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Validation Studies of Subarea 5 Cod Otolith Age Determinations

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Studies to determine the validity of otolith age determinations for Subarea 5 cod are underway at the Woods Hole Laboratory with material collected from commercial vessel and research vessel catches. Although the investigations are not complete, some preliminary results are noted below.

Origin of Samples

The Georges Bank (5Z) fishery contributes the largest proportion of the United States cod landings, but research vessel catches on this bank include very few cod less than 20 cm in length. In contrast, the Gulf of Maine (5Y) fishery contributes a relatively small proportion to United States landings, but research samples from Division 5Y include many small cod, particularly in June and July. Because examination of otoliths from small fish is important to any validation study and because our most complete samples were collected there, present studies are centered on the Gulf of Maine (5Y) samples.

Collections of otoliths for the present study were made at sea aboard the Bureau of Commercial Fisheries vessel Delaware and ashore from cod landed by commercial otter trawlers. The Delaware samples consist of 445 pairs of otoliths from cod that ranged in size from 9.7 cm to 11.0 cm, fork length. The fish were taken in an otter trawl fitted with a fine-mesh liner and represent all the cod caught during research cruises in the study area. This collection is particularly valuable because it includes the small fish that are not landed by the commercial fleet.

The samples from the commercial fleet consist of 130 pairs of otoliths from cod 47.7 to 104.5 cm, fork length, landed at Gloucester, Massachusetts, and Portland, Maine. The commercial samples were examined primarily to help determine the periodicity of the growth zones.

Seasonal Changes in Otolith Edges

Examination of otolith edge formation through one year (June 1961-May 1962) showed that one hyaline and one opaque zone is formed annually. I examined a total of 575 otoliths from research collections and from commercial catches made throughout the year (no otoliths were available in September and December 1961 and April 1962). The hyaline zone began to form as early as June and by November virtually all the otoliths had hyaline edges (Fig.1).

The season of zone formation is not the same for all individuals. A few cod were found each month with one type of otolith edge while the majority had the other type of edge. This is probably due to individual differences in growth.

Analysis of Length Frequencies

To denote the various age groups it was necessary to consider the spawning period and time of maximum frequency of spawning of the cod. In the Gulf of Maine, cod spawn mostly in March, although pelagic eggs or females with running eggs have been found during the period from late November to mid-May (Bigelow and Schroeder, 1953). I chose March 1st as the arbitrary birthdate.

The length distribution for 235 cod from the July Delaware collection is shown in Fig.2. Three modes appear at 12, 27 and 36 cm. The ranges of fish lengths around each mode was 9-18 cm, 19-30 cm and 31-42 cm, respectively. Examination of the otoliths revealed a distribution of number of hyaline zones (annuli) within each length range. These data are shown as percentages in Table 1. Thus, the age composition of the length frequency distribution shows that the modes represent the majority of the 0-, I-, and II-age-group cod.

Conclusion

The evidence discussed here tends to support the validity of age determinations based on the formation of a single hyaline and opaque zone per year from cod otoliths in Subarea 5Y. Although the study is continuing, it seems reasonable to conclude that the results will apply as well to cod from Subarea 5Z.

Literature Cited

Bigelow, Henry B. and William C. Schroeder. 1953. Fishes of the Gulf of Maine. U.S. Fish and Wildlife Service, Fishery Bulletin, 53(74): 577 p.

Table 1. Percentage of otoliths with 0, 1, 2, 3 or 4 hyaline zones under each mode in cod length frequency.

Number of hyaline zones (annuli)	Mode length range 1 9-18 cm	2 19-30 cm	3 31-42 cm
	%	%	%
0	95	--	--
1	5	66	9
2	--	32	61
3	--	2	29
4	--	--	1

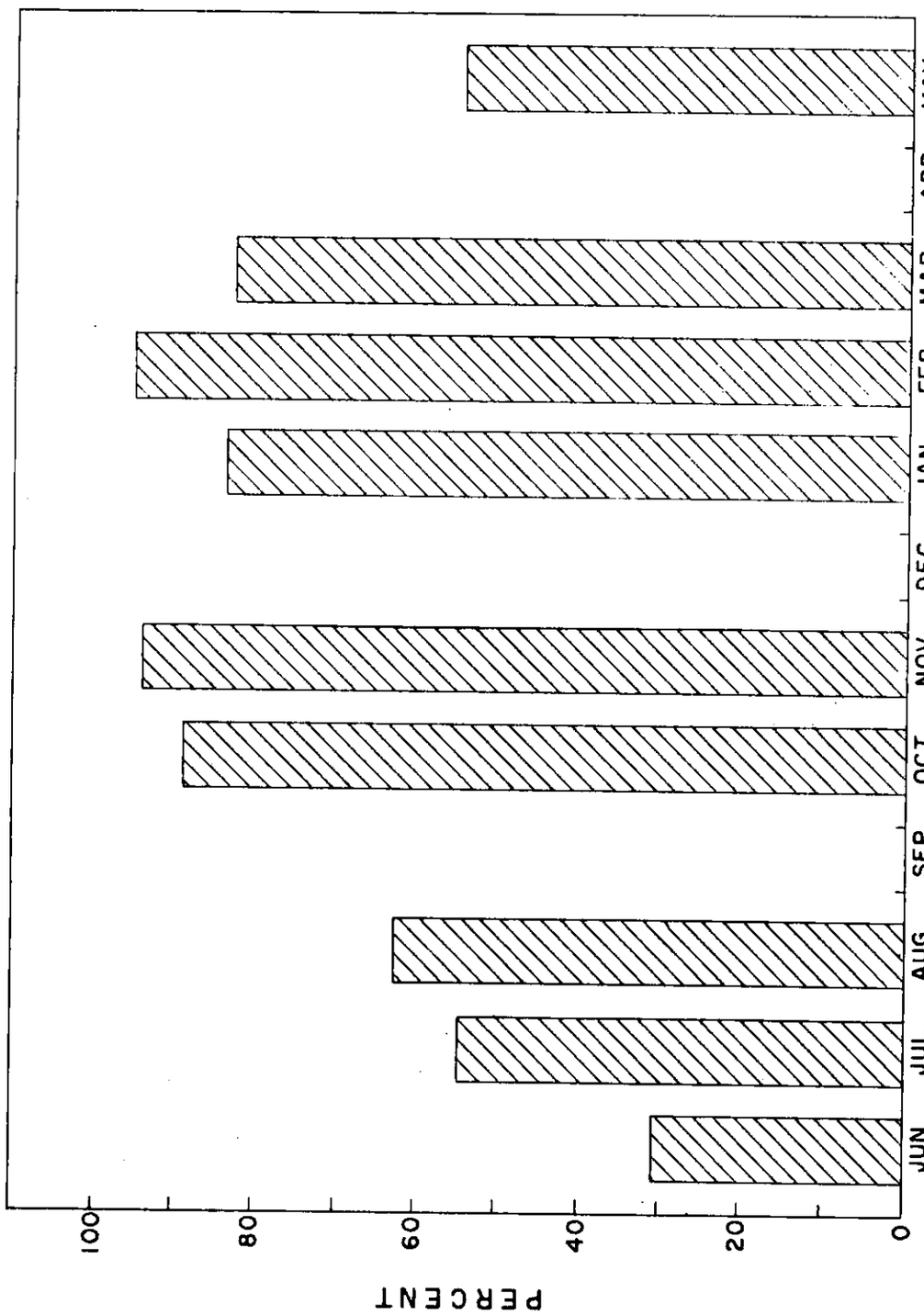

Figure 1. Percent of fish with hyaline edge in 575 cod otoliths from the Gulf of Maine (5Y).

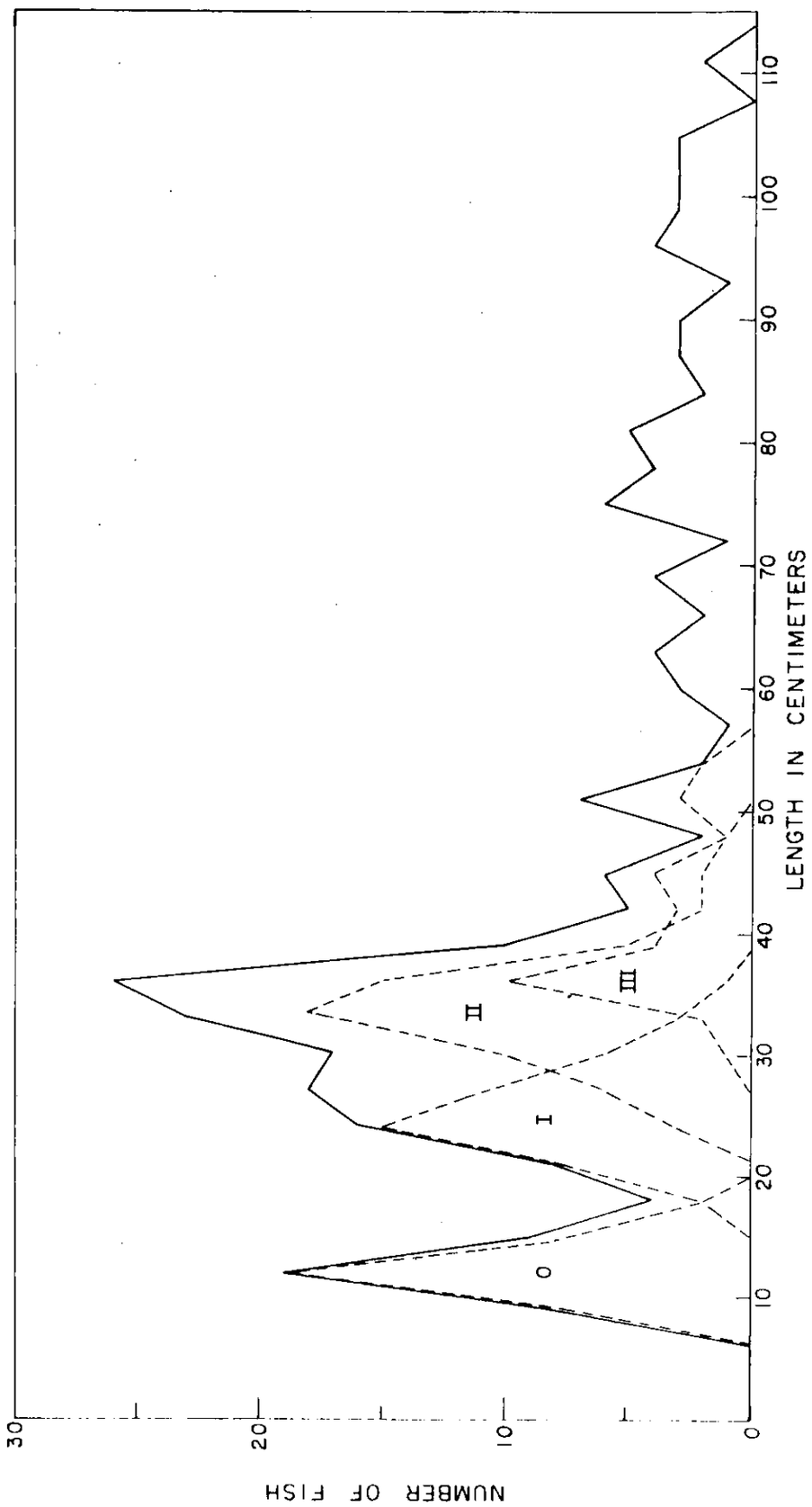

Figure 2 Length-frequency distribution of 235 Gulf of Maine (5Y) cod collected on Delaware Cruise 61-12, July 1961.