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Investigations in the Georges Bank Area in October/November of 1973, 1974 and 1975

by

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Introduction

The Georges Bank (GB), situated on the East-American Shelf between 40° - 42° N and 66° - 71° W, is found to have a mean depth of about 100 m. In its central part, throughout one third of the total area, depths are only between 40 m and 60 m. The Continental Slope separates the GB in the south and east from the open Atlantic. To the north of the GB there are several deep basins with depths down to almost 400 m which partly are connected with the open Atlantic through the North-East Channel.

Due to intense mixing processes between three water masses, the Coastal Water, the Slope Water and the Gulf Stream Water, the hydrographic parameters in this area show important fluctuations. Any one of these three water masses on the GB may replace the others or at least strongly influence them.

During three cruises devoted to fishery-biological studies the hydrographic conditions on the GB were determined on stations selected by ICNAF. Table 1 gives a survey of the observational periods and the number of stations and samples, respectively.

Table 1

Ship	Time Interval	Number of Stations	Number of Probes
FRV "WALTHER HERWIG"	28/10 - 8/11/73	126	190
FRV "ANTON DOHRN"	16/11 - 23/11/74	76	278
FRV "ANTON DOHRN"	1/11 - 15/11/75	136	826

In addition to Nansen bottles, bathythermographs were used on the stations and, in 1973, an STD probe was occasionally employed.

In 1975, observations were extended over the Continental Slope region and oxygen determinations (not shown here) were undertaken.

Fig. 1 shows the ICNAF stations and several depth contours in the area of investigations.

Hydrographic Situations

Figs. 2 through 7 (a - c) show the horizontal distributions of temperatures and salinities in three depth horizons. During the three years of observations in the GB area a relatively steady increase of surface temperature from about 10° C to 13° C in the

northern part and to 14°C in the southern part was observed above the 100m contour. Adjacent to this area there is a transition zone to the Slope Water where the temperature rose to about 18°C. A warmer area in the middle of the GB was conspicuous during the three years of observations. In 1973 and 1975, this warmer area could be recognised as an isolated core early in November whereas, in mid-November 1974, with generally somewhat lower temperatures over the bank, there was still a connection to the west. Salinities on the GB were generally between 32‰ and 32.5‰. As with temperature, a convergence zone is observed on the Slope where the salinity rose to 36‰.

To the west and south of Nova Scotia there was a flow of low saline ($S < 30.5‰$) and relatively cold water towards the south-west, in the direction to the GB.

The distribution of temperature and salinity at a depth of 30 m (graphs were drawn for specific fishery-biological purposes) generally depart only slightly from the surface distributions, as the mixed layer has a thickness of more than 30 m in almost all parts.

The distributions of temperature and salinity shown in figs. 4a-c and 7a-c are only comparable for depths down to 100 m. While for the years 1973 and 1974 the distributions near the bottom are shown (figs. 4a,b; 7a,b), the 1975 values are given for depths of 100 m. It is only for depths of less than 100 m that the near bottom values have been included in the 1975 data for the purpose of completion. During the three years of investigations the hydrographic conditions on the GB differed only slightly from each other. Where differences occur the causes cannot be explained by means of the observed data. Due to the very short intervals of observations the differences appear to be occasional rather than systematic.

Figs. 8a, b and 9a, b show temperature sections from the years 1973 and 1975 running over the bank from south to north. In figs. 10a, b and 11a, b the salinity is shown for the same sections.

The transition from the warmer high saline Slope Water at the southern edge of the bank to the coastal water on the GB can be seen where the water column was thoroughly mixed. To the north of the bank temperature decreases with depth. At depths of about 100 m a temperature minimum of less than 6°C was observed in both years.

T-S Relations

In fig. 12 a scatter diagram of all hydrographic casts is shown as a T-S relation. The number of pairs of data amounts to 1085. The values are within the following limits:

- A Gulf Stream Water (surface)
- B Intermediate Slope Water (< 75 m)
- C Mid-Depth Slope Water
- C' Deeper Slope Water/North Atlantic Deep Water
- D Shelf Water (bottom)
- E Shelf Water (surface)
- E' Nova Scotian Current Water

The scatter diagram depending on the seasons is bounded by the curve which is formed by the Slope Water and the North Atlantic Deep Water. It indicates an upper limit for the salinity at a given temperature in this area. The other boundary values vary with the seasons, but appear to differ only slightly in the autumns of the three years of investigations.

The scatter diagram shows that the Deeper Slope Water is not directly responsible for the horizontal mixing process in this area. Only through the vertical mixing with the Mid-Depth Slope

Water does the Deeper Slope Water have a stabilising effect. The shape of the scatter diagram (between A and E) also suggests that no linear mixing occurs between the Shelf Water and the Gulf Stream Water.

References

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|----------------|--------|--|
| Hachey, H.B. | (1961) | Oceanography and Canadian Atlantic Waters. Fish.Res.Bd. Canada, Bull.No.134. |
| Hayes, R.M. | (1975) | Oceanographic Observations Nova Scotia to Cape Hatteras, North Carolina (Oct.-Nov.1969 and May-June 1970). Oceanogr.Report No. C G 373-66 US Coast Guard Oceanogr.Unit. Washington, D.C. |
| McLellan, H.J. | (1954) | Temperature, Salinity Relations and Mixing on the Scotian Shelf. Fish.Res.Bd.Canada, II(4),1954 |
| Miller, A.R. | (1950) | A Study of Mixing Processes over the Edge of the Continental Shelf. J. of Mar.Res. IX,2,1950. |

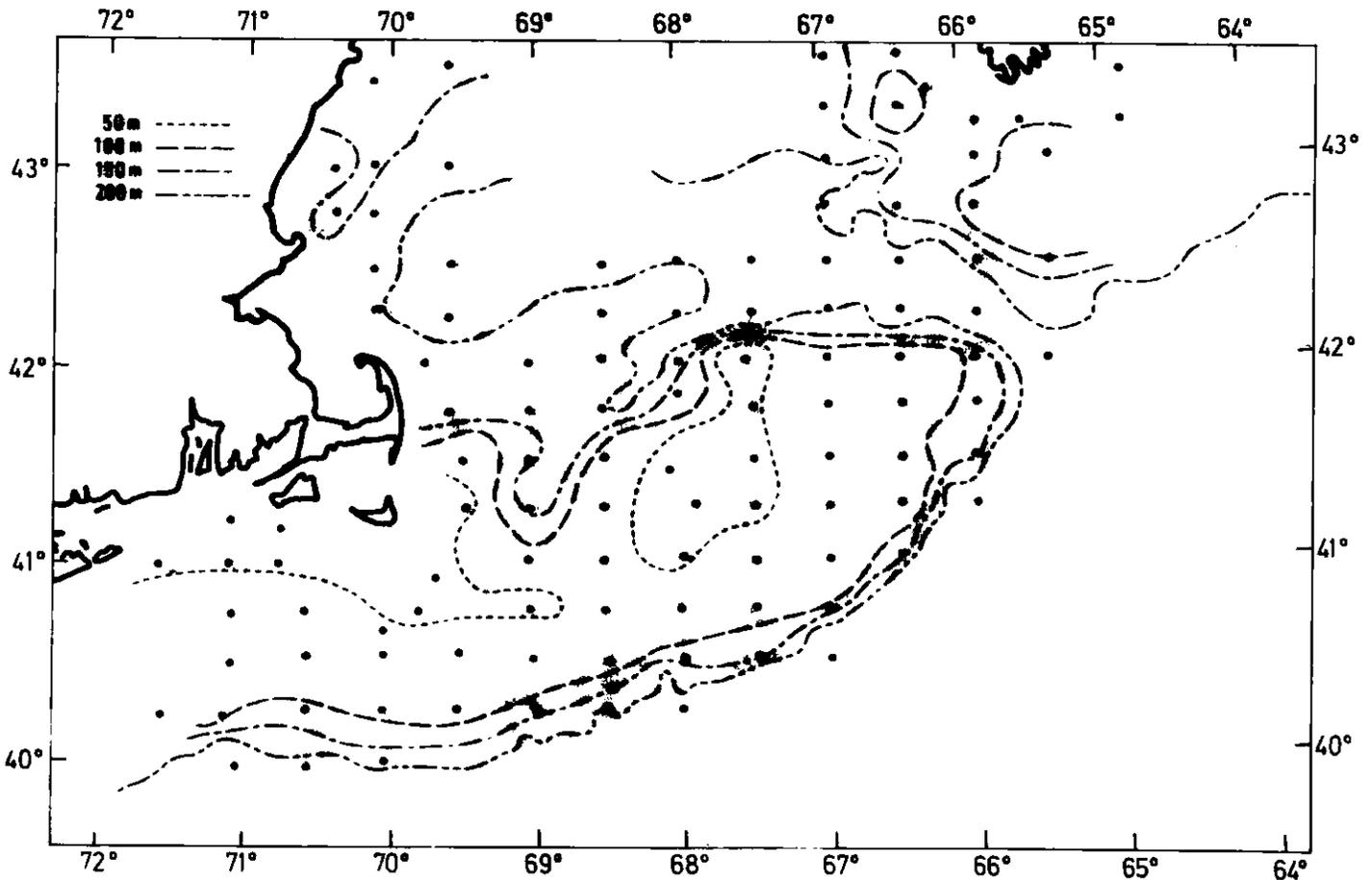


Figure 1. Depth Contours and Locations of ICNAF Stations

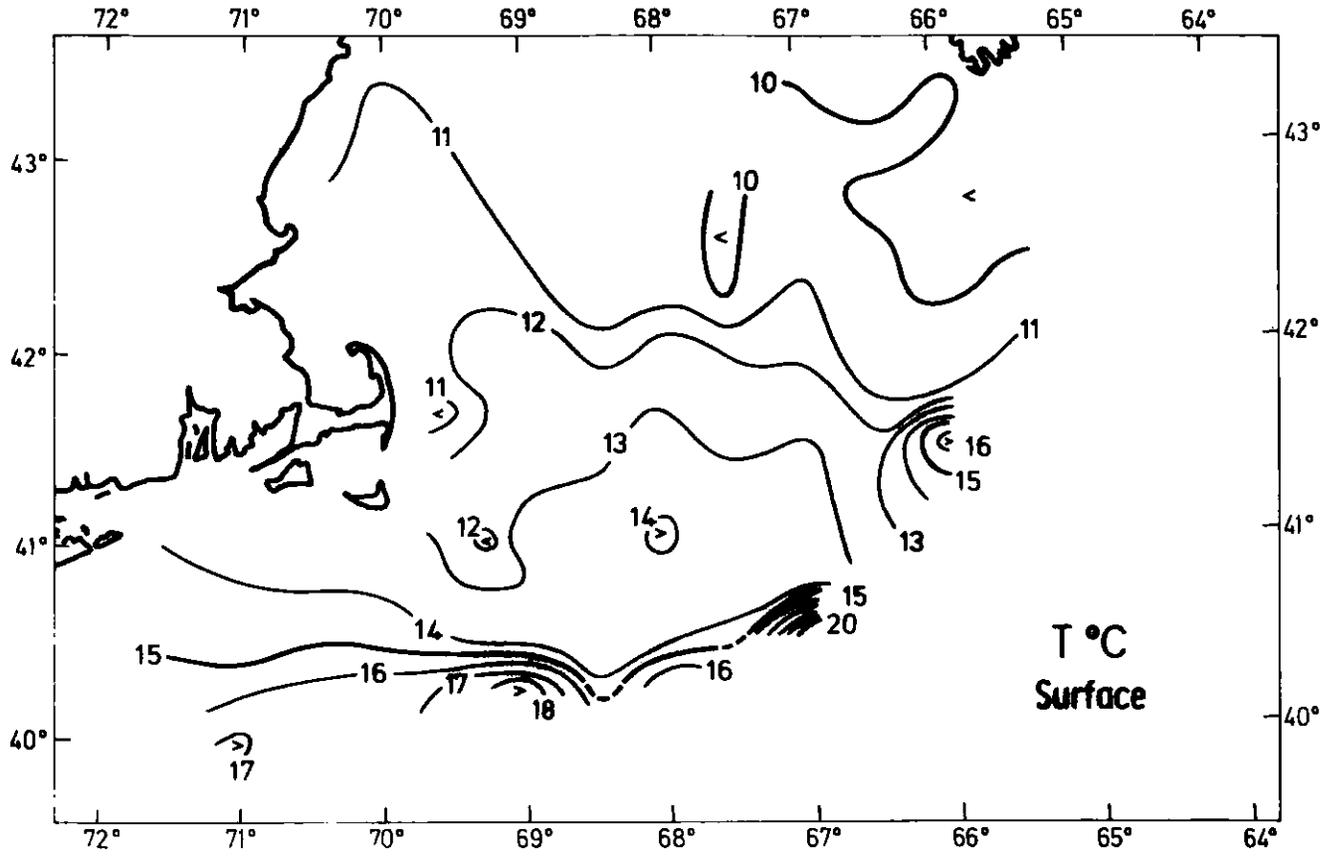


Figure 2a: Distribution of Surface Temperature Oct/Nov 1973

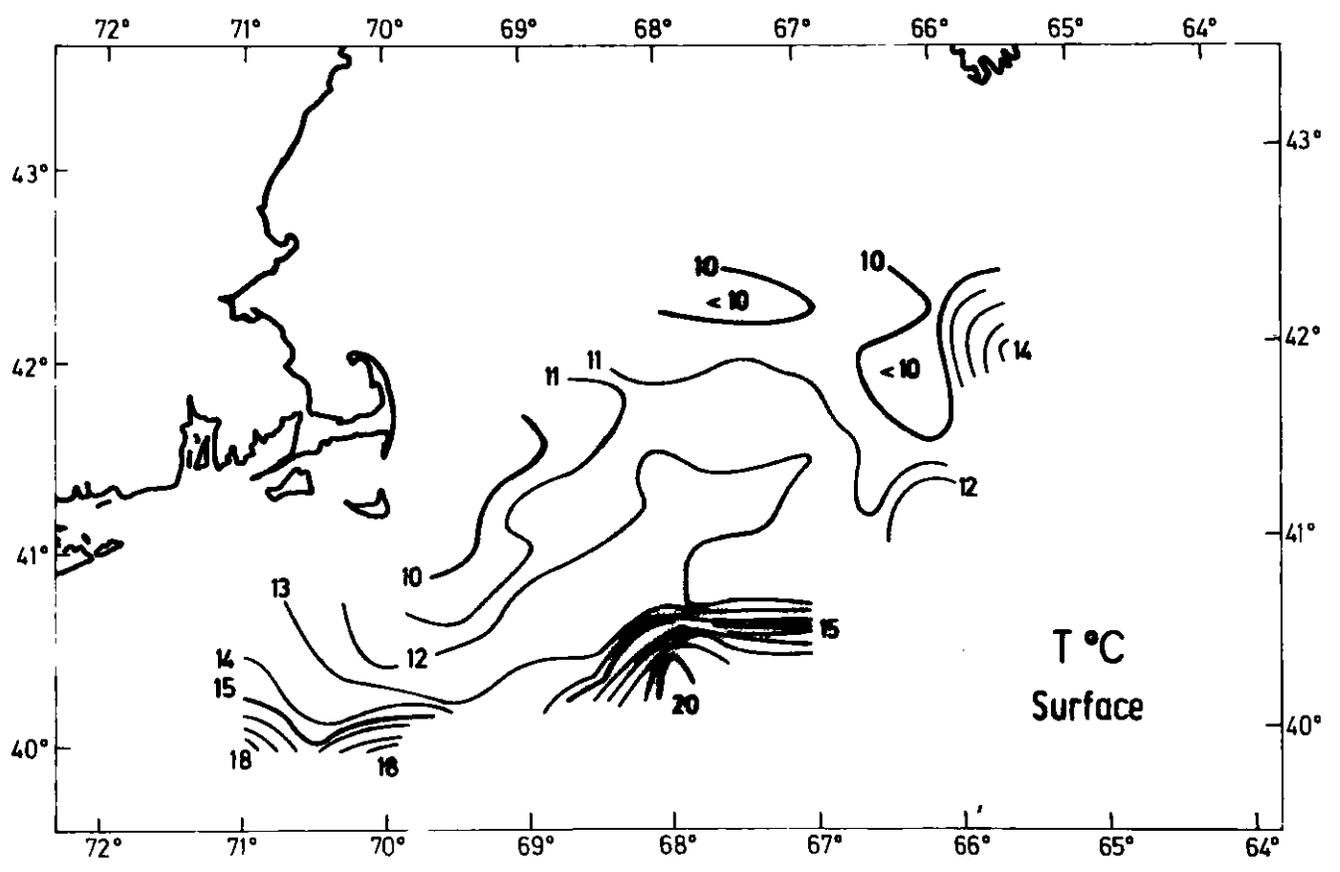


Figure 2b. Distribution of Surface Temperature Nov. 1974

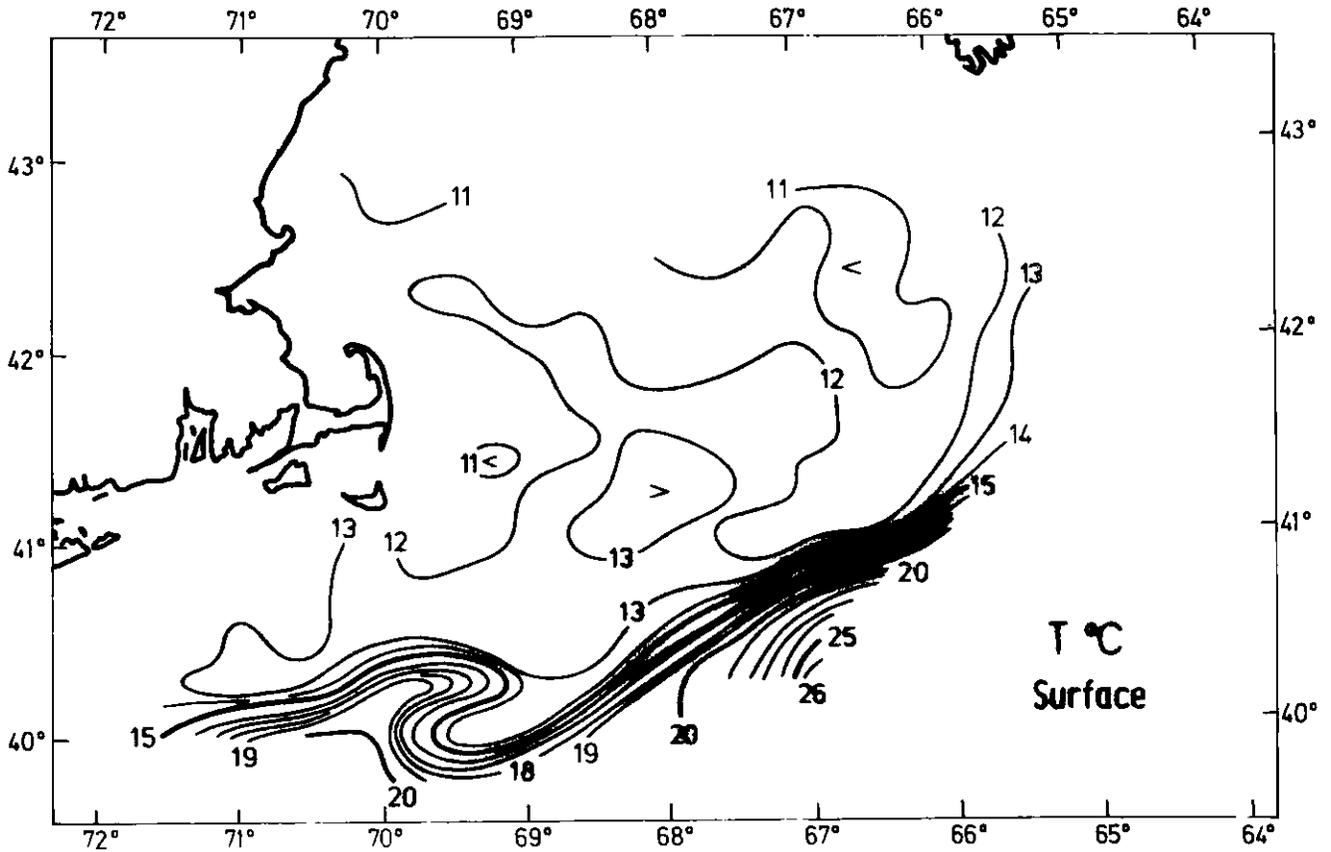


Figure 2c. Distribution of Surface Temperature Nov. 1975

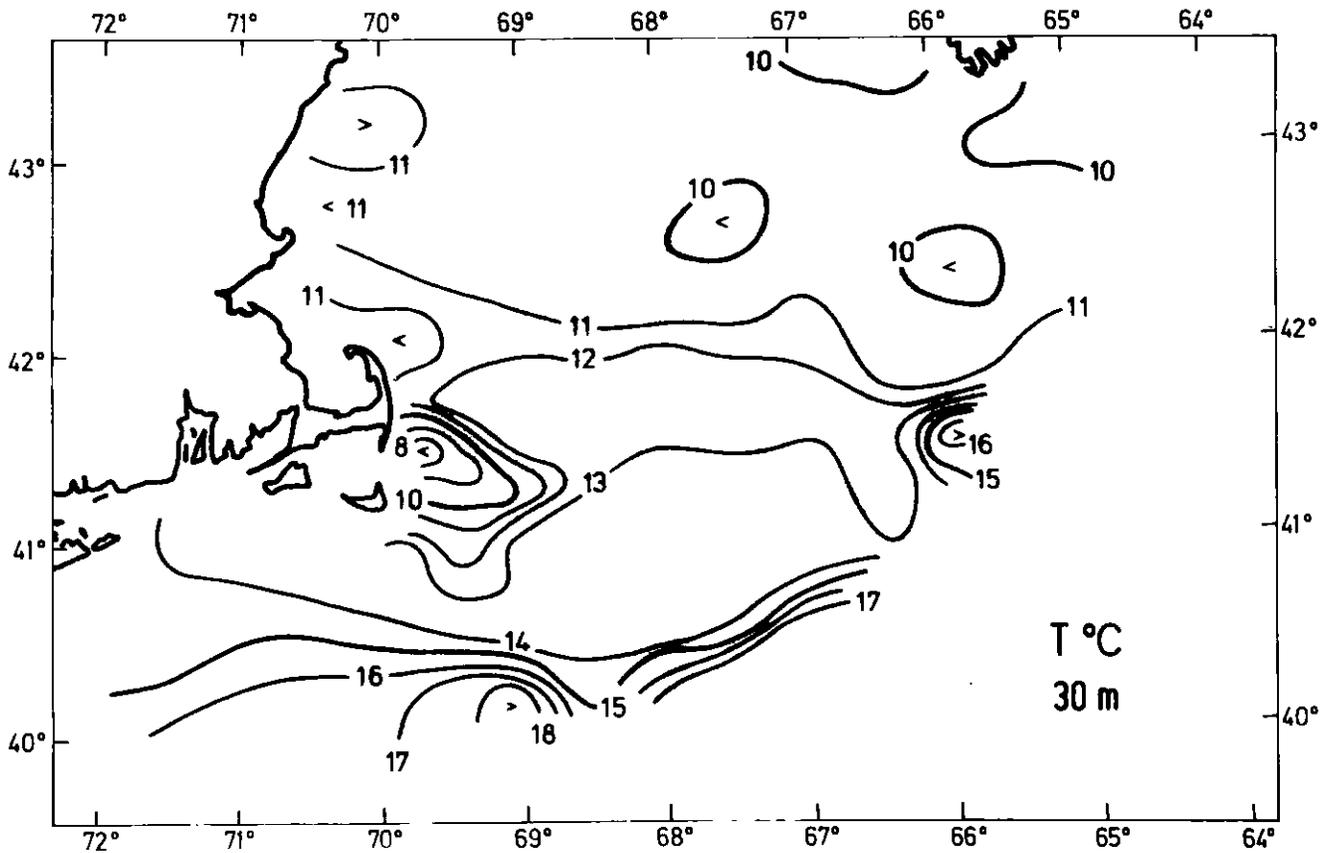


Figure 3a. Distribution of Temperature at 30 m Depth, Oct/Nov 1973

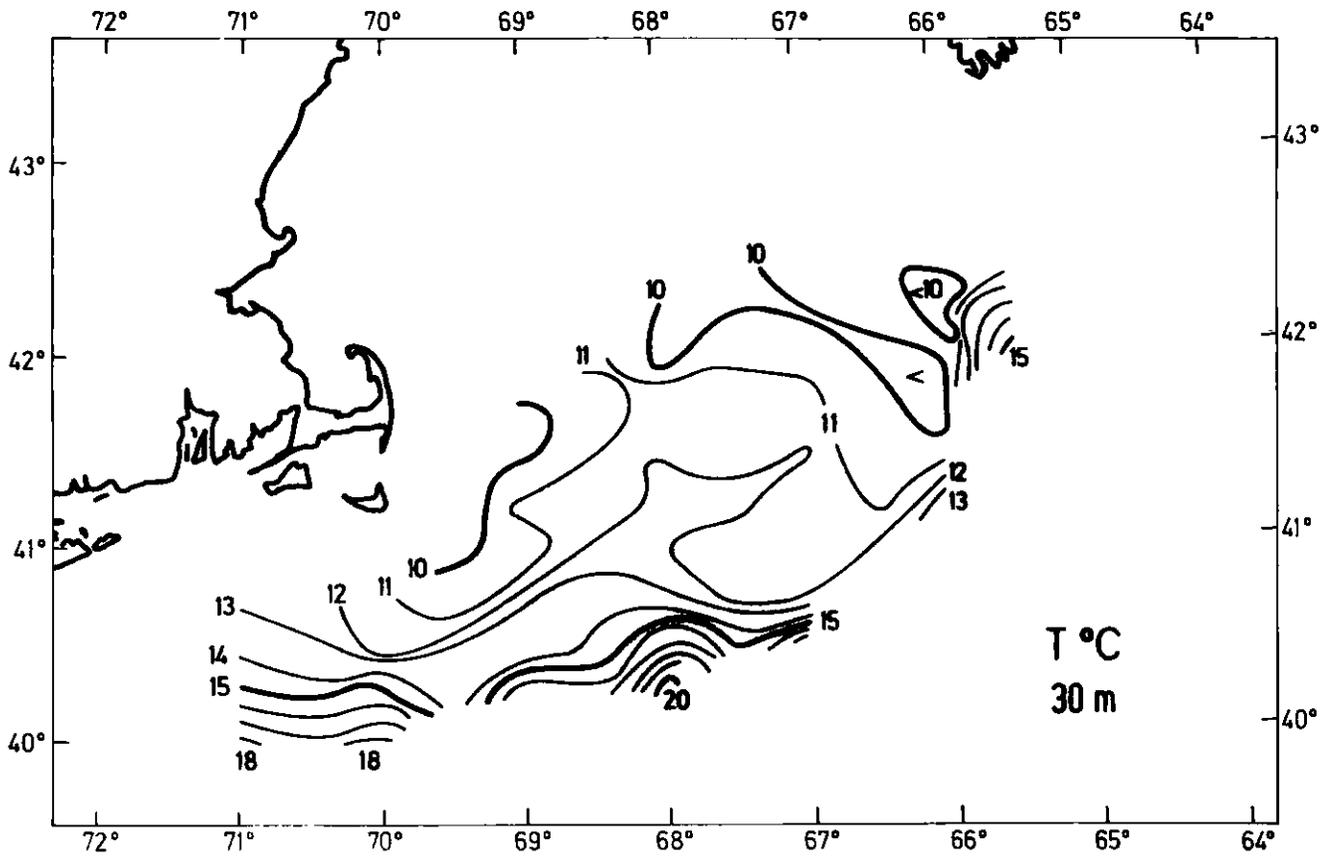


Figure 3b. Distribution of Temperature at 30m Depth, Nov. 1974

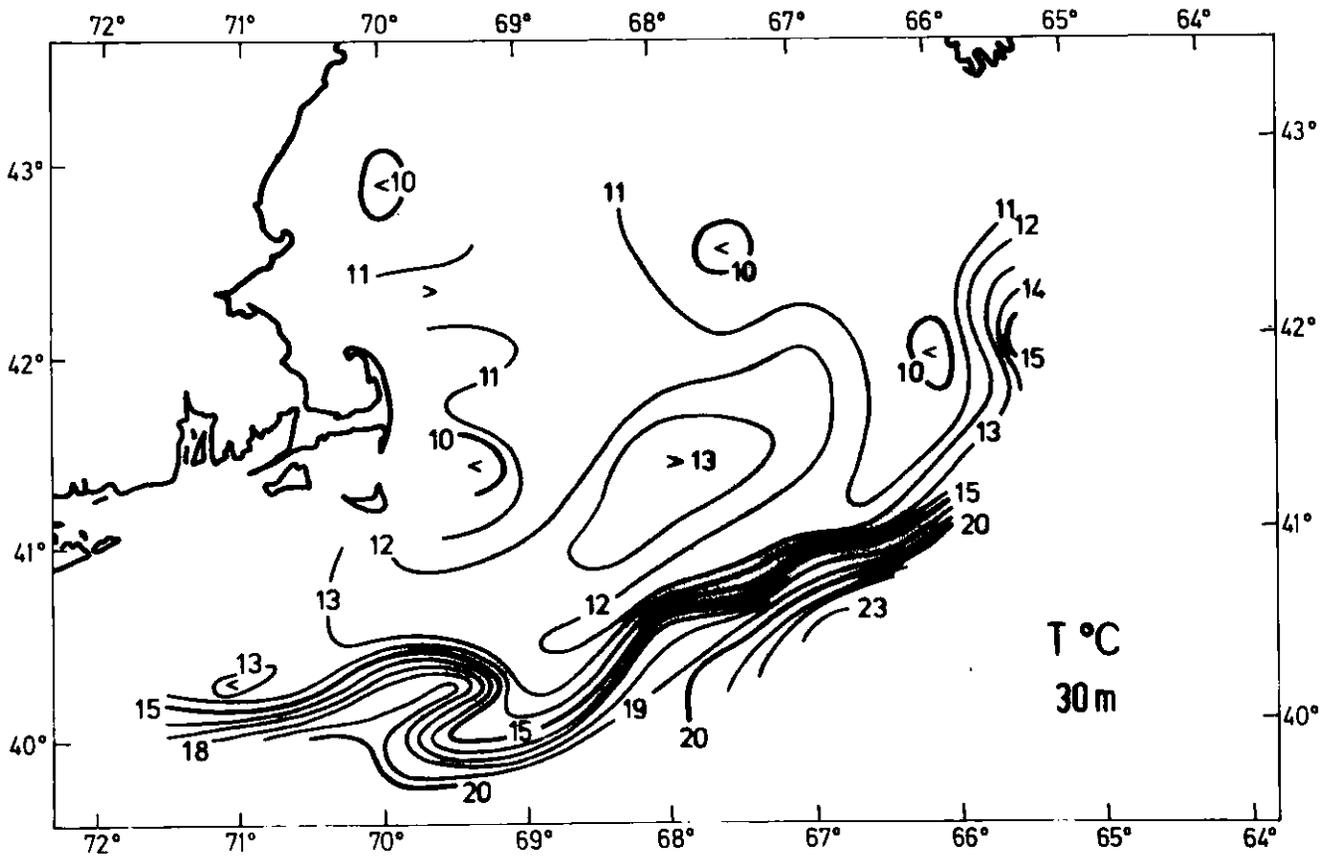


Figure 3c. Distribution of Temperature at 30m Depth, Nov. 1975

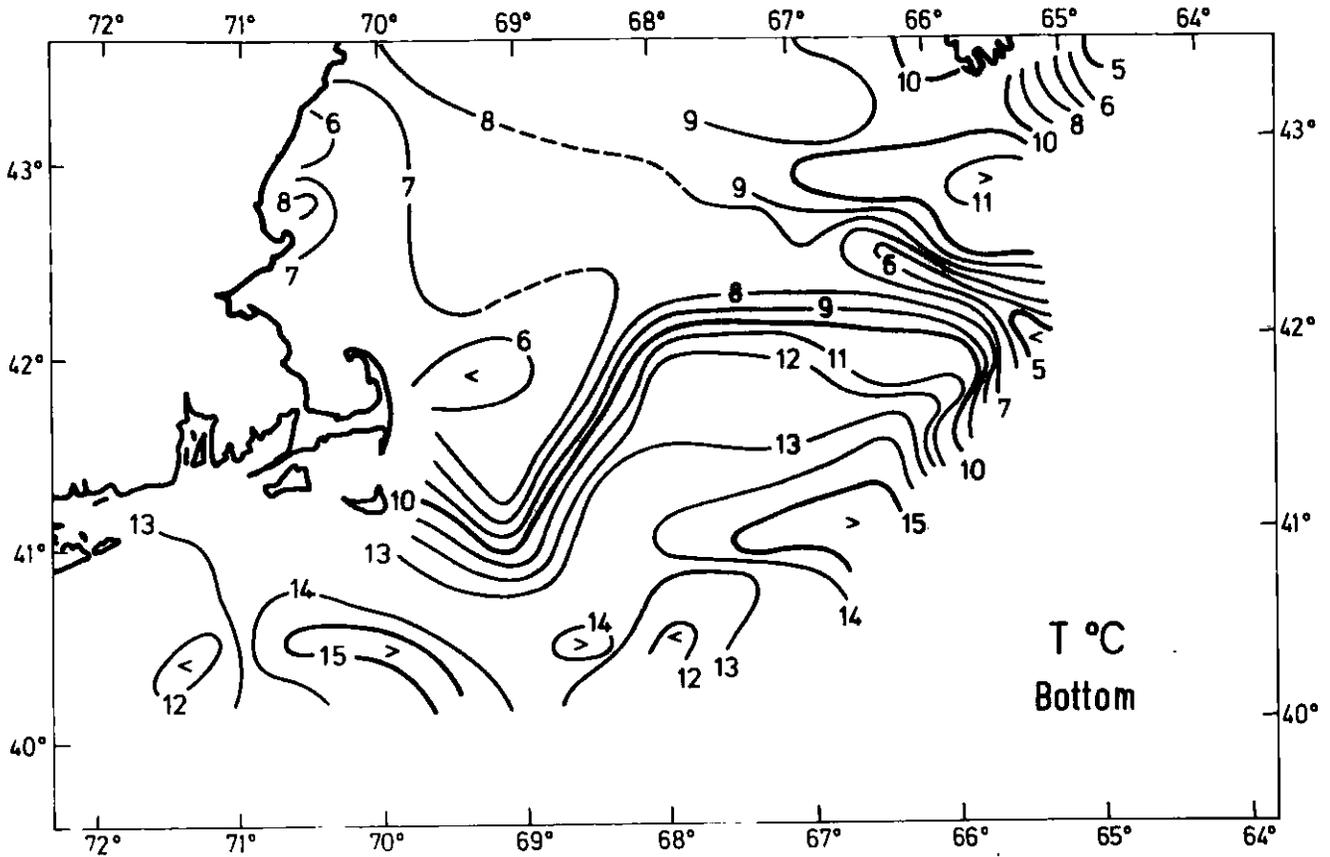


Figure 4a. Near Bottom Temperature, Oct/Nov 1973

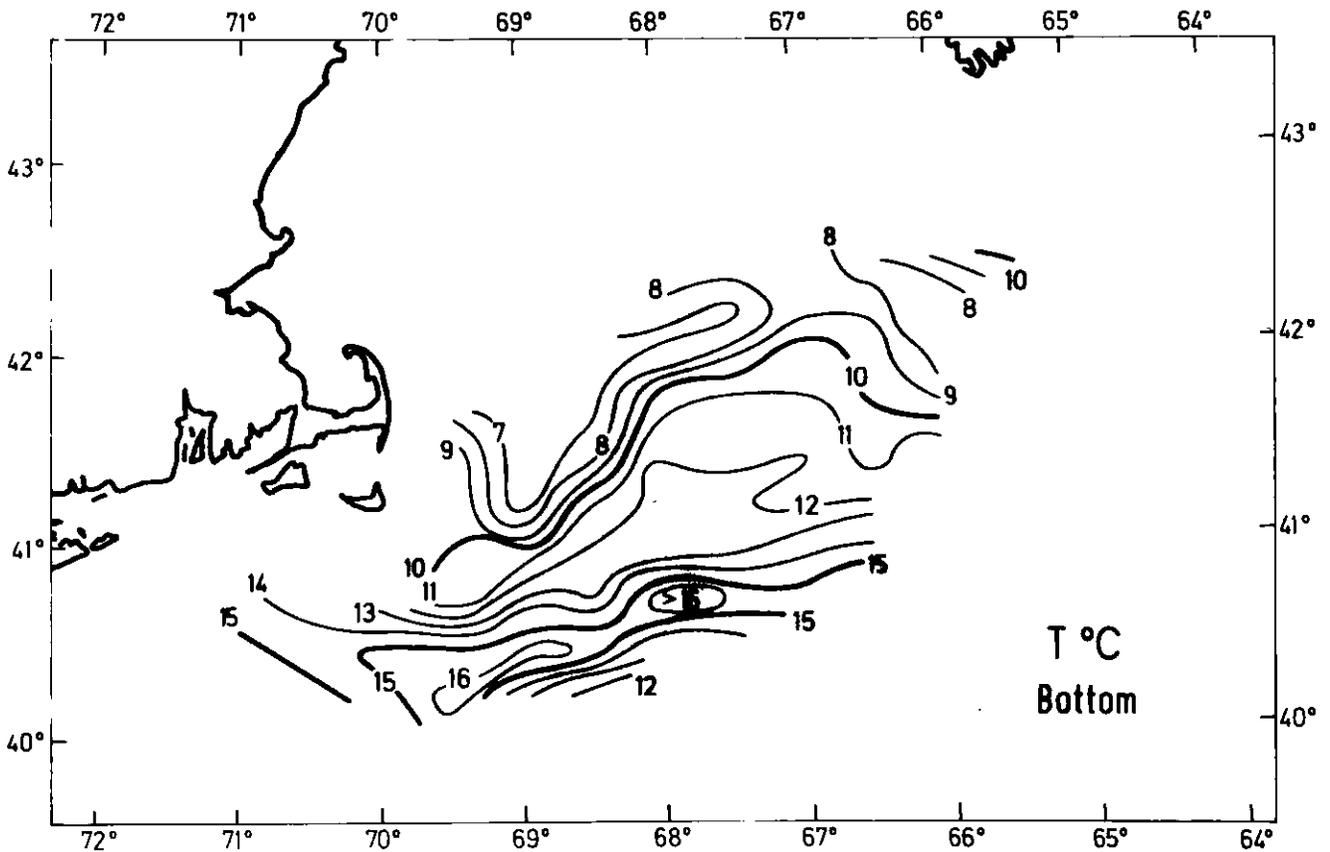


Figure 4b. Near Bottom Temperature, Nov. 1974

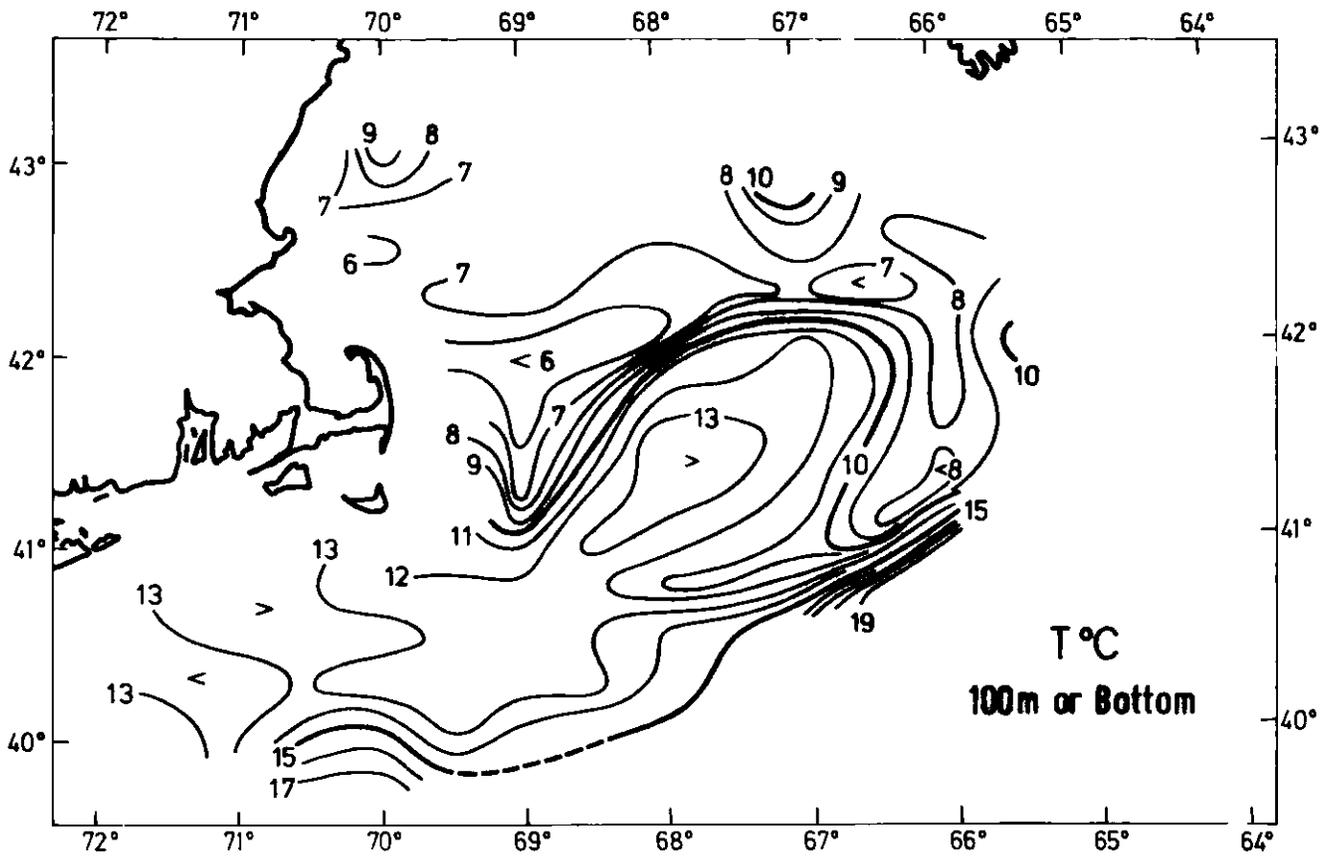


Figure 4c. Distribution of Temperature at 100m Depth (or near bottom), Nov. 1975

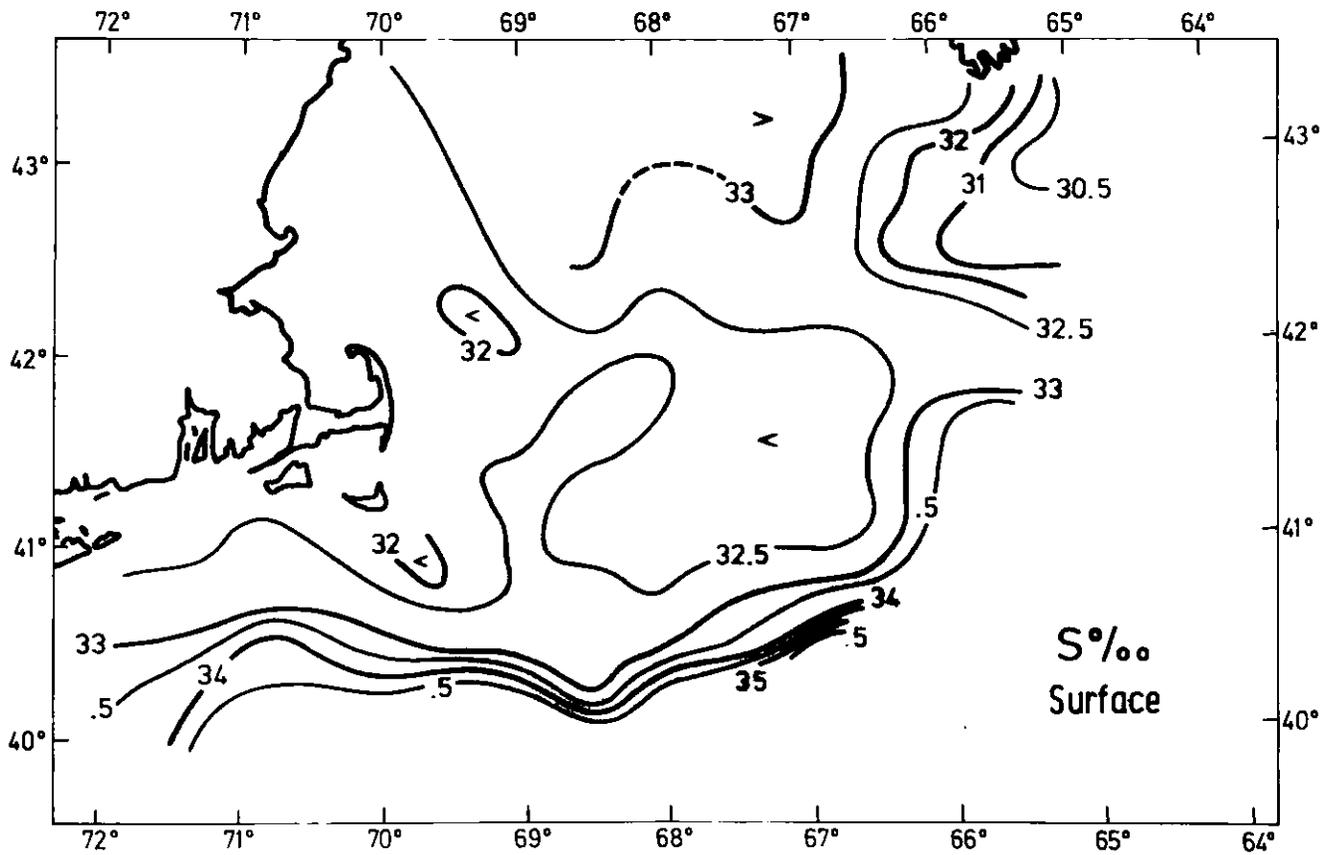


Figure 5a. Distribution of Surface Salinity, Oct/Nov 1973

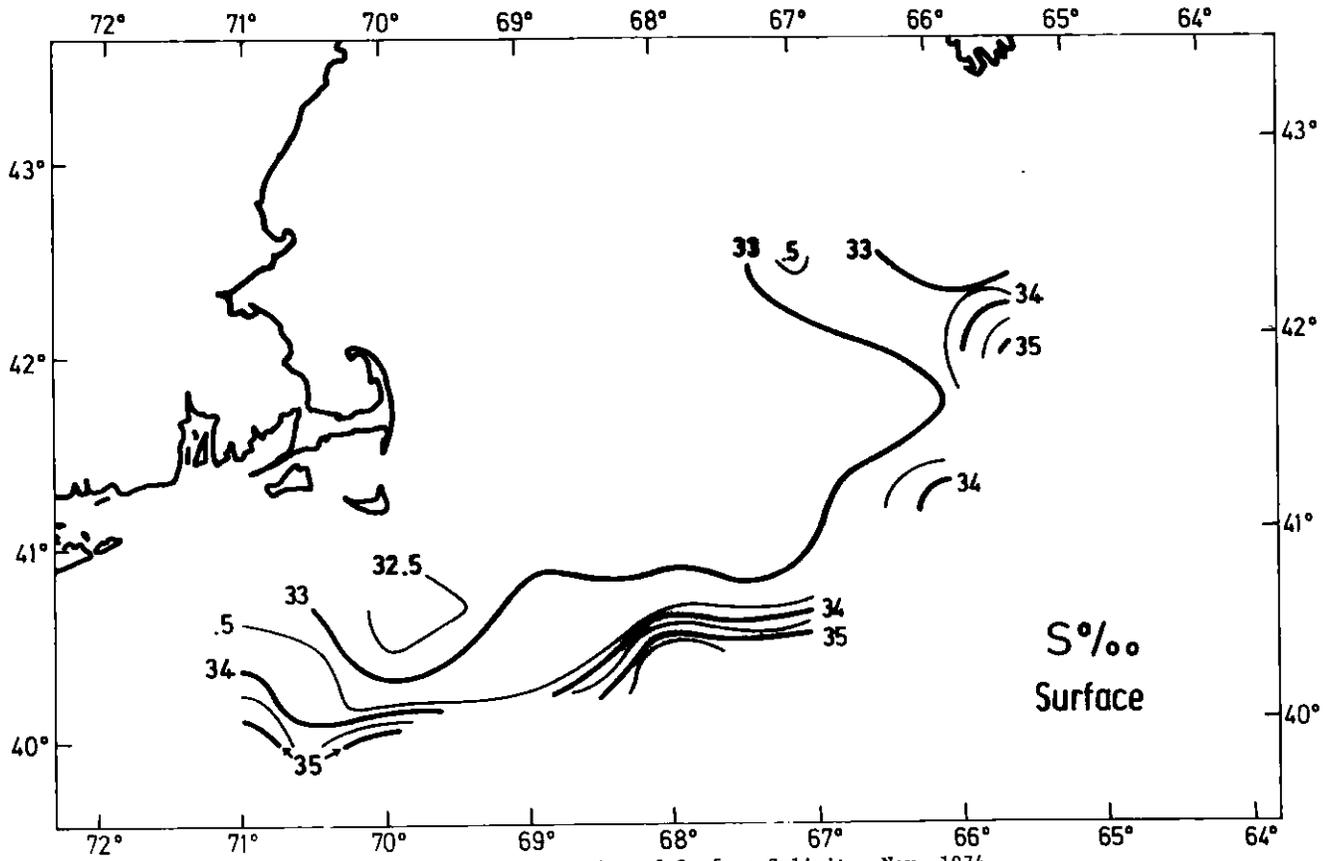
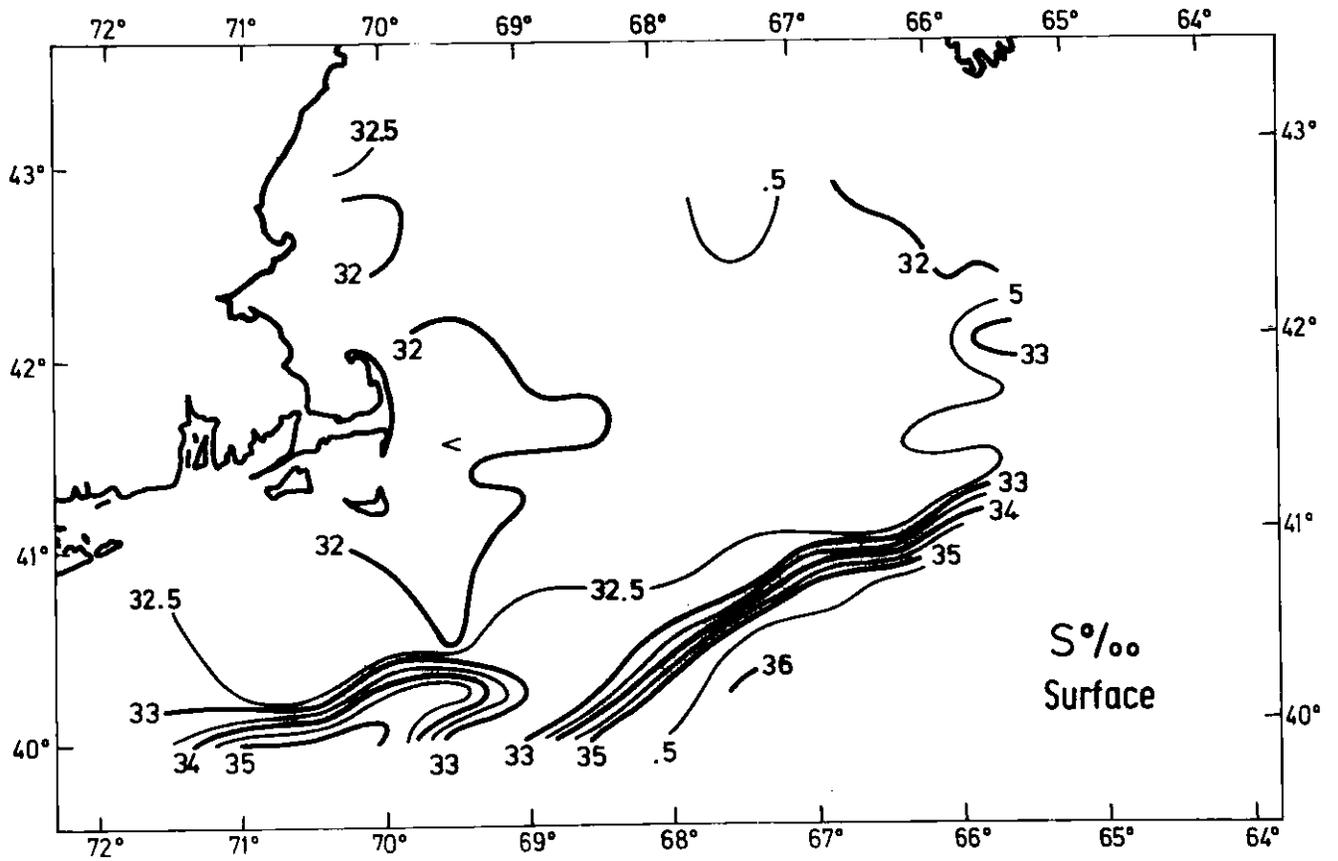


Figure 5b. Distribution of Surface Salinity, Nov. 1974



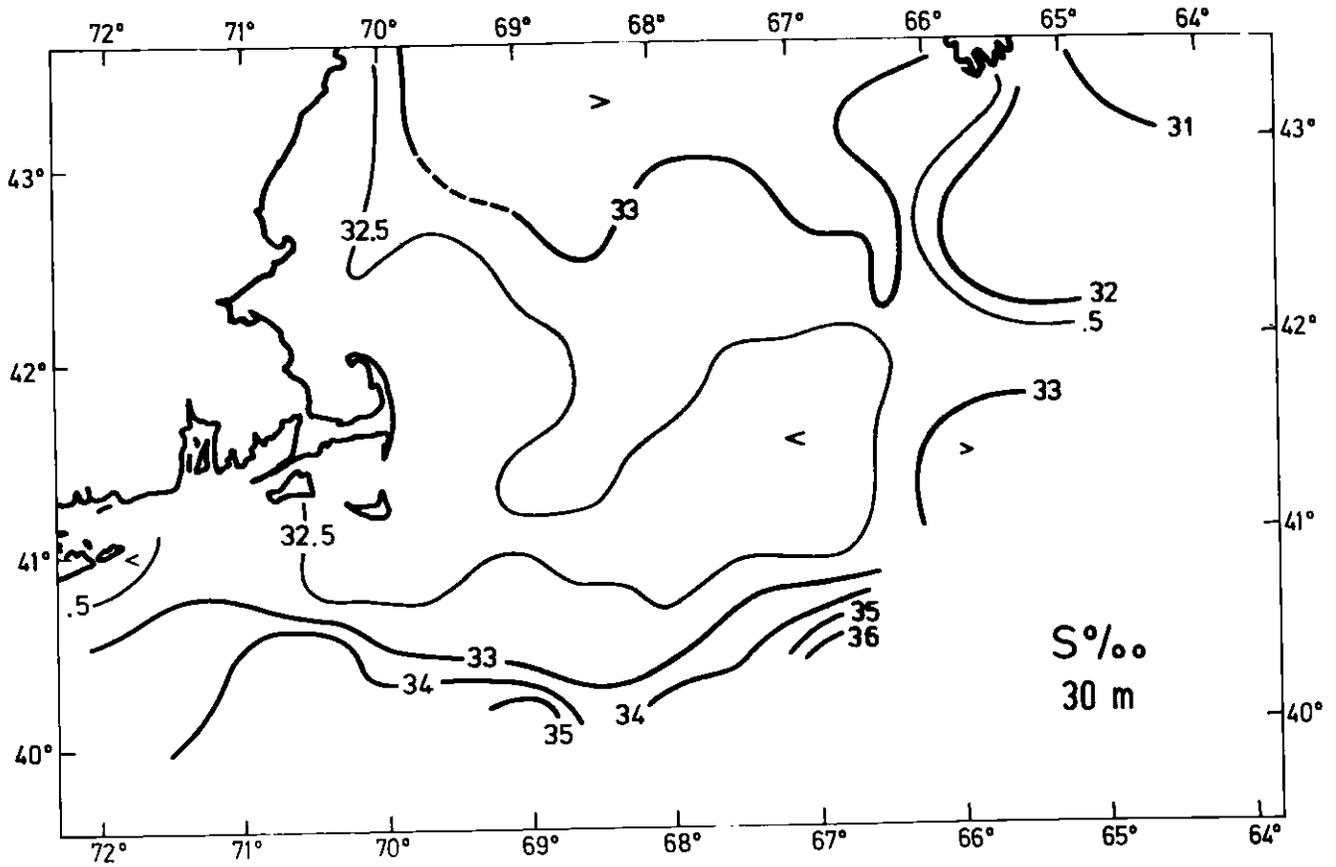


Figure 6a. Distribution of Salinity at 30, Depth, Oct/Nov 1973

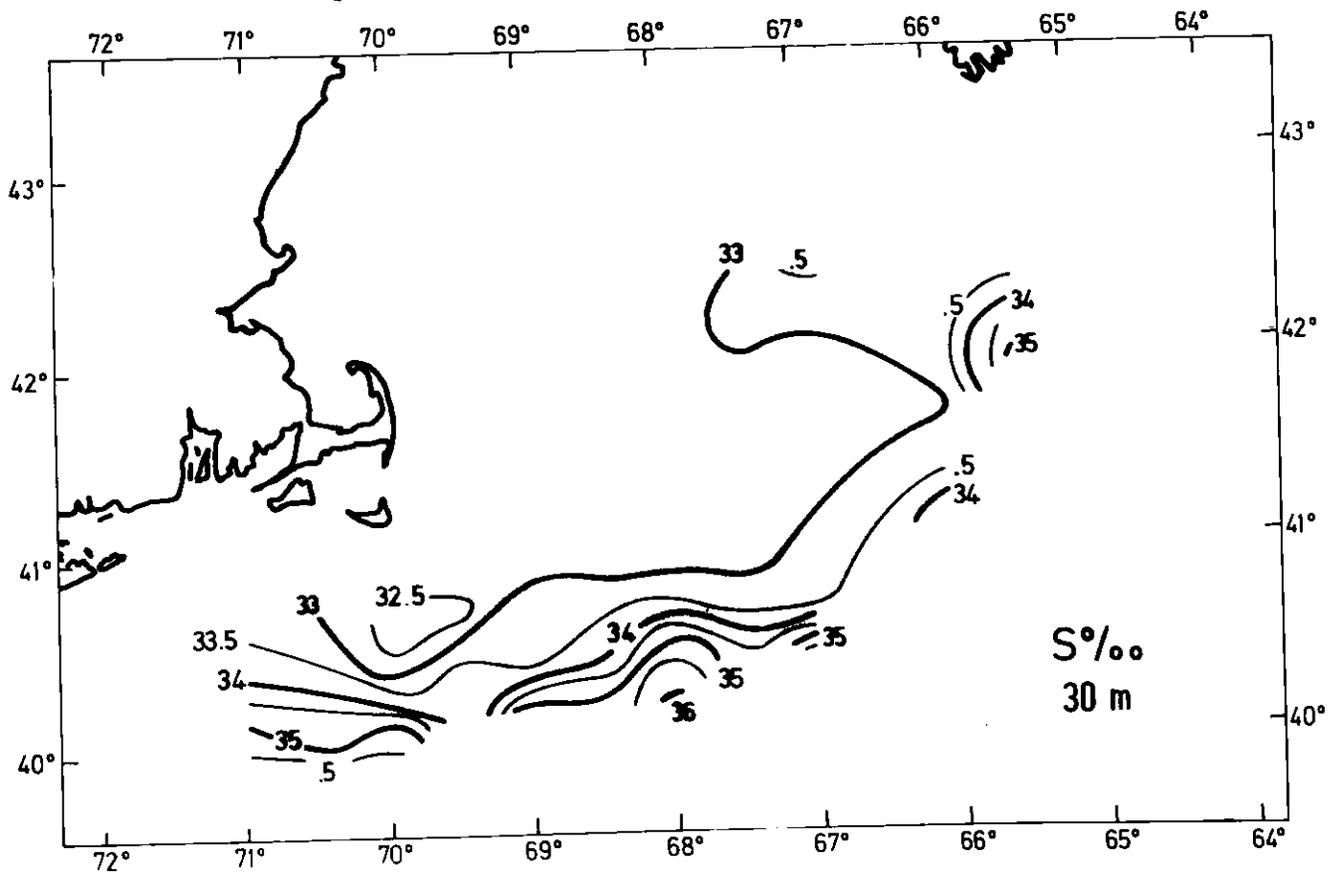


Figure 6b. Distribution of Salinity at 30m Depth, Nov 1974

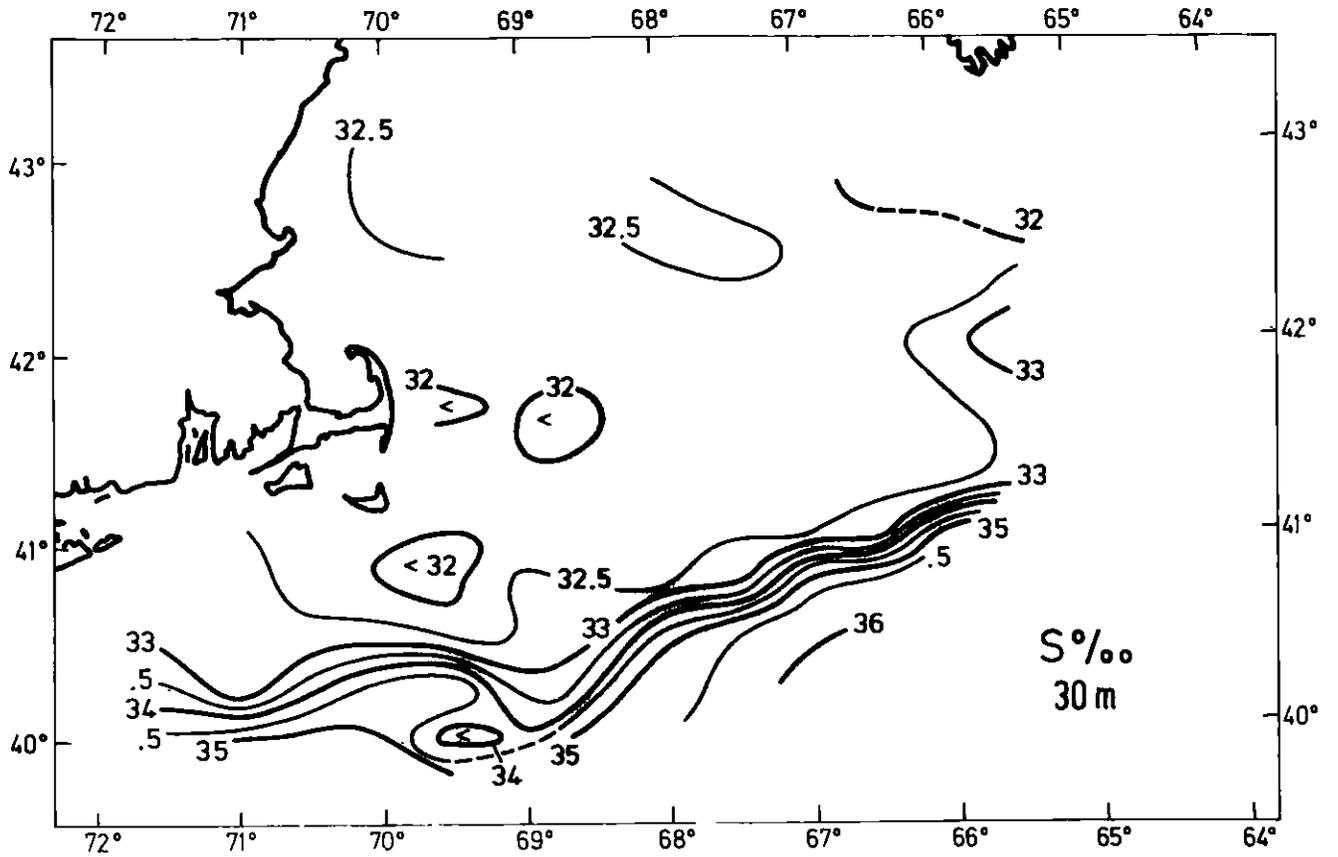


Figure 6c. Distribution of Salinity at 30m Depth, Nov 1975

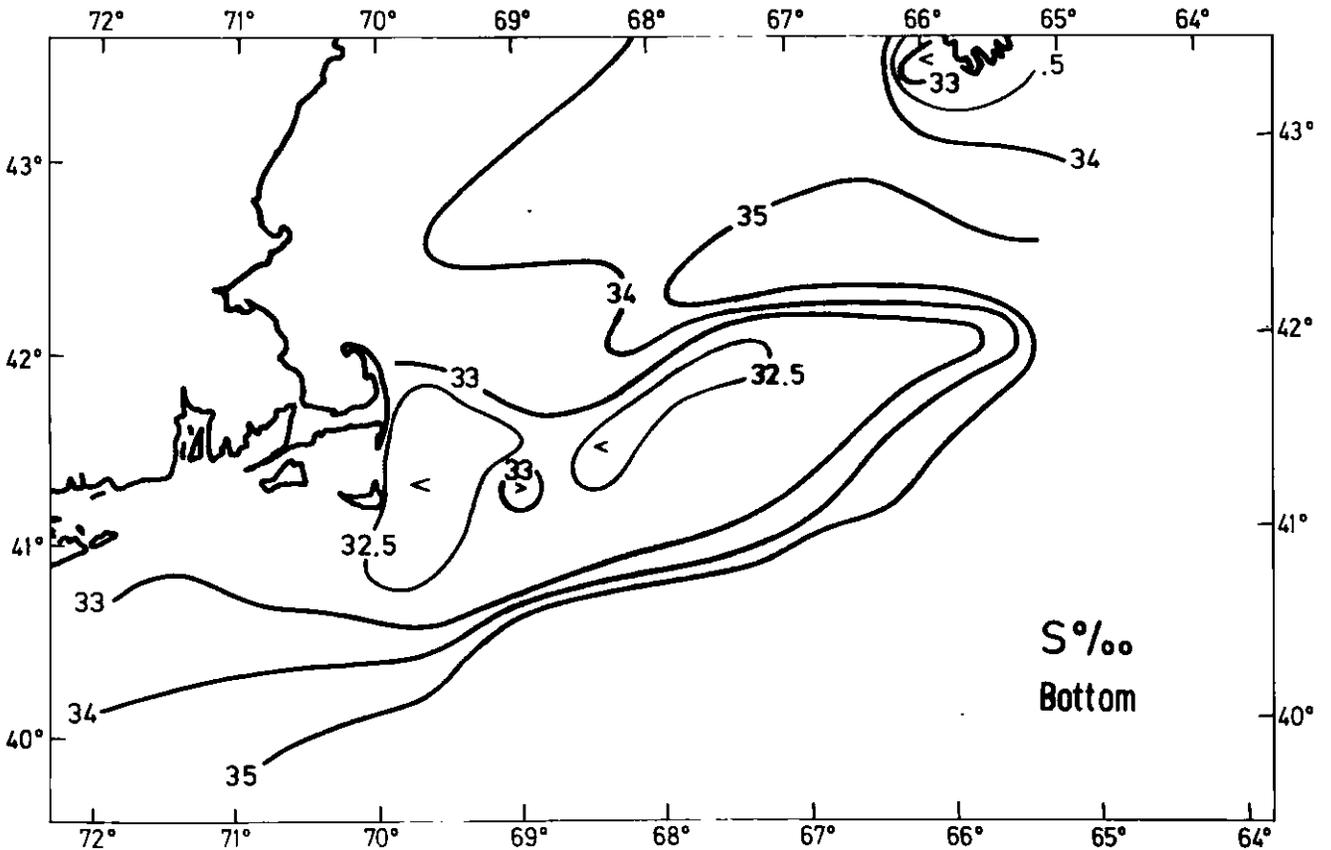


Figure 7a. Near Bottom Salinity, Oct/Nov 1973

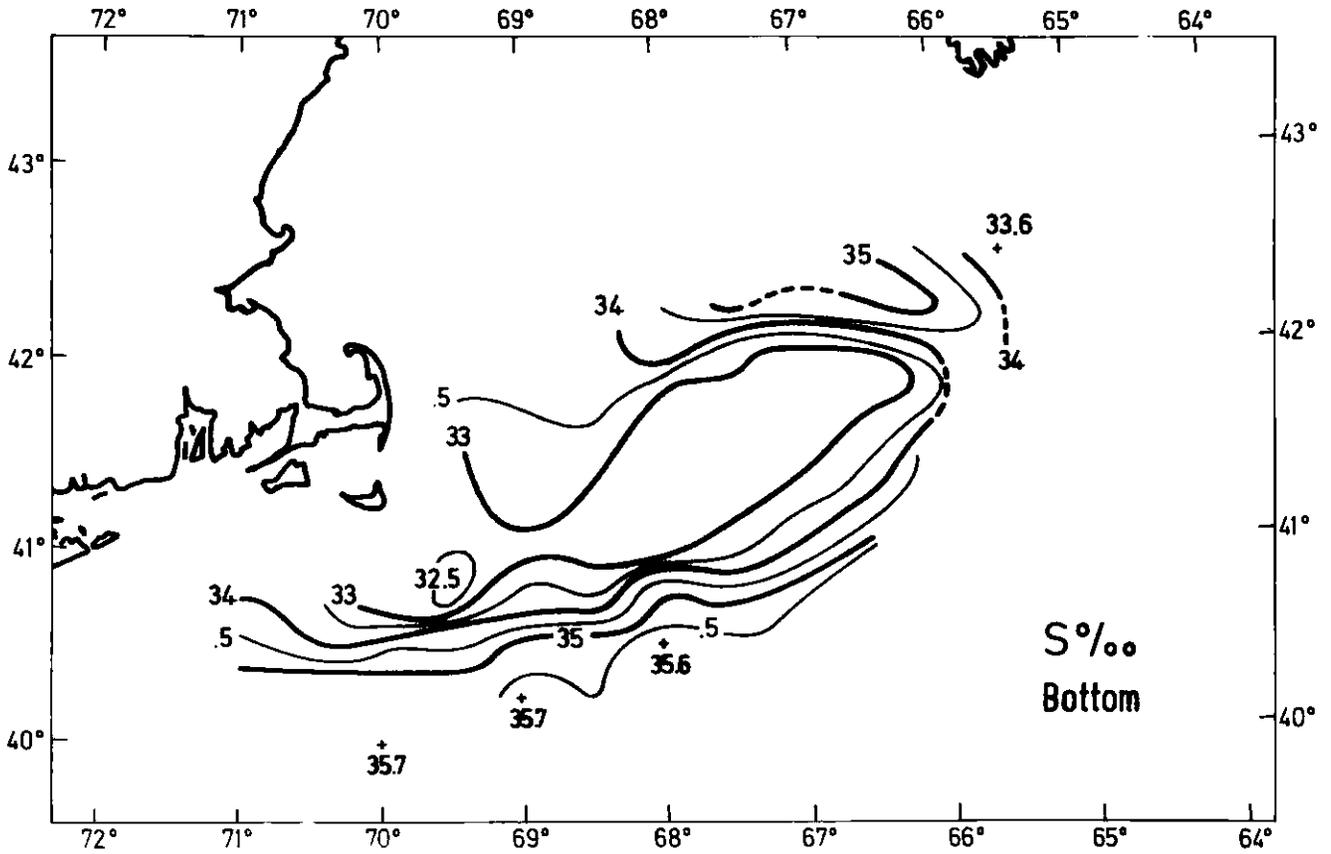


Figure 7b. Near Bottom Salinity, Nov 1974

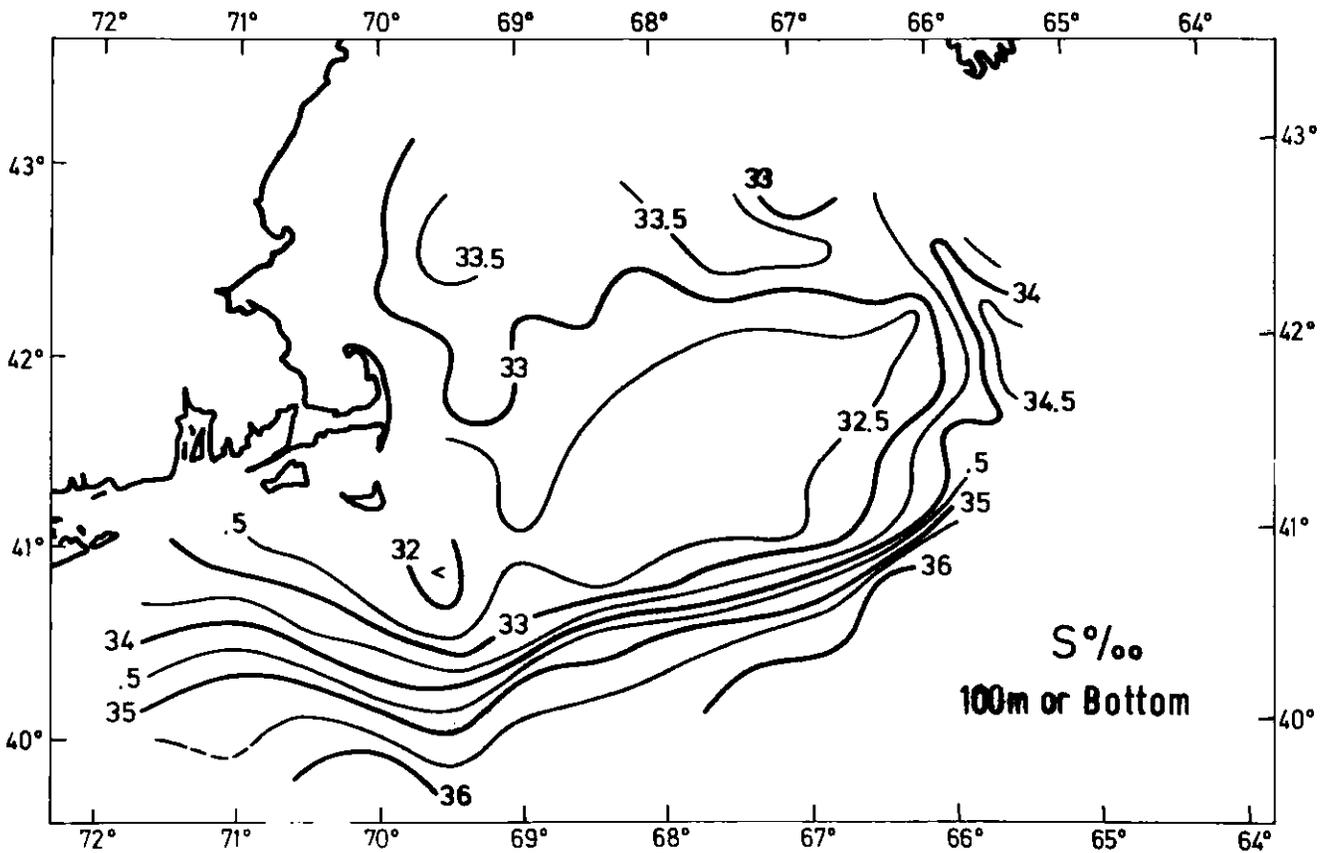


Figure 7c. Distribution of Salinity at 100m Depth (or near bottom), Nov. 1975

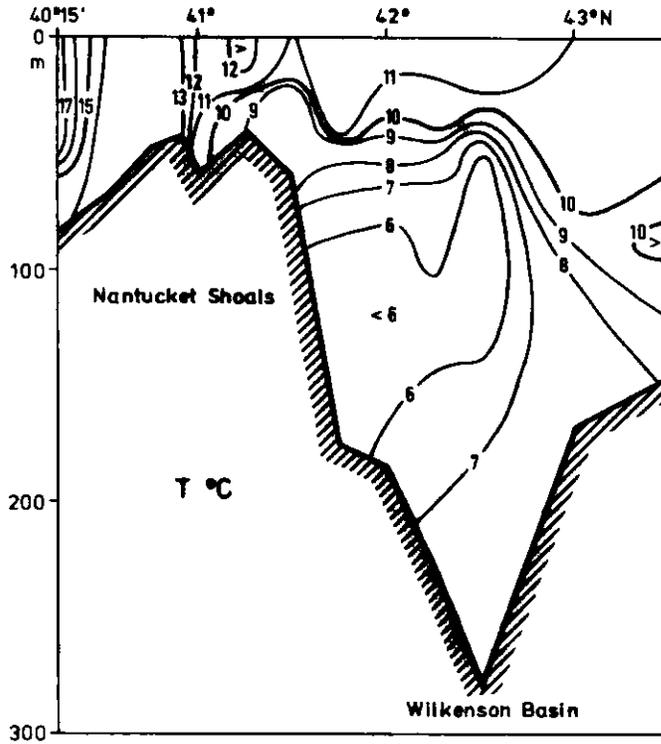


Figure 8a. Temperature section along 69°30'W (40°15'N to 43°30'N) 30/10 to 1/11/1973

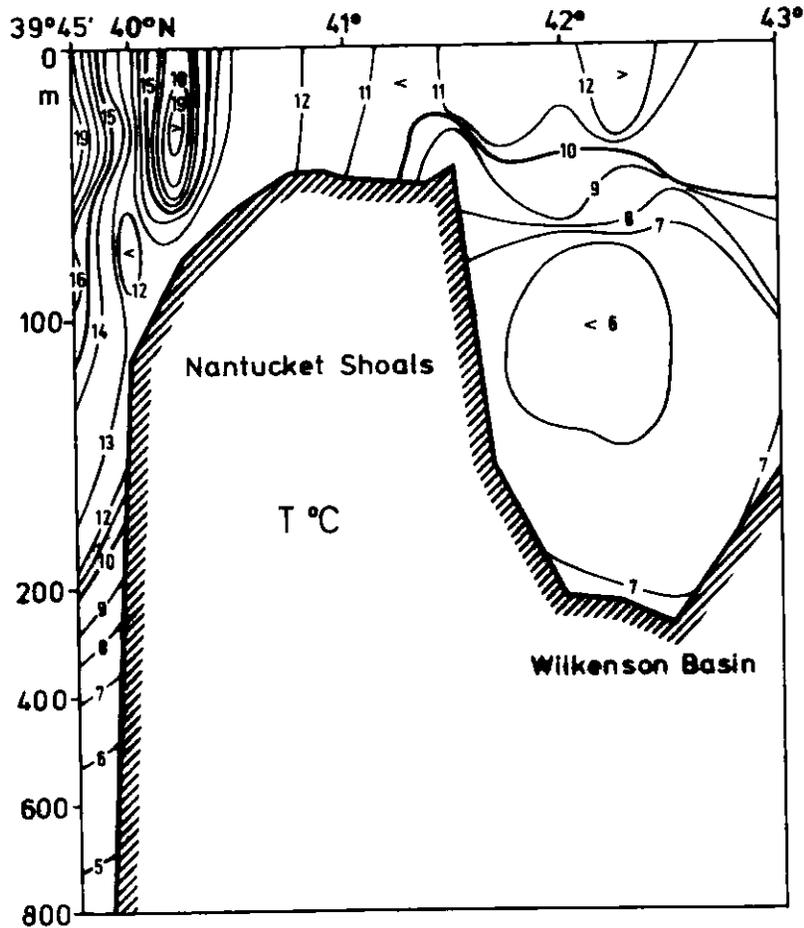


Figure 8b. Temperature section along 69°30'W (39°45'N to 43°00'N) 1/11 to 12/11/1975

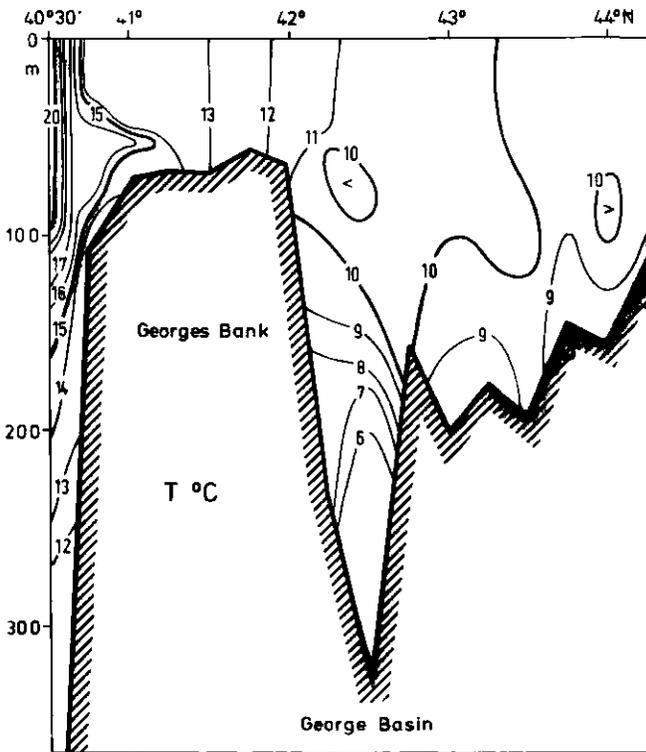


Figure 9a. Temperature section along 67°W (40°30'N to 44°00'N) 5/11 to 8/11/1973

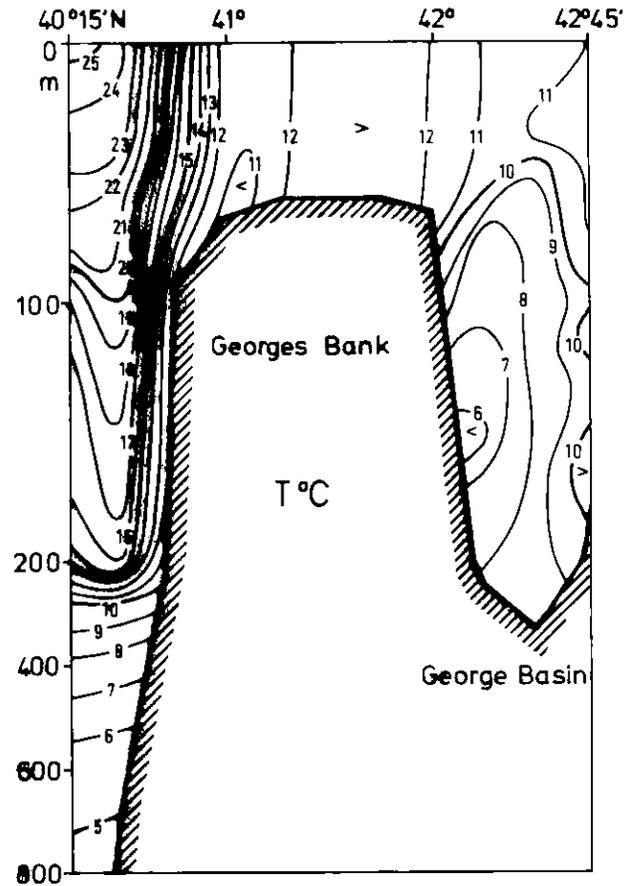


Figure 9b. Temperature section along 67°W (40°15'N to 42°45'N) 2/11 to 6/11/1975

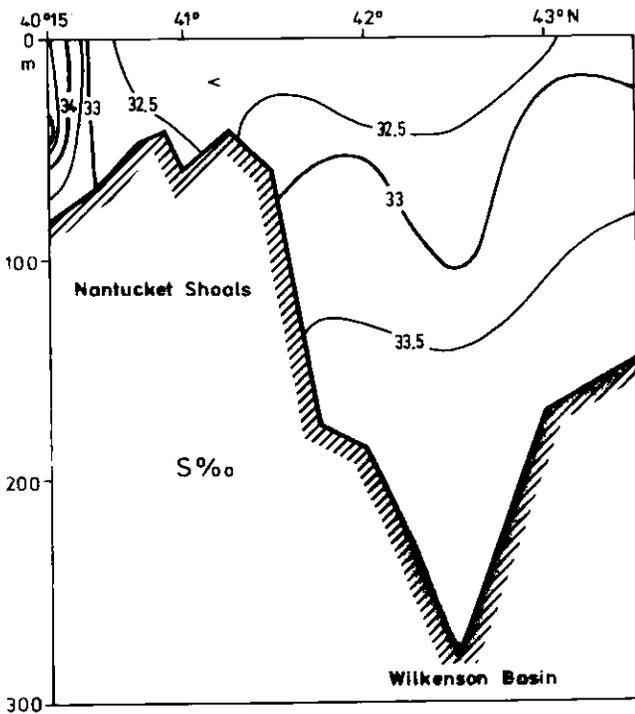


Figure 10a. Salinity section along 69°30'W (40°15'N to 43°30'N) 30/10 to 1/11/1973

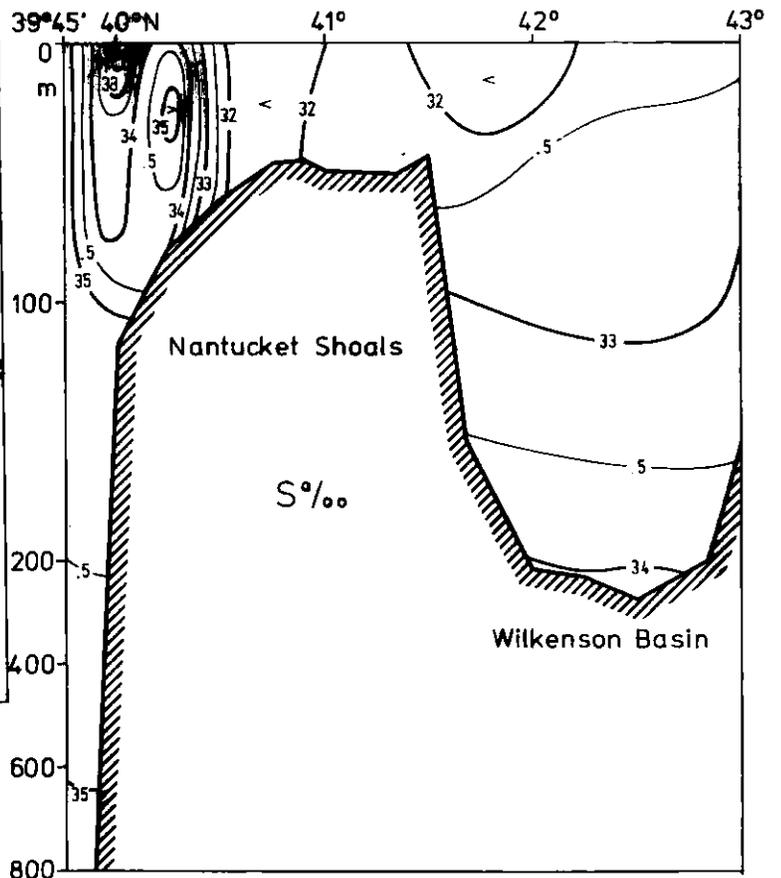


Figure 10b. Salinity section along 69°30'W (39°45'N to 43°00'N) 1/11 to 12/11/1975

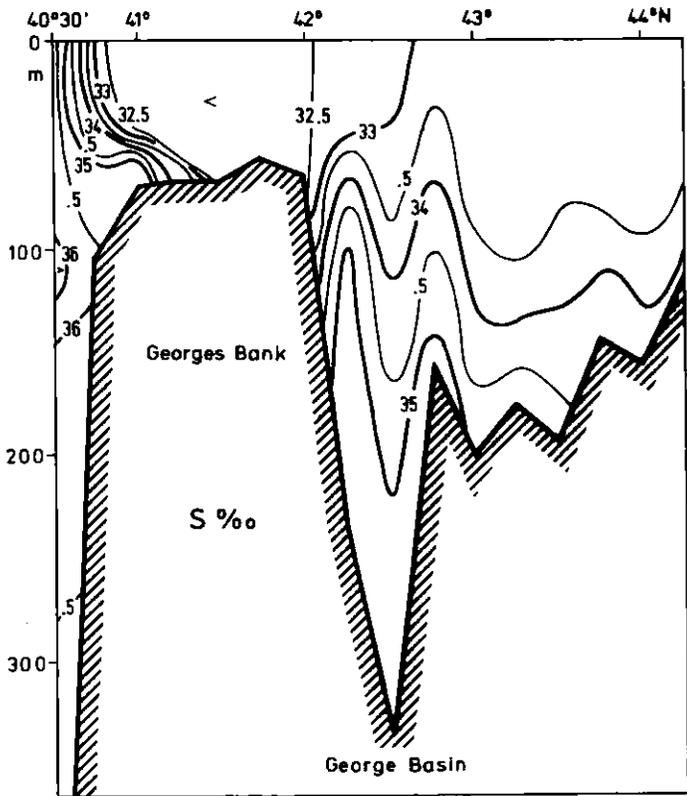


Figure 11a. Salinity section along 67°W (40°30'N to 44°15'N) 5/11 to 8/11/1973

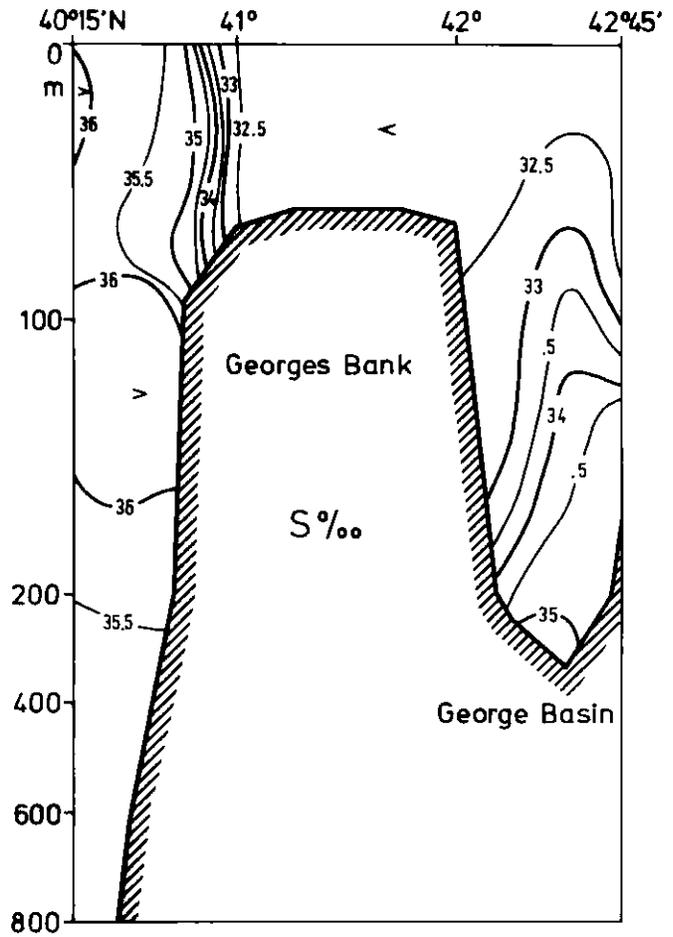
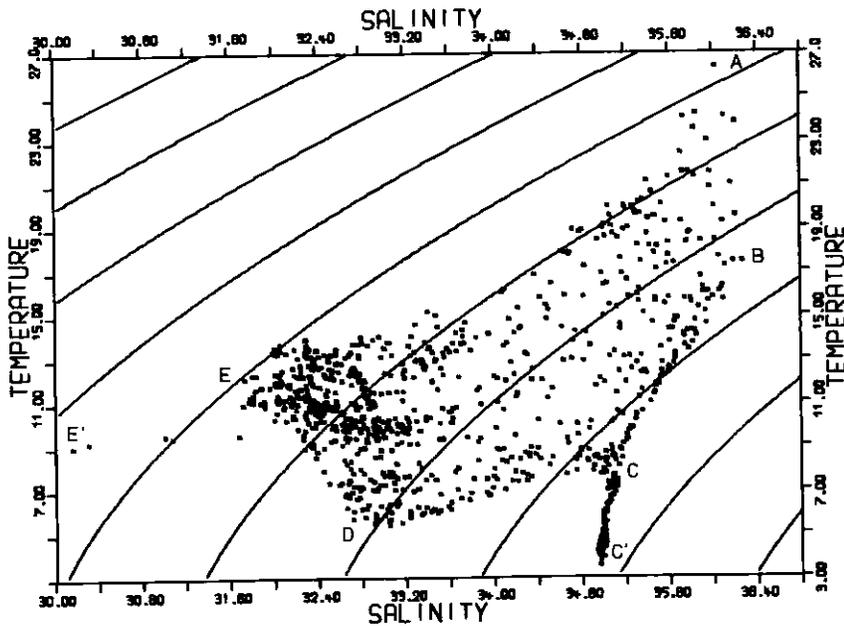


Figure 11b. Salinity section along 67°W (40°15'N to 42°45'N) 2/11 to 6/11/1975



T-S-DIAGRAM GEORGES BANK AREA OCT/NOV 73/74/75
DEPTH INTERVAL 0 TO 2000 (M) N= 1085

Figure 12. T-S Diagram showing all samples connected in 1973/1974/1975

