RESTRICTED

INTERNATIONAL COMMISSION FOR THE NORTHWEST ATLANTIC FISHERIES

Serial No. 2114
(D.c.9)

ICNAF Res.Doc. 68/53

ANNUAL MEETING - JUNE 1968

Observations on Herring Caught in Georges Bank

by

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Catches

Polish herring catches on Georges Bank began in 1965 and amounted to 1,447 tons. In 1966 the catch increased tenfold, reaching 14,473 tons. Still larger quantities were landed in 1967, namely 37,547 tons. This increase was caused both by the demand for herring on the Polish market and by the drop in herring catches in the North Sea. For these reasons some of the side trawlers, which had operated until 1967 in the North Sea, were directed for herring fishing on Georges Bank. These vessels landed 26,798 tons of herring, while the stern trawlers landed only 10,849 tons from the ICNAF area.

Thus the increase of herring catches was connected with the increase of fishing effort. This fishing effort, expressed as a number of catch-hours per chosen standard vessel (factory trawler) amounted to 3,421 hours in 1966 and to 11,995 hours in 1967. It appears from these figures that herring landings were disproportionate to the increase of fishing effort, or, we may say, the catch per unit of fishing effort dropped.

The best fishing yield was noted for motor side-trawlers, operating with bottom trawls. These vessels obtained 2.5-4.0 tons of herring - average 2.75 tons - per 1 hour trawling. The best fishing results were obtained in the period from 18 September till 5 October in the fishing ground bounded by the lines of 41°55' - 42°10'N and 67°30'W. The herring in the catches were with running gonads. The great concentration of fish at that place is evidenced by the yield of stern trawlers, which from 1-5 October landed, on the average, up to 12.25 tons per 1 hour trawling.

Material

Sampling for studies on herring was performed mainly aboard the commercial stern trawler M/T Aries in the period from 26 August to 8 October and, additionally, aboard research vessel Wieczno in the period 2-4 November, 1967. There were made 10,200 measurements and 2,006 otoliths were taken from fish in commercial catches, 1,674 measurements and extraction of 200 herring otoliths were performed aboard the research vessel. Length measurements were made with an accuracy of 0.5 cm. For herring, from which otoliths were taken, sexual maturity and the degree of stomach filling were also determined.

Age readings

Age of herring was read with possibly high accuracy and into the technique there was included the experience of various researchers in this scope. Having in view, however, some differences in the results of age readings among the experts from Canada, United States and Poland, we would like to present our revised manner of interpretation of otolith zones. For this purpose the drawings are attached, on which it has been possible to show better than in the photograph presentation of opaque and hyaline zones (Fig. 1).

As it has been mentioned above, our materials were collected in the period from August till November, i.e. in the period when annual life cycles of herring are being completed. In the drawing of the first otolith ("a") we see two hyaline zones, one less and one more distinct, and dimly outlined nucleus. Since fish is born in autumn months therefore it is to be assumed that nucleus corresponds to the first winter zone. Winter zones of the otolith "a" are sufficiently clear and along with nucleus they permit to determine with some accuracy the age of the fish. We may then conclude that the fish with such otolith is completing its third year of life and may be classified into age-group III.

In the former investigations /Draganik and Zukowski/ the number of distinct hyaline zones was taken as a basis for determination of particular age-groups of fish, while the nucleus was disregarded. This disregarding of the nucleus reduced, however, the given age-group of herring by one year. Still, year-classes were determined correctly, because counting was started from the outside of otolith towards its centre and hyaline zones correspond to each consecutive winter period, while starting point of the nucleus was taken to be the year the fish was born.

As it is known, the opaque zones in the otoliths of herring of different size and age are not formed simultaneously, but in various months of the period from spring till autumn. In young herring, one to three years old, this zone begins to form in the spring months, while in older herring from June till October. Similar is the process of formation of opaque zones in cod, which was described by A. W. May.

The drawings give approximately such picture of the zones of an otolith as they might be observed under binocular microscope. According to the usual method the basis for determination of an age-group used to be taken the final stage of increase of hyaline zone, which is marked by the formation of next opaque zone. On survey of the pictures of otoliths we note that along with the increase of the number of hyaline zones the last opaque zone at the edge of otolith becomes less and less distinguishable. This phenomenon may be attributed, among other factors, to the age of fish, so that the older is the fish the more retarded is the formation of opaque zones in their otoliths. In the case of the otolith "d" the opaque zone was distinguishable only at two spots, which in the drawing are marked by arrows. In still older fish /otoliths "e" and "f"/ the opaque zone at the edge of otolith was not distinguishable at all. Under such circumstances the question arose: how to determine the age of these fish? It was accepted as a right solution to read the age of such fish when they were caught in summer or autumn, as if the outer opaque zone were already formed.

Fig. 2 shows the changes in length composition of 1960 year-class, depicted by the curves, each shifted over to the right for successive years 1965, 1966 and 1967. We note that the year-class 1960 was predominant through these years. Taking into consideration the modal lengths of this year-class we see that their changes followed the changes in general length composition. The measurements showed that the most abundant were the fish of the following lengths: in 1965 - 29.0 cm., 1966 - 30.5 cm. and 1967 - 31.5 cm., and accordingly the mean lengths of 1960 year-class were: 29.0 cm., 30.5 cm. and 31.7 cm. We find here close correlation between the occurrence of a very abundant year-class /1960/ and the changes in length composition of the exploited fish stock. The participation of such an abundant year-class was in a sense a natural tagging. Thus the results obtained from otoliths reading are in conformity with the results obtained from herring measurements in the catches and this justifies to some extent the accepted by us interpretation of otolith reading. It is evident that some mistakes are unavoidable, being caused both by the structure of otolith and the technique of making observations.