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Distribution of Autumn Water Temperature Anomalies on the Scotian Shelf
in 1986 and Their Relative Changes in Recent Decade, 1977-1986

by

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ABSTRACT

The present report continues a series of papers on year-to-year variability of the water temperature on the Scotian Shelf. It is based on comparison of current observations made in October-November and mean autumn temperatures for 1962-1972. The values of autumn temperature anomalies in 1986 were calculated for each square (20' x 30') covered by the joint USSR-Canada inventory survey of silver hake larvae carried out from 18 October to 6 November 1986. The run and values of autumn temperature anomalies for 1977-1984 determined from the data of similar surveys were presented by the author in 1985 (NAFO SCR Doc. 85/60). Now these series are supplemented by the 1985 and 1986 data. In autumn 1986, on the shelf, negative anomalies predominated in the surface layer and positive anomalies in intermediate and near bottom layers. In the recent four years a downward trend of the surface layer temperatures has been observed. Such a trend has been observed in intermediate and near bottom layers since 1985 and is particularly obvious in spawning grounds and on the shelf slope. Nevertheless, the temperature anomalies in these layers still exceed the norm by 2-3°.

INTRODUCTION

In autumn 1986, a traditional USSR-Canada trawling inventory survey of the young silver hake was carried out on the Scotian Shelf. As in the previous 9 years, the water temperatures were

measured by BT at each trawling station. In 1985 the temperature measurements from these surveys were summarized for the 1977 to 1984 period to reveal year-to-year water temperature fluctuations on the shelf and presented in a special report to NAFO (Sigaev, 1985). A decade of observations of the water temperature variations was completed by the analysis of the 1986 observations. During this observation period the years of increased and lowered temperatures of the shelf water column relative to the adopted norm were observed (1962-1972).

MATERIALS AND METHODS

As before, the values of the water temperature gained during the survey carried out from 18 October to 6 November 1986 were subject to the by-square processing. After calculating mean values for each 30' x 20' square (Fig. 1) the anomalies of these values from the means for 1962-1972 were calculated. Then the values of the 1986 anomalies were plotted on the charts as isotherms (Figs. 2,3), and the values for 1985 and 1986 averaged by area were plotted on the graphs (Fig. 4). As before, the temperature values were averaged for the surface, intermediate (50 and 75 m) and near bottom (to 200 m) layers relative to the entire survey area, silver hake spawning ground and a part of the shelf slope.

RESULTS

As is evident from Fig. 2, the negative anomalies prevailed in the surface layer in autumn 1985. They covered approximately 2/3 of the investigated area including the eastern and central parts of the shelf and the slope. Their maximum absolute values (-2.2 - -2.5)° were observed along the eastern boundary. The area with positive anomalies was located along 65°W, from the slope to the inshore part and further on eastward along the inshore part to 62°W. Their maximum values reached 4.1-4.7°. The appearance of negative anomalies began to show along the western boundary. The averaging by area gives the value of the anomaly close to the zero and indicates that the downward trend of the surface temperatures has been continued since 1983 (Fig. 4). The distribution of the

anomalies in intermediate and near bottom layers (Figs. 2,3) shows that the positive anomalies undoubtedly prevail among these and that the areas with negative anomalies gradually decrease from the surface to the bottom. From the graphs of year-to-year variations (Fig. 4) it can be noted that the mean autumn temperatures in intermediate and near bottom layers changed insignificantly throughout the area in the recent three years (Fig. 4 - I). At the same time the mean temperatures for different sites of the spawning ground and the slope clearly showed a downward trend that may be terminated in 1987-1988. As is evident from the graphs, similar drops of temperature were observed in 1978 and 1982. On the whole, in the past decade a downward trend was obvious in the surface layer, especially marked after 1982. The run of temperature variations in intermediate and near bottom layers is characterized by two declines in 1978 and 1982 and two rises in 1980 and 1984-1985. The next third temperature decline began in these layers, especially in some parts of the spawning ground and of the slope. Thus, it can be stated that successive declines and rises are separated by 4-5 year intervals.

DISCUSSION

The analysis of a series of ten-year measurements of autumn temperatures for different layers of the Scotian Shelf water column and some comparisons between their variability and other data (Trites and Drinkwater, 1983, 1984; Ingham and McLain, 1983; Burmakin, 1984; Scott, 1984) given by the author in NAFO SCR Doc. 85/60 are indicative of quantitative variations of the water temperature on the shelf that had really taken place. As we have a ten-year uninterrupted series of autumn temperatures at our disposal, it seems reasonable to continue such observations in the future by carrying out the autumn inventory surveys of silver hake fry accompanied by hydrographic observations. In terms of the methods, it has become possible to calculate the anomalies relative not to the 1962-1972 norm, as it was practised by the author before, but to the 1977-1986 norm.

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REFERENCES

- BURMAKIN, V. V. 1984. Water temperature off Newfoundland and Labrador in 1982. NAFO SCR Doc. 84/VI/11, 5 p.
- INGHAM, M. C., and D. R. McLAIN. 1983. Sea-surface temperature in North-western Atlantic in 1982. NAFO SCR Doc. 83/VI/16, 11 p.
- SIGAEV, I. K. 1985. Year-to-year variability of water temperatures on the Scotian Shelf in summer 1978-1981 and fall 1977-1984. NAFO SCR Doc. 85/60, Serial No. N1010, 11 p.
- TRITES, R. W., and K. F. DRINKWATER. 1984. Overview of environmental conditions in the Northwest Atlantic in 1983. NAFO SCR Doc. 84/VI/70, 29 p.
- TRITES, R. W., and K. F. DRINKWATER. 1983. Overview of environmental conditions in the Northwest Atlantic in 1982. NAFO SCR Doc. 83/VI/23, 42. p.

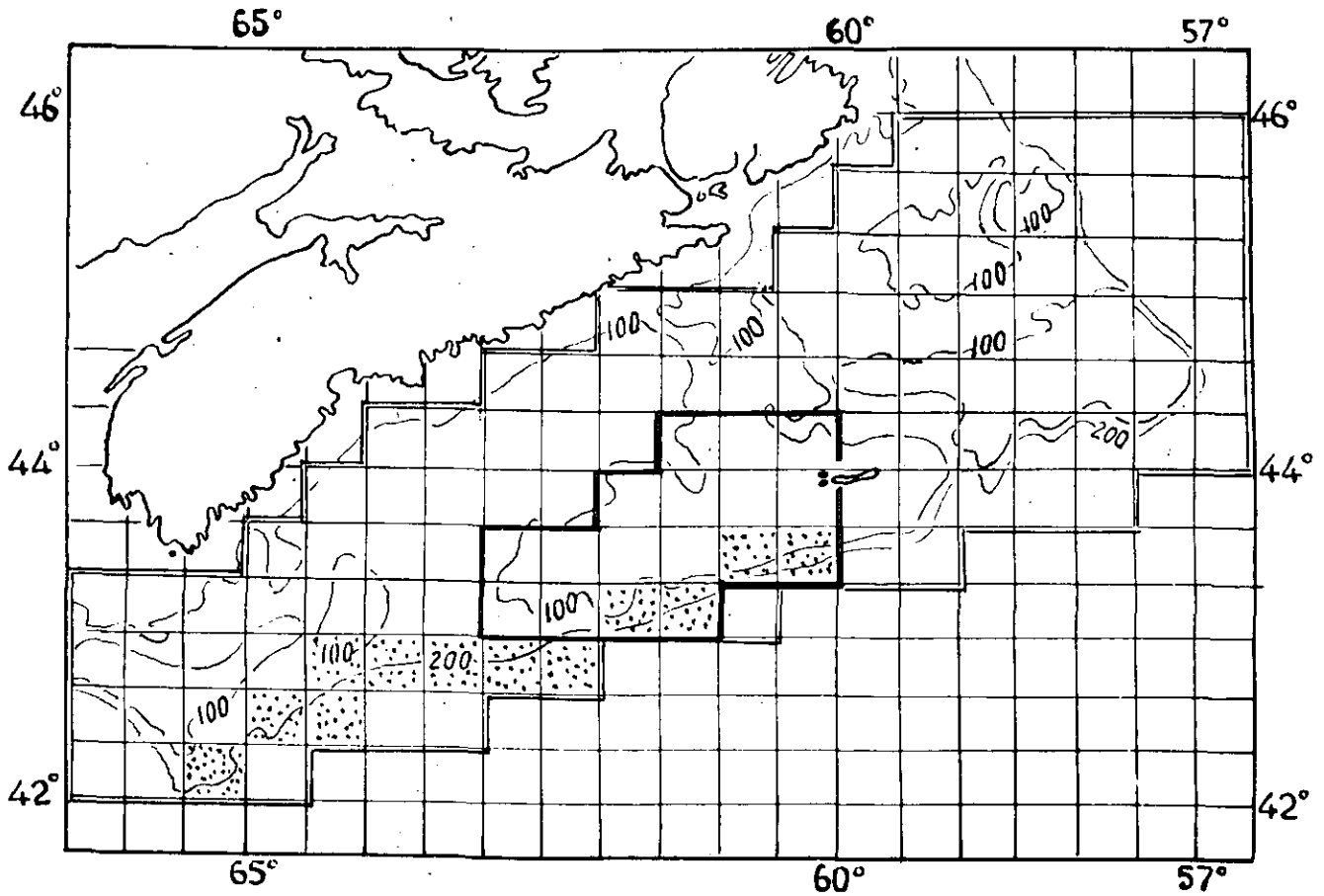


Fig. 1. Grid of squares for which the water temperatures were averaged. A thick line contours the spawning ground, dots indicate fishing squares.

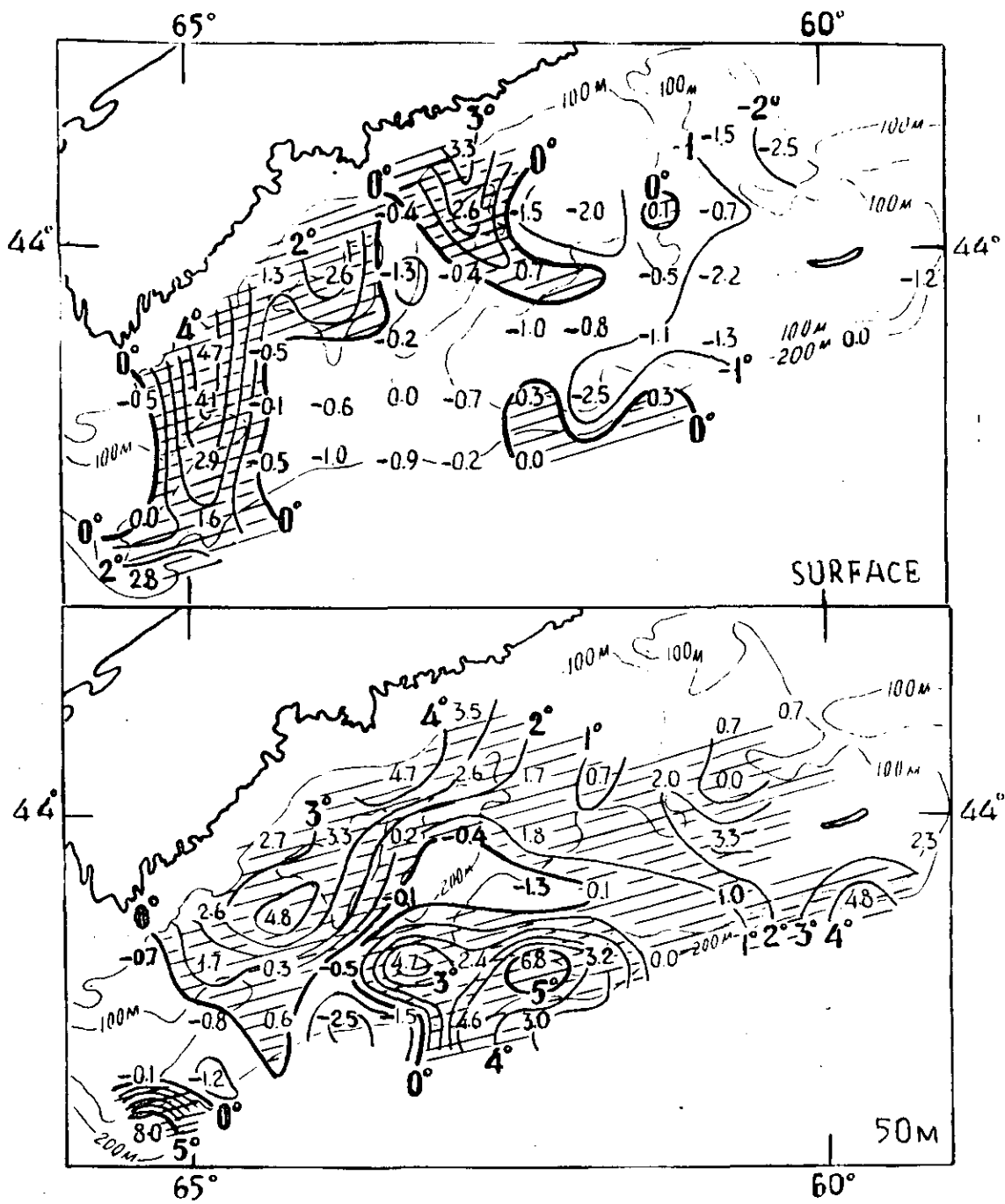


Fig. 2. Distribution of water temperature anomalies on the surface and at 50 m depth, 18.10-06.11, 1986.

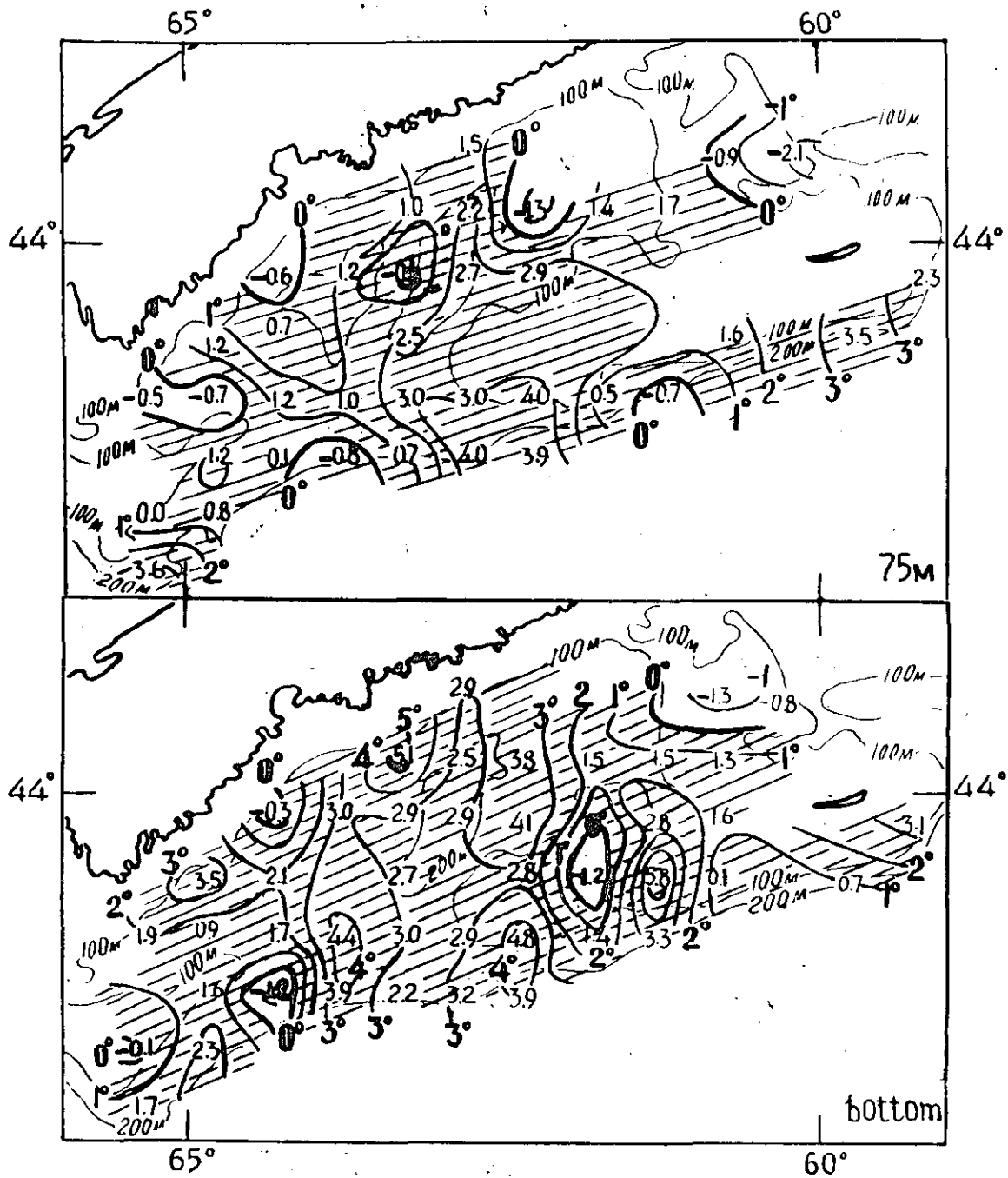


Fig. 3. Distribution of water temperature anomalies at 75 m depth and near the bottom, 18.10-06.11, 1986.

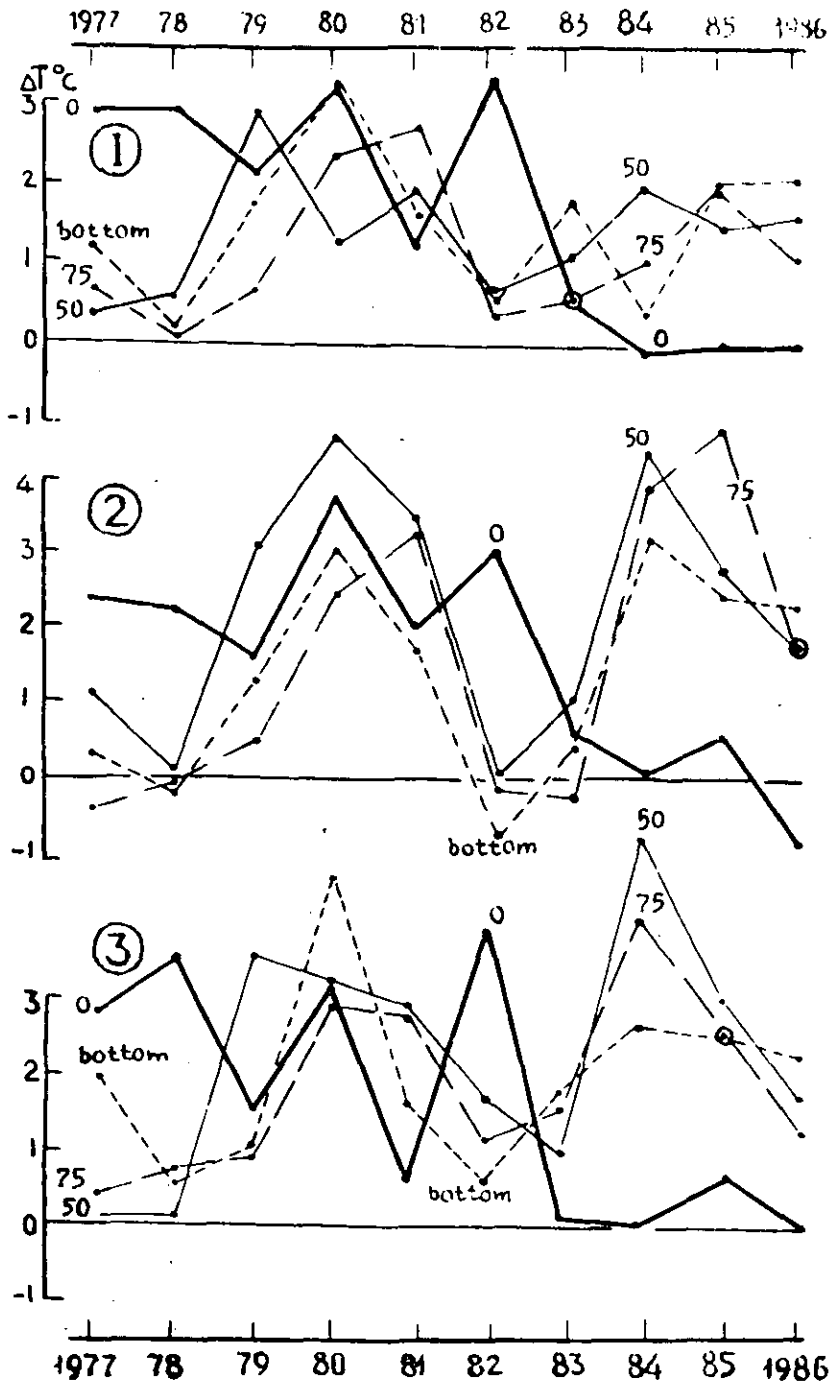


Fig. 4. Autumn variations of the water temperatures on the Scotian Shelf in 1977-1986 relative to mean values for 1962-1972 at 0, 50 and 75 m depths and near the bottom.

1 - entire survey area, 2 - part of spawning ground,
3 - part of the slope.