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Geostrophic Circulation of the Northwest Atlantic Waters
According to Long-term Data

by

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Abstract

The new schemes of geostrophic circulation of the Northwest Atlantic waters, constructed on the basis of generalization of the dynamic topography charts of some hydrological surveys carried out by PINRO research vessels for 1962-1978, are given in this report.

Introduction

One of the first charts of dynamic topography of the surface layer waters in the Northwest Atlantic was drawn up by Smith, Soule and Mosby (1937). In the subsequent years for the period of work performed by some expeditions many dynamic charts for the ICNAF areas were published in the U.S. Coast Guard and ICNAF editions (Kollmeyer, 1967).

Mean monthly charts of dynamic topography of sea surface relatively the 1000bar level for April-July were constructed by Scobie and Schultz (1976). These charts cover the area of the International Ice Patrol activity east and south of the Newfoundland banks. Similar charts for other parts of the ICNAF area are not known. While carrying out scientific and commercial investigations the necessity often arises to have the detailed scheme of water circulation, which is the mean for a definite period of time (month, season). The availability of mean charts gives an opportunity to find out specific features of water circula-

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tion according to data of each concrete hydrological survey. Unfortunately, observations in space and by seasons cover the ICHAF zone unequally and their small total for most areas excluding the Newfoundland area and Flemish Cap Bank, make it difficult so far to construct the reliable long-term mean chart of the ICHAF zone water circulation.

The aim of the given contribution was drawing up two charts:

- a) probable scheme of mean geostrophic water circulation in the surface layer of the North-west Atlantic in the warm period of a year;
- b) mean long-term chart of dynamic topography of the Newfoundland area and Flemish Cap Bank for a spring-summer period.

Materials and methods

More than 40 charts of dynamic topography for separate parts of the North-west Atlantic area, constructed according to data of hydrological surveys carried out by the PINRO research vessels for 1962-1978 (Alekseev, Kudlo et al., 1972; Kudlo and Burmakin, 1972; Kudlo, 1975; Kudlo and Boytsov, 1978 and others) were used for drawing up a probable scheme of geostrophic circulation. April-October, i.e. the warm period of a year, was covered by observations.

The comparison of charts and selection of the chart, closest to a mean pattern of circulation, were performed by visual review of the set of charts for each subarea. "Mean" charts selected this way were composed and, as a result, the probable scheme of mean geostrophic water circulation in the surface layer of the North-west Atlantic (ICHAF area) for the warm period of a year was obtained (Fig.1). Data from the mean chart by Scobie and Schultz (1976) for June were used for the deep-sea ^{area} south-east of the Grand Bank and south of the Flemish Cap Bank.

Data of hydrological observations performed in 1972-1976 cruises of the PINRO research vessels for determining the commercial fish abundance (total trawl surveys) were used for construc-

ting the long-term mean chart of dynamic topography of the Newfoundland area and Flemish Cap Bank (subarea 3). The observations were carried out from March to September, most observations were performed in June-August, i.e. in summer. Averaging was carried out by groups of stations in which the maximal distance between the stations was not more than five miles in various years. 330 groups of stations were formed. Coordinates of the mean geometric position of each group of stations were taken as coordinates of the "mean" station, they are shown by dots in Fig.2. On the basis of data from each hydrological survey on the stations the dynamic heights were calculated (Zubov and Mamayev, 1956) over the zero dynamic level of 2000dbar, which were averaged then arithmetically for each group of stations, i.e. for five years, and attributed to a "mean" station. Calculated values of dynamic heights were the basis for constructing the mean chart (Fig.2).

Conclusion

Mean charts of water circulation (Figs. 1 and 2) constructed by detailing circulation elements, especially in the Newfoundland area and Flemish Cap Bank, differ advantageously from the existing schemes of currents and are the reliable basis for investigations of abiotic conditions influence on commercial species reproduction.

At the same time both charts have some defects. For the first one it is the subjectivity of the method of its construction, for the second one - a short period of observations, used while averaging. The charts may be made more accurate as the new data of observations are being stored.

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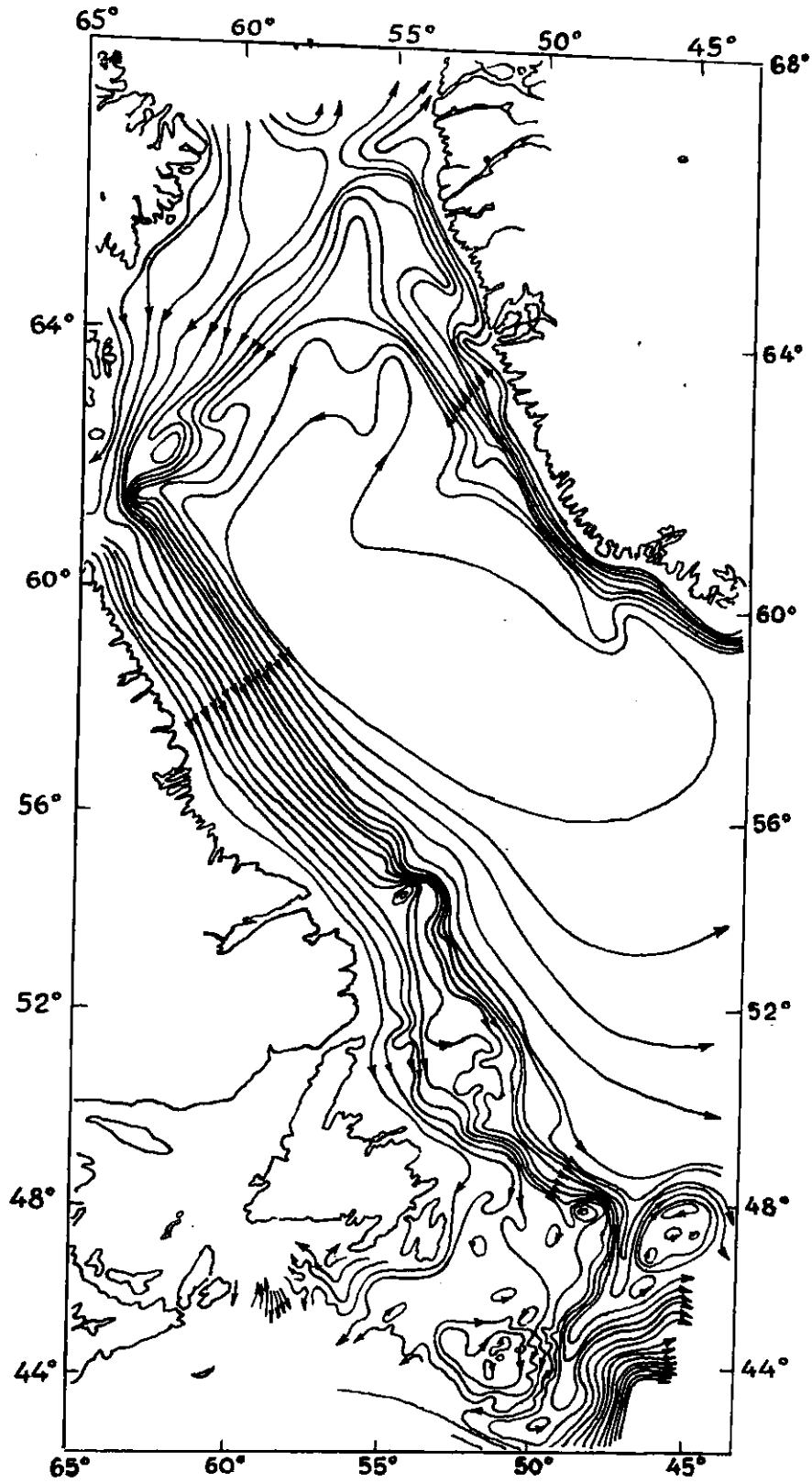


Fig. 1. The probable scheme of mean geostrophic water circulation in the surface layer of the North-west Atlantic for a warm period of a year.

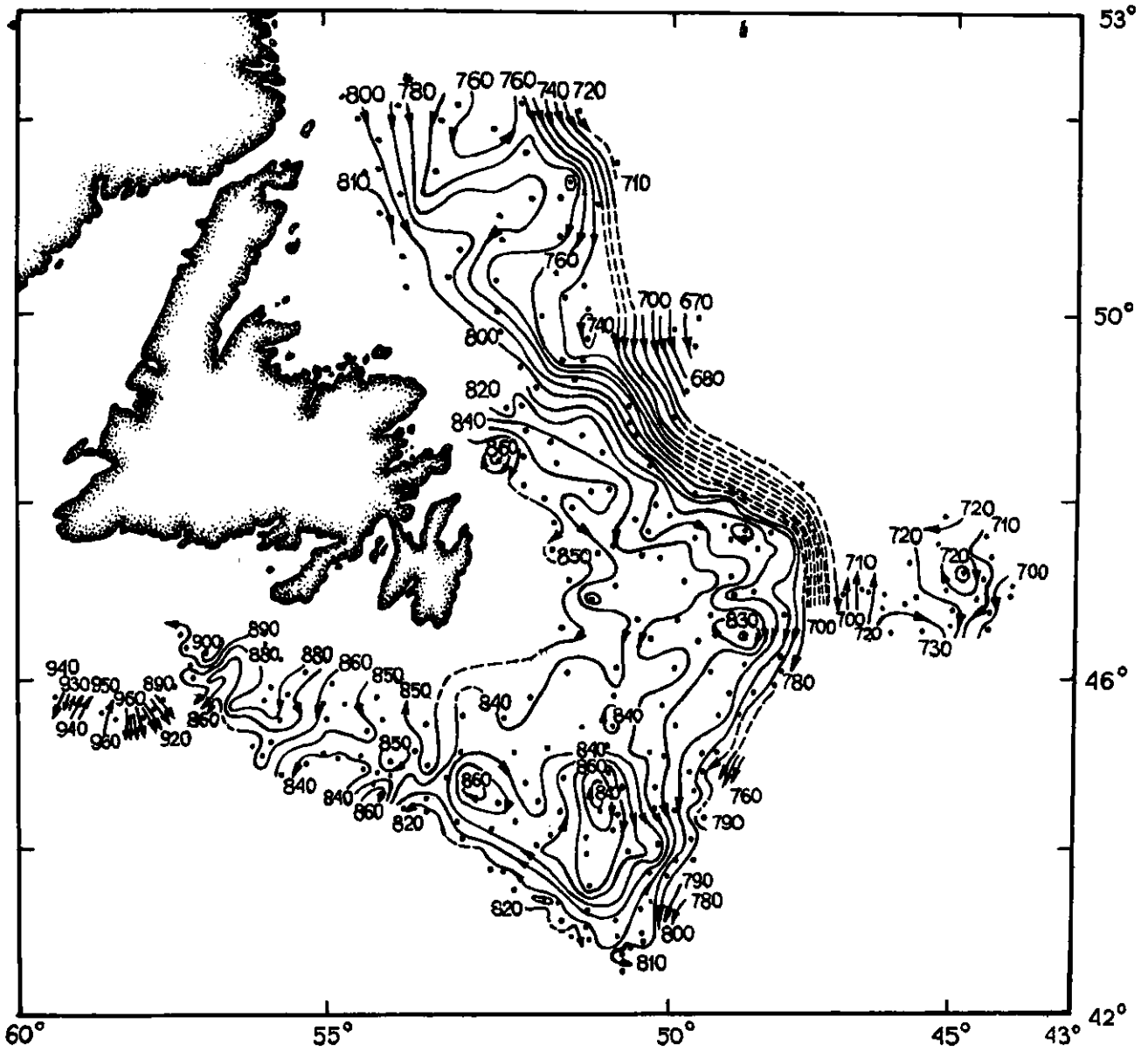


Fig. 2. Long-term mean chart of geostrophic water circulation in the surface layer of the Newfoundland area and Flemish Cap Bank for a spring-summer period (1972-1976).