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Observations on Geostrophic Currents and Distribution of Cod off West Greenland, 1989-95

by

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Background

During the NAFO Workshop on "Assessment of Groundfish Stocks Based On Bottom Trawl Survey Results" (4-6 September 1996, St. Petersburg, Russia) an analysis of biological and oceanographic data sampled during groundfish surveys was carried out. The oceanographic data were interpolated and plotted as contour plots using the software SURFER. A combination of the 1995 CTD data set and the groundfish survey results on cod distribution obtained by FRV "Walther Herwig" off West Greenland (RÄTZ, 1996), indicated a possible correlation between the distribution of cod and certain abiotic variables. During the workshop, it was suggested that this should be investigated further, and an analysis of the distribution of cod in relation to the extent of geostrophic shear is given below.

Data and Methods

The biotic data on cod distribution (1989-1995) were taken from RÄTZ (1996), and superimposed on the geopotential anomaly charts for the corresponding years (Fig. 1, 2). The geopotential anomaly of the 100dbar surface relative to the sea surface is given in dynamic centimeters. The current flow is directed along the isolines with the high values on the right when looking along the direction of flow. For the years 1990, 1992 (Fig. 1a, 2a) and 1993 (Fig. 1b, 2b) the coverage of the area with oceanographic data is rather poor, especially for the year 1990 when only standard stations are available. Figures 1a, b display individually scaled cod distributions to better indicate relative maxima in the annual distribution, whereas Fig. 2a, b use the same scaling for the cod distribution in all years.

Results and Discussion

Figures 1a, b reveal a dynamic feature to the southeast of Frederikshaab (about 60°N, 47°W) which seems to be consistent throughout the years (c.f. 1989, 1991, 1994, 1995): From the southeast, water flows in a northerly direction and turns to the west. Cod were consistently observed in this region in all years examined, even in 1990 and 1992 when the oceanographic data were not sufficient to resolve this dynamic feature. A second consistent feature may be seen at the northwestern boundary of the survey area: Offshore warm waters (> 4.5°C, STEIN (1996)) flow to the slope and shelf area off West Greenland. This flow is documented in Fig. 1a, b for the years 1989, 1991, 1993 and 1995. In these years the relative maxima in cod distribution were encountered in the area around 62°N, 50°W.

Although these observations have not been extensively analyzed, there does appear to be some consistency between years irrespective of the amount of cod in the area (Figures 1a,b). If they are truly a persistent feature, it may be important to take into account, these two areas where the distribution of cod might be influenced by physical and topographic processes, when designing future bottom trawl surveys off West Greenland . With regard to the topographic influences on the distribution of cod, the area to the southeast of Frederikshaab is known as "Salter's hole", a site where a pronounced submarine trough is washed by warm saline waters from the offshore regions off West Greenland.

By plotting the cod distribution on the same scale for the years 1989-95, the rapid decline of the West Greenland cod stock is documented in Fig. 2a, b.

References

RÄTZ, H.-J. 1996. Relevance of Some Environmental Parameters to Distribution Patterns of Groundfish and Implications for Reasonable Survey Design: Case Study Atlantic Cod off Greenland. NAFO Workbook: Assessment of Groundfish Stocks Based On Bottom Trawl Survey Results. Special Session St. Petersburg, Russia, 4-6 September, 1996: 35-40.

STEIN, M. 1996. Overview of the Environmental Aspects of the Analysis of Fish Stocks Using Bottom Trawl Surveys. NAFO Workbook: Assessment of Groundfish Stocks Based On Bottom Trawl Survey Results. Special Session St. Petersburg, Russia, 4-6 September, 1996: 19-28.

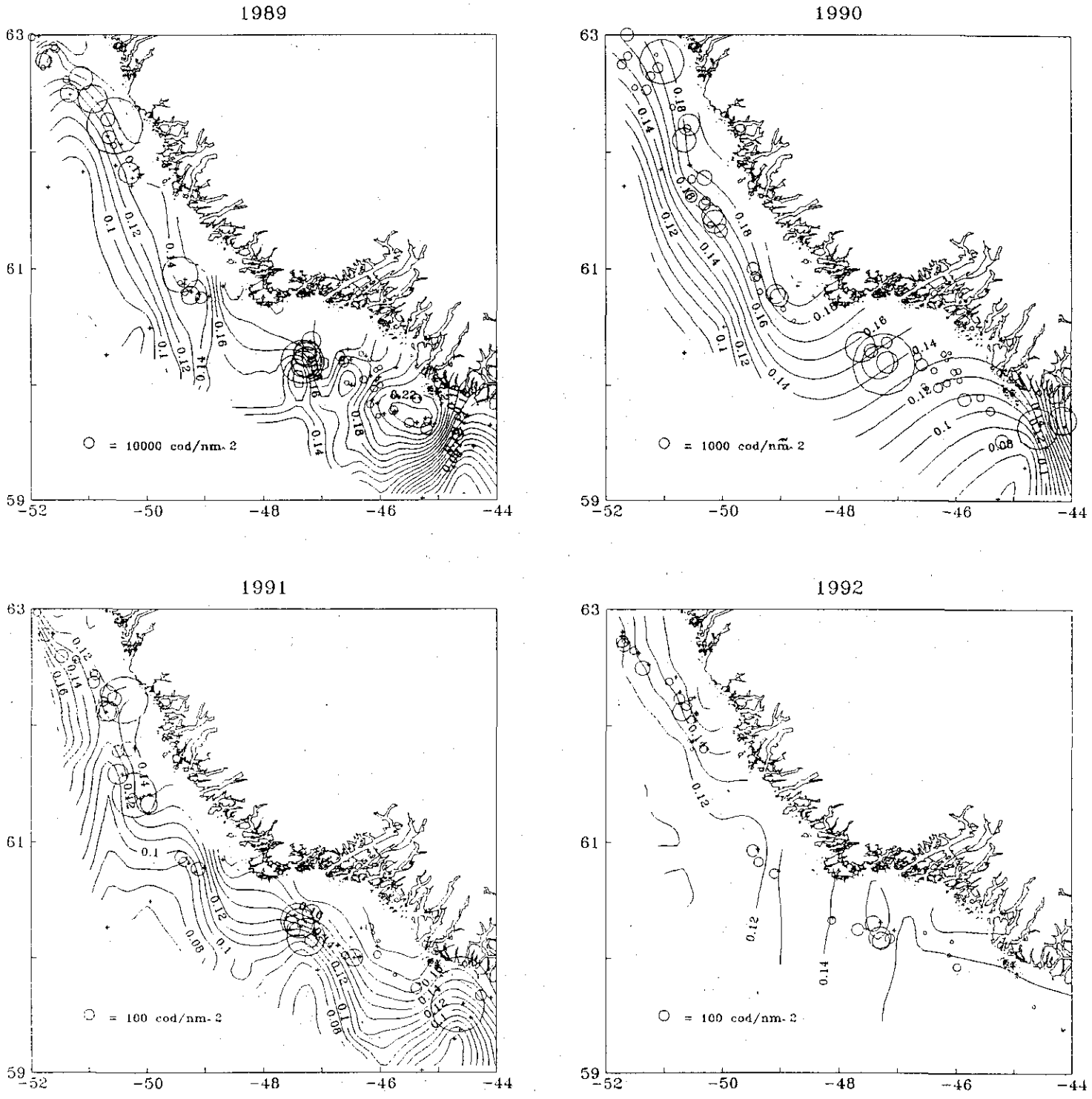

Fig. 1a. Geopotential anomaly of the 100dbar surface relative to the sea surface (given in dynamic centimeters) and cod distribution individually scaled for the years 1989-1992.

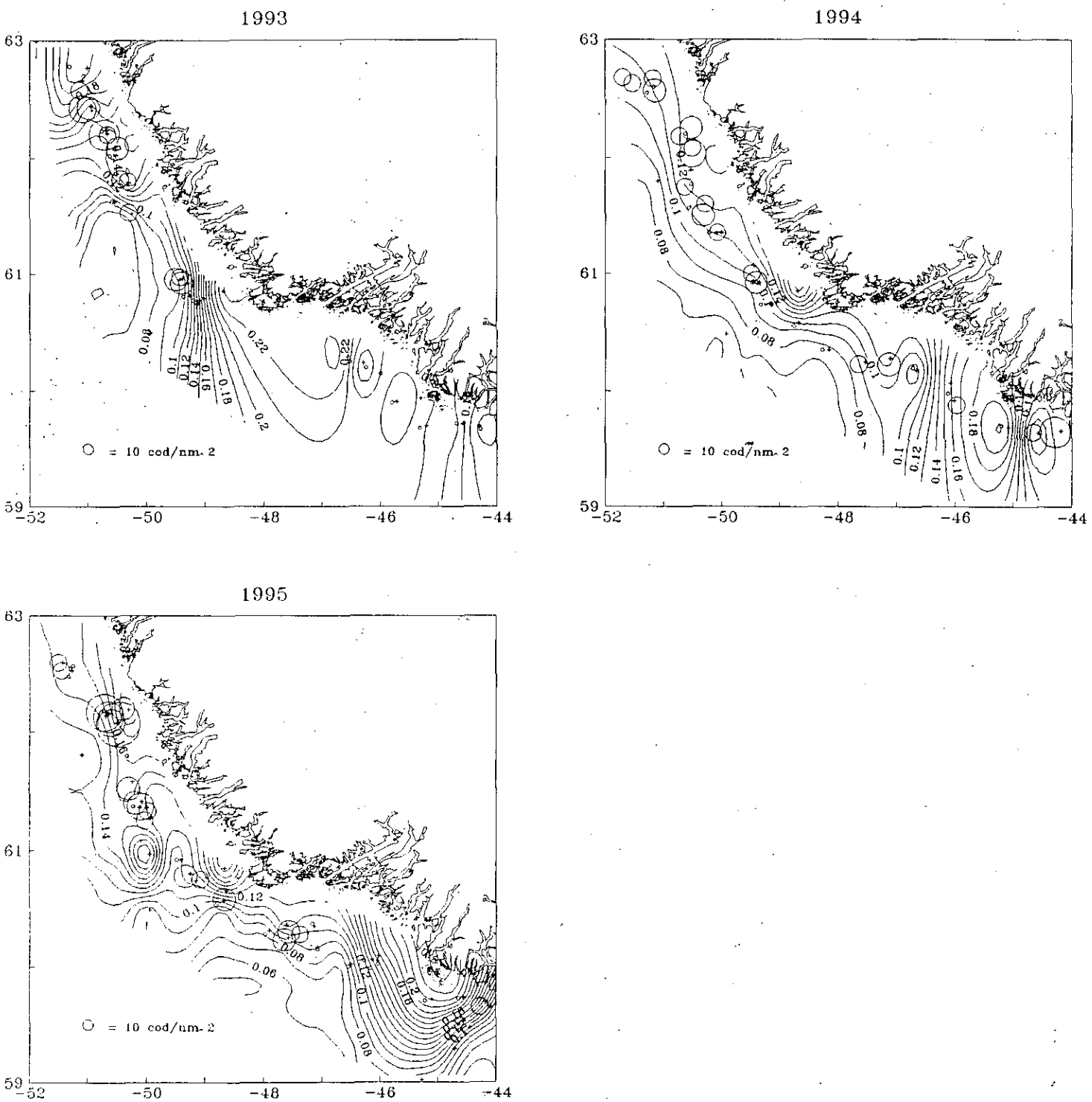

Fig. 1b. Geopotential anomaly of the 100dbar surface relative to the sea surface (given in dynamic centimeters) and cod distribution individually scaled for the years 1993-1995.

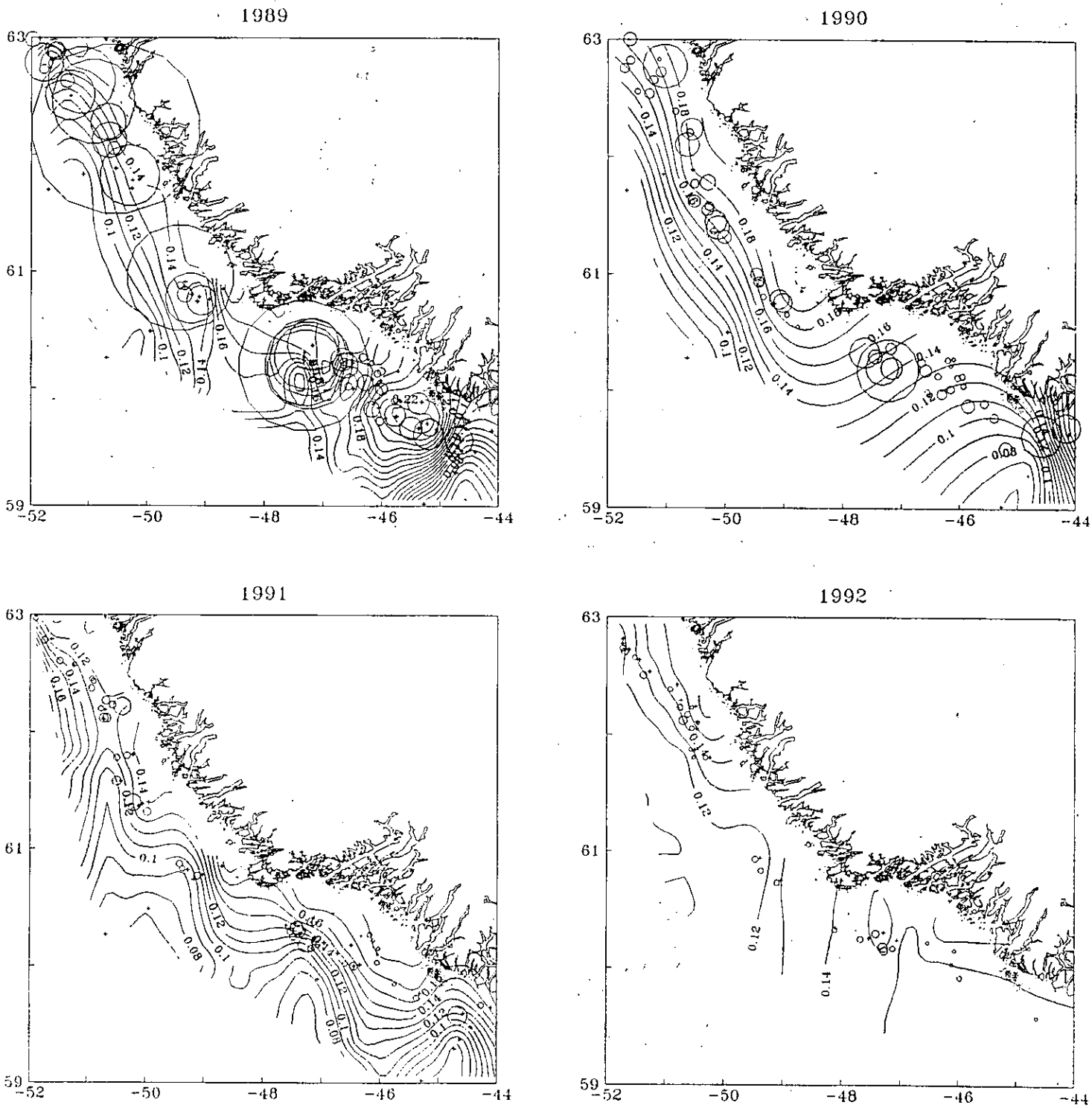

Fig. 2a. Geopotential anomaly of the 100dbar surface relative to the sea surface (given in dynamic centimeters) and cod distribution for the years 1989-1992.

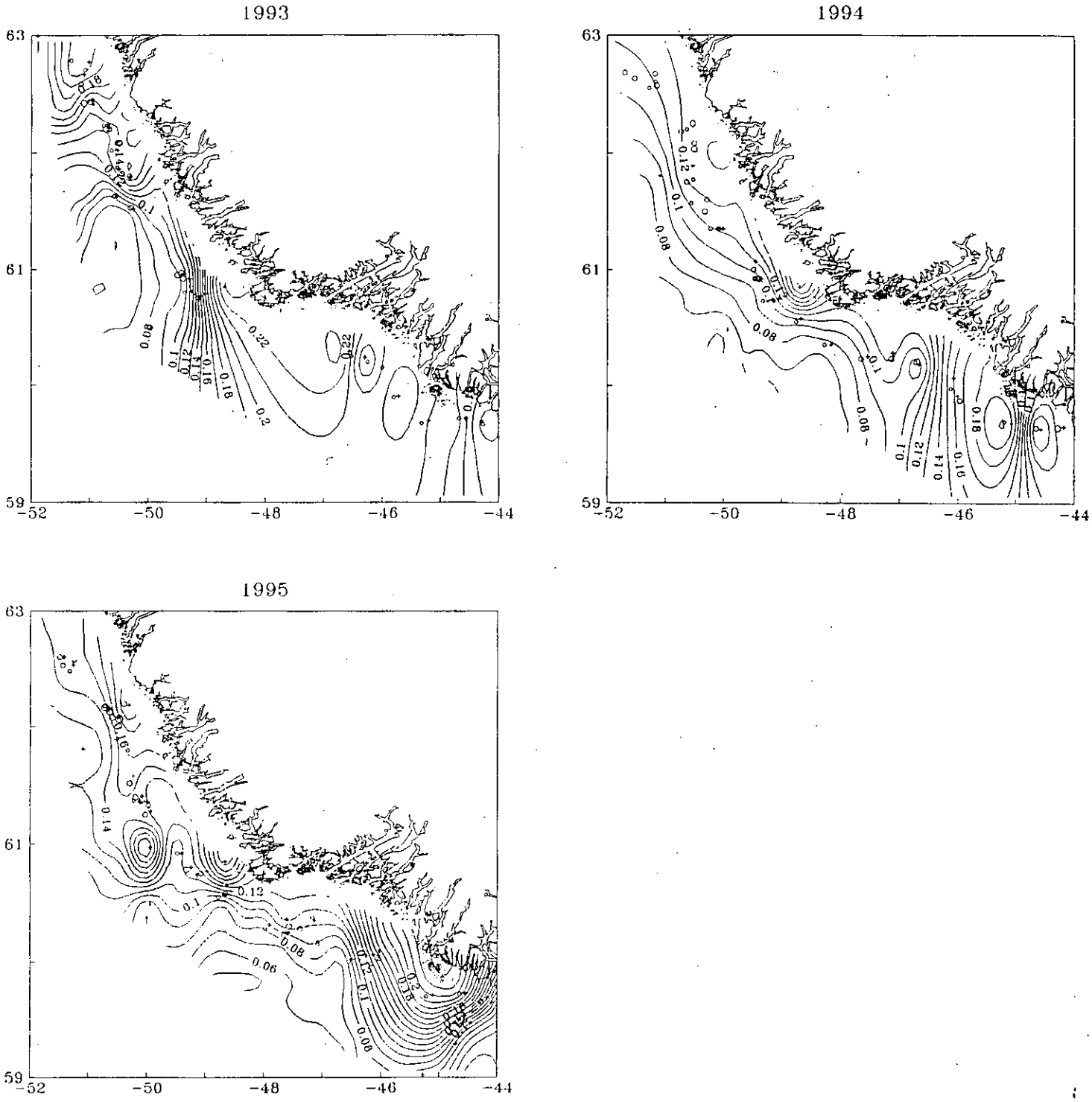

Fig. 2b. Geopotential anomaly of the 100dbar surface relative to the sea surface (given in dynamic centimeters) and cod distribution for the years 1993-1995.