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Juvenile Haddock Abundance and Water Temperature on the Scotian Shelf in 1983

by

J. S. Scott

Marine Fish Division, Fisheries Research Branch (Scotia-Fundy Region)
Department of Fisheries and Oceans, Biological Station, St. Andrews, N. B. E0G 2X0

ABSTRACT

Research cruise results indicate that 1983 was a poor year for haddock recruitment on the Scotian Shelf. Abundance estimates of 0-group fish for Divs. 4X and 4W show similar trends from 1979 to 1983 and indicate a strong 1980 year-class but poor 1983 year-class. Reports of abnormal water temperatures are supported by ranges of surface temperatures but not by monthly mean temperatures from available data.

INTRODUCTION

The year 1983 was marked by an apparently poor year-class of haddock on the Scotian Shelf. A dearth of eggs and larvae was noted early in the year (Koslow et al., unpubl.) and trawl surveys later in the year reported a scarcity of 0-group juveniles. As well as poor haddock recruitment in 1983, there were reports of unusual weather conditions and informal references to anomalous seawater temperatures, usually implying some connection with the Pacific El Niño.

In order to quantify the reports and confirm that 1983 was indeed a poor year for young haddock on the Scotian Shelf, estimates of distribution and abundance of juvenile haddock on the Scotian Shelf were made for each of the years 1979 (a normal year), 1982, 1983 (good years) and 1983 from the results of fall research survey cruises. The fall cruises were chosen as they are the earliest in which good representation of young-of-the-year haddock are obtained. In addition, the results of summer surveys for juvenile haddock in the Sable Island area in 1981, 1982 and 1983 were included.

Sea surface and bottom water temperature data were obtained from the Canadian Marine Enviromental Data Services (MEDS). Two areas were selected on the basis of known haddock spawning grounds: Browns, representing Div. 4X, bounded by positions 42°30', 43°, 64° 30', 66° 30', and Emerald, representing Div. 4W, bounded by positions 42° 30', 44°, 62°, 63°. Monthly and annual mean temperatures and ranges for each of these areas were provided for each of the years 1979 to 1983 and annual mean temperatures for the longer term 1973 to 1983. These data were compared with haddock catches to see if temperature could be identified as a probable cause of poor recruitment.

Haddock were identified as 0-group or 1-group each year on the basis of length frequency distribution. Geographical distribution of 0-group haddock on the Shelf was plotted on the basis of mean catch per tow in each of the 1/2-degree "squares" covering the area surveyed. Aubundance was estimated for Divs. 4X and 4W by dividing the total number of fish per Division by the total number of sets made in the Division, including zero catches.

RESULTS

Abundance

Estimates of 0-group abundance confirm that 1983 was a low year compared with the previous 4 yr (Fig. 1). This was obvious for both Div. 4X and 4W and supported by the extremely poor results of the 1983 Sable Island survey. There is good correlation between the patterns of change in abundance of 0-group fish in the two divisions for the period 1979-83, with a corresponding high in 1981. Correlation of 1-group with 0-group abundance was poor and the expected relationship of high 0-group abundance in 1 yr with high 1-group the next year was not in evidence.

Distribution

Plots of 0-group distribution for the years 1979, 1981, 1982, 1983 (Fig. 2) all show major concentrations of haddock in the Browns and Emerald areas with occasional high concentrations in the Sable Island area. In 1979, distribution was confined to the area west of Sable Island Bank but in 1981 and 1982 it had extended well to the eastern edge of the survey area (Banquereau Bank). In 1983, 0-group fish distribution had retreated to the west again and concentrations were lower than in any of the other years.

Temperature

Comparison of 1983 surface and bottom mean temperatures in the Browns and Emerald areas with those for the period 1979-83 (Fig. 3) shows very little difference in monthly values, certainly not enough on which to base a judgment of effect on fish spawning or survival. An examination of monthly mean temperature ranges means and long-term (1973-83) mean (Fig. 4) indicates that, 1983 had considerably higher highs and lower lows for much of the earlier part of the year for which data were available, in both Browns and Emerald areas.

DISCUSSION

Extremes of temperature could affect juvenile distribution and abundance in several ways by:

1) Stopping, advancing, or delaying spawning as a result of the physiological effect on the spawners, either on a long-term basis prior to spawning time as in the short term about the spawning period.

2) Forcing spawners to other areas where conditions are suitable for spawning (but not necessarily for survival of larvae).

3) Preventing survival and for development of eggs and larvae.

4) Adversely affecting food supplies of larvae and juveniles.

The reported dearth of haddock eggs on the Scotian Shelf in 1983 suggests that it was spawning that was affected. The spawning stock was not so low as to explain the lack of eggs, so some other factor was involved, presumably, and the temperature extremes noted above may be one explanation. More extensive data on water temperature in the areas concerned may help to clarify the situation, but other factors such as salinity and water movement should also be considered if the basic data are available elsewhere.

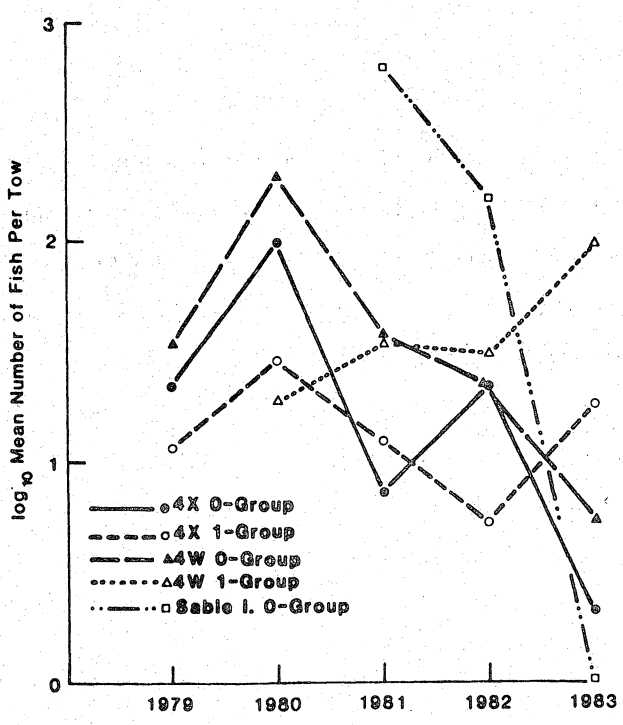

Fig. 1. Estimated abundance of 0- and 1-group haddock in Div. 4X and 4W for the years 1979 to 1983, and of 0-group in the Sable Island area 1981-1983 from research vessel surveys.

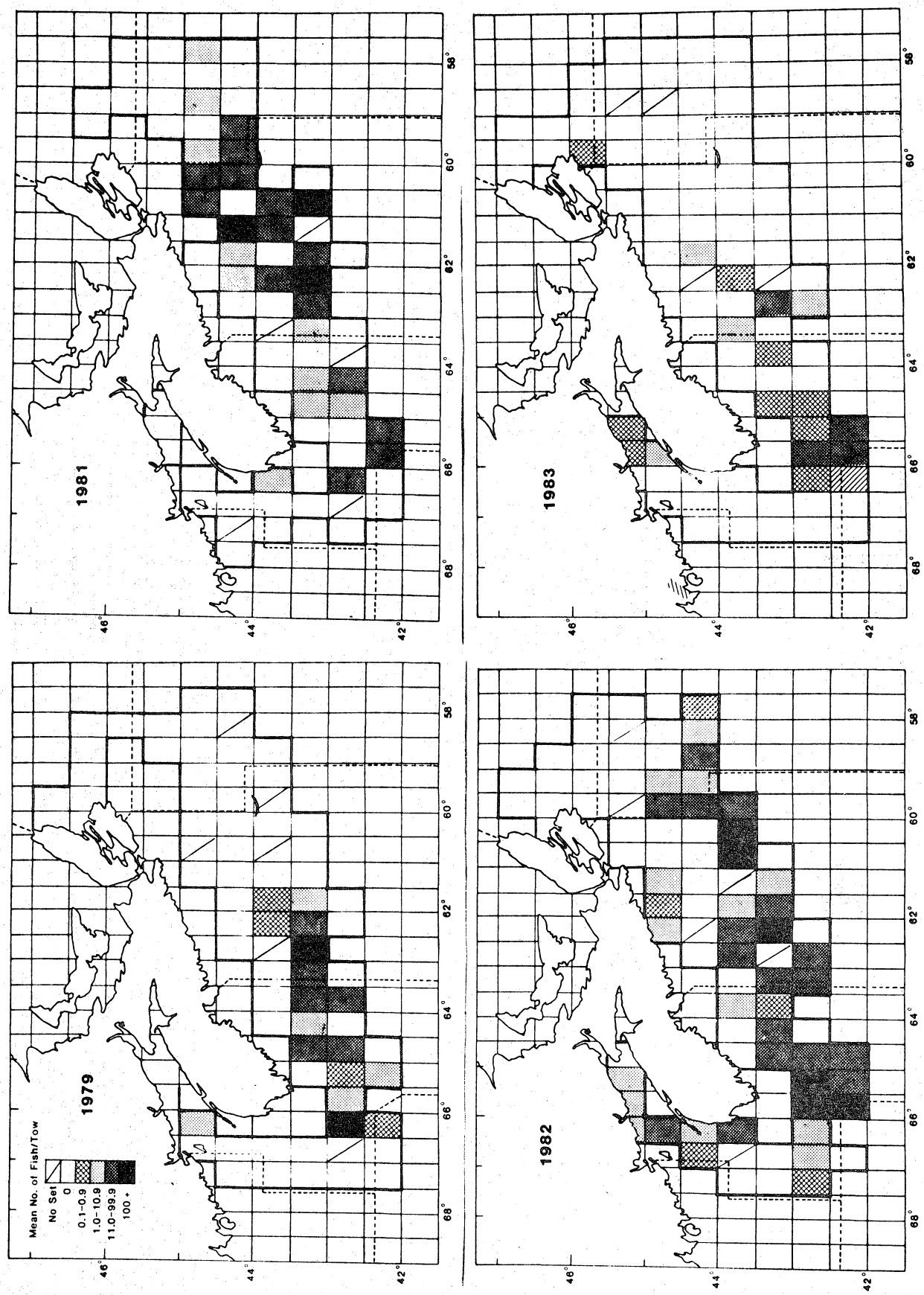

Fig. 2. Distribution of 0-group haddock on the Scotian Shelf for the years 1979, 1981, 1982, 1983 from research vessel surveys. (Heavy line outlines the survey area.)

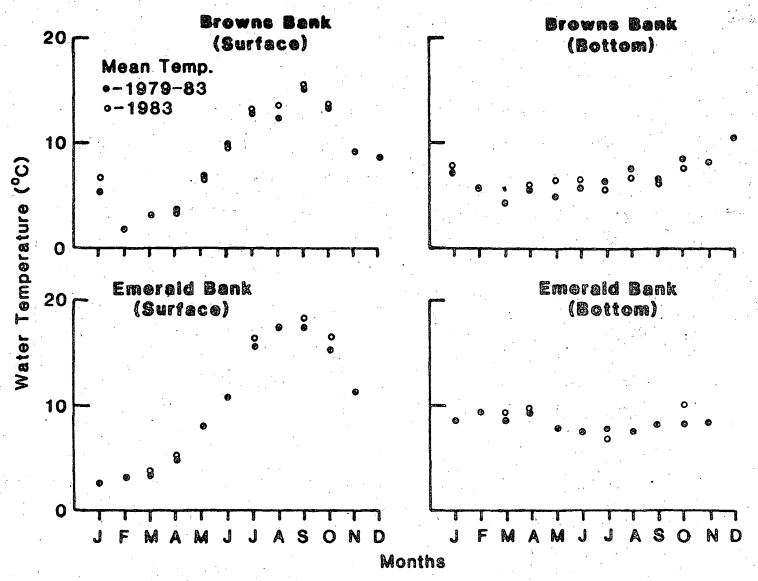

Fig. 3. Mean monthly surface and bottom temperatures in representative areas of Divs. 4X and 4W for the period 1979-1983 and the year 1983.

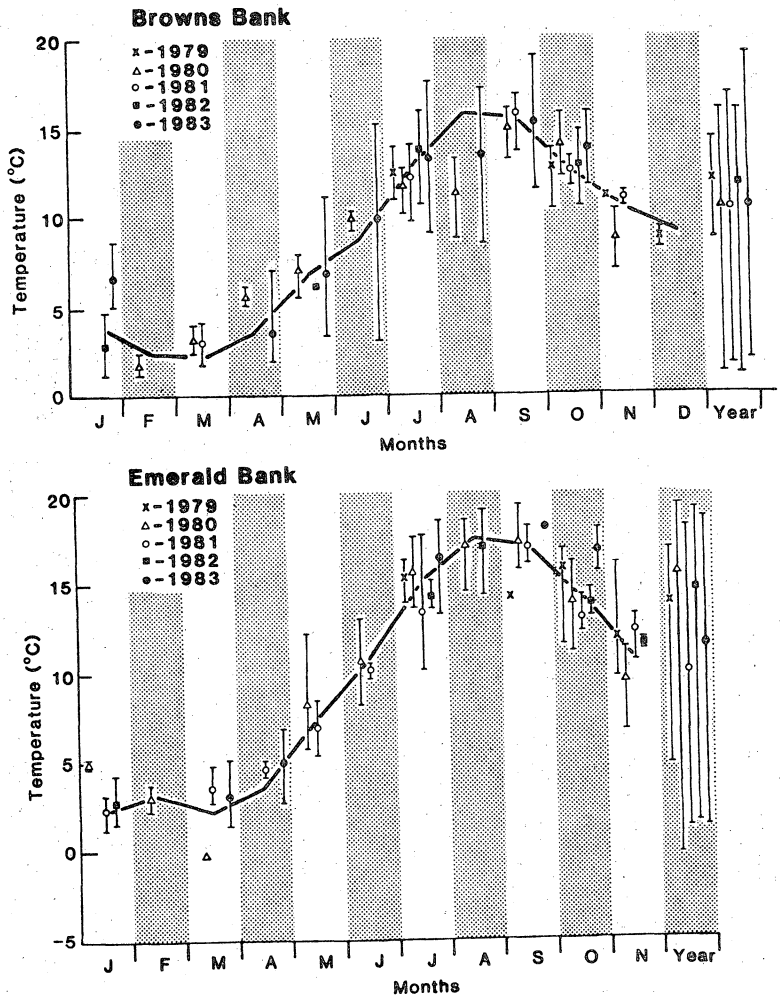

Fig. 4. Monthly means and ranges of surface temperature in representative areas of Div. 4X (Browns) and 4W (Emerald) for each year 1979-1983 and for the period 1973-83 (heavy line).