

Northwest Atlantic



Fisheries Organization

Serial No. N582

NAFO SCR Doc. 82/IX/76

FOURTH ANNUAL MEETING - SEPTEMBER 1982

Geographical Distribution of Haddock on the Scotian Shelf

by

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Abstract

The two nominal stocks of haddock on the Scotian Shelf (NAFO Divs 4X and 4W) were originally delineated on the basis of commercial fish catches. More recently, groundfish research surveys have confirmed concentration of haddock in each of the delineated areas and have shown that the distributions persist from year to year and, more obviously, in the two 5-yr periods 1970-74 and 1975-79. Concentrations of juvenile haddock also persist but in additional localities, which may indicate seasonal nursery areas. The haddock exhibit a degree of segregation between 0-group, 1-group and older fish.

Results and Discussion

A basic assumption in considering fish stocks on the Northwest Atlantic is that they persist over long periods of time, if not indefinitely, unless they are eradicated by some mechanism, manmade or otherwise. Has this assumption any basis other than that the fisheries for commercial species are concentrated in certain areas which may vary according to species and season? In the past we were totally reliant on fisheries information, but in recent years the development of regular, extensive research trawl surveys in the Northwest Atlantic has provided an alternative to the commercial fisheries information. Annual summer surveys have now been running for 12 years on the Scotian Shelf, long enough to provide evidence of persistent patterns of geographical distribution of groundfish and to permit comparison with stock delineation as determined by commercial catches.

One of the best documented species is haddock (Melanogrammus aeglefinus). Needler (1931) published a distribution chart of the North American haddock catch from 1917 to 1925, including the Scotian Shelf (Fig. 1). Major concentrations are shown at St. Mary's Bay in the Bay of Fundy, on Browns Bank, in the central part of the Shelf from Emerald Bank to Sable Island Bank and extending to Banquereau Bank, in Chedabucto Bay and off Inigonish, Cape Breton. The different groups are well separated and without further examination, could be assumed to be separate stocks.

Kohler (1968) produced a somewhat similar distribution plot, based on haddock catches from 1962 to 1966 (Fig. 2). The concentrations at St. Mary's Bay and in the Browns Bank and Emerald Bank areas are still evident, but the concentrations to the east, on Sable Island and Banquereau Banks, in Chedabucto Bay and off Inigonish have virtually disappeared. The Chedabucto Bay and Inigonish fisheries were very seasonal (May-June and Dec.-Jan.) and were dependent on the spawning group on the central part of the Shelf. This group supported a seasonal feeding migration to the Gulf of St. Lawrence, in spring, following spawning, with a return migration to the spawning grounds at the turn of the year. Extremely heavy exploitation in the mid-1960's presumably reduced the spawning group to such an extent that the migration to the Gulf of St. Lawrence was effectively eliminated, with consequent failure of the Gulf and coastal haddock fisheries - although construction of the Canso Causeway has been implicated.

Kohler (1968) postulated division of the Scotian Shelf haddock into two stocks, the Browns-St. Mary's Bay group (NAFO Div. 4X stock) and the central Shelf group (NAFO Divs 4W stock). This division has since formed the basis for management of haddock in the Scotian Shelf.

Annual groundfish research surveys on the Scotian Shelf provide information on distribution and abundance of all common groundfish species, including haddock. Annual distribution plots indicate summer concentrations but the fishing stations are too widely dispersed (average station to 300-350 sq naut. miles) to allow delineation of the concentrations with any certainty. Even at this level, however, comparison of distribution for the years 1976, 1977, 1978 and 1979, for instance (Fig. 3), shows a common

pattern from year to year. The persistence of the pattern is much more clearly shown by comparison of distributions for the periods 1970-74 (Scott 1976) and 1975-79 (Fig. 4). The concentrations on Browns Bank and at St. Mary's Bay are obvious for both periods. The central Shelf concentration is evident in the 1970-74 period but much more so in 1975-79, due to a marked increase in catch rates concomitant with the improved stock status there.

The persistence of the St. Mary's Bay concentration is interesting. Needler (1931) describes it as a summer fishery and it is at present regarded as a summer component of the Browns Bank stock. It does include 0-group fish as well as older fish, which may indicate the presence of a (local) spawning population in the area, or an early-developed migratory pattern in the young fish.

Geographical aggregation is not limited to adult fish. Research vessel survey results show concentrations of 0- and 1-group haddock in specific areas (Fig. 5). These correspond to a large degree with concentrations of the older fish which constitute the bulk of research catches. There are some areas of special interest in juvenile haddock, particularly the mouth of St. Mary's Bay, the north edge of Sable Island Bank and the shallows around Sable Island. The latter two areas are not known areas of concentration of adults and, like St. Mary's Bay, may be seasonal nursery areas. A detailed survey of the Sable Island area in 1981 showed contagious distributions of juveniles with evidence of year-class segregation in 0- and 1-group (Fig. 6). Virtually no adults were present. Results of ongoing seasonal surveys at all stages of the life-history should shed more light on problems of haddock stock structure.

The well-defined summer distributions from survey information, when the fish are relatively dispersed in their feeding mode, and the known spawning concentrations on Browns Bank and in the Emerald Bank area complement the evidence of the commercial fisheries for existence of two separate haddock stocks in the Scotian Shelf.

Tagging studies have not been very revealing so far as defining haddock stocks on the Shelf is concerned. Needler (1931) and McCracken (1960) showed that there was a major exchange between the central Scotian Shelf and

the southern Gulf of St. Lawrence, and Needler (1931) showed some movement from southwest Nova Scotia eastwards along the coast and to the central Shelf (Fig. 7). There is evidently some exchange between the 4X and 4W stocks and also between the Bay of Fundy, Gulf of Maine and Georges Bank (McCracken 1960), but more extensive tagging experiments are required and are under way.

The research surveys provide distributional information on all common groundfishes, not only commercial species. For instance, comparisons can be made between distributions in the periods 1970-74 and 1975-79 for cod (Fig. 8A,B), thorny skate (Fig. 8C,D), yellowtail flounder (Fig. 8E,F) and redfish (Fig. 8G,H) in each of which distinctive distributional patterns are repeated in the periods reviewed. This indicates persistent and limited geographic distributions which are essential characteristics of a fish stock.

References

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- McCracken, F. D. 1960. Studies of haddock in the Passamaquoddy Bay region. J. Fish Res. Board Can. 17(2): 175-180.
- Scott, J. S. 1976. Summer distribution of groundfish on the Scotian Shelf 1970-'74. Fish. Mar. Serv. Res. Dev. Tech. Rept. 635: 13 p, 37 Fig.

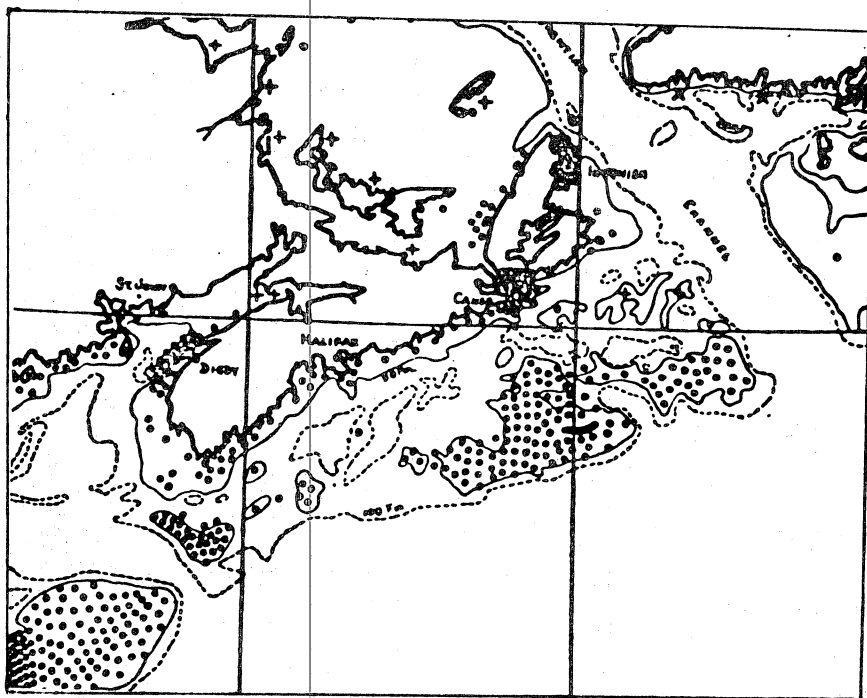


Fig. 1. Distribution of North American haddock catches 1917-1925 (from A. W. Needler, 1931).

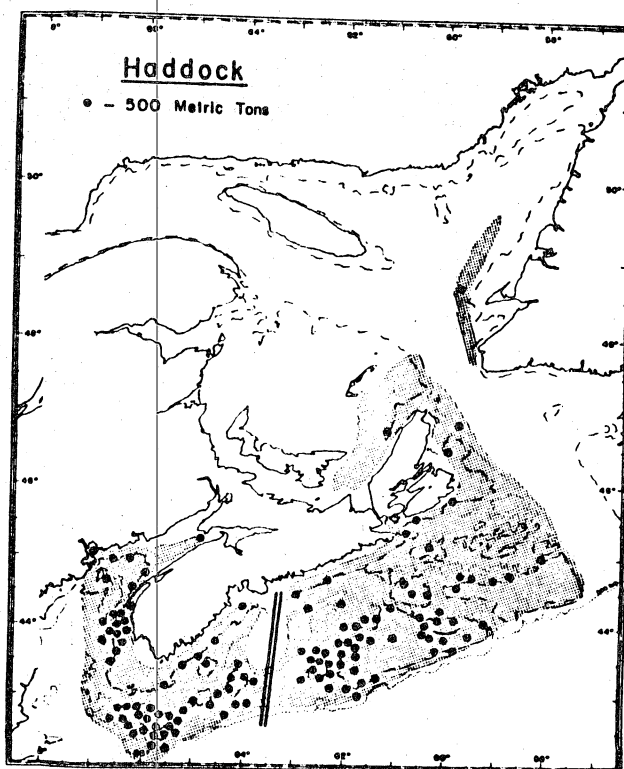


Fig. 2. Distribution of haddock catches on the Scotian Shelf and in the Gulf of St. Lawrence 1962-1966 (from A. C. Kohler, 1968).

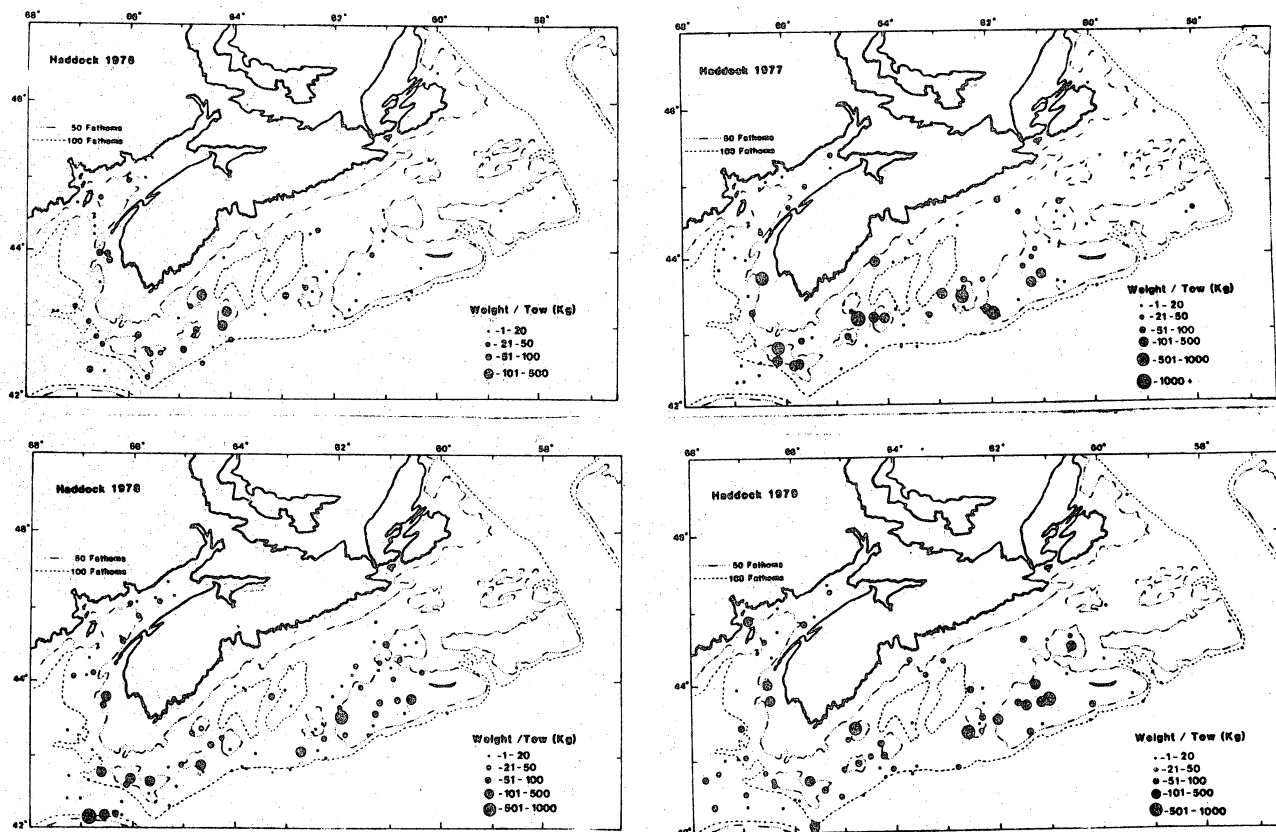


Fig. 3. Summer distributions of haddock catches from research groundfish surveys in the Scotian Shelf in the years 1976, 1977, 1978 and 1979.

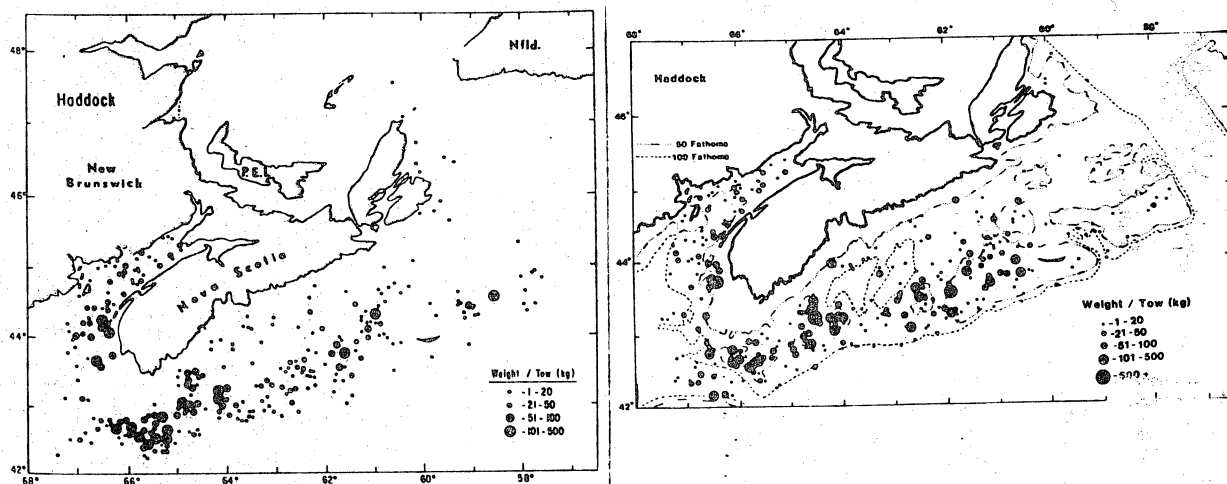


Fig. 4. Summer distributions of haddock catches from research groundfish surveys on the Scotian Shelf for the periods 1970-74 and 1975-79.

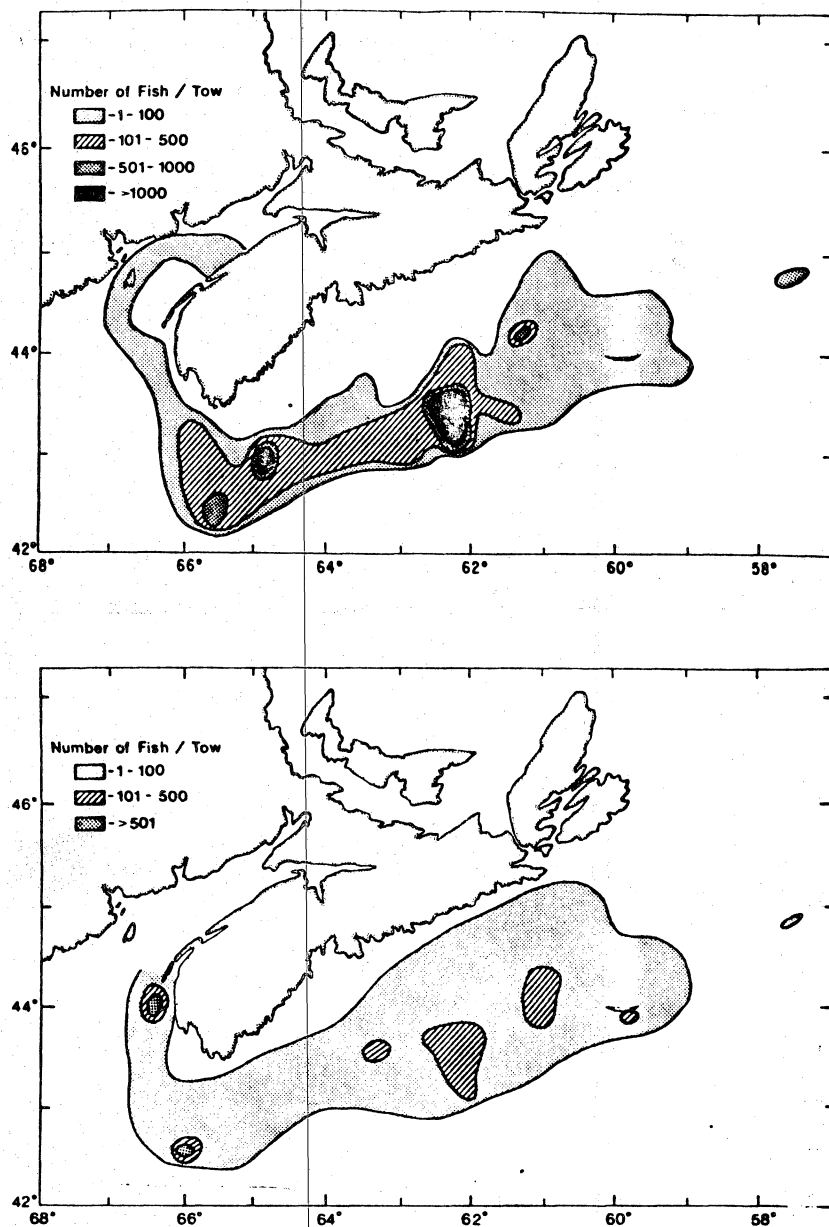


Fig. 5. Summer distributions of 0- and 1-group haddock on the Scotian Shelf from research groundfish surveys for the years (above 1980 and (below) 1981.

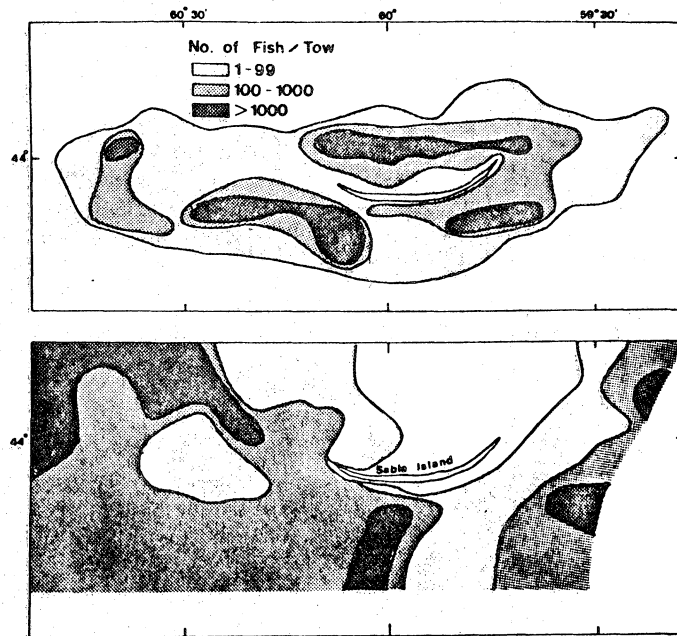


Fig. 6. Distributions of (above) 0-group and (below) 1-group haddock in the Sable Island area in August 1981.

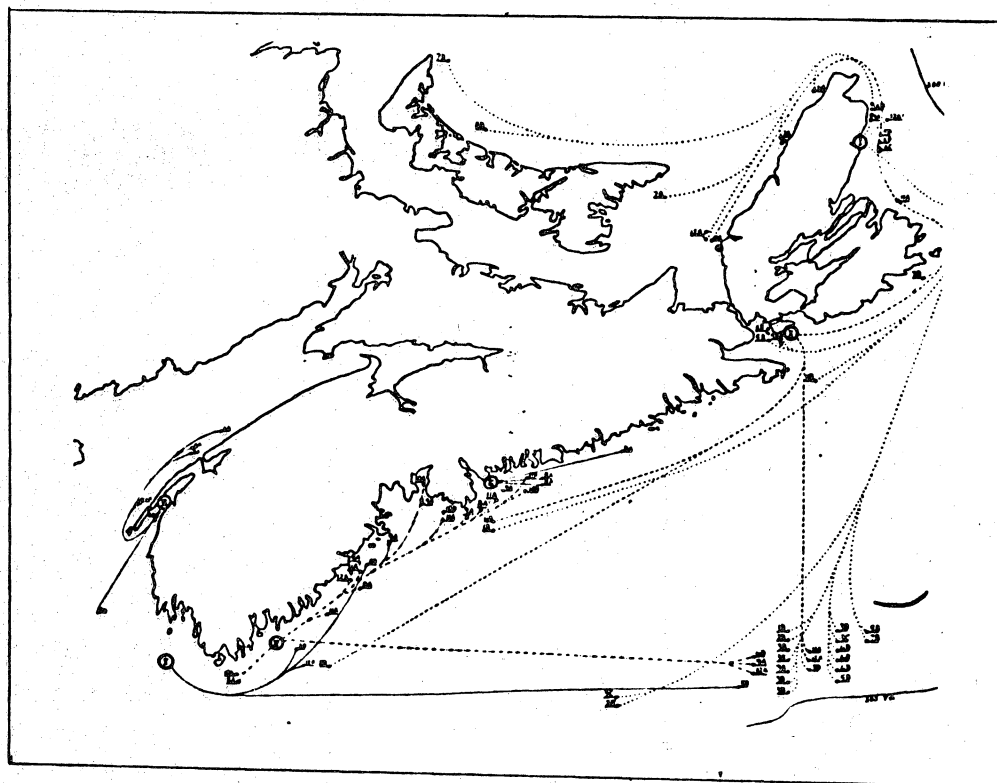


Fig. 7. Results of tagging experiments on haddock on the Scotian Shelf from 1926-1929 (from A. W. Needler, 1931).

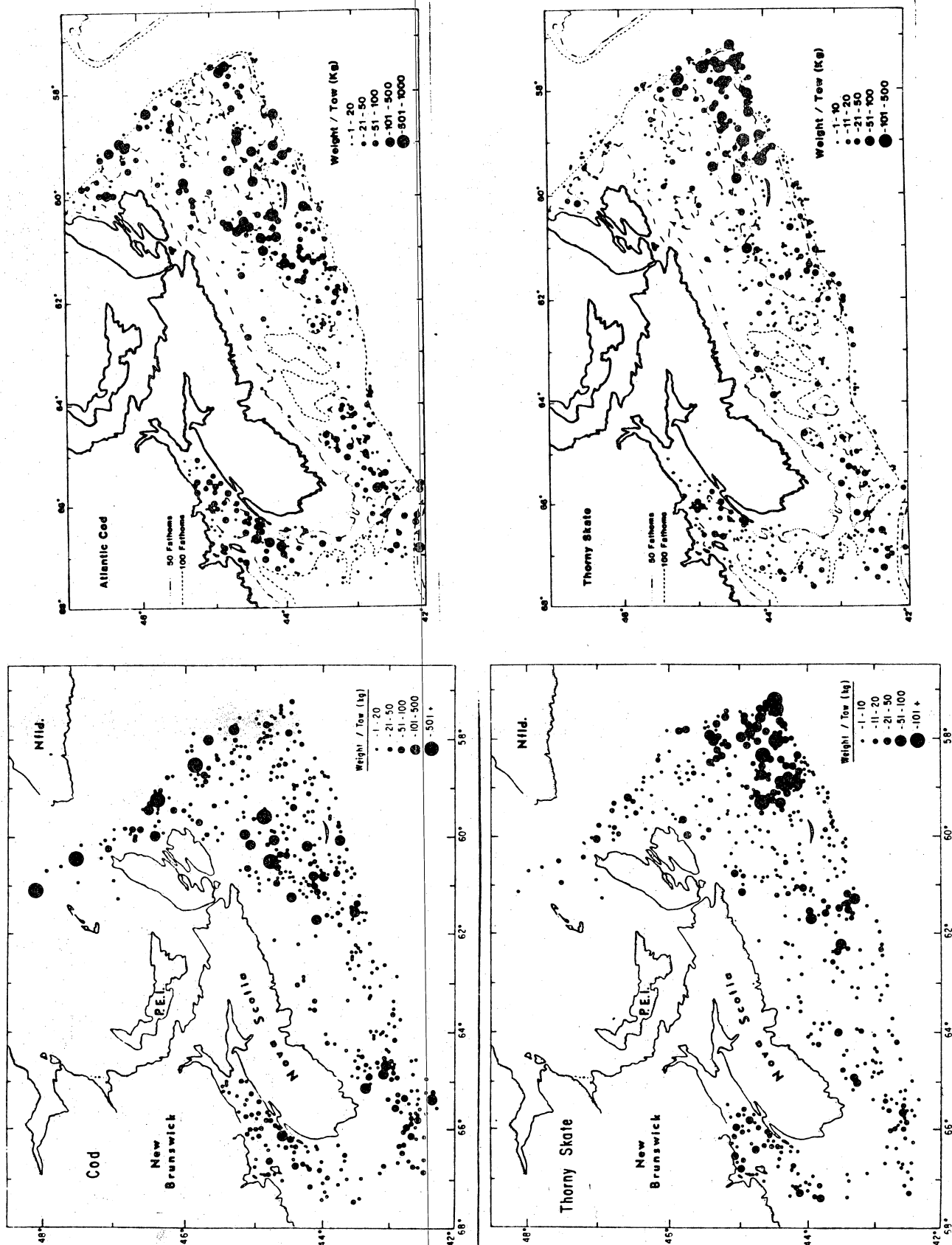


Fig. 8. Summer distributions of groundfish from research surveys on the Scotian Shelf, for the periods 1970-74 and 1975-79. left 1974-75, right 1975-79.

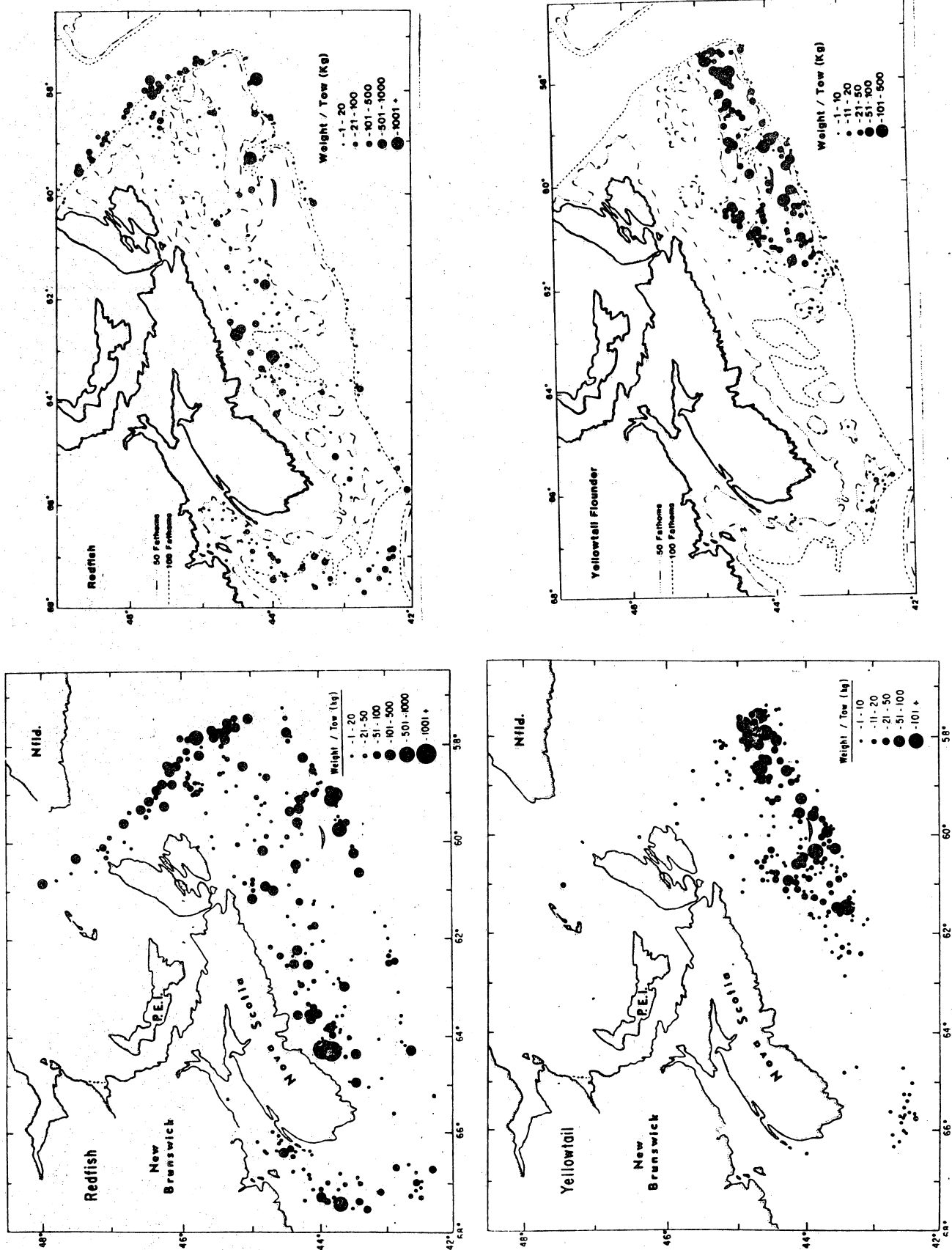


Fig. 8 (cont'd). Summer distributions of groundfish from research surveys on the Scotian Shelf, for the periods 1970-74 and 1975-79. left 1970-74; right 1975-79.