Distribution of Eastern Scotian Shelf Cod (*Gadus morhua*) With Respect to Age, Depth and Temperature*

Alan Sinclair
Department of Fisheries and Oceans, Maurice Lamontagne Institute
P. O. Box 1 000, Mont-Joli, Quebec, Canada G5H 3Z4

Abstract

The two factors important in determining the age-specific exploitation pattern of the fishery, commonly referred to as partial recruitment (PR), are the selectivity of the fishing gear and the availability of different aged fish to the fishery. Regulation of mesh and hook size in commercial fisheries tends to limit the importance of selectivity changes in interannual variations in PR. However, if the fish are segregated by age, then the fishery could target large year-classes thus making availability an important component in PR variation. The objectives in this study were to investigate whether age groups of cod (*Gadus morhua*) are spatially segregated and see how this may be related to PR, and also to examine the relationship of depth and temperature with cod distribution at age.

The cod management unit on the eastern Scotian Shelf area (NAFO Subdiv. 4Vs and Div. 4W) was used for the study. The depths of the study area were highly variable with many areas deeper than 200 m, and several shallow banks less than 100 m in depth. With respect to temperature, the area forms three layers in summer; a warm surface layer, a cold intermediate layer, and warmer deep water.

Data were obtained from stratified-random groundfish abundance surveys (Halliday and Koeller, 1981), conducted on the Scotian Shelf during the summer between 1970–89. Catch-at-age of cod were calculated on a tow-by-tow basis. Catches were weighted by the ratio of stratum area and the number of tows in each stratum on an annual basis. Cumulative frequencies were calculated for ages 1 to 12.

Cumulative frequencies of temperature (Smith *et al.*, 1991) and depth were used as an indication of the distribution of the fish in relation to these environmental variables. The median temperature or depth was defined as the 50% point of the cumulative frequency and the first and third quartiles were defined as the 25 and 75% points.

There was a distinct tendency for cod of older ages to be distributed at greater depths. The medians and quartiles of the depth distributions for the entire time series (Fig. 1),

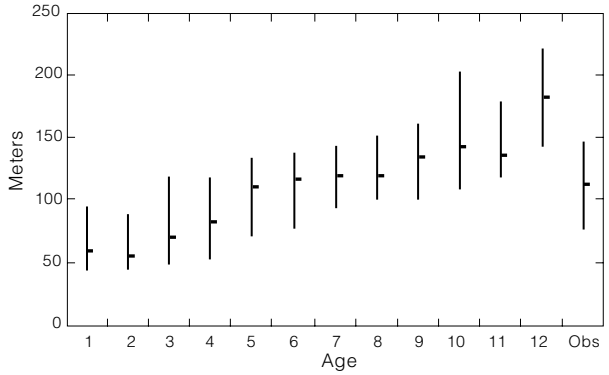

Fig. 1. Medians and quartiles of catch-at-age by depth distributions of NAFO Subdiv. 4Vs and Div. 4W cod for the period 1970–89. The last vertical line (Obs) represents the distribution of sampled depths.

* Material presented in this abstract is fully reported in Sinclair, 1992.

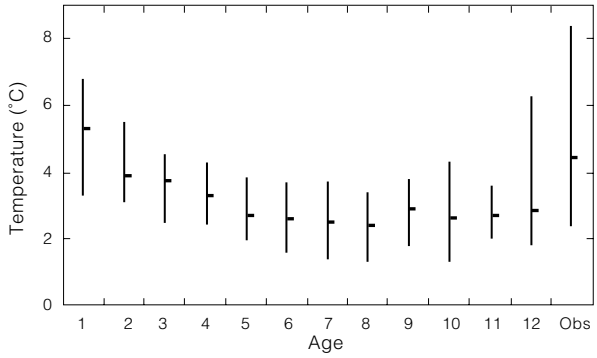

Fig. 2. Medians and quartiles of catch-at-age by temperature distributions of NAFO Subdiv. 4Vs and Div. 4W cod for the period 1970–89. The last vertical line (Obs) represents the distribution of sampled temperatures.

indicated the trend of the apparent age-dependent shift. The annual median temperature distribution showed catch of age 1 cod were highest at the highest median temperature (Fig. 2). A trend of decreasing temperature was apparent with increasing age.

This study demonstrated age segregation of cod in Subdiv. 4Vs and Div. 4W. The age segregation of cod has important implications in the interpretation of fisheries statistics. A shift of the commercial fishery to shallower waters and toward the south and west of the management unit would result in an increase in the availability of younger age groups to fishing effort. The opposite effect would occur for older age groups if effort shifted toward deeper water and toward the north and east. Fishermen could follow strong year-classes and thus PR could vary annually. Such a tendency could bias trends in CPUE-at-age used to calibrate sequential population analyses in stock assessments, as well as parameters used in catch projections.

Key words: Age, cod, *Gadus morhua*, depth, NAFO Divisions 4VsW, partial recruitment, Scotian Shelf, temperature

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