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NOTE

Short-term Changes in Distribution, Size and Availability of Juvenile Haddock Around Sable Island off Nova Scotia

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Abstract

A survey of the shallows around Sable Island on the Scotian Shelf in July-August 1982 confirmed the summer concentrations of juvenile haddock, *Melanogrammus aeglefinus*, which were evidence from a survey in August 1981. Comparison of the spatial distributions of juveniles showed some persistence of concentration of 0-group fish, but not of 1-group fish, both during two successive surveys in 1982 and from surveys in 1981 and 1982. Two 24-hr fishing experiments showed well-defined diel vertical migration in 0-group but not in 1-group haddock. Estimates of population size indicate reductions of about 46% for 0-group and 39% for 1-group fish from 1981 to 1982. The results from such surveys may be indicative of recruitment to the haddock stock on the central part of the Scotian Shelf.

Introduction

A bottom trawl survey of the shallows around Sable Island on the Scotian Shelf in August 1981 revealed large concentrations of 0-group and 1-group haddock (Scott, 1982). Distribution was contagious, and there was evidence of changes in availability of the young fish in relation to time of day, but neither the persistence of spatial distribution nor the changes in availability were tested. The area was surveyed again in July-August 1982, and special effort was aimed at investigating those aspects, the results of which are reported here.

Materials and Methods

As in 1981 (Scott, 1982), a grid of 58 stations (Fig. 1) was fished by the *Kevin O. A.* with a No. IIA Western trawl which had a 9.5-mm mesh 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). The whole area was surveyed during 27 July-5 August 1982, and the southern half of the area was covered again during 10-19 August 1982 for comparison of the spatial distribution of young haddock after a 2-week interval. Survey operations were restricted to daylight hours (0600-2000) and to depths of 8-39 fath (15-71 m). In addition, one station in the southern zone (Fig. 1), where high catches of 0-group haddock were obtained during the survey, was fished at 2-hr intervals for two separate 24-hr periods (11-12 August and 18-19 August) to examine diel variation in availability.

Catches were sorted by species and weighed. Haddock were measured as fork length to the nearest centimeter. Subsamples were taken in the case of very large catches. The numbers of 0-group and 1-group haddock were determined from the length frequencies which exhibited distinct modal groups. For comparison of catch rates and estimates of abundance between the 1981 and 1982 surveys, only the southern part of the survey area (Fig. 1) was considered.

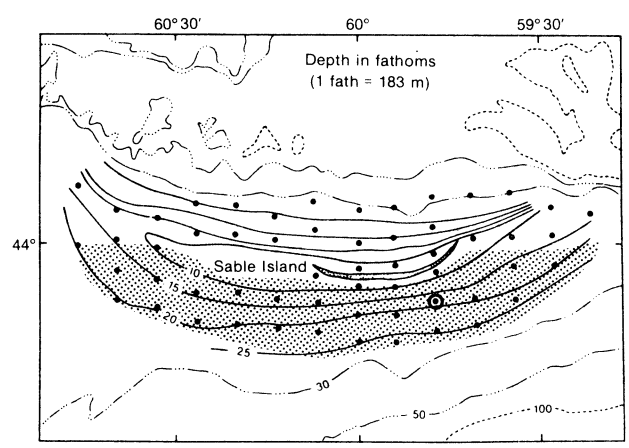

Fig. 1. Distribution of fishing stations for the juvenile haddock surveys around Sable Island in July-August 1982. (The shaded southern sector was surveyed twice; the circled station was used for the two 24-hr fishing experiments.)

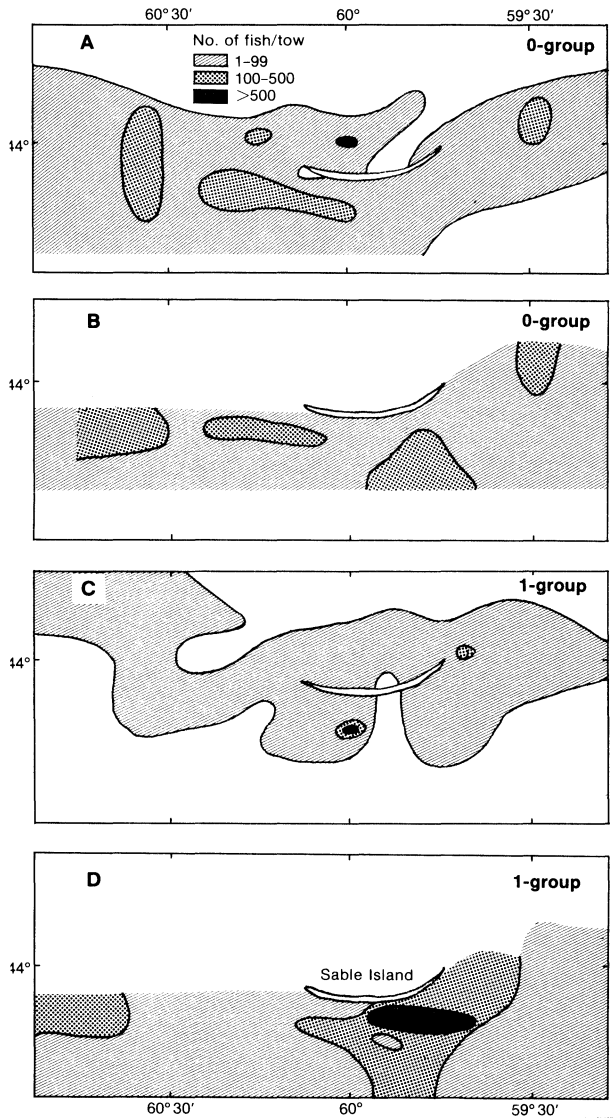

Fig. 2. Distribution of juvenile haddock near Sable Island from surveys in 1982: **A**, 0-group on 27-29 July; **B**, 0-group on 10-19 August; **C**, 1-group on 27-29 July; **D**, 1-group on 10-19 August.

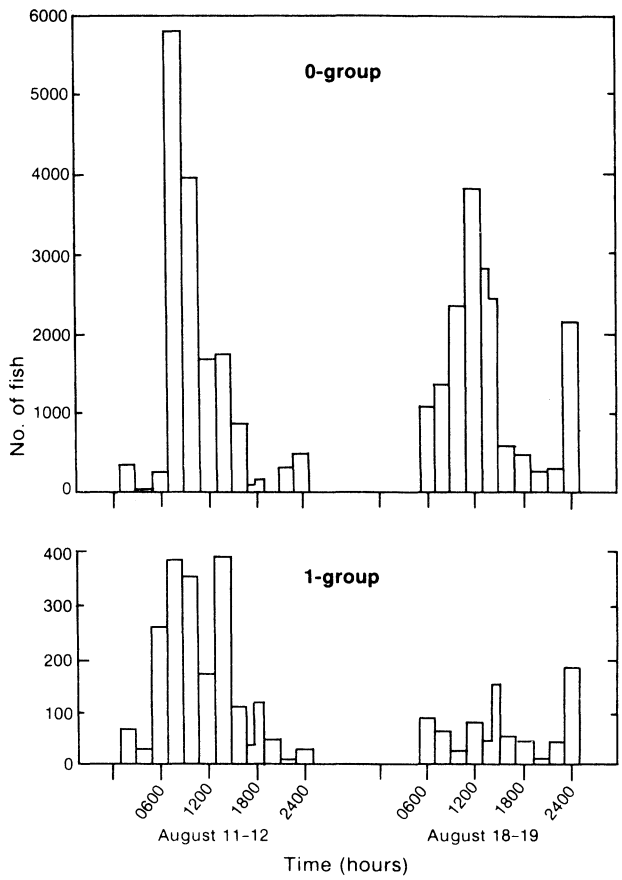

Fig. 3. Catch per tow of 0-group and 1-group haddock at 2-hr intervals in two 24-hr fishing experiments at a station near Sable Island during 11-12 August and 18-19 August 1982. (Stepped columns indicate replicate sampling.)

Results

Although there were noticeable changes in the distribution of 0-group haddock between the first and second surveys (Fig. 2, A and B) of the southern half of the area in 1982, particularly in the appearance of a concentation to the south of Sable Island during the second survey, concentrations persisted to the east, west and southwest of the Island. The lack of evidence for persistence of 1-group concentrations (Fig. 2, C and D) indicates that this group may be more mobile than the 0-group fish. The average catch (number of fish per tow) increased from 51.7 in the first survey to 168.9 in the second survey for 0-group haddock and from 75.6 to 101.9 for 1-group fish. The 24-hr fishing experiments clearly resulted in markedly higher catches of 0-group haddock during daylight hours (0600-2000) than at night (Fig. 3). This pattern was common to both experimental periods, apart from an anomalously high catch at midnight on 18 August, possibly associated with a brief but severe storm that interrupted operations until 0600 hr the next morning. The increase at midnight may be an accentuation of increased catches well after dark as is also reflected by slight increases at 2200 hr and midnight in the 11-12 August experiment. The consistency of abundance of 0-group haddock in relation to fishing time is illustrated by the similarity of catches 24 hr apart at 1800 hr in the 11-12 August experiment and at 1400 hr in the 18-19 August experiment, as indicated by the stepped columns for these time periods.

There was no correspondence between the patterns of catch rates in the 24-hr experiments for 1-group fish (Fig. 3). The pronounced increase in catches during daylight in the first experiment was not evident in the second one, when the best catch

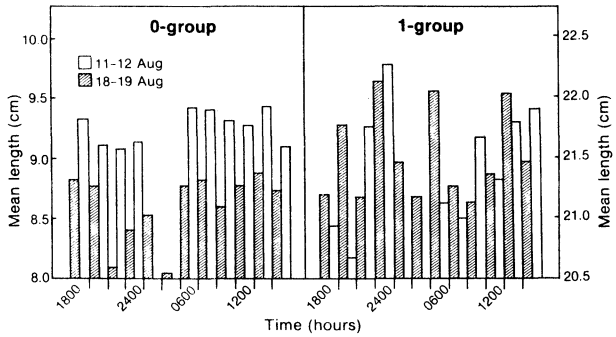

Fig. 4. Mean lengths of 0-group and 1-group haddock at 2-hr intervals in two 24-hr fishing experiments at a station near Sable Island in August 1982.

occurred at midnight, coincident with the large catch of 0-group fish. Also, there was no consistency in replicate catches 24 hr apart at 1800 hr and 1400 hr in the first and second experiments respectively.

Mean lengths of 0-group haddock were generally lower in catches from 2200 hr to 0400 hr than during the remainder of the day in both 24-hr experiments (Fig. 4). However, the mean lengths of 1-group haddock were quite erratic, with little correspondence between values at similar times of the day approximately 1 week apart. The highest mean lengths of 1-group haddock were recorded for samples taken at 2400 hr on 11 August and 18 August.

Mean lengths of 0-group haddock sampled on a daily basis throughout the surveys in 1982 (Fig. 5) increased from about 8.0 cm on 27–29 July to about 9.2 cm on 17–19 August, which is equivalent to a growth rate of approximately 1.6 cm per month. The increase in mean length was associated with an expansion of the size range from 6–12 cm during the first 3 days to 6–16 cm during the last 3 days of the survey. The lower limit of the range was maintained throughout the surveys except on the last day (Fig. 5). The minimum length of 6 cm (actual interval 5.5–6.4 cm) was apparently the smallest size of haddock available for capture by the gear, although some smaller cod, *Gadus morhua*, were taken.

Discussion

The spatial distribution during the two surveys of the area south of Sable Island in 1982 indicated some degree of short-term stability in the distribution of 0-group fish except for the appearance of an additional concentration in the second survey. The distributions are presumably determined by seasonably stable environmental factors, because the pattern in 1982 was similar in many respects to that shown by the 1981 survey (Scott, 1982).

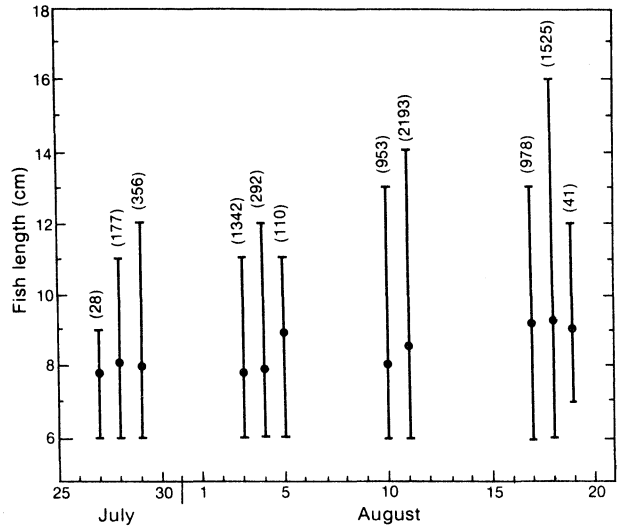

Fig. 5. Length range and mean length of 0-group haddock sampled each day during daylight surveys near Sable Island, 27 July–19 August 1982. (Gaps indicate no fishing due to adverse weather and vessel servicing.)

Migration may explain the differences between the distribution of juvenile haddock in the two surveys of 1982. Some indication that 0-group fish were migrating to the area, or were changing from the pelagic to the demersal phase of their life history and so becoming available for capture by the bottom trawl, is given by the change in catch rates during the survey and by the persistence in minimum length of haddock at 6 cm (Fig. 5). Mean catch rates increased threefold in the area south of the Island from 27–29 July to 10–19 August 1982. This indicates that timing of surveys for the purpose of estimating abundance from year to year is quite critical.

Plotting concentrations of fish on the basis of catch rates (catch-per-unit-effort) is questionable when the rates vary to the degree shown by the 24-hr experimental data. The spatial distributions are based on fishing in daylight hours only, which greatly reduce the variability, and the fact that a sample station yielded exceptionally high daytime catches on several occasions during the course of the 24-hr experiment and during the regular surveys confirms the peristence of concentrations and validates the plots.

Diel variation in catch rates indicates that 0-group haddock have a marked vertical migration pattern involving movement from the bottom at night and return to the bottom during daylight, presumably in relation to changes in light. Such phototaxis is a common phenomenon in marine animals, including haddock (Woodhead, 1965). Changes in mean length of 0-group haddock during the two 24-hr experiments (Fig. 4) indicate that larger fish moved off the bottom at

night in greater proportions than the smaller fish of the same year-class.

Comparions of catch rates from 1981 and 1982 surveys at approximately the same time (August), in the area south of Sable Island, show a decrease in numbers from 670 to 169 per tow for 0-group fish and from 364 to 102 per tow for 1-group fish. Estimated numbers of 0-group haddock in this area decreased from 23.4 million in 1981 to 12.7 million in 1982, a decline of 46%. The estimated abundance of 1-group fish also declined by 39% from 1981 to 1982. Changes of this magnitude should be reflected in recruitment to the fishery, and it will be interesting to see what the relative sizes of the 1981 and 1982 year-classes of haddock on the central part of the Scotian Shelf are in 2 or 3 years time when these year-classes enter the fishery. Such information will provide a preliminary test of the Sable Island survey results as indicators of stock abundance in the area.

References

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