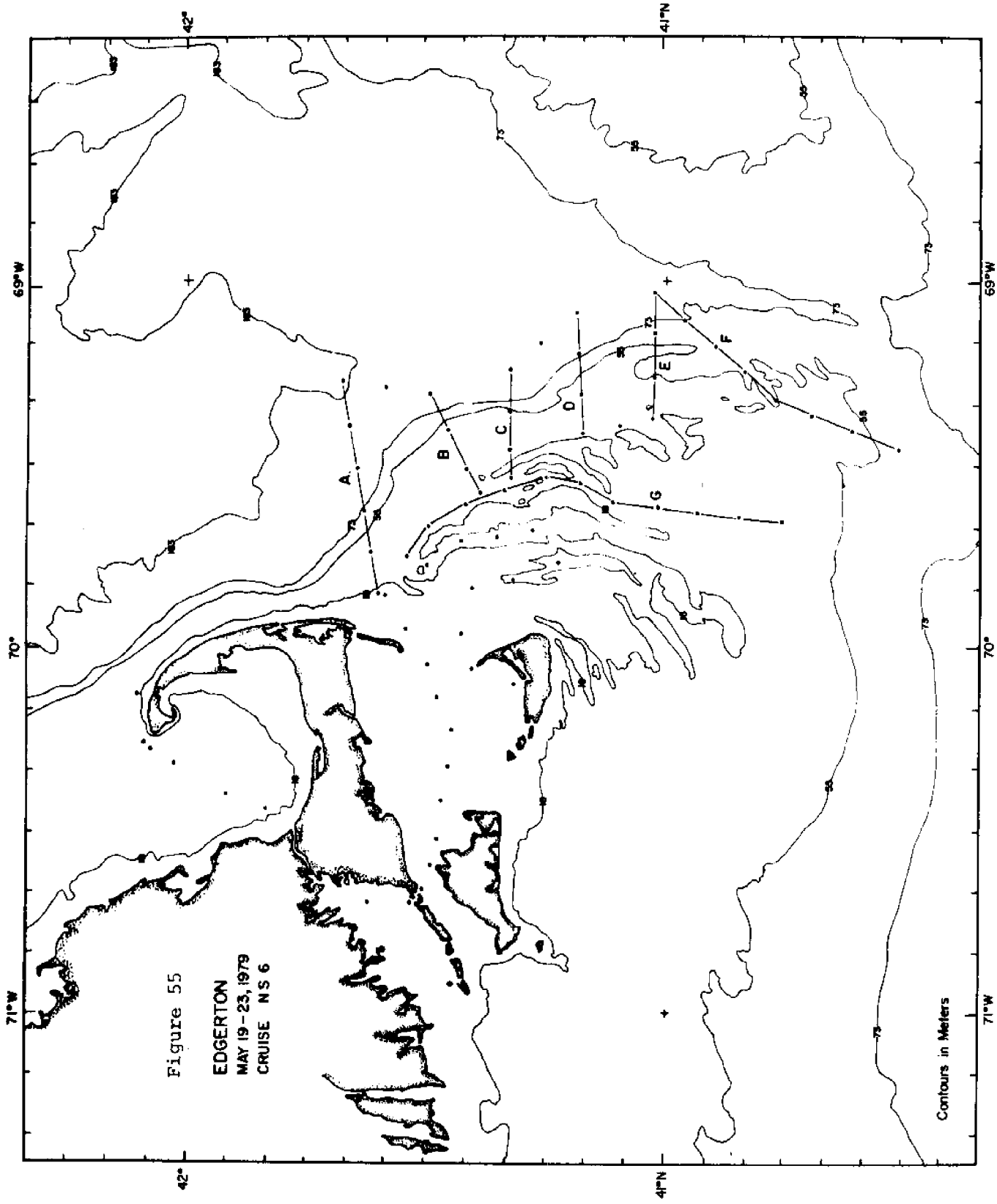
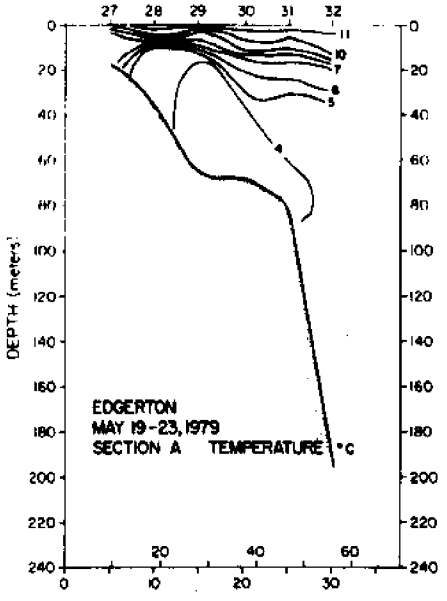
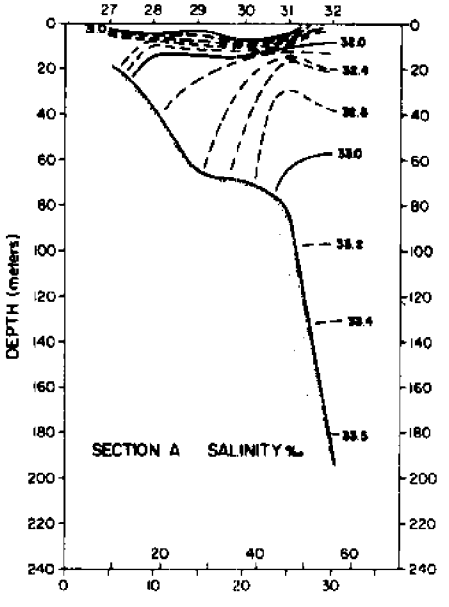


Figure 54. Edgerton, May T/S.


42°
41°N
69°W
70°
71°W
A
B
C
D
E
F
G
Contours in Meters
Figure 55
EDGERTON
MAY 19 – 23, 1979
CRUISE NS 6


EDGERTON
MAY 19-23, 1979
SECTION A TEMPERATURE °C
DEPTH (meters)


SECTION A SALINITY ‰
DEPTH (meters)

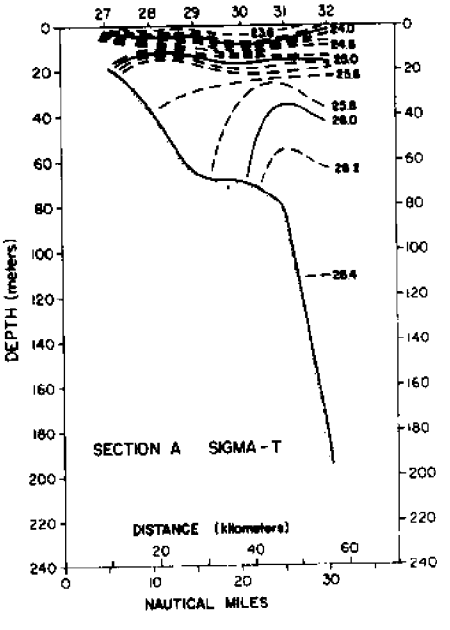

SECTION A SIGMA-T
DEPTH (meters)
DISTANCE (kilometers)
NAUTICAL MILES

Figure 56

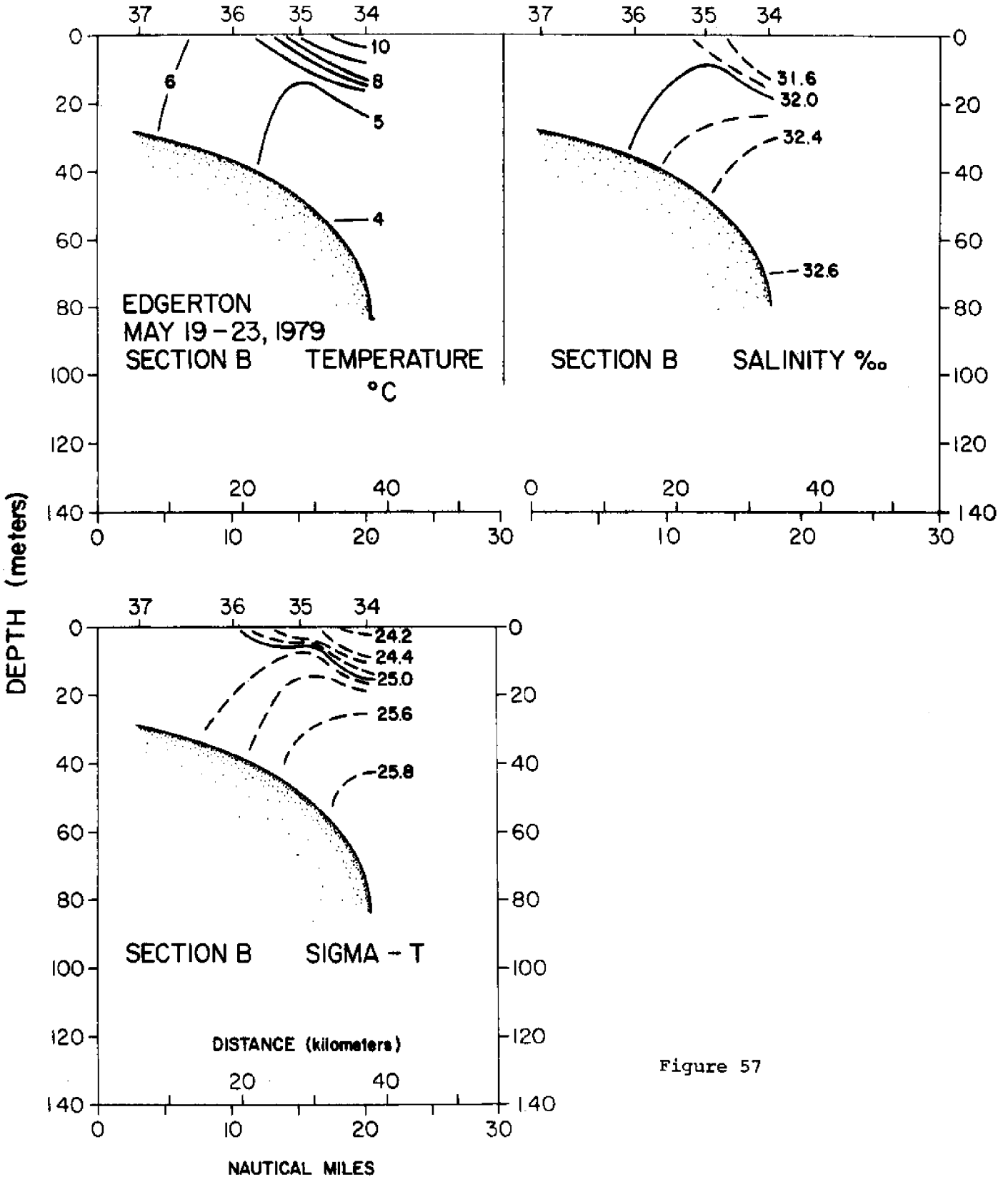

37
36
35
34
0
20
40
60
80
100
120
140
10
8
6
5
4
EDGERTON
MAY 19 – 23, 1979
SECTION B TEMPERATURE
°C
31.6
32.0
32.4
32.6
SECTION B SALINITY ‰
0
20
40
10
20
30
DEPTH (meters)
24.2
24.4
25.0
25.6
25.8
SECTION B SIGMA – T
DISTANCE (kilometers)
NAUTICAL MILES

Figure 57

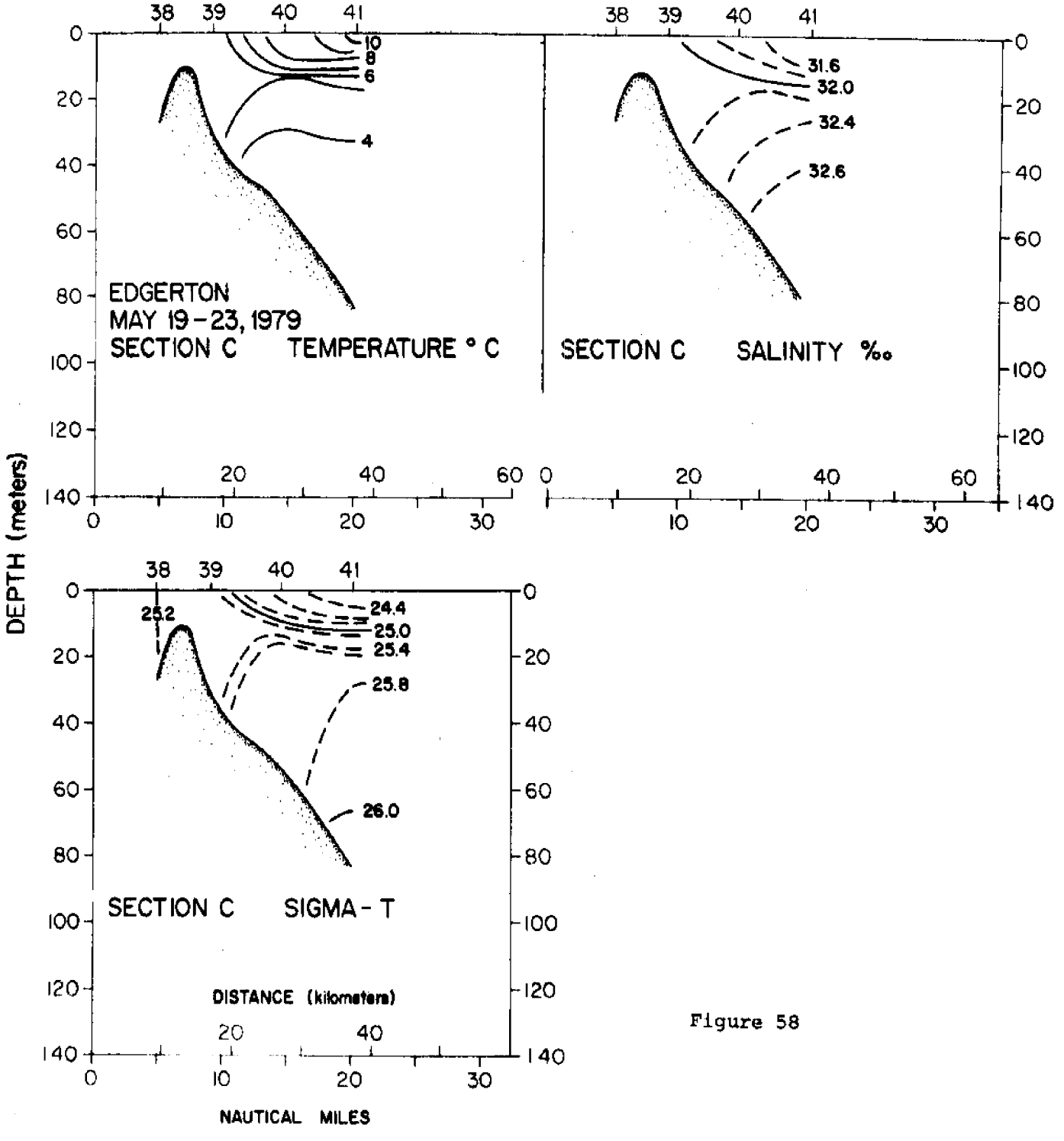

EDGERTON
MAY 19 – 23, 1979
SECTION C TEMPERATURE ° C
SECTION C SALINITY ‰
SECTION C SIGMA - T
DEPTH (meters)
DISTANCE (kilometers)
NAUTICAL MILES
38 39 40 41
10
8
6
4
31.6
32.0
32.4
32.6
25.2
24.4
25.0
25.4
25.8
26.0

Figure 58

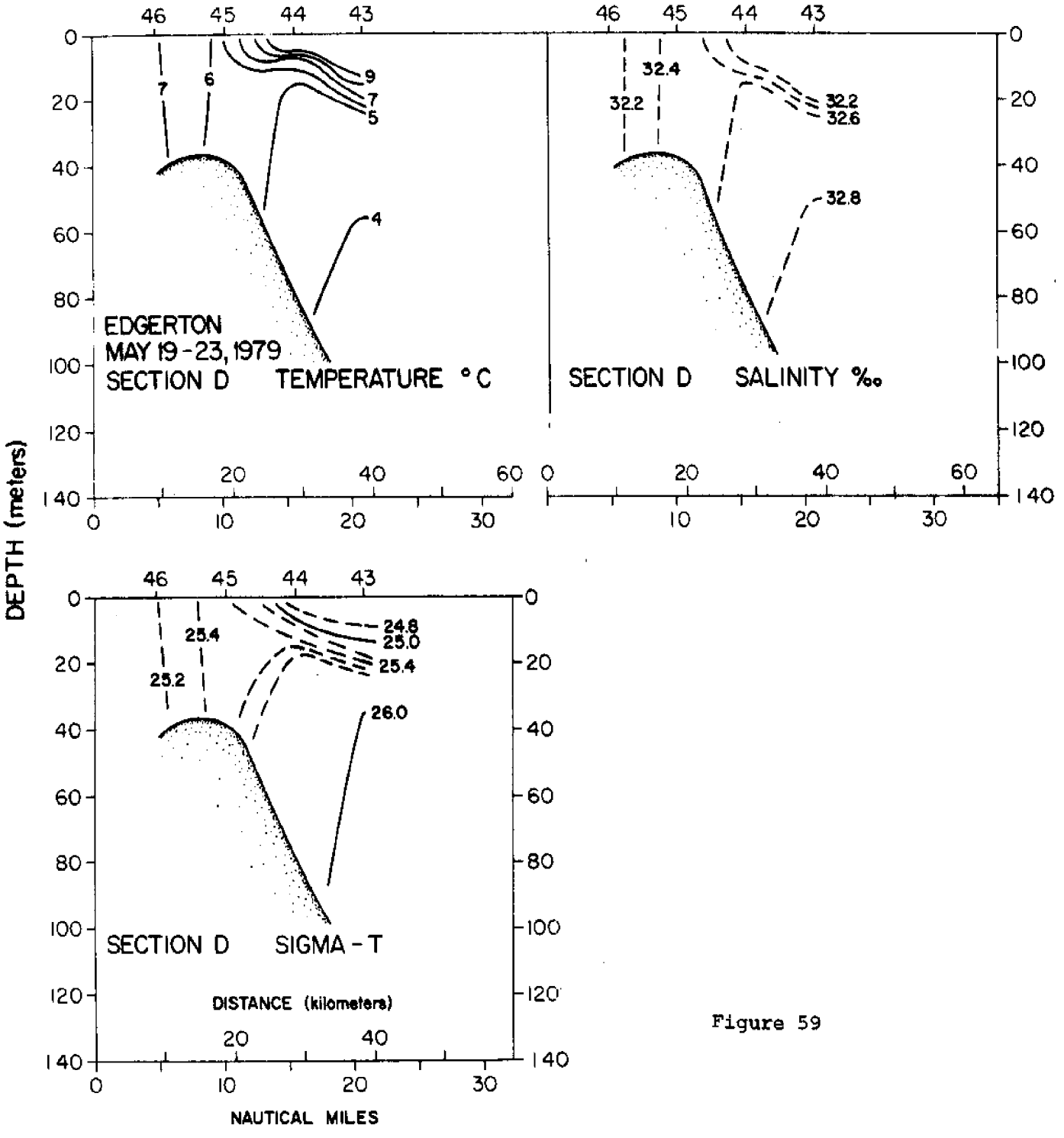

EDGERTON
MAY 19-23, 1979
SECTION D TEMPERATURE °C
SECTION D SALINITY ‰
SECTION D SIGMA-T
DEPTH (meters)
DISTANCE (kilometers)
NAUTICAL MILES
46 45 44 43
0 20 40 60 80 100 120 140
0 10 20 30
7 6 9 7 5 4
32.4 32.2 32.2 32.6 32.8
25.4 25.2 24.8 25.0 25.4 26.0

Figure 59

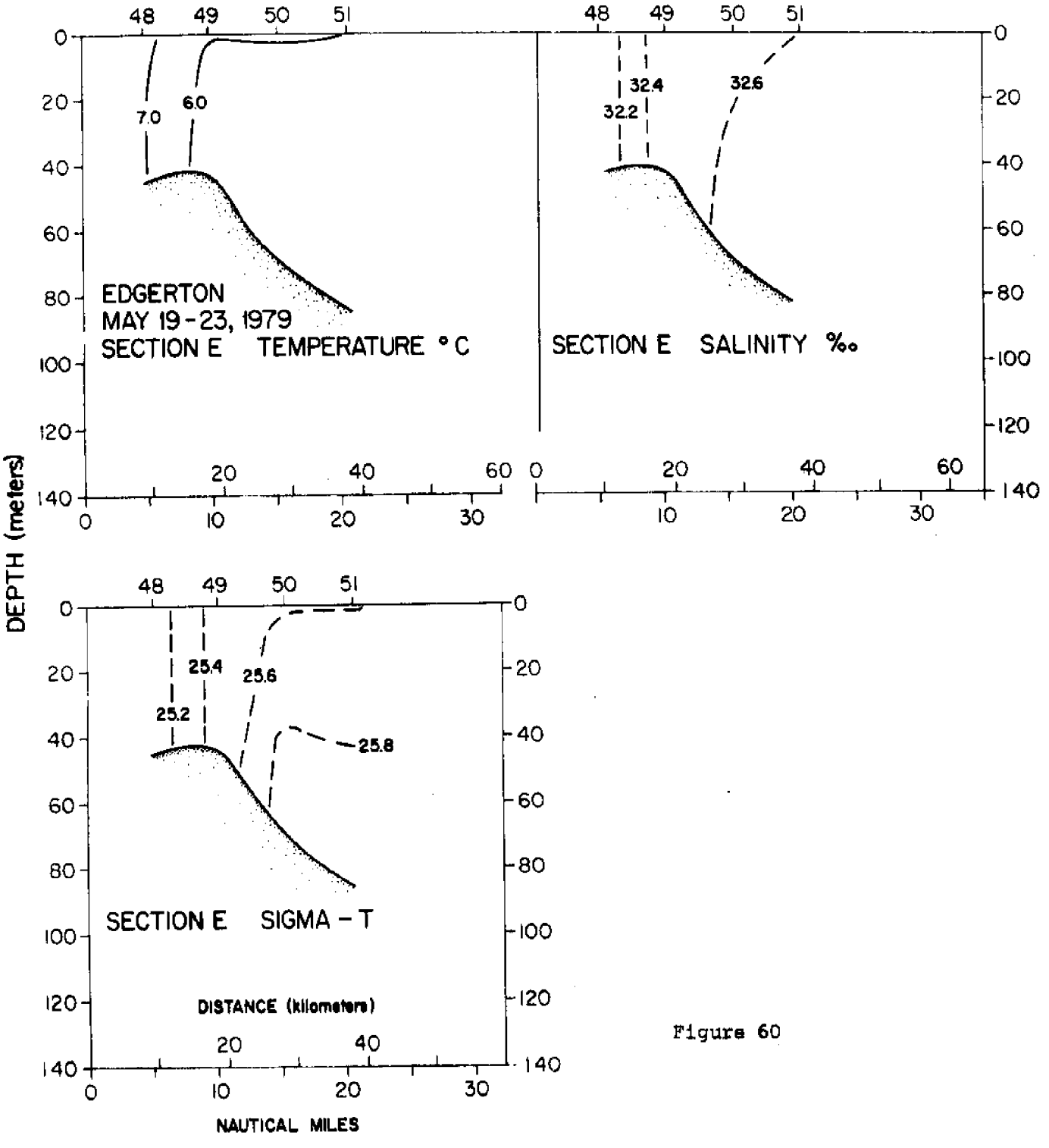

48 49 50 51
0
20
40
60
80
100
120
140
7.0
6.0
EDGERTON
MAY 19-23, 1979
SECTION E TEMPERATURE °C
0 20 40 60
0 10 20 30
32.2
32.4
32.6
SECTION E SALINITY ‰
25.2
25.4
25.6
25.8
SECTION E SIGMA - T
DISTANCE (kilometers)
20 40
NAUTICAL MILES
DEPTH (meters)

Figure 60

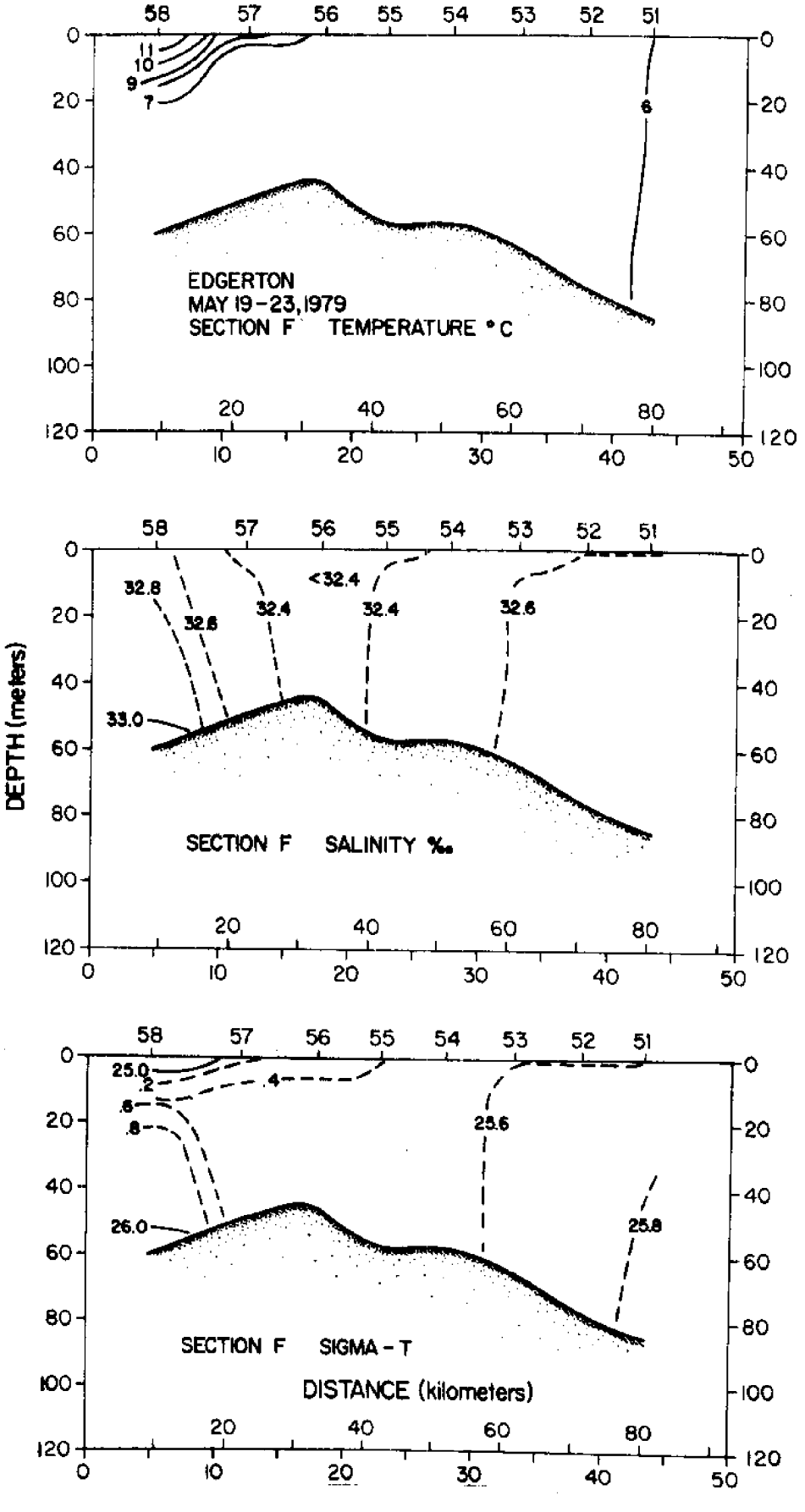

58 57 56 55 54 53 52 51
11
10
9
7
6
EDGERTON
MAY 19-23, 1979
SECTION F TEMPERATURE °C
DEPTH (meters)
32.8
32.6
32.4
<32.4
32.4
32.6
33.0
SECTION F SALINITY ‰
25.0
.2
.4
.6
.8
25.6
26.0
25.8
SECTION F SIGMA-T
DISTANCE (kilometers)
0 10 20 30 40 50
0 20 40 60 80 100 120

Figure 61

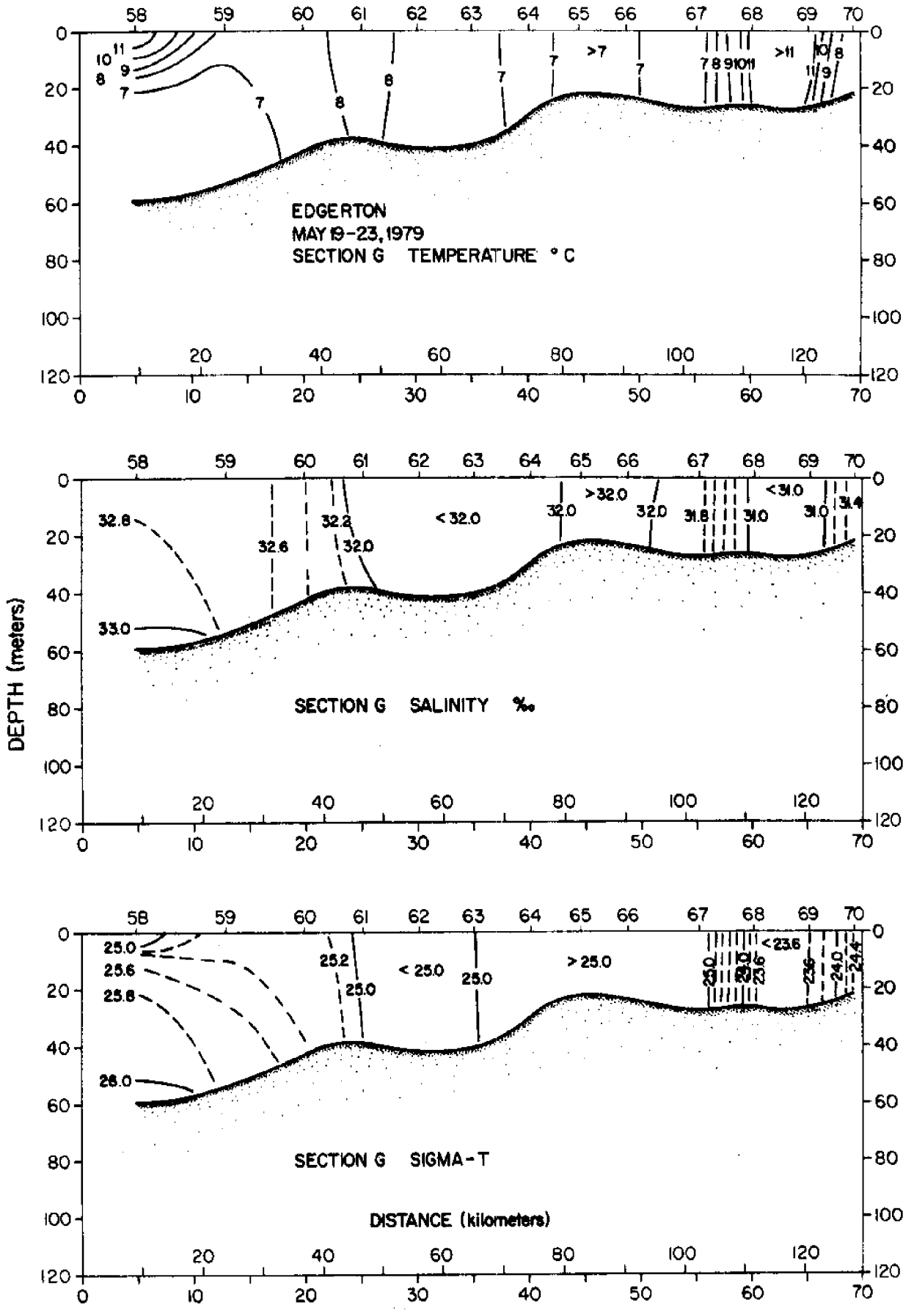

EDGERTON
MAY 19-23, 1979
SECTION G TEMPERATURE °C
SECTION G SALINITY ‰
SECTION G SIGMA-T
DEPTH (meters)
DISTANCE (kilometers)

Figure 62

References

Limeburner, R. and R. Beardsley, 1979. Hydrographic Station data obtained in the vicinity of Nantucket Shoals, May, July, September, 1978. Woods Hole Oceanographic Institution Technical Report WHOI 79-30, 88 pp.

Strickland, J. D. H. and T. R. Parsons, 1972. A practical handbook for seawater analysis. Bull. Fish. Res. Board Can., 167.

APPENDIX A

(Stations 655, 855 refer to samples taken between 65, 66 and 85, 86. -- indicates no data.)

Table 2

CHLOROPHYLL AND NUTRIENT DATA NS1 - May '78

STA	DEPTH	CHL	PHEO	PO4	SIO4	NO3	NO2
10	0	0.70	0.58	0.59	5.73	2.27	0.61
11	0	0.98	0.80	--	--	--	--
11	19	0.38	0.55	0.57	4.68	1.99	0.12
12	0	1.66	0.50	--	--	--	--
12	24	0.53	0.52	0.76	7.48	9.79	0.19
13	0	1.13	0.29	--	--	--	--
14	0	1.25	0.68	--	--	--	--
14	68	0.19	0.20	0.74	8.06	9.98	0.32
15	0	1.01	0.64	--	--	--	--
15	37	0.12	0.19	0.75	6.55	9.55	0.29
16	0	0.82	0.45	--	--	--	--
16	60	0.11	0.25	0.76	6.68	10.31	0.20
17	0	0.46	0.34	--	--	--	--
17	70	0.12	0.31	0.87	10.70	12.63	0.07
18	0	0.65	0.42	--	--	--	--
18	84	0.08	0.18	--	--	--	--
19	0	0.87	0.39	0.24	2.69	0.10	0.05
19	67	0.14	0.35	0.77	7.22	9.55	0.20
20	0	0.89	0.61	0.25	1.87	0.05	0.03
20	16	0.87	0.71	0.33	2.97	0.85	0.07
21	0	1.22	0.70	0.33	1.82	0.05	0.03
22	0	0.66	0.34	0.26	1.23	0.05	0.02
23	0	0.77	0.65	0.26	2.84	0.05	0.35
23	51	0.12	0.37	0.60	4.97	5.68	0.21
24	0	1.34	0.50	0.19	2.28	0.05	0.34
25	54	0.04	0.06	0.79	9.17	11.83	0.34
27	0	0.22	0.21	0.33	1.92	0.24	0.07
28	0	1.05	0.66	0.17	1.74	0.10	0.07
28	5	--	--	0.78	1.87	0.05	0.05
29	0	0.94	0.40	0.25	1.95	0.05	0.08
30	0	0.50	0.37	0.27	2.64	0.57	0.08
30	6	0.84	0.69	0.20	1.54	0.05	0.04
31	0	0.74	0.42	0.29	2.79	1.22	0.10
31	41	0.19	0.45	0.55	4.78	4.28	0.30
32	0	0.54	0.36	0.19	3.06	0.30	0.15
32	29	0.31	0.57	0.60	4.53	4.74	0.32
33	0	0.43	0.36	0.19	2.77	0.38	0.15
33	81	0.11	0.25	0.76	6.58	8.98	0.34
34	0	0.67	0.29	0.20	2.72	0.32	0.14
34	78	0.09	0.37	0.78	8.02	10.29	0.35

CHLOROPHYLL AND NUTRIENT DATA NS1

STA	DEPTH	CHL	PHEO	PO4	SIO4	NO3	NO2
35	0	0.48	0.40	0.19	2.83	0.40	0.16
35	40	0.17	0.29	0.62	5.98	8.20	0.35
36	0	0.43	0.33	0.17	2.12	0.34	0.16
36	20	0.25	0.33	0.45	4.20	3.78	0.29
37	0	0.48	0.34	0.48	4.18	3.82	0.30
37	15	0.28	0.37	0.57	4.10	3.82	0.30
38	0	1.34	1.29	0.42	4.29	3.72	0.30
38	23	0.34	0.40	0.47	4.32	3.71	0.30
39	0	1.03	0.61	0.56	3.63	2.33	0.27
39	42	0.12	0.33	0.73	6.37	8.00	0.38
40	0	0.72	0.33	0.17	2.41	0.33	0.20
40	77	0.06	0.33	0.93	8.31	11.39	0.37
41	0	0.48	0.26	0.25	2.31	0.41	0.22
41	10	0.74	0.50	0.13	2.27	0.40	0.20
41	20	1.15	0.60	0.19	2.45	0.40	0.36
41	30	0.23	0.30	0.44	3.25	4.17	0.43
41	40	0.29	0.36	0.60	4.15	6.72	0.48
41	50	0.08	0.27	0.82	6.00	9.07	0.34
41	75	0.06	0.27	0.93	8.89	12.85	0.24
41	100	0.06	0.19	0.97	11.04	14.78	0.35
42	0	0.38	0.21	0.26	2.83	0.07	0.05
42	118	0.11	0.25	1.01	8.59	11.23	0.21
43	0	1.20	0.22	0.53	4.62	4.42	0.17
44	0	0.87	0.42	0.53	4.37	3.89	0.20
44	70	0.44	0.61	0.61	5.37	5.31	0.21
45	0	0.83	0.62	0.48	3.81	2.94	0.19
45	45	0.58	0.44	0.47	3.79	3.17	0.22
46	0	1.34	0.77	0.63	3.80	1.94	0.10
46	21	0.78	0.53	0.30	3.42	1.56	0.08
47	0	0.85	0.81	0.44	4.22	2.62	0.12
47	28	0.50	0.49	0.39	4.10	2.60	0.11
48	0	2.69	0.75	0.37	2.74	0.90	0.10
48	15	2.23	0.66	0.30	2.72	0.85	0.07
49	36	1.30	0.63	0.42	3.77	2.51	0.16
50	0	1.22	0.36	0.45	3.19	1.90	0.12
50	60	2.41	0.54	0.32	2.60	1.47	0.11
51	0	0.89	0.33	0.31	2.63	1.04	0.04
51	45	1.27	0.34	0.39	2.87	1.51	0.08
52	0	0.98	0.23	0.28	2.53	0.10	0.06
52	40	4.42	1.33	0.39	2.57	1.23	0.06

CHLOROPHYLL AND NUTRIENT DATA NS1

STA	DEPTH.	CHL	PHEO	PO4	SI04	NO3	NO2
53	0	1.32	0.36	0.39	2.24	0.90	0.08
53	43	2.90	0.38	0.31	2.52	0.90	0.05
54	0	0.76	0.16	0.27	2.14	0.05	0.01
54	32	3.01	1.15	0.41	3.45	0.47	0.03
55	0	2.69	0.88	0.29	2.25	0.01	0.01
55	20	6.08	3.74	0.35	2.02	0.05	0.01
56	0	1.30	0.57	0.25	2.10	0.01	0.01
56	27	1.45	0.79	0.28	1.93	0.01	0.02
57	0	1.58	0.63	0.29	2.36	0.24	0.03
57	29	2.28	1.01	0.30	2.81	0.71	0.07
58	0	1.78	0.95	0.29	2.84	0.90	0.04
58	28	1.13	0.85	0.31	2.92	0.99	0.06
60	0	1.08	0.76	0.36	3.81	2.09	0.00
60	8	0.50	0.41	0.49	3.75	2.29	0.11
61	0	0.67	0.40	0.20	3.80	2.43	0.13
62	0	0.36	1.43	0.95	3.90	2.53	0.13
62	16	0.56	0.36	0.93	3.94	2.49	0.11
63	0	1.18	0.61	0.30	3.26	0.41	0.05
63	16	0.46	0.54	0.42	3.97	2.40	0.14
64	0	0.59	0.22	0.18	3.15	0.04	0.03
64	18	0.64	0.52	0.38	3.80	1.84	0.07
65	0	1.34	0.75	0.41	3.44	1.08	0.06
655	0	1.54	0.80	0.49	2.97	0.80	0.06
66	0	1.96	0.72	0.29	2.81	0.67	0.05
66	11	1.09	0.64	0.28	2.91	0.81	0.07
68	0	2.05	0.88	0.27	2.69	0.63	0.07
68	11	0.98	0.74	0.26	2.74	0.63	0.07
70	0	1.66	0.81	0.37	3.34	1.58	0.13
70	11	70.00	11.00	0.32	3.28	1.77	0.12
71	0	1.20	0.67	--	--	--	--
72	0	2.30	1.07	0.35	2.41	0.26	0.17
72	29	1.16	0.85	0.27	2.86	1.02	0.12
73	0	1.60	1.01	0.28	2.39	0.41	0.07
74	0	1.83	0.86	0.25	2.38	0.46	0.08
74	21	1.54	0.96	0.24	2.07	0.27	0.05
75	0	1.39	0.92	0.27	2.37	0.10	0.05
75	18	1.14	0.97	0.29	2.31	0.14	0.08
76	0	1.56	0.78	0.21	2.10	0.14	0.06
76	10	1.05	0.58	0.26	2.52	0.01	0.08
77	0	0.99	0.50	0.23	2.19	0.01	0.01

CHLOROPHYLL AND NUTRIENT DATA NS1

STA	DEPTH	CHL	PHEO	PO4	SIO4	NO3	NO2
77	32	0.82	0.31	0.23	2.27	--	0.07
78	0	1.27	0.37	0.48	5.27	--	0.10
78	50	2.18	0.22	0.35	3.91	--	0.07
79	0	0.72	0.16	0.22	2.31	--	0.05
79	40	2.14	0.13	0.31	3.92	--	0.07
80	0	0.70	0.15	0.26	1.96	--	0.07
80	35	2.33	0.42	0.21	1.83	--	0.04
81	0	0.84	0.32	0.15	2.22	--	0.05
81	35	0.77	0.19	0.33	2.86	--	0.01
82	0	2.39	1.30	0.32	2.64	--	0.04
83	13	1.16	0.64	0.24	2.82	--	0.01
84	0	1.63	0.71	0.19	1.90	--	--
85	0	1.80	0.64	0.77	1.98	--	--
85	26	1.49	0.66	0.21	1.90	--	0.02
855	0	1.94	0.74	0.20	2.75	--	0.04
86	0	3.12	1.16	0.20	3.24	--	0.03
87	0	1.25	0.74	0.20	2.81	--	0.01
87	20	1.39	0.93	0.21	2.68	--	0.04
88	0	2.03	0.81	0.26	2.72	0.24	0.03
88	22	1.45	0.77	0.25	2.91	0.28	0.05
89	0	1.65	0.96	0.22	1.52	--	0.02
90	0	1.61	0.84	0.30	3.35	0.90	0.07
90	5	1.15	0.72	0.32	3.39	0.90	0.08
92	0	1.01	0.52	0.21	1.43	0.05	0.02
94	0	1.06	0.50	0.30	3.52	0.05	0.01
95	0	0.99	0.58	0.34	3.40	0.10	0.03
95	8	0.70	0.41	0.24	2.32	0.10	0.02
96	0	1.22	0.84	0.24	2.05	0.05	0.02
97	0	1.04	0.61	0.26	2.39	0.01	0.01
98	0	1.17	0.74	0.12	1.72	--	--
99	0	1.20	0.82	0.17	0.18	--	--
100	0	1.52	0.98	0.16	1.81	--	--
100	32	1.16	0.58	0.12	1.85	--	--
101	0	1.41	0.82	0.20	1.65	--	--
101	9	0.98	0.63	0.20	1.38	--	--
102	0	1.22	0.79	0.20	1.33	--	0.01
103	0	2.07	0.72	0.24	2.20	--	0.01
103	10	1.67	0.91	0.17	2.09	--	--
104	0	0.83	0.28	0.27	2.34	--	0.01
105	0	1.01	0.21	0.27	2.39	--	0.01

CHLOROPHYLL AND NUTRIENT DATA NS1

STA	DEPTH	CHL	PHEO	PO4	SIO4	NO3	NO2
106	0	1.17	0.31	0.27	2.18	--	0.04
106	36	0.80	0.57	0.32	4.38	--	0.03
107	0	0.78	0.11	0.23	2.33	0.01	0.03
107	30	0.80	0.12	0.27	3.19	0.01	0.03
108	0	0.48	0.23	0.20	2.67	0.01	0.04
108	41	1.00	0.16	0.31	4.62	0.11	0.04
109	0	0.89	0.30	0.28	2.66	0.01	0.04
109	41	1.10	0.12	0.34	5.22	0.06	0.01
110	0	0.74	0.19	0.30	2.25	0.07	0.03
110	33	0.65	0.17	0.33	4.80	0.12	0.06
111	0	0.82	0.26	0.19	2.29	0.17	0.01
111	31	0.64	0.36	0.20	4.23	0.03	0.05
112	0	0.65	0.17	0.13	2.38	0.12	0.01
112	21	0.55	0.27	0.27	4.17	0.01	0.05
113	0	0.65	0.30	0.24	2.22	0.04	0.03
113	23	0.98	0.74	0.33	3.85	0.04	0.05
114	0	0.58	0.36	0.11	1.44	0.04	0.03
115	0	0.62	0.40	0.02	1.13	0.05	0.04
115	8	0.98	0.63	0.19	1.54	0.05	0.04
116	0	0.44	0.19	0.12	1.73	0.04	0.01
116	17	1.00	1.01	0.20	2.81	0.09	0.01
117	0	0.60	0.21	0.08	2.60	0.08	0.02
117	19	1.69	0.84	0.27	3.57	0.08	0.02
118	0	0.65	0.20	0.27	2.75	0.13	0.05
118	17	1.25	0.75	0.32	4.18	0.13	0.04
119	0	0.53	0.41	0.17	3.15	0.12	0.01
120	0	0.48	0.13	0.16	2.79	0.12	0.01
121	0	0.62	0.25	0.15	2.70	0.12	0.01
122	0	0.50	0.23	0.13	1.28	0.07	0.01
123	0	0.43	0.19	0.24	2.74	0.12	0.01
124	0	0.60	0.21	0.20	2.89	0.12	0.02
125	0	0.79	0.37	0.20	2.17	0.11	0.03
126	0	0.62	0.20	0.21	2.17	0.11	0.03
127	0	0.42	0.25	0.26	2.22	0.11	0.03
128	0	0.48	0.26	0.23	1.65	0.11	0.03
128	24	1.01	0.66	0.31	3.44	0.35	0.07
129	0	0.43	0.23	0.21	1.85	0.10	0.03
129	0	0.80	0.57	0.41	4.15	0.34	0.06
130	0	0.91	0.45	0.36	2.21	0.10	0.06
131	0	1.06	0.87	0.41	2.56	0.10	0.05

Table 3

NSB CHLOROPHYLL AND NUTRIENT DATA - September '78

STA	DEPTH	CHL	PHEO	PO4	SIO4	NO3	NO2
10	0	1.71	0.66	0.42	0.71	0.38	0.26
10	52	0.09	0.22	0.99	10.71	11.17	0.10
11	0	3.43	0.62	0.46	1.48	0.58	0.09
12	0	1.71	0.56	0.35	1.43	0.19	0.24
12	42	0.26	0.45	0.79	7.15	7.70	0.10
13	0	2.31	0.52	0.59	0.98	0.24	0.12
13	0	1.71	0.81	0.39	1.03	0.19	0.12
15	0	1.58	0.44	0.38	0.52	0.14	0.11
15	99	0.04	0.11	1.13	11.08	14.33	0.11
16	0	0.74	0.76	0.27	0.88	0.28	0.11
16	10	0.69	0.43	0.24	0.68	0.14	0.10
17	0	0.64	0.27	0.40	0.84	0.28	0.17
18	0	2.53	1.06	0.50	0.84	0.33	0.14
18	109	0.02	0.05	3.40	13.18	16.09	0.15
19	0	1.32	0.46	0.43	0.64	0.33	0.16
19	116	0.09	0.12	1.57	11.10	13.79	0.12
20	0	1.88	0.64	--	0.88	0.90	0.19
20	44	1.71	1.32	0.42	1.80	1.27	0.17
21	0	--	--	0.51	1.31	0.66	0.10
22	0	1.76	0.47	0.41	0.85	0.33	0.09
23	0	1.14	0.41	0.23	0.68	0.24	0.11
23	61	0.09	0.12	0.66	4.94	6.35	0.08
25	0	0.90	0.42	--	0.60	2.29	0.07
25	51	0.09	0.22	1.72	5.17	7.39	0.08
26	0	1.16	0.56	0.41	1.50	0.59	0.14
26	11	0.34	30.00	0.31	1.66	0.79	0.22
28	0	3.21	1.08	0.39	0.32	0.28	0.20
28	3	4.71	1.35	0.56	0.30	0.24	0.15
230	0	1.37	0.55	0.23	0.47	0.55	0.38
31	0	1.35	0.54	0.20	0.35	0.22	0.11
31	39	0.10	0.38	0.68	4.38	5.79	0.20
32	0	0.26	0.15	0.25	0.70	0.34	0.12
32	54	0.09	0.07	0.47	4.40	3.86	0.05
33	0	0.69	0.53	0.23	0.69	0.48	0.15
33	145	0.05	0.07	0.97	9.54	11.35	0.14
34	0	0.81	0.35	0.25	0.59	0.33	0.14
35	0	0.90	0.46	--	--	--	--
35	38	0.04	0.06	0.97	9.08	11.79	0.14
36	0	1.88	1.45	0.36	2.26	0.89	0.10
37	0	1.48	0.79	0.53	3.86	3.17	0.21

NS3 CHLOROPHYLL AND NUTRIENT DATA

STA	DEPTH	CHL	PHEO	PO4	SIO4	NO3	NO2
37	19	1.71	0.81	0.56	3.50	3.29	0.23
38	0	2.92	1.06	0.49	4.36	2.49	0.17
39	0	1.76	0.97	0.64	4.33	4.88	0.22
39	21	1.54	0.84	0.58	15.68	7.14	0.22
40	0	1.46	0.82	0.35	2.82	0.85	0.12
41	0	0.51	0.30	0.20	1.93	0.12	0.07
41	10	0.94	0.62	0.25	2.07	0.16	0.08
42	0	1.62	0.60	0.56	4.50	3.96	0.32
43	0	0.43	1.39	0.55	4.06	4.26	0.28
43	57	0.30	0.51	0.65	5.47	6.60	0.18
44	0	0.75	0.45	2.73	3.51	4.59	0.19
45	0	1.50	0.57	0.52	3.82	4.26	0.24
45	25	0.86	0.61	0.38	3.52	4.18	0.14
46	0	1.03	0.67	0.48	2.86	3.33	0.19
47	0	1.70	0.86	0.59	3.55	4.02	0.26
47	22	1.63	0.90	0.58	3.69	4.02	0.26
48	0	1.80	1.13	0.98	1.51	2.12	0.22
49	0	1.71	0.76	0.84	2.68	2.91	0.37
49	42	1.13	0.70	0.80	3.10	2.91	0.37
51	0	0.86	0.46	0.89	1.74	0.93	0.19
51	57	--	--	0.52	2.65	1.91	0.27
52	0	1.11	0.55	0.34	1.67	0.21	0.08
53	0	0.86	0.46	0.47	2.82	2.57	0.31
53	46	--	--	0.52	9.04	4.46	0.34
54	0	1.84	0.94	0.41	1.32	2.01	0.22
55	0	3.60	1.26	0.32	0.96	1.30	0.22
55	35	2.06	1.08	0.43	1.78	1.91	0.34
56	0	2.70	0.49	0.45	3.00	2.51	0.35
57	0	1.42	0.52	0.20	0.82	0.25	0.07
57	30	0.54	0.63	0.66	5.02	4.69	0.44
58	0	0.75	0.36	0.32	1.62	0.43	0.12
59	0	0.86	0.40	0.28	1.56	0.23	0.08
59	45	0.56	0.40	0.63	5.35	4.66	0.42
60	0	2.57	1.47	0.46	1.76	1.27	0.31
61	0	1.76	0.97	0.49	2.05	1.25	0.22
61	28	1.63	1.51	0.48	1.95	1.20	0.25
62	0	1.89	0.98	0.50	2.37	2.23	0.33
63	0	1.84	0.89	0.49	2.70	2.66	0.22
63	25	1.67	1.16	0.57	3.24	2.94	0.26
64	0	2.34	1.27	0.50	1.74	1.88	0.24

NS3 CHLOROPHYLL AND NUTRIENT DATA

STA	DEPTH	CHL	PHEO	PO4	SIO4	NO3	NO2
65	0	2.36	1.44	0.67	1.51	1.95	0.25
66	0	2.87	1.33	0.53	1.04	1.18	0.19
66	12	1.67	1.41	0.54	1.32	1.37	0.24
67	0	2.86	1.33	0.45	1.59	0.88	0.15
68	0	2.04	2.01	0.42	1.96	0.98	0.17
68	17	1.93	1.36	0.58	14.69	7.40	0.35
69	0	0.86	0.41	0.47	3.19	1.87	0.15
70	0	1.20	0.52	0.23	1.23	0.53	0.09
70	11	0.69	0.53	0.64	5.10	5.42	0.20
71	0	1.07	0.50	0.51	3.62	3.88	0.22
72	0	1.20	0.62	0.42	4.68	4.99	0.21
72	9	0.77	0.49	0.42	3.09	3.41	0.14
73	0	2.31	1.02	0.48	2.84	2.05	0.18
74	0	2.30	1.77	0.33	1.49	0.54	0.10
74	7	2.48	1.66	0.26	1.21	0.37	0.10
75	0	2.27	1.12	0.38	0.48	0.48	0.13
76	0	1.34	1.15	0.56	1.19	0.83	0.18
76	7	0.94	1.08	0.39	0.61	0.51	0.13
77	0	2.06	1.58	0.55	1.78	1.79	0.24
78	0	2.78	1.01	0.48	1.88	1.43	0.22
79	0	2.78	1.01	0.40	1.51	0.61	0.11
80	0	2.36	1.54	0.44	1.88	0.70	0.12
80	23	1.70	0.97	0.43	14.11	4.09	0.24
81	0	2.14	0.97	--	--	--	--
82	0	1.18	0.60	0.30	1.69	0.16	0.07
82	30	0.52	0.59	0.67	5.77	3.84	0.47
83	0	0.37	0.18	0.18	2.77	0.55	0.10
84	0	1.80	0.93	0.45	1.40	1.16	0.53
85	0	2.14	0.89	0.51	1.61	0.35	0.12
86	0	1.71	1.32	0.42	1.21	0.25	0.08
87	0	2.14	0.89	0.37	0.20	0.25	0.08
88	0	1.58	0.94	0.38	0.51	0.25	0.09
89	0	2.31	1.53	0.32	0.42	0.20	0.08
90	0	1.76	1.23	0.19	0.88	0.35	0.09
91	0	3.08	1.36	0.26	0.07	0.15	0.08
92	0	3.86	1.20	0.92	2.73	2.61	0.20
93	0	3.00	1.55	0.72	0.80	0.20	0.09
94	0	2.30	1.25	0.79	1.98	0.39	0.09
95	0	2.23	1.21	0.48	1.02	0.15	0.06
96	0	1.97	0.98	0.74	9.29	1.92	0.14

NS3 CHLOROPHYLL AND NUTRIENT DATA

STA	DEPTH	CHL	PHEO	PO4	SIO4	NO3	NO2
97	0	2.52	1.41	0.42	0.11	0.24	0.11
98	0	2.59	1.27	0.61	0.89	0.29	0.11
99	0	2.66	1.29	0.58	0.54	0.24	0.08
100	0	2.31	1.02	0.70	0.54	0.34	0.11
101	0	1.46	0.77	0.50	0.24	0.19	0.07
102	0	1.62	0.75	0.47	0.63	0.17	0.07
103	0	1.93	1.10	0.44	1.15	0.24	0.09
103	13	2.23	0.96	0.34	1.18	0.17	0.08
104	0	2.40	1.34	0.18	1.83	0.29	0.09
105	0	0.56	0.35	0.13	1.25	0.32	0.08
105	28	1.37	0.85	0.48	4.57	1.53	0.32
106	0	0.32	0.06	0.35	2.23	0.48	0.12
107	0	0.19	2.00	0.18	1.13	0.24	0.10
107	39	0.19	0.38	0.52	7.00	3.83	0.44
108	0	0.81	0.57	0.29	1.94	0.28	0.09
109	0	1.08	0.43	0.29	1.84	0.15	0.08
109	41	--	--	0.85	13.10	8.26	0.68
110	0	0.69	0.48	0.33	1.82	0.23	0.11
111	0	0.52	0.40	--	2.24	--	0.11
111	7	0.69	0.33	0.36	2.34	--	0.10
112	0	1.11	0.50	0.39	1.43	--	0.10
113	0	1.74	0.89	0.53	2.20	--	0.13
113	24	1.63	1.10	0.62	4.72	--	0.24
114	0	2.18	1.42	0.84	0.92	--	0.13
115	0	1.63	1.10	0.68	2.65	--	0.10
115	14	0.73	1.50	0.28	2.19	--	0.11
116	0	2.13	1.37	0.36	0.97	--	0.08
117	0	1.18	0.47	0.33	1.42	--	0.12
117	13	1.20	0.52	0.34	0.96	--	0.11
118	0	0.56	0.20	--	--	--	--
120	0	0.98	0.63	0.37	1.04	--	0.10
0	0	--	--	--	--	--	--
0	0	--	--	--	--	--	--
0	0	--	--	--	--	--	--
0	0	--	--	--	--	--	--

Table 4

NS4 CHLOROPHYLL AND NUTRIENT DATA - January '79

STA	DEPTH	CHL	PHEO	PO4	SIO4	NO3	NO2
1	0	2.60	1.15	0.76	1.34	2.12	0.14
2	0	6.19	0.62	0.71	0.79	0.85	0.09
3	0	5.78	1.04	0.86	0.37	0.15	0.06
4	0	6.60	2.16	0.62	0.61	0.25	0.07
5	0	7.43	1.34	0.74	2.32	2.19	0.14
6	0	3.71	0.67	1.19	3.55	4.96	0.20
7	0	1.28	0.43	0.96	4.60	6.67	0.20
8	0	1.16	0.31	1.10	6.01	8.46	0.20
9	0	1.24	0.42	0.99	3.85	5.69	0.17
10	0	2.56	1.24	1.09	5.12	7.35	0.24
11	0	5.78	1.53	0.98	2.37	3.24	0.18
12	0	9.90	1.78	0.61	0.56	0.27	0.08
13	0	4.95	0.89	0.61	0.00	0.11	0.06
14	0	4.13	0.74	0.76	0.00	0.14	0.06
15	0	6.19	1.11	0.64	0.00	0.32	0.07

NS4 CHLOROPHYLL AND NUTRIENT DATA

STA	DEPTH	CHL	PHEO	PO4	SIO4	NO3	NO2
11	0	1.24	0.33	1.03	6.61	8.35	0.32
13	0	0.39	0.12	1.12	10.05	12.99	0.15
14	0	0.26	0.15	0.96	8.56	10.45	0.08
21	0	0.69	0.23	0.84	7.02	8.60	0.19
22	0	1.07	0.29	0.99	8.05	9.51	0.20
23	0	0.73	0.28	0.78	7.59	6.20	0.13
24	0	0.21	0.04	1.09	9.28	11.85	0.22
25	0	0.60	0.21	0.93	7.02	8.83	0.18
26	0	0.86	0.36	0.76	6.46	7.48	0.20
27	0	0.77	0.64	0.70	4.20	5.05	0.12
28	0	1.37	1.21	1.13	7.23	10.10	0.28
29	0	1.03	0.49	1.20	8.05	10.72	0.23
30	0	0.56	0.25	0.76	4.10	5.37	0.12
32	0	0.39	0.17	0.71	6.66	6.82	0.15
33	0	0.31	0.13	0.66	4.46	5.72	0.14
34	0	0.43	0.13	1.02	8.05	11.20	0.21
35	0	0.47	0.24	0.88	5.84	7.42	0.17
36	0	0.47	0.09	0.78	5.48	7.32	0.18
37	0	0.86	0.56	0.85	4.97	7.02	0.18
39	0	0.47	0.44	0.92	6.36	8.56	0.15
40	0	0.51	0.09	1.19	3.63	12.35	0.26
41	0	0.41	0.13	1.21	4.36	13.01	0.15
42	0	0.21	0.04	1.19	4.15	12.96	0.17
43	0	0.34	0.16	0.82	4.07	12.69	0.20
45	0	0.46	0.25	0.93	7.86	12.39	0.18
46	0	0.56	0.40	0.76	5.58	9.16	0.19
51	0	0.56	0.41	0.87	7.11	11.30	0.25
52	0	1.03	0.49	0.85	5.78	9.15	0.21
53	0	0.26	0.25	0.60	5.00	8.15	0.20
54	0	--	--	0.82	7.03	11.19	0.23
55	0	1.29	1.04	0.89	5.74	9.83	0.27
56	0	1.30	1.03	1.04	4.33	7.59	0.22
57	0	4.46	1.10	0.26	0.00	0.45	0.10
58	0	6.00	1.59	0.22	0.23	0.37	0.09
59	0	4.93	1.14	0.65	0.00	0.23	0.09
60	0	4.50	1.57	0.41	0.00	0.15	0.07
61	0	3.43	1.63	0.60	0.00	1.31	0.13
62	0	1.20	0.32	0.86	7.19	10.88	0.25
63	0	1.20	0.47	0.77	5.99	9.03	0.20
64	0	1.54	0.68	0.92	5.93	8.86	0.29

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16. Abstracts

Six cruises were made from May, 1978 to May, 1979 to measure the regional distributions of chlorophyll, silicate, nitrate and nitrite, phosphate, temperature, and salinity in the vicinity of Nantucket Shoals on the New England continental shelf. A summary of the hydrographic observations made on the first three cruises has already been presented in Limeburner and Beardsley (1979). A summary of the biological data obtained on five of the six cruises and the hydrographic observations made during the last three cruises is presented here in graphic form.

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