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NOTE

Distribution of Juvenile Haddock Around Sable Island on the Scotian Shelf

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Abstract

An intensive bottom-trawl survey of the shallows around Sable Island on the Scotian Shelf revealed large concentrations of 0-group and 1-group haddock, *Melanogrammus aeglefinus*. Spatial distributions were uneven and differed between the groups, with 0-group fish showing a preference for shallower water. Segregation by size was also evident for 0-group fish. It is suggested that the shallows around Sable Island are important nursery areas for young haddock and should be considered for protection. Regular surveys of the area might be useful for estimating recruitment to the Scotian Shelf haddock fishery.

Introduction

In August 1981, the 20-m wooden stern trawler *Kevin O. A.* was chartered to carry out an exploratory survey of juvenile fish distribution around Sable Island (Fig. 1), which is located on the Scotian Shelf about 300 km east of Halifax, Nova Scotia. Although the deeper water of Sable Island Bank is included in the annual groundfish surveys of the Scotian Shelf by Canadian research vessels, these large vessels are not suited for work in shallow water around Sable Island where juvenile fish were expected to concentrate in summer. The shallows represent a potential nursery area about which little is known. There is a need to determine the importance of such areas in relation to biology, resource-mapping, protection (from pollution, fishing, mineral exploration, and other man-made disturbances), and to the provision of pre-recruit abundance estimates for fish stock assessment. This paper describes initial observations on the distribution of juvenile haddock in the shallows around Sable Island.

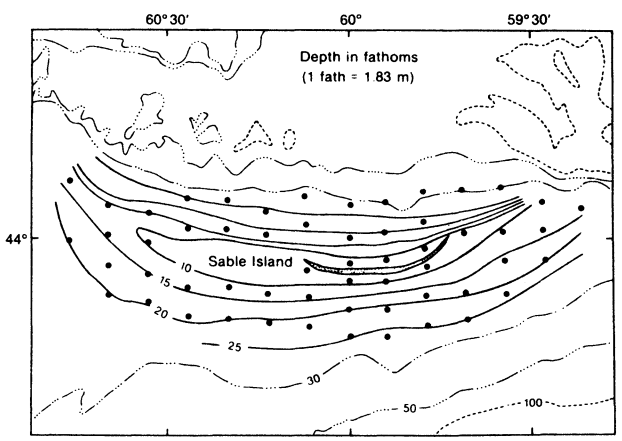

Fig. 1. Distribution of fishing stations for the juvenile fish survey around Sable Island in August 1981. (Depth contours of 10, 15, 20 and 25 fath are based on survey records.)

Materials and Methods

A grid of 58 stations was fished during 10-20 August 1981 with a Western IIA bottom-trawl which had a 9.5 mm liner in the codend. Each set consisted of towing the trawl on bottom for 30 min at a speed of 2.5 knots (76 m/min). Operations were restricted to daylight hours (0600-2000) and to depths of 8-39 fath (15-71 m). Stations in very shallow water near shore and off the eastern and western ends of the island were occupied only when weather conditions were good.

Catches were sorted by species and weighed, and length measurements were recorded to the nearest centimeter. The haddock were measured from snout to mid-fork of the caudal fin (fork length). When catches were large, subsamples were taken to produce representative length frequencies. Age-groups were estimated from the length-frequency distributions, in which the modal groups of 0-group and 1-group haddock were quite distinct. The time, position and depth were recorded at the beginning and end of each tow.

The overall survey catch consisted of 20 fish species and squid, of which haddock was the most abundant in terms of number, weight, and frequency of occurrence (Table 1).

TABLE 1. Comparative catches of various marine species taken during the shallow-water survey around Sable Island in August 1981.

Species	Number caught	Weight caught (kg)	Length range (cm)	Occurrence frequency (%)
Haddock, *Melanogrammus aeglefinus*	57,050	3,941	6-53	97
Silver hake, *Merluccius bilinearis*	5,186	1,617	16-59	74
Atlantic cod, *Gadus morhua*	3,967	1,169	7-73	88
Yellowtail flounder, *Limanda ferruginea*	660	137	18-42	66
Atlantic herring, *Clupea harengus*	650	351	26-36	9
Atlantic butterfish, *Peprilus triacanthus*	225	7	6-22	14
Atlantic mackerel, *Scomber scombrus*	161	65	24-43	34
Winter skate, *Raja ocellata*	66	137	43-108	36
Sand lance, *Ammodytes* sp.	53	—	7-24	16
Windowpane flounder, *Scophthalmus aquosus*	47	5	17-49	21
Longhorn sculpin, *Myoxocephalus octodecemspinosus*	31	—	17-30	22
Short-finned squid, *Illex illecebrosus*	27	—	12-30	43
Winter flounder, *Pseudopleuronectes americanus*	22	—	16-34	17
American sea raven, *Hemitripterus americanus*	11	5	34-50	14
American plaice, *Hippoglossoides platessoides*	11	—	26-39	10
White hake, *Urophycis tenuis*	7	—	20-50	9
Witch flounder, *Glyptocephalus cynoglossus*	2	—	39-44	2
Thorny skate, *Raja radiata*	2	—	49-55	3
Little skate, *Raja erinacea*	1	—	50	2
Pollock, *Pollachius virens*	1	—	37	2
Filefish, Monacanthidae	1	—	12	2

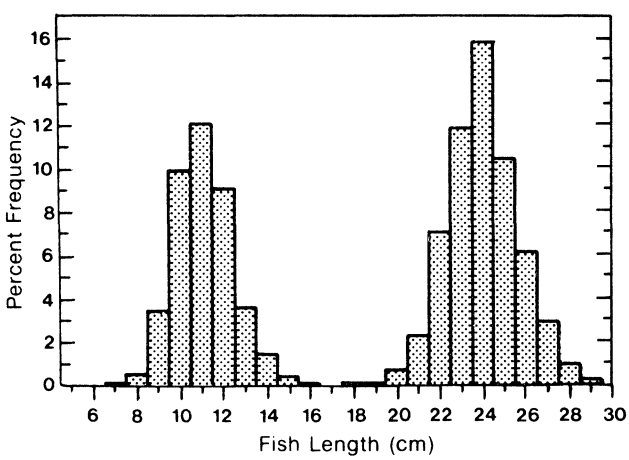

Fig. 2. Length distribution of juvenile haddock caught during the survey around Sable Island, August 1981.

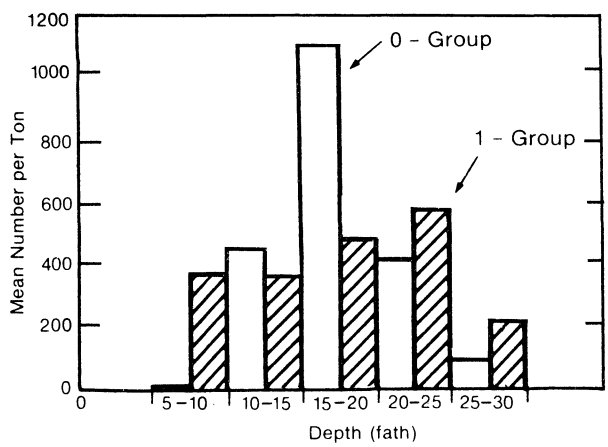

Fig. 3. Depth distribution of juvenile haddock caught during the survey around Sable Island, August 1981.

Results

Approximately 50,050 haddock were caught during the survey around Sable Island, of which 57.5% were age-group 0, 41.2% were age-group 1, and the remainder (1.3%) were age-group 2 and older. The length ranges of 0-group and 1-group haddock were 6-17 cm (mean 11.4) and 18-29 cm (mean 23.7) respectively (Fig. 2). The main concentrations of 0-group haddock were found in 15-20 fath (27.4-36.6 m), whereas the 1-group fish showed, to a lesser degree, a preference for the 20-25 fath (36.6-45.7 m) depth zone (Fig. 3).

Patchiness in catch rates of juvenile haddock are evident in Fig. 4. The 0-group fish were aggregated in areas of moderate to low concentrations of 1-group fish, particularly in shallow water north and southeast of the island where the 1-group fish were virtually absent. The major concentrations of 1-group fish were in deeper water to the west and east of the island where 0-group fish were not abundant, and the aggregation south of the island was located between two aggregations of 0-group fish. The survey appears to have covered the entire range of 0-group haddock around Sable Island (Fig. 4A), but the distribution of 1-group fish extended beyond the limits of the surveyed area (Fig. 4B). Bottom contours produced from the survey records gave no indication of localized depth variations which might explain the locations of the concentrations. Depth decreased gradually towards Sable

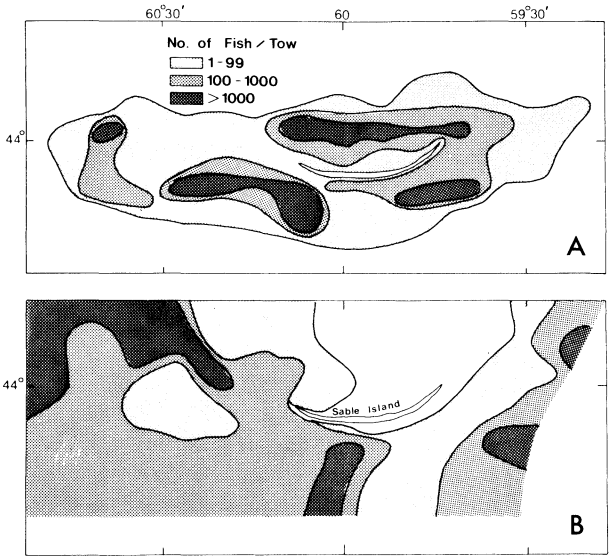

Fig. 4. Geographic distribution of catch rates of (**A**) 0-group and (**B**) 1-group haddock around Sable Island, August 1981.

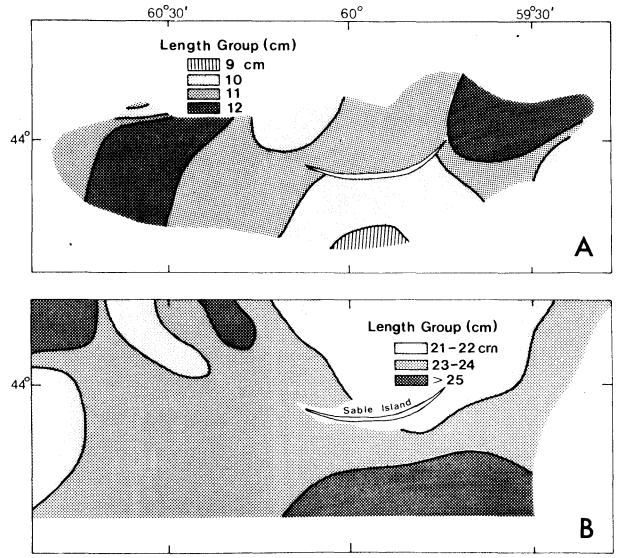

Fig. 5. Geographic distribution of mean lengths of (**A**) 0-group and (**B**) 1-group haddock in survey catches around Sable Island, August 1981.

Island and the sand bars at either end, with no significant irregularities (Fig. 1).

There was evidence of distinct zoning of 0-group haddock by length (Fig. 5A), with the smallest fish located south of Sable Island and a general increase in length eastward and westward from the island. For 1-group haddock (Fig. 5B), there was a general, but not uniform, increase in fish length outward from the island, corresponding to a large degree with increasing depth. The four major aggregations of 0-group fish (Fig. 4A) show no evident correspondence with the spatial distribution by length, but the aggregations of 1-group fish west and south of the island (Fig. 4B) generally occurred where the fish were largest (Fig. 5B).

Catch rates of juvenile haddock varied considerably during the day (Fig. 6A). The mean number per tow (2-hr intervals) ranged from 200 to 900 for 0-group fish, with maxima in early afternoon (1200–1400 hr) and early evening (1800–2000 hr). For 1-group haddock, the catch rate varied from about 250 to 700 fish, with a maximum in mid-morning (0800–1000 hr), and an increase in early evening. These patterns showed no correspondence with the significant variation in mean length of fish per tow by 2-hr intervals (Fig. 6B). The 0-group fish exhibited a more consistent pattern than the 1-group fish, with larger fish being taken in early morning and late afternoon to evening and smaller fish during the intervening period.

The area around Sable Island covered by the survey is approximately 700 square nautical miles (2,400 km^2). Applying a swept area of 0.034 km^2 per tow and catch rates of 565.5 for 0-group and 405.3 for 1-group fish results in estimates of 39.5 million 0-group and 28.2 million 1-group haddock in the Sable Island area at the time of the survey, making no allowance for catchability.

Discussion

Large-scale aggregations of haddock have been recorded on the Scotian Shelf (Scott, 1976), and clumped distribution of fish within these major aggregations is a standard feature of echo-sounder traces associated with haddock catches. However, clumping or patchiness in juvenile haddock has not been previously recorded in the region. Such spatial structure may explain the high variance associated with survey estimates of haddock abundance on the Scotian Shelf. This structure around Sable Island is not related to obvious physical features such as local depth variation. It may be related to temperature but this was not examined. The segregation of groups of fish is shown by differences in distribution and in depth preference of 0-group and 1-group haddock and by apparent zoning of fish by size within age-groups. There was considerable variation in mean length among samples of 0-group haddock, up to a maximum of 2 cm relative to the overall length range of 6–17 cm in all samples. Mean fish length and depth of occurrence appeared to be positively related for both 0-group and 1-group haddock. Segregation by size is a common phenomenon in fishes but does not appear to have been previously recorded within a single year-class of juvenile marine fish.

Comparison of the results of the Sable Island survey in August 1981 with those of the regular bottom-trawl survey of the Scotian Shelf in July 1981

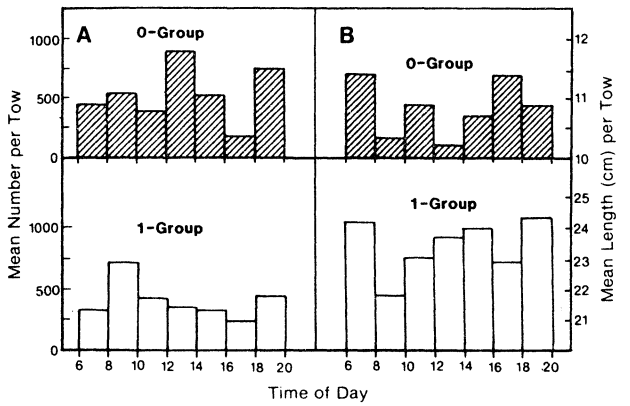

Fig. 6. Distribution by 2-hr intervals of (**A**) mean number per tow and (**B**) mean length per tow, for 0-group and 1-group haddock around Sable Island, August 1981.

emphasizes the value of intensive juvenile surveys in special areas and the need for special gears. Although the same type of trawl was used for the Sable Island survey and the much more extensive Scotian Shelf survey, the sizes and towing speeds of the vessels were different (18-m *Kevin O. A.* at 2.5 knots, and 61-m *Lady Hammond* at 3.5 knots) and the codend liners were also different (10 mm and 19 mm respectively). Catches of 0-group haddock in the regular July survey were relatively small, the only significant concentrations being found on the northeast edge of Sable Island Bank and southeast of Sable Island, both in close proximity to the area surveyed in August. Even with the necessarily wide dispersion of fishing stations and in the absence of shallow water coverage during the July survey, it is impressive to note that concentrations of young haddock were found in the vicinity of Sable Island. Further comparisons between intensive surveys for juveniles around Sable Island and the much more extensive summer surveys of the Scotian Shelf are needed to evaluate whether the latter adequately estimates the relative abundance of young haddock on the Scotian Shelf.

The August 1981 survey has shown the importance of the Sable Island area as a nursery ground for young haddock and possibly other species, implying the need for protective measures from pollution and fishing. If the high concentrations of young fish there are a regular occurrence, a short-term intensive survey of the area each year might serve to estimate the relative abundance of 0-group and 1-group fish for predictive assessment of recruitment to the fisheries.

Acknowledgements

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References

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