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Distribution of Capelin on Grand Bank (Div. 3LNO) in the Springs of 1987 and 1991,
as Inferred From Bottom-Trawl By-Catches and Cod Stomach Examinations

by

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Introduction

Because of uncertainty in 1991 about the status of the capelin stock in Div. 3L, STACFIS recommended that additional data be presented to a special meeting in March 1992 (NAFO, 1991). The data requested included "capelin by-catch in groundfish bottom-trawl surveys" and "predation by cod and other major predators including historical comparisons".

This paper provides information on capelin by-catch, cod catch, and the quantity of capelin in cod stomachs, on a station-by-station basis, for bottom-trawl surveys of Grand Bank (Div. 3LNO) in spring 1991. For comparison, similar data are presented for the spring of 1987.

Materials and Methods

Capelin and cod were caught during random depth-stratified bottom-trawl surveys conducted with the R/V Wilfred Templeman on Grand Bank and the southern part of the Northeast Newfoundland Shelf (Div. 3LNO) in the springs of 1987 and 1991 (Table 1). An Engel-145 trawl, with 29 mm mesh liner in the codend, was towed at 3.5 knots for 30 min at each fishing station. Catches from the few stations of duration other than 30 min were appropriately adjusted. Fishing was conducted on a 24 h basis.

Stomachs were collected from the cod caught in each fishing station. A maximum of 5 cod per 9-cm length group were sampled from each station in Div. 3L and 3 cod per 9-cm length group were sampled in Div. 3NO. The sampling protocol ensured that sampling was well distributed with respect to cod size and geographic distribution.

Cod stomachs were individually tagged, and fixed and preserved in 4% formaldehyde solution in sea water prior to examination in the laboratory. Examination involved separation of food items into taxonomic categories. Fish were identified to species. Items in each taxon were placed briefly on absorbent paper to remove excess liquid, and then counted and weighed to the nearest 0.1 g.

The quantity of capelin in the stomachs of the cod sampled at each station was expressed as a mean partial fullness index:

$$PFI_c = \frac{1}{n} \sum_{j=1}^n \frac{W_{cj}}{L_j^3} * 10^4$$

where W_{cj} is the weight of capelin in fish j , L_j is the length of fish j , and n is the number of fish in the sample. Analyses were restricted to cod within the 36-71 cm length range (Lilly 1991).

I used expanding symbol plots to illustrate the distribution of capelin, cod and capelin in cod stomachs.

Results

In 1987, and in many other years not reported here, capelin were caught in eastern, northern and western Div. 3L, northwestern Div. 30, and toward the shelf break in both Div. 30 and Div. 3N (Fig. 1). Only rarely were large catches obtained on the plateau of Grand Bank in Div. 30, Div. 3N and southern Div. 3L. In 1991, capelin were caught at many stations in eastern and northern Div. 3L and at numerous stations near the shelf break in southern Div. 3NO (Fig. 2). A notable difference from earlier years was the absence of large capelin catches in southwestern Div. 3L. Ice cover prohibited fishing in the most northern part of Div. 3L.

Examination of stomachs of cod caught during the bottom-trawl surveys in 1987 (Fig. 3) and most other years prior to 1991 revealed a geographic pattern of predation on capelin (Fig. 5) which was similar to the pattern shown by the capelin catches. In 1991, poor cod catches (Table 1, Fig. 4) resulted in the lack of stomach content data for most stations in western and southern Div. 3L, many stations in Div. 30, and most stations in Div. 3N (Fig. 6). At some stations, particularly on the plateau of the southern Grand Bank, cod were caught, but no specimens were within the size range (36-71 cm) selected for the present analysis. Large quantities of capelin were found in cod stomachs from northeastern Div. 3L (Fig. 6), where large quantities were found in cod stomachs in many previous years. There was little or no capelin found in stomachs at the few stations for which stomachs were available in southwestern Div. 3L.

Discussion

In May 1991, capelin were caught during the bottom-trawl survey at numerous stations in eastern and northern Div. 3L, and recorded in large quantities in stomachs of cod caught in northeastern Div. 3L. This distribution is not unexpected, when compared with distributions found in previous years during May acoustic surveys (Miller, 1991) and bottom-trawl surveys (Lilly and Rice, 1983; Lilly and Carscadden 1986; Fig. 1,5 of this paper). However, the small capelin catches and small quantities of capelin in cod stomachs in southwestern Div. 3L in 1991 is a departure from most previous years. Kovalyev and Kudrin (1973) reported that capelin migrate during March-April from the northern parts of Grand Bank to southwestern Div. 3L and northwestern Div. 30. It appears that a migration of large quantities of capelin into southwestern Div. 3L had not occurred by May 1991.

Determination of the extent to which capelin distribution was anomalous in spring 1991 requires comparison with a longer time-series than has been attempted in this paper. Analysis of data collected in 1971-1991 is in progress.

Acknowledgements

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References

- Kovalyov, S. M., and B. D. Kudrin. 1973. Soviet investigations on capelin in the Northwest Atlantic in 1971 and 1972. ICNAF Redbook 1973. Part III: 121-126.
- Lilly, G. R. 1991. Interannual variability in predation by cod (*Gadus morhua*) on capelin (*Mallotus villosus*) and other prey off southern Labrador and northeastern Newfoundland. ICES mar. Sci. Symp. 193: 133-146.
- Lilly, G. R., and J. Carscadden. 1986. Capelin in Division 3L and their occurrence in the NAFO Regulatory Area. NAFO SCR Doc. 86/84, Serial No. N1206, 15 p.

Lilly, G. R., and J. C. Rice. 1983. Food of Atlantic cod (Gadus morhua) on the northern Grand Bank is spring. NAFO SCR Doc. 83/87, Serial No. N753, 35 p.

Miller, D. S. 1991. Estimates of biomass from an acoustic survey for capelin (Mallopus villosus) in Division 3L, May 1990. NAFO SCR Doc. 91/37, Serial No. N1917, 14 p.

NAFO. 1991. Report of Standing Committee on Fishery Science. NAFO Sci. Coun. Rep., 1991: 129-131.

Table 1. Selected data for bottom-trawl surveys in Divisions 3LNØ in the springs of 1987 and 1991.
WT = WILFRED TEMPLEMAN

Year	Div.	Ship/Trip	Sampling dates (d/mo.-d/mo.)	Number of stations occupied	Stations with cod		Stations with capelin	
					No.	%	No.	%
1987	3L	WT 59, 60	14/05-01/06	181	169	93	53	29
	3NØ	WT 58, 59	23/04-14/05	190	168	88	56	29
1991	3L	WT 106, 107	11/05-29/05	143	89	62	69	48
	3NØ	WT 105, 106	19/04-11/05	209	128	61	44	21

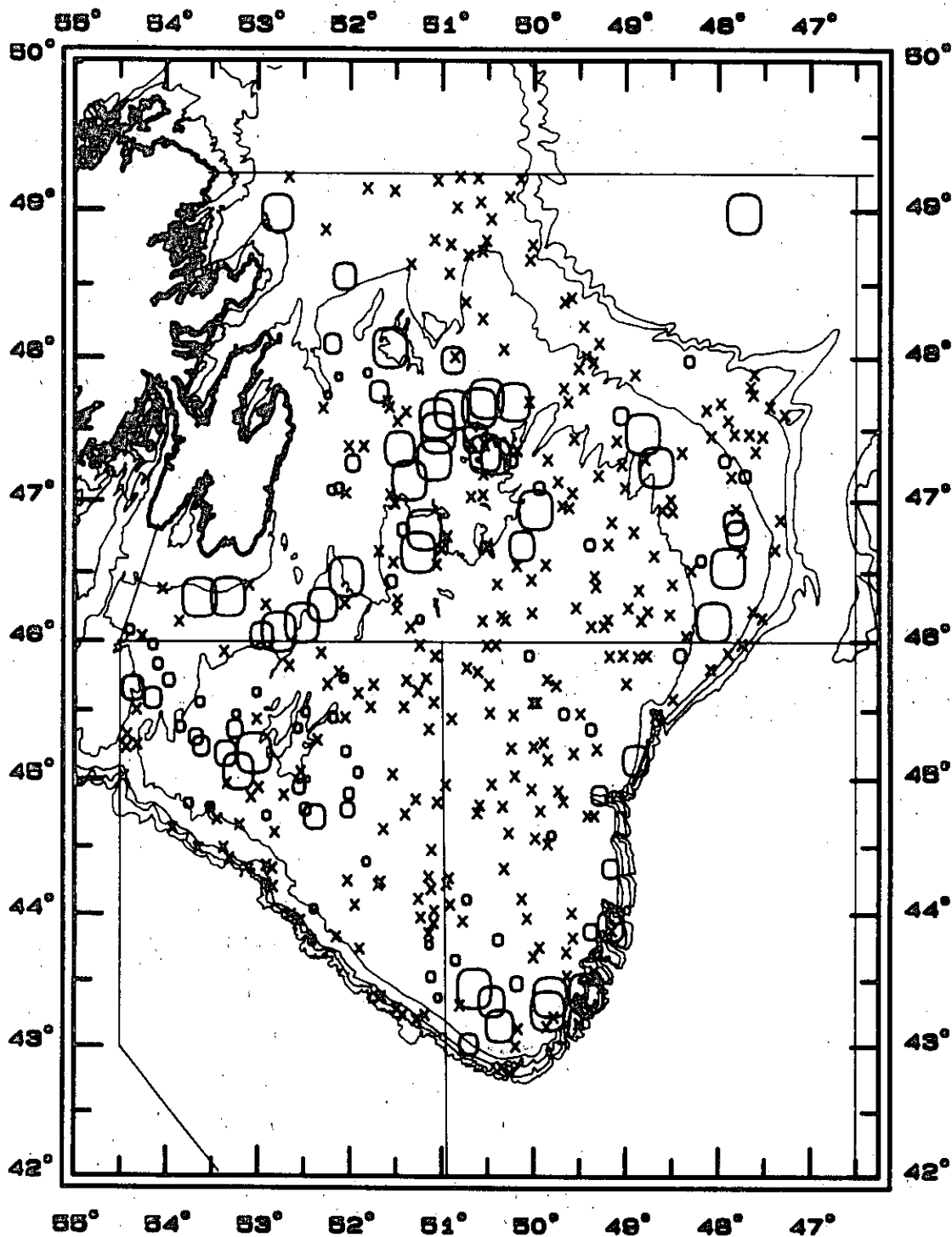


Fig. 1. Capelin catches (kg/30 min tow) during random depth-stratified bottom-trawl surveys in Div. 3LNO in spring 1987. Catches were set to a maximum of 10 kg before plotting. A symbol for 10 kg is shown at top right. Symbol area is proportional to catch. x = nil.

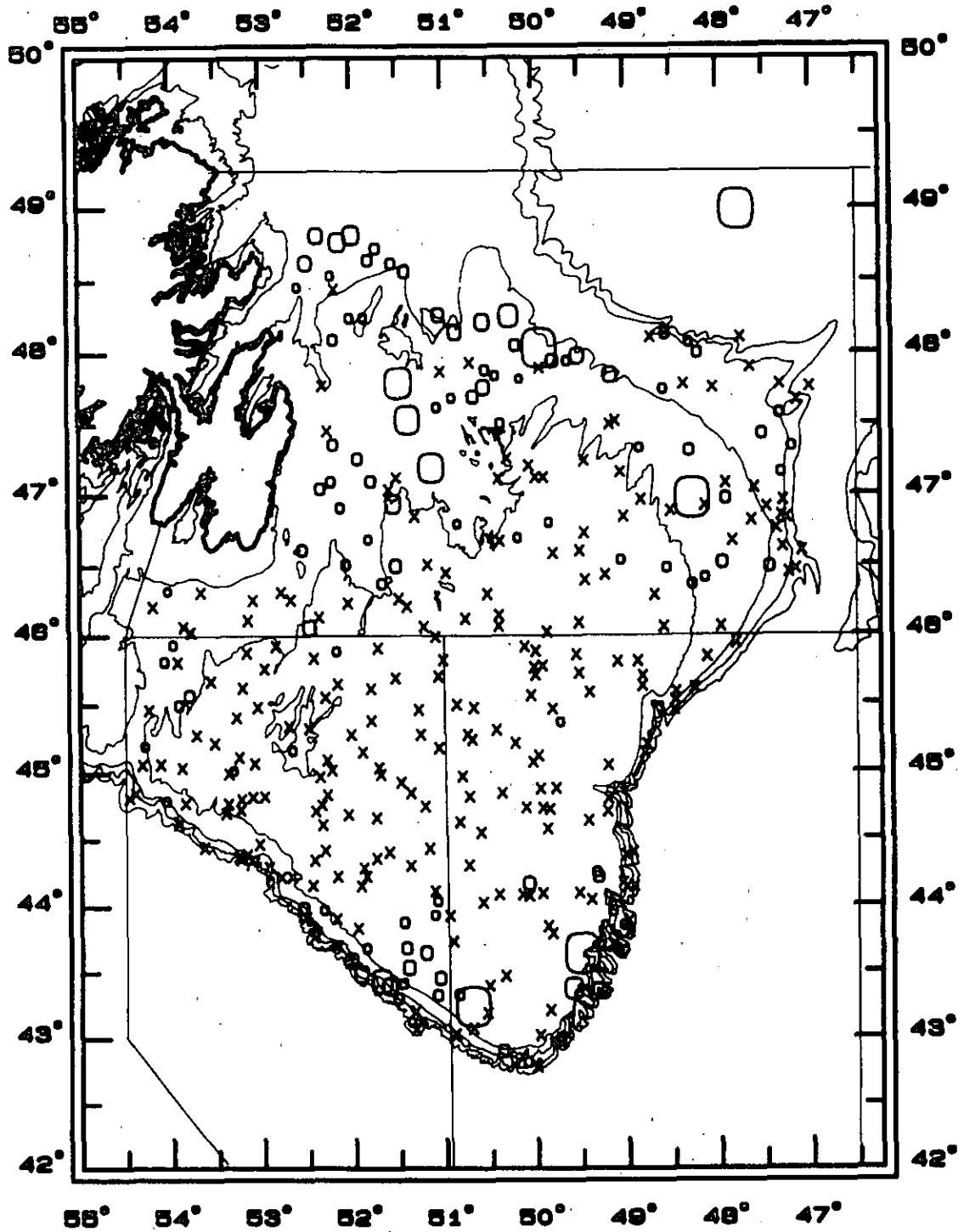


Fig. 2. Capelin catches (kg/30 min tow) during random depth-stratified bottom-trawl surveys in Div. 3LNO in spring 1991. Catches were set to a maximum of 10 kg before plotting. A symbol for 10 kg is shown at top right. Symbol area is proportional to catch. x = nil.

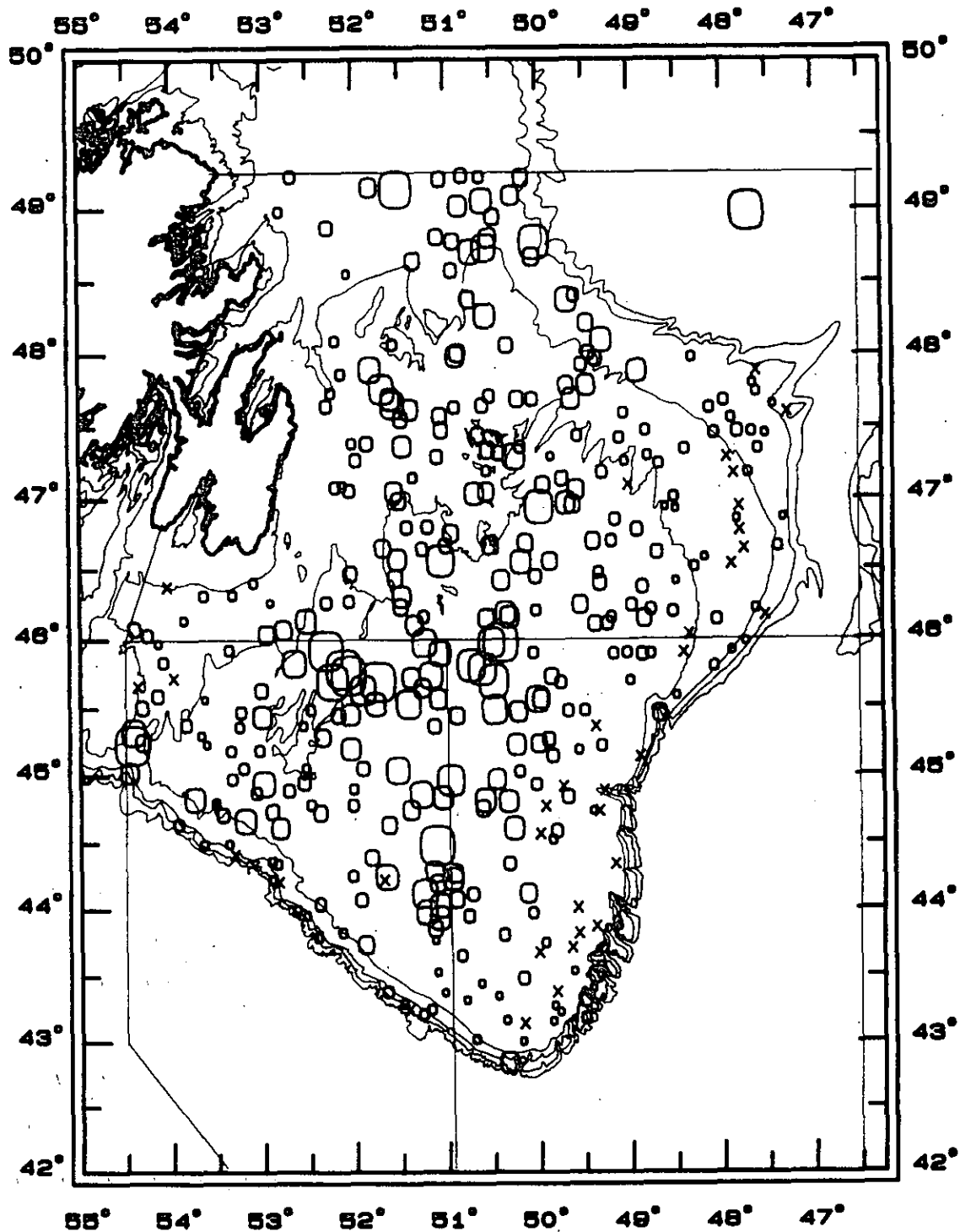


Fig. 3. Cod catches (kg/30 min tow) during random depth-stratified bottom-trawl surveys in Div. 3LNO in spring 1987. Catches were set to a maximum of 1000 kg before plotting. A symbol for 1000 kg is shown at top right. Symbol area is proportional to catch. x = nil.

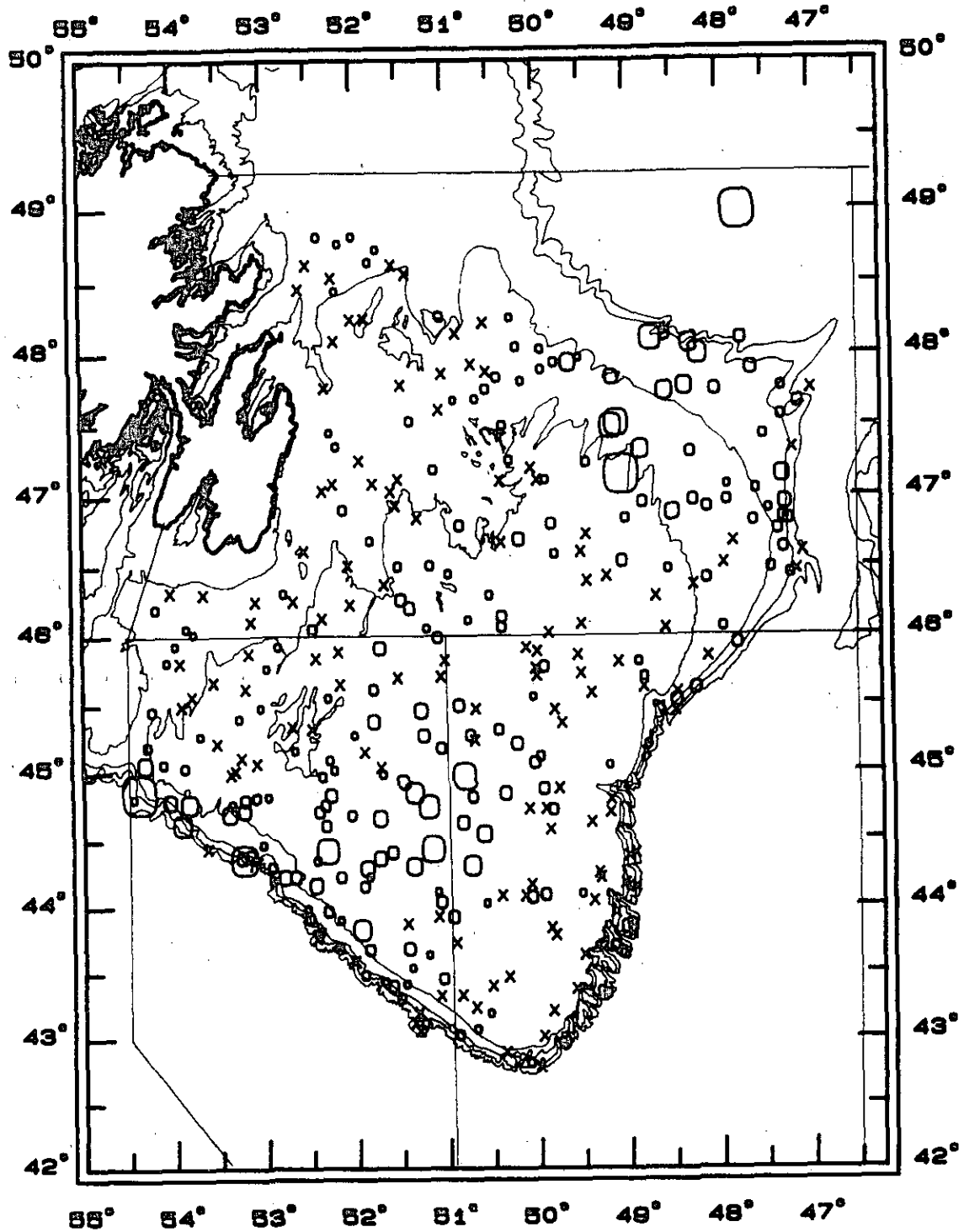


Fig. 4. Cod catches (kg/30 min tow) during random depth-stratified bottom-trawl surveys in Div. 3LNO in spring 1991. Catches were set to a maximum of 1000 kg before plotting. A symbol for 1000 kg is shown at top right. Symbol area is proportional to catch. x = nil.

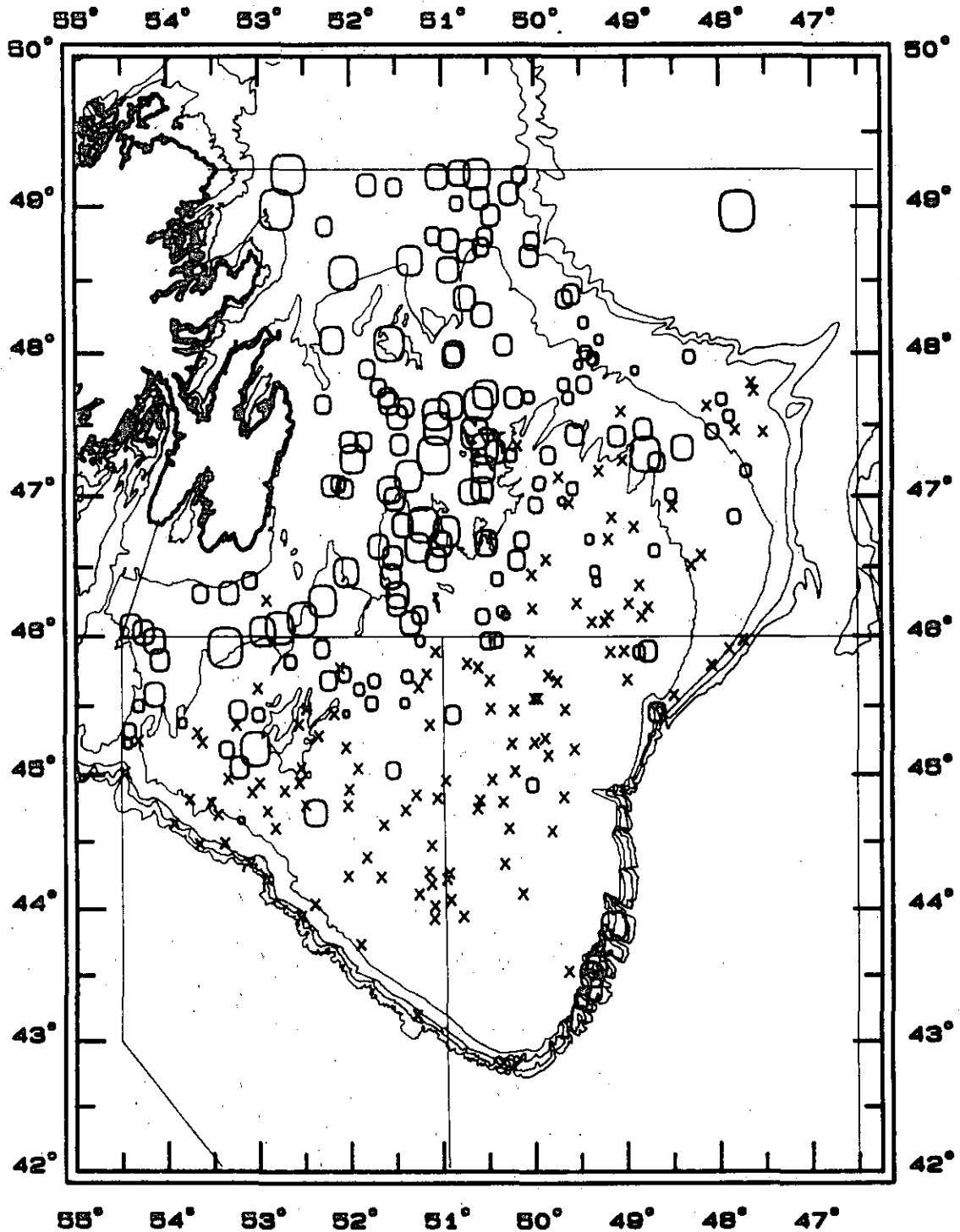


Fig. 5. Mean partial fullness index (PFI) of capelin in stomachs of cod (36-71 cm only) by fishing station in Div. 3LNO in spring 1987. PFI values greater than 10 were set to 10 before plotting. A symbol for PFI = 10 is shown at top right. Symbol area is proportional to fullness index. x shows where stomachs were collected but no capelin were found.

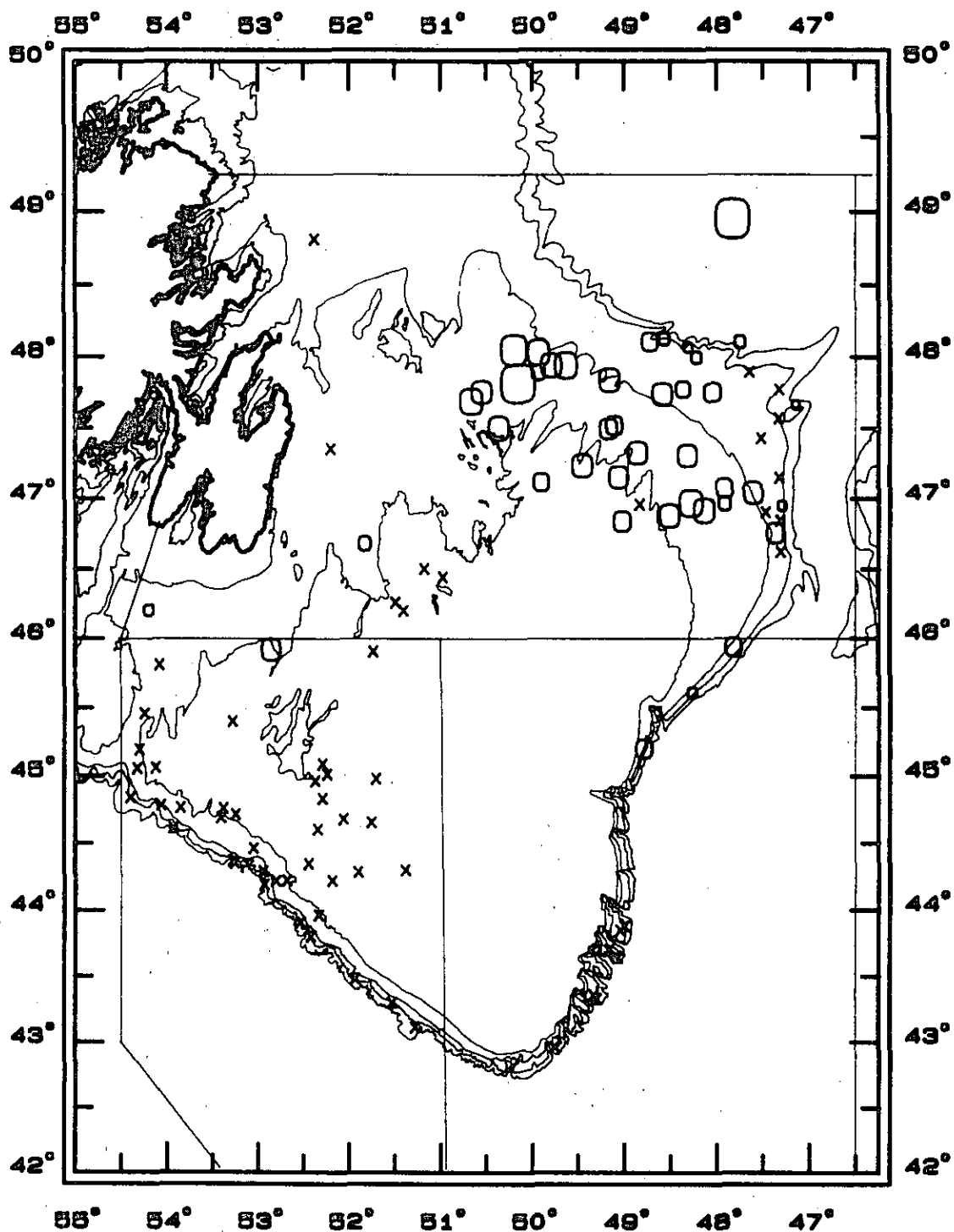


Fig. 6. Mean partial fullness index (PFI) of capelin in stomachs of cod (36-71 cm only) by fishing station in Div. 3LNO in spring 1991. PFI values greater than 10 were set to 10 before plotting. A symbol for PFI = 10 is shown at top right. Symbol area is proportional to fullness index. x shows where stomachs were collected but no capelin were found.