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United Kingdom Investigations in Sub-areas 2 and 3

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The R.V. ERNEST HOLT worked in Labrador waters (Sub-area 2) between 22 November and 1 December. Groups of trawl hauls were made in seven areas between 52°20'N and 55°30'N, most of them around the Hamilton Inlet Bank. The main interest was in cod, and 372 were marked with yellow plastic flag tags. The Canadian hydrographic section north-east from Seal Islands was worked on 26-27 November. The hydrographic section between St. John's and Flemish Cap (Sub-area 3) was worked between 4 and 6 December.

A. Fishing

The most northerly group of hauls was centered at about 55°20'N 56°30'W on good ground in between 80 and 170 fathoms. The best catch was 3,400 lb of cod per hour in 115-120 fathoms with a bottom temperature of 2.5°C, and the lowest catch was 1,275 lb in 140-170 fathoms.

On top of the northern part of Hamilton Inlet Bank at about 54°20'N 55°10'W the catches were about 600 lb cod and 500 lb American plaice per hour in 85 fathoms with bottom temperature 0.9°C. In one haul on this ground over 3,000 lb of the crab Chionoecetes opilio were caught.

Two areas were fished east of Hamilton Inlet Bank. At about 54°40'N 54°30'W the average catch of cod was 675 lb per hour in depths of between 120 and 175 fathoms. The best catch of cod in this area was 1,100 lb in 125 fathoms with a bottom temperature of 1.1°C, while in 170 fathoms with 3.4°C over 4,250 lb of redfish were caught. Further south in 54°10'N 54°10'W the catches were also about 700 lb cod with 2.9°C in 110 fathoms.

To the south-west of Hamilton Inlet Bank at about 55°27'N 54°40'W the best catch was over 3,400 lb of cod per hour in 170-200 fathoms, with an average of 2,300 lb in between 165 and 205 fathoms. The bottom was uneven and bottom temperatures were about 3°C.

In the Sundall area (53°N 52°10'W) catches were poor, with between 100 and 400 lb of cod per hour in between 130 and 190 fathoms. In the deepest haul 1,700 lb of redfish were caught. Catches were also poor off Belle Isle (52°20'N 54°45'W), where the trawl was badly damaged.

Most of the cod were between 45 and 55 cm in length, although in the two areas of best catches north and south-west of Hamilton Inlet Bank between half and a quarter of the catch were between 55 and 65 cm. In the areas of poor catches the fish were between 40 and 50 cm. (Age and length data will be submitted for

publication in the Sampling Year Book).

Length at maturity was low. For females the largest immature fish was 53 cm and the smallest mature 46 cm. For males the corresponding lengths were 51 cm and 40 cm. 85% of the cod stomachs examined were well filled. The main food was Themisto, followed by other crustacea, including Pandalus and Chionoecetes.

B. Hydrography

1. Seal Islands - Hamilton Inlet Bank Section

This section was worked during the period 26-27 November in relatively good weather conditions. Owing to a strong cross-current and poor Loran coverage, however, the line of stations sampled diverged from the standard section worked by the St. John's laboratory as the coast was approached. The resulting temperature and salinity sections (Figure 1) show that the water over and adjacent to the main bank had a simple structure which followed the general lines of the bottom topography, the only unusual feature being a pocket, situated seaward of the coastal zone in between 200 and 300 metres, that was slightly warmer than the main mass. The T-S diagram for each station has been constructed and compared with the 13-year mean T-S diagrams, beginning at 50 metres for the Labrador Current, Atlantic Current and Mixed Water in the Grand Banks region as shown in the report of the International Ice Patrol for 1960 (Figure 2). The curves for the five inshore stations (23-19) are very similar in shape to that typical of the Labrador Current and lie between it and that identifying the Mixed Water; those for stations 18, 17 and 16 further offshore are closer for the most part both in shape and position to the latter. The Labrador Current would seem therefore to be restricted to the shallow shelf area at this time of year, while the deeper water seaward of the Hamilton Inlet Bank is essentially a mixture of the Labrador and Atlantic Currents.

Comparison of these sections with those for the summer season, e.g. those obtained by the INVESTIGATOR II in August 1960, shows a marked similarity in salinity structure and an equally marked dissimilarity as far as the temperature sections are concerned. In both instances layers of water of salinity 32.5 ‰ - 34.5 ‰ lie over the bank itself and a homogeneous mass lies seaward of the continental slope. The "ear" winter" situation of the November temperature section shows no water below 0°C, and temperature increasing with depth; winter cooling has only just started to set in. The summer situation, on the other hand, is one of surface heating over the whole section and of the survival at depth over the bank of the very cold water, less than 0°C and approaching -1.5°C in parts, of the previous winter and spring.

2. Grand Banks - Flemish Cap Section

The standard stations of the St. John's laboratory on this section were worked between December 4 and 6, although bad weather prevented complete sampling at stations 46, 47 and 48, so that in the Flemish Cap area the 34.75 ‰ isohaline cannot be completed. The structure of the water over the line of stations was complicated (Figure 3) and unusual in that while temperature decreased sharply with depth salinity gradually increased. This is not, in fact, a simple case of the cold, relatively fresh water of the Labrador current appearing beneath water typical of the warm, saline North Atlantic Drift. Comparison of the temperature-salinity relationship for each station with those given in the 1960 International Ice Patrol report bears this out (Figure 4). By this means not only is the water over the Grand Banks, stations 39-43, sharply distinguished from that seaward of it, stations 44-50, but also both groups of curves are seen to be rather

different in the 50-70 m layer from those given as typical of the three main types of water in the region. There seems little doubt that Labrador Current water covers the Grand Banks and gives way eastwards to Mixed Water, but higher temperatures and lower salinities than the 13-year mean values between 50 and 70 metres have led to a displacement relative to the typical curves.

Great similarity in the shape and range of the isohalines and marked differences in the temperature structures are seen when these diagrams are set alongside those obtained in July 1960 by INVESTIGATOR II. Both temperature sections show water of less than 0°C lying over the Grand Banks but in July this region has colder water at its core, -1.3°C, and seems better defined insofar as its presence has altered the form of the isotherms in the surface layer. There is a suggestion in December of a body of water even colder than that found on the Grand Banks, lying close to the shore and below 50 metres to match that found in the July diagram. These, therefore, may be pockets of cold water that stay in position throughout the year and have temperatures just below or relatively well below 0°C according to the season. This is in contrast to conditions on the Seal Islands-Hamilton Inlet Bank section where sub-zero water is found in August but not in December, so that it has the higher temperatures of the two sections at 75 m depth in December. The general cooling of the surface layers on the Grand Banks-Flemish Cap Section with the coming of winter is implied by the fact that the 10°C isotherm just appears at the eastern end of the December section, whereas in July it was found at every station.

References

1. Report of the International Ice Patrol Service in the North Atlantic Ocean for 1960. Bulletin No. 46. U.S. Treasury Department, Coast Guard. Washington 1961.
2. Canadian Research Report, 1960. A, Subareas 2 and 3. W. Templeman, ICNAF, Serial No. 806, Document No. 10.

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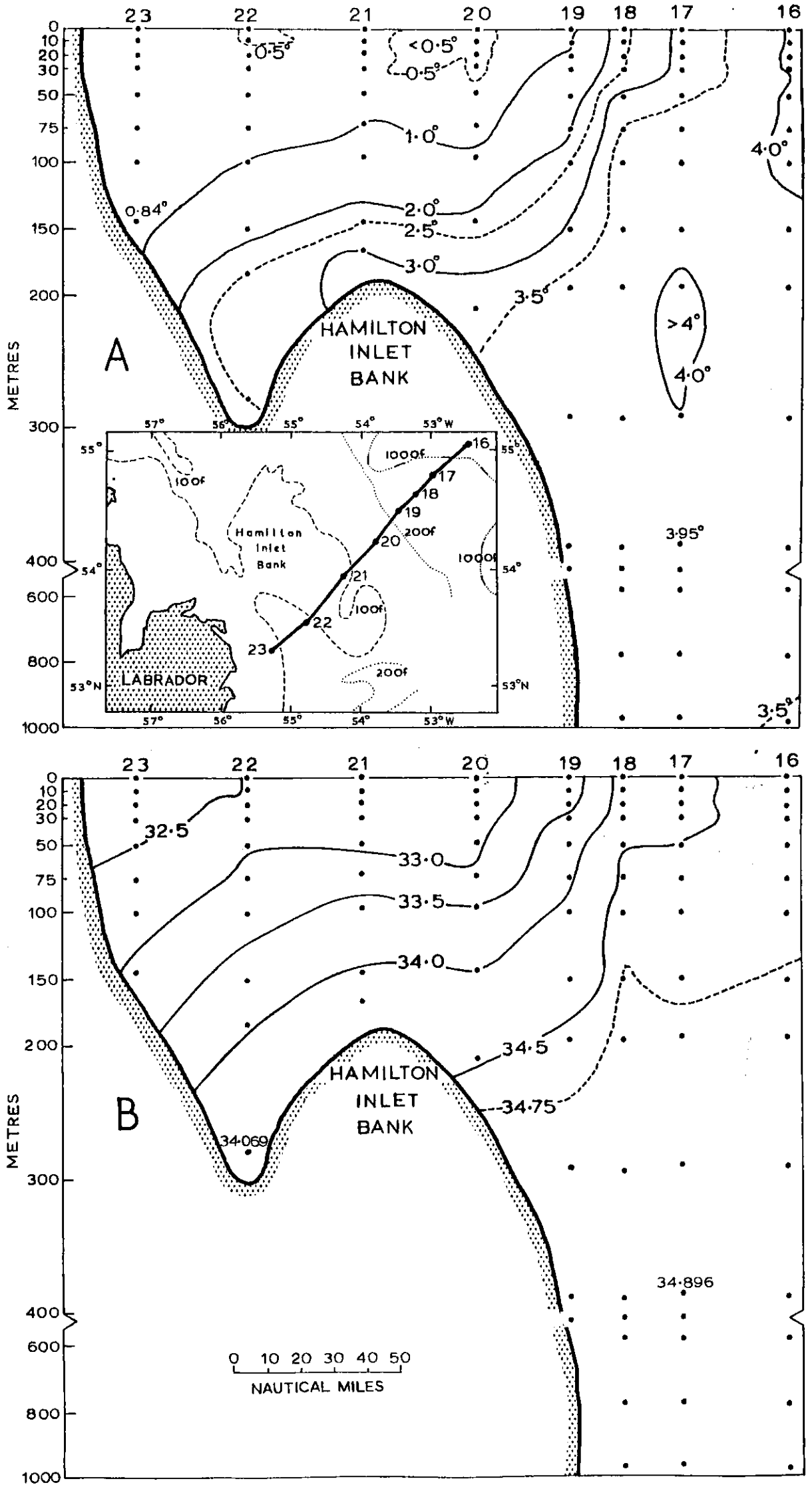


Figure 1: Temperature and salinity distributions: Hamilton Inlet Bank Section: 26-27 November, 1962.

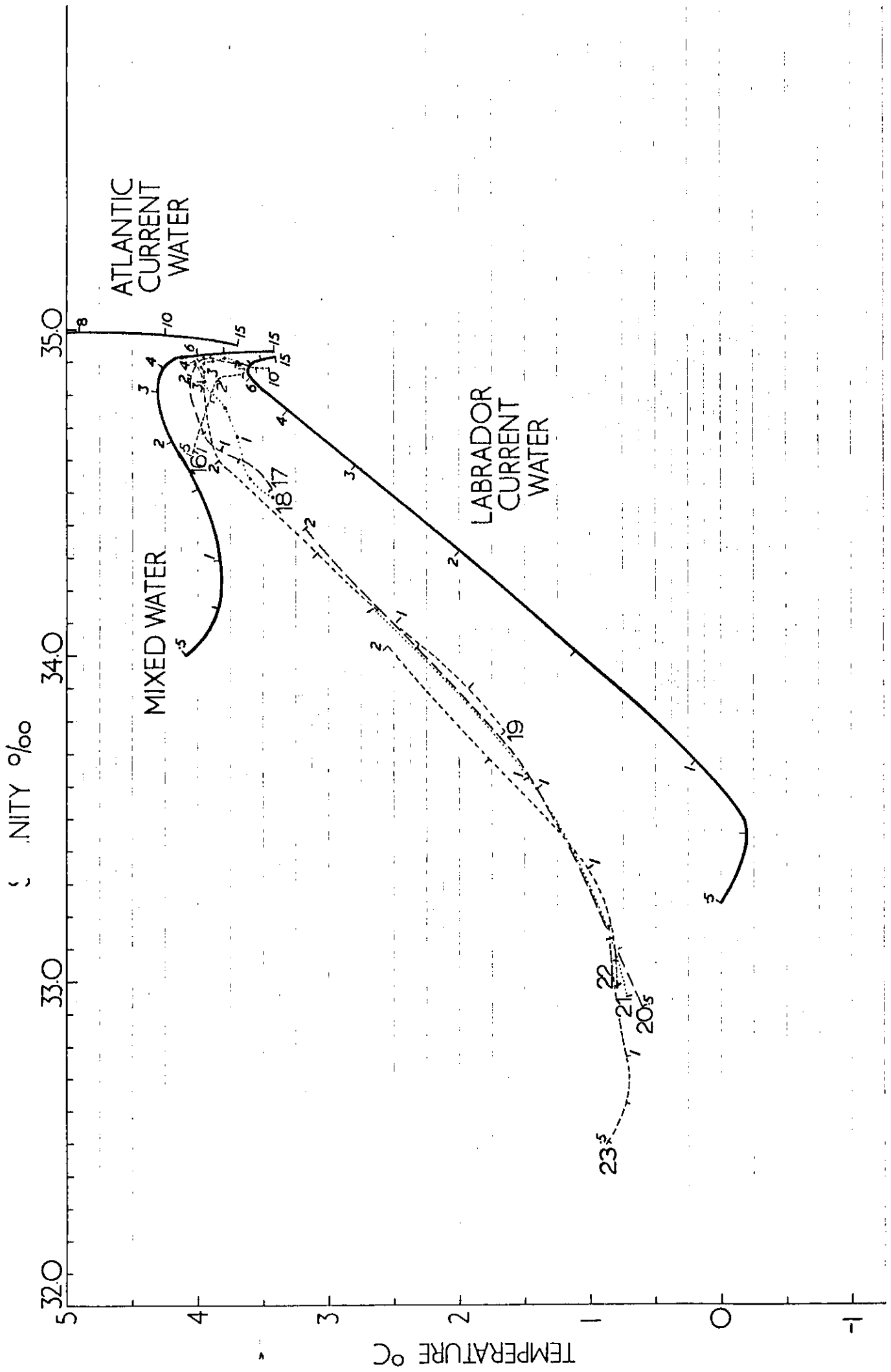


Fig. 2. Temperature-salinity diagrams for Hamilton Inlet Bank Section compared with 13-year mean values for Labrador Current, Atlantic Current and Mixed Waters. Depths in decametres.

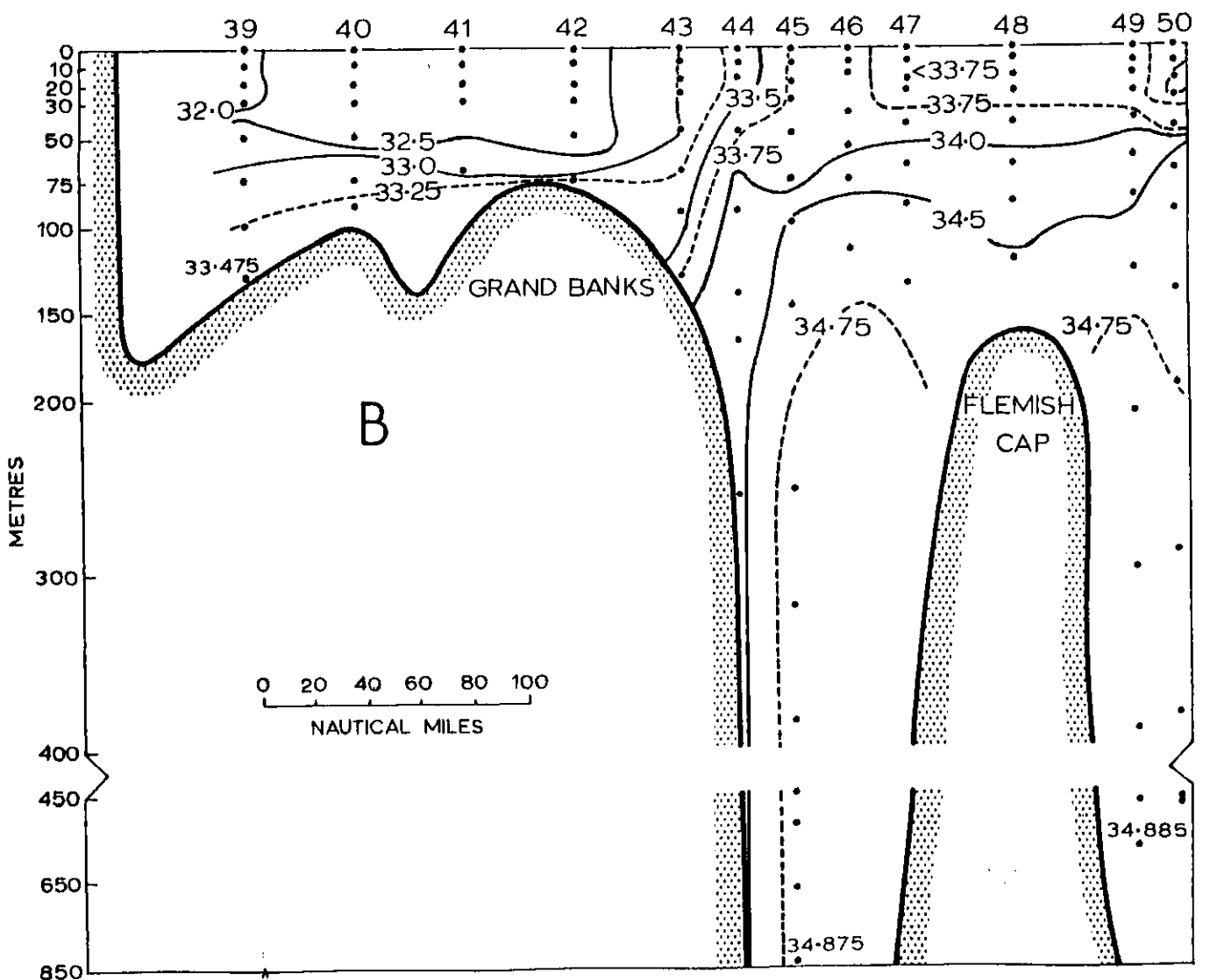
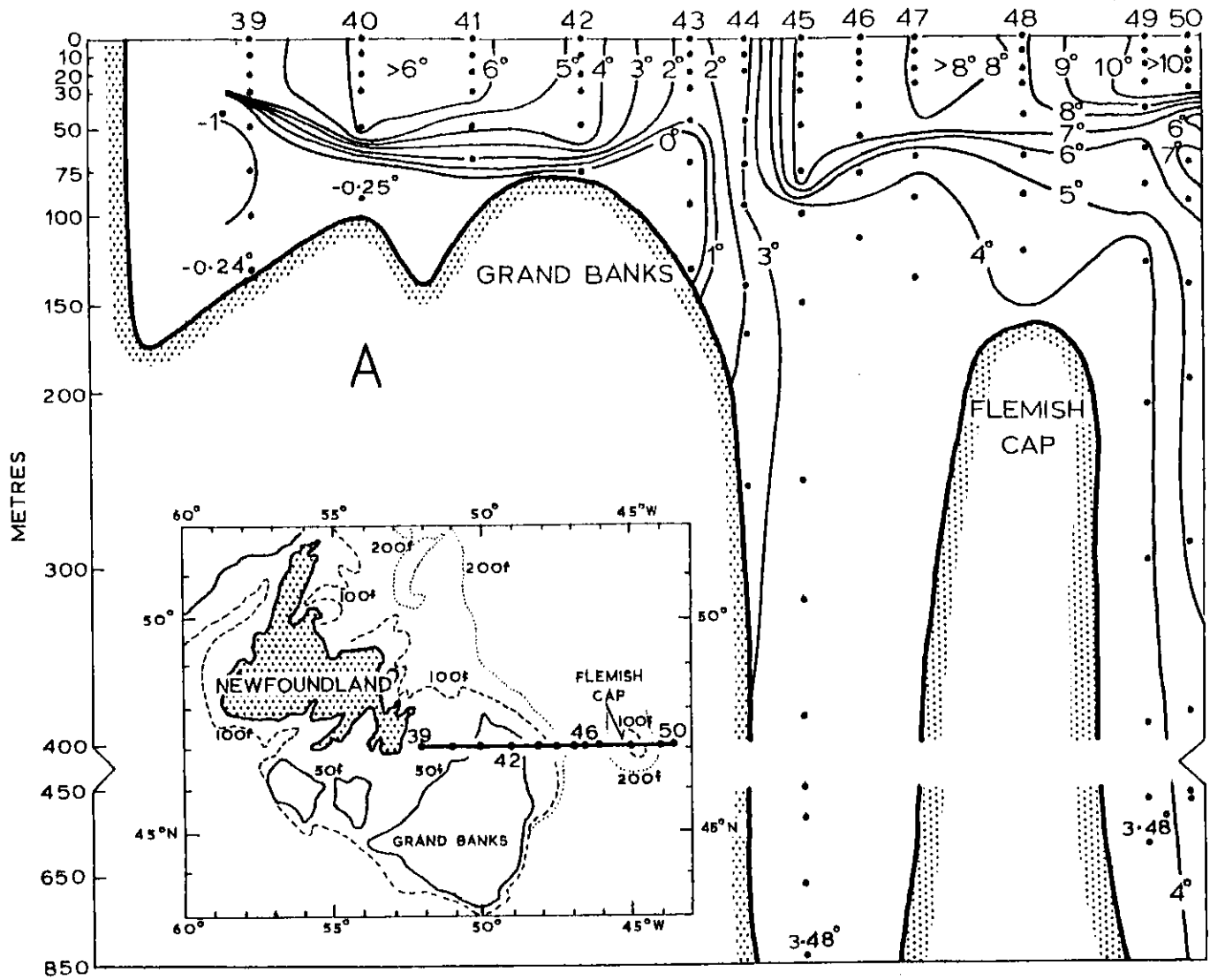


Figure 3: Temperature and salinity distributions: Grand Banks-Flemish Cap Section: 4-6 December, 1962.

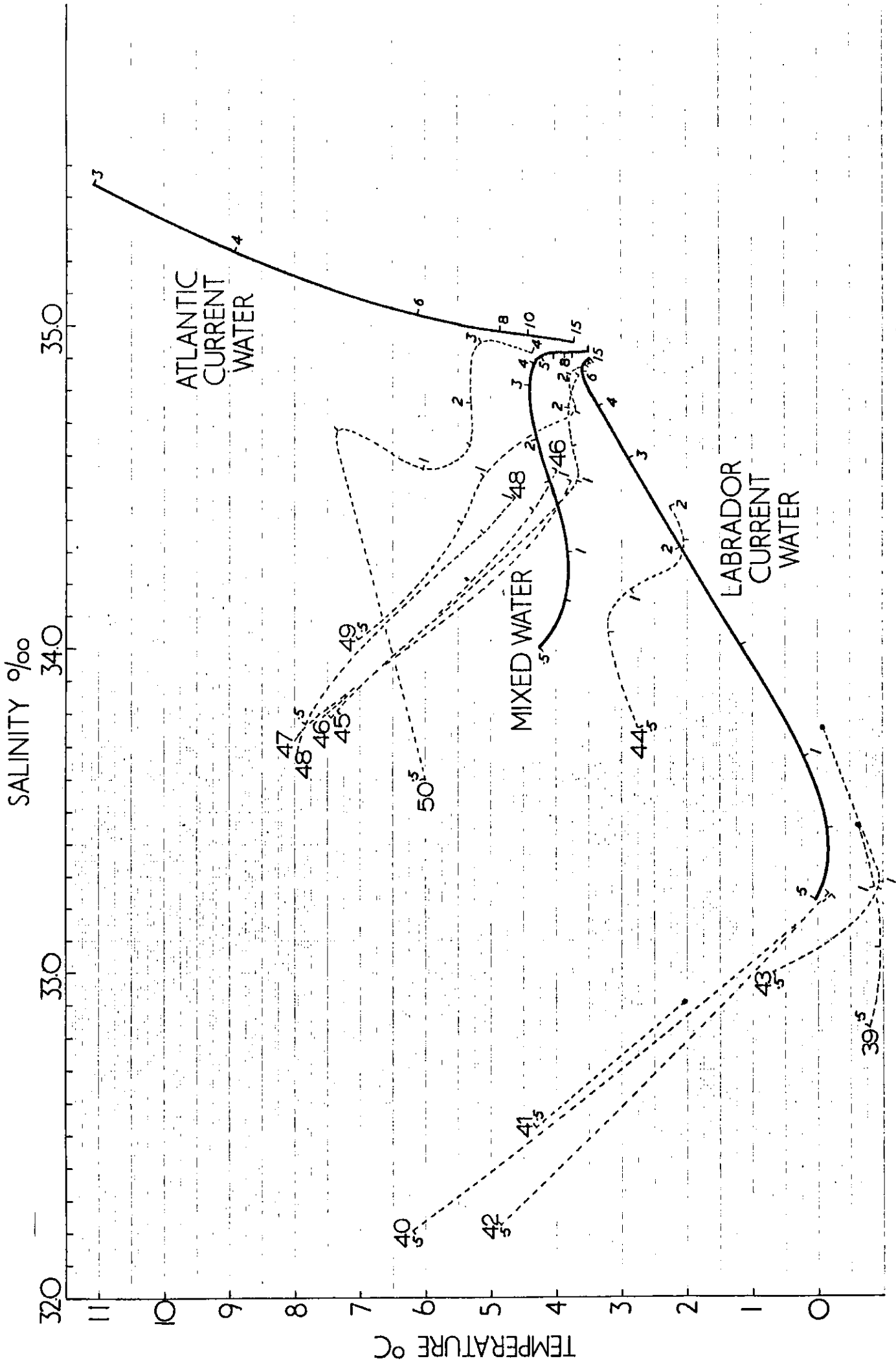


Fig. 4. Temperature-salinity diagrams for Grand Banks-Flemish Cap section compared with 13-year mean values for Labrador Current, Atlantic Current and Mixed Waters: Depths in decametres.