which predominate in the early months of the year (p. 122, Smith, Soule and Mosby, 1937).

In the extreme northern portion of the section (station 7H), in the vicinity of the entrance to Hudson strait, a comparative decrease in stratification, both as to temperature and salinity, is indicative of an area of mixing. Here also, at depths of 75 to 250 metres, is located a water mass of temperatures less than 1.0°C. and of a salinity of approximately 33.50 °/₀₀. On the basis of temperature and salinity characteristics this mass of water originates from the Baffin Land Current.

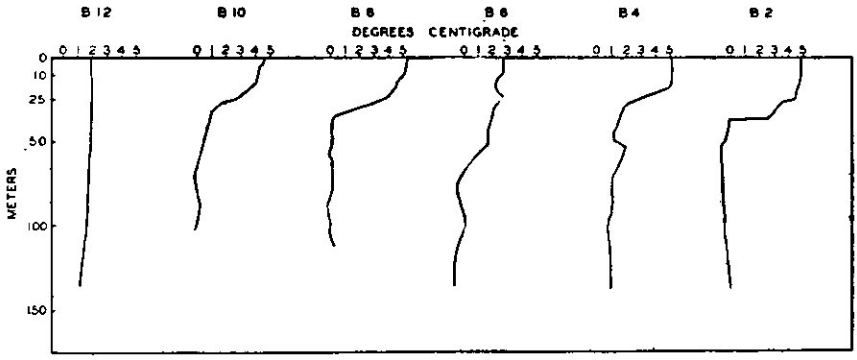

Figure 5. Temperature-Salinity correlation curves for Labrador coastal waters in September, 1948.

Temperature-salinity diagrams

On the basis of observations made in 1931 by the "Marion" and "General Greene" expedition, temperature-salinity correlation curves were obtained for all observations below a depth of 50 metres in the Labrador Current (p. 112, Smith, Soule and Mosby, 1937). These correlation curves show that the main water mass of the Labrador Current is a mixture of two characteristic waters as follows:

(1) Baffin Land water exhibiting average temperatures of -0.5 °C. and average salinities of 33.50 °/₀₀;

(2) West Greenland water exhibiting temperatures as high as 3.8° C. and salinities as high as 34.60 °/₀₀.

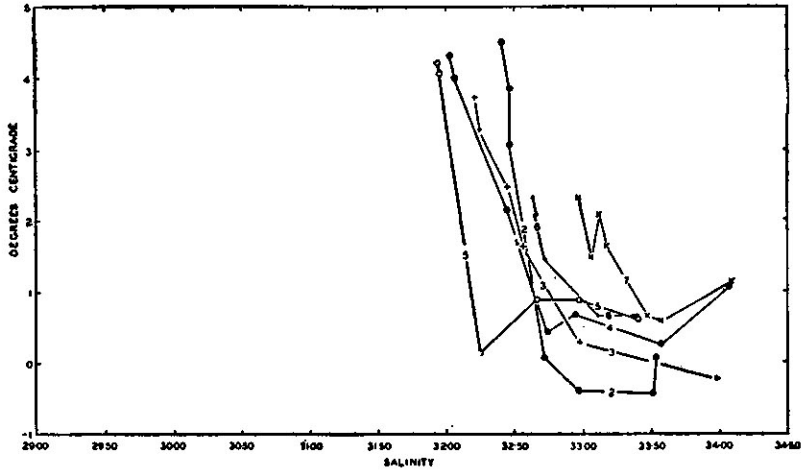

Figure 6. Typical Bathythermograph traces taken in the Labrador Current.

A temperature-salinity diagram was constructed from the 1948 data collected by the "Haida", and shown in Figure 5. As the "Haida" data were collected only along the axis of the Labrador Current, and to depths not exceeding 300 metres, the diagram gives pre-eminence only to two characteristic water masses as follows:

(1) A-water exhibiting temperatures greater than 3.0° C. and salinities between 32.00 and 32.50 °/₀₀;

(2) B-water exhibiting temperatures between -0.5° C. and 1.0° C. and salinities between 32.70 and 34.00 °/₀₀.

The A-water is therefore representative of the coastal contributions to the Labrador Current, and confined, in the main, to the upper fifty metres within the coastal belt. The B-water is obviously water of the Baffin Land Current, while no sampling of the waters of the West Greenland Current is in evidence.

The bathythermograph (Spilhaus, 1938), giving a con-

tinuous record of water temperatures from surface to depth, provides an excellent means of examining in detail the vertical temperature structure of a water mass. While in the Labrador Current, bathythermographic observations were taken from the "Haida" at intervals of fifty miles from Belle Isle Strait northward and again on the return journey. Twenty-two observations were made, twelve in early September and ten in late September. Positions of the points of observations are shown in Figure 1. Typical records are shown for early September in Figure 6.

The development of temperature stratification, as indicated between station 12B, off Hudson Strait, and station B2, north of Belle Isle is the main feature of the observations. The changing temperature characteristic of the main water mass, below 50 metres, from 0.0°C. or less at stations B2, B6, and B8 to 1.0°C. or greater at stations B4 and B12 might indicate that the sampling was not altogether along the axis of the Current. There are also traces of intrusions of small tongues of water seemingly foreign to the main water mass. These are indicated at stations B6 at depths of 10 to 30 metres and B4, at depths of 50 to 75 metres. The variation in thickness of an approximately isothermal layer from 5 metres at station B10 to 20, 17, and 25 metres at stations B8, B4, and B2 respectively, is another feature of interest.

The bathythermographic observations taken in the Labrador Current were plotted to illustrate the vertical temperature structure in section. The data for early September based on twelve bathythermograms are plotted in Figure 7, and the data for late September, based on ten bathythermograms are plotted in Figure 8. While the general features of the temperature structure as presented in Figures 6 and 7 are similar to those in Figure 2, the bathythermograms allow for a more precise determination of the temperature fine structure within the Current.

The early September section (Figure 6) shows several important features. There is a general stratification in the up-

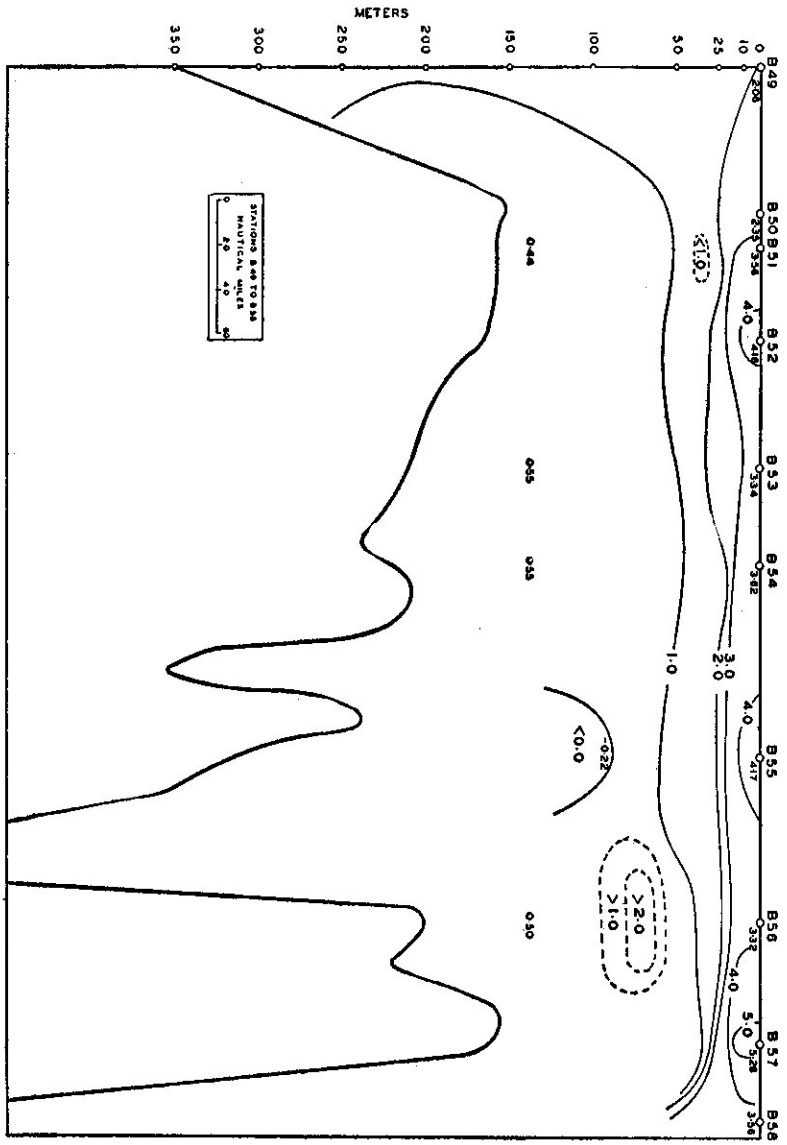

Figure 7. The Temperature structure of the Labrador current in September 4-6, 1948.

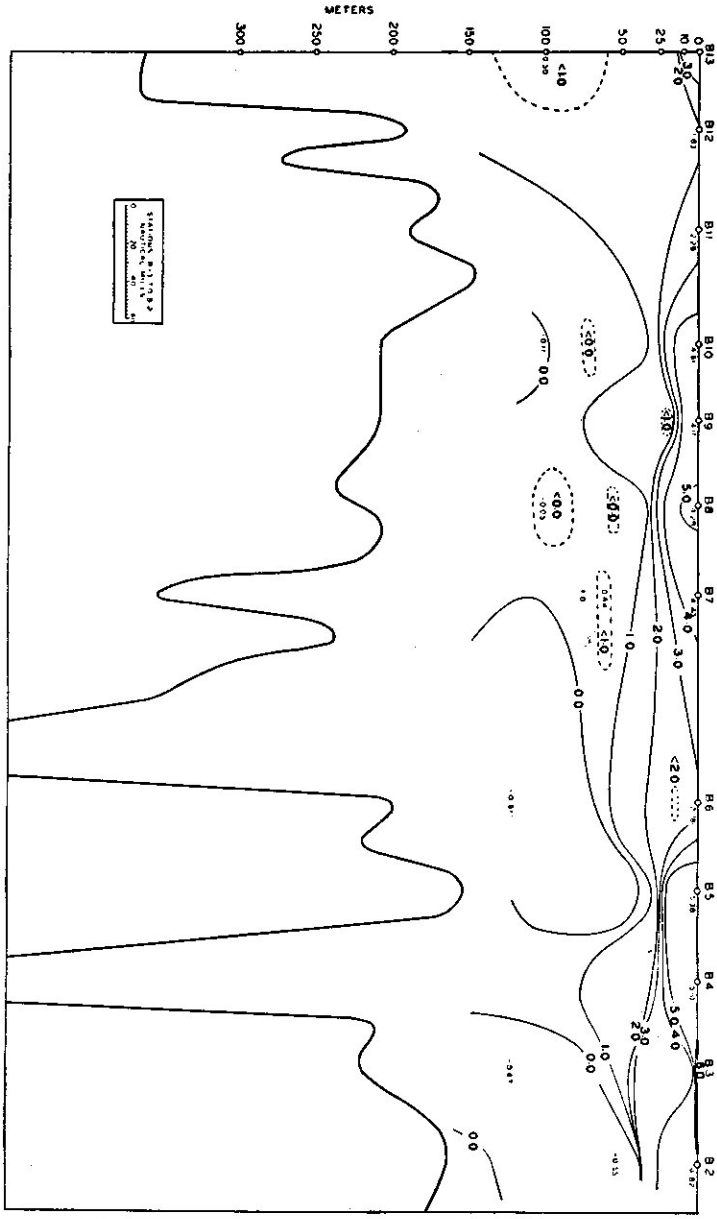

Figure 8. The temperature structure of the Labrador current in September 23-25, 1948.

per 50 metres that deepens towards the southern end of the section. This is clearly indicated by the depth of the isotherm of 2.0° C. which appears at a depth of 25 metres in the north and 45 metres in the south. The waters below the 50 metre level are, on the average, below 1.0° C. with a minimum of -0.67° C. Near Hudson Strait, the discontinuity of the isotherms at station B12 indicates that this is an area of strong mixing. Although the intensity of mixing is not as great as at station B12, the area of mixing appears to extend from south of station B11 almost to station B13, a distance of approximately 110 miles.

In various portions of the section traces of water temperatures, seemingly foreign to the main water mass, are to be found. In some cases these are probably tongues of cold water extending outward from the coast. The main water mass is of a temperature between 0.0. and 2.0° C., and the after effects of the summer season are shown in the surface layer, which at no point is thicker than 45 metres, and with the highest temperature in the vicinity of 5.0° C.

The late September section (Figure 8) exhibits the same general features as that for early September, with autumnal cooling and resultant vertical mixing shown in the surface layer by lowered temperatures and decreased stratification. One prominent tongue of comparatively warmer water has protruded into the section in the neighbourhood of station B 56.

Discussion

On the basis of the temperature-salinity characteristics of the water sampled at the "Haida" stations while proceeding in the Labrador current, in September 1948, it is obvious that the track of the "Haida" was in a water mass contributed, to a large extent, by the Baffin Land current, and that any water mass sampled was either of the Baffin Land Current, or a mixture of these waters with waters of coastal origin, and/or modification. Hence the water masses originating from the West Greenland Current or in the intermixing of water of the

West Greenland Current and Baffin Land Currents were on the ocean side of the "Haida" track. It has been estimated that the average volume of water contributed to the Labrador Current by the West Greenland Current and the Baffin Land Current is in the proportion of 3 to 2 (Smith, Soule, and Mosby, 1937).

The vertical temperature structure of the waters of the Labrador Current in the main water mass is shown to be quite stable and fairly uniform in temperature characteristics, undergoing only normal seasonal changes in the surface layer within the month of September.

The dynamics of the Labrador Current is to a large extent associated with a mixing process where waters of the West Greenland Current and Baffin Land Currents merge. While this merging probably takes place over a considerable area in Davis Strait and Baffin Bay and particularly along the continental shelf adjacent to Baffin Island, there is indicated by our observations a large area of mixing in the region of Hudson Strait, where probably waters from Hudson Bay and Foxe Channel merge with waters of the Baffin Land Current to create what might be termed Labrador coastal water. In any event, this additional mixing process gives acceleration to the southward movement of northern waters.

Summary

1. The temperature and salinity distributions in a section along the axis of the Labrador Current is described for September 1948, as having the main body of water at depths of 25 to 250 metres with temperatures between 2.0 and -0.4°C., and salinities ranging from 32.50 to 33.50 °/₀₀, while on the surface temperatures greater than 4.0°C. and salinities less than 32.00 °/₀₀ are found.

2. The vertical temperature structure of the water mass along the axis of the Labrador Current has been examined in some detail which reveals:

(a) The development of temperature stratification with variations in the thickness of an approximately isothermal layer from 5 metres at station B10 to 20, 17 and 25 metres at stations 8B, B4 and B2.

(b) Near Hudson Strait the discontinuity of the isotherms indicates an area of strong mixing which extends 110 miles southward from station B13.

(c) Tongues of cold water from inshore are protruding into the section.

(d) The temperature of the main water mass is between 0.0 and 2.0°C.

(e) Autumnal cooling with resultant vertical mixing is in evidence during September.

3. The vertical temperature structure of the water of the Labrador Current in the main water mass is shown to be quite stable and fairly uniform in temperature characteristics, undergoing only normal seasonal changes in the surface layer within the month of September.

Acknowledgements

The observations discussed herein were made possible through the co-operation of the Defence Research Board of Canada, the Royal Canadian Navy, and the Canadian Joint Committee on Oceanography, and this paper is published with their permission

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