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Comparative Analysis of Length-age Composition of Greenland Halibut (*Reinhardtius hippoglossoides*) from the Commercial Catches Taken by Russia, Spain and Portugal in the Flemish Pass (Divisions 3LM) in 1998-2000

by

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**Abstract**

The data earlier published in the national reports of Spain and Portugal for 1998-1999, as well as the materials from Russian investigations for 1998-2000, are used in the paper.

By results from the investigations, the catches taken by three countries consisted of halibut of 22-100 cm long; of 42.7-48.4 cm mean length, with the length groups from 38-39 to 44-45 cm long being predominant. By-catch of young fish below 30 cm did not exceed 1.6% that was not a violation of the mesh-size regulation established. Fish sexual ratio varied slightly; the abundance of females dominated over that of males. The fish age, read by scales and otoliths, made up from 2 to 20 yr, with the specimens at age 4-8 yr being predominant. The age of specimens from dominated age groups in Russian catches was by 1-2 year younger than that from the catches taken by the EU countries.

In 1999, occurrence of large-size halibut in the Spanish catches is explained by a large fishing depth used during that year. In 2000, appearance of small-size halibut in the Russian catches is explained by a significant increase in proportion of recruits in 1994-1995.

Age difference in halibut specimens by 1-2 years for the Russian samples and for the samples taken by the EU countries is probably accounted for a different method of age reading used by age readers. Absence of a generally accepted method for age determination adversely affects a creation of models by which the decisions are made for the stock management. The conclusion was drawn about a necessity of pooling efforts by the researchers from different countries to search for the optimum methods for age reading and to apply the agreed methods in future.

**Introduction**

Information on the deep-sea fishery for Greenland halibut in the Flemish Pass Deep first appeared in the late-1980s. Since then the harvesting of Greenland halibut in this area has been of great importance for a number of countries. The national quota for Greenland halibut has been exploited by the Russian fishing fleet since 1998.

The age and length composition of the stock, life span and sexual ratio are specific for the species and are its adaptive properties. The paper gives the analysis of the length-age composition of Greenland halibut from commercial catches taken by Spain and Portugal in 1998-1999 and by Russia - in 1998-2000.

## Material and Methods

Biological data collected by observers placed onboard the vessels of Russia (1998-2000), Spain and Portugal (1998-1999), operated on Greenland halibut in the NAFO Regulatory Area, are used in the paper. The data on the length and age composition of Greenland halibut from commercial catches taken in the NAFO Divisions were published in the reports by these countries (Sigaev *et al.*, 1999, 2000; Junquera *et al.*, 1999, 2000; Alpoim *et al.*, 1999; Vargas *et al.*, 2000). No data were published on the fish sexual ratio. To analyse sexual composition, the author therefore used only Russian data.

The fishery for Greenland halibut, with a bottom trawl in use, was carried out by three countries in Div. 3LMNO. Its major proportion was caught in Div. 3L and 3M on the continental slope of the Grand Newfoundland and Flemish Cap Banks. In Div.3NO the fishery was less intensive. For this reason the biological data for Divs.3LM were used by the author in order to compare the data.

Pair-trawlers were also used in the fishery for Greenland halibut. Data on length frequencies from the catches taken by the pair-trawlers from Spain are available for 1999 (Junquera *et al.*, 2000). It should be noted that in 1999 these vessels operated at the depths above 700-1 100 m, compared to those at which the rest of the Spanish trawlers fished (700-1 700 m). For that reason, and due to few biological data from the pair-trawlers, the author did not use them.

During the fishery for demersal fish species, not less than a 130 mm mesh-size in a trawl codend is allowed to be used in the NAFO Regulatory Area. The commercial size for Greenland halibut was established to be 30 cm in this area (NAFO Fisheries Commission, 1998, 1999, 2000).

To read age in Greenland halibut, its scales are used by Russian age readers and otoliths - by those from most other countries. For most species, methods of reading the age using the scales and otoliths contain some difficulties due to subjective criteria (Boehlert, 1985). Williams and Bedford (1974) suggested "... that otolith reading remains, for the present at least, as much an art as a science".

## Results

Over the period of the investigations, halibut of 22-100 cm long occurred in commercial catches taken by Russia, Spain and Portugal (Fig. 1). In different years those countries fished off the halibut with the mean length from 42.7 to 48.4 cm. In most cases, the length of fish was 44.1-45.7 cm. Minimum mean length - 42.7 cm was noted in catches by Russian vessels in 2000 and maximum one - 48.4 cm - in Spanish catches taken in 1999.

The length groups from 38-39 to 44-45 cm were predominant for Greenland halibut during the years mentioned. The predominant length group - 42-43 cm - remained to be the same in Russian catches during all three years. The proportion of specimens at that length from the catches for 1998-2000 increased from 11.4 to 17.5%.

According to available data, by-catch of young fish below 30 cm long did not exceed 1.6% for that period that was not a violation of the fisheries management measures.

Sexual ratio of fish in commercial catches taken by Russia varied slightly from year to year. Proportion of males made up 38.0-39.2%.

Fish at age 2-20 yr occurred in commercial catches (Fig. 2). In different years the specimens at age 4-8 yr were predominant in catches by different countries. In 1998 and 1999, the catches taken by Spanish and Portuguese vessels consisted mainly of individuals at age 5-7 and 6-8 yr, respectively. Halibut at age 4-5 and 6-7 yr, respectively, were predominant in Russian catches. Thus, the age of specimens from predominant age group in catches taken by the EU countries was by 1-2 years higher than that in the catches by Russian vessels. The Russian catches for 1998 and 1999 consisted of the age groups from the 1994 and 1993 year-classes, respectively. However, the individuals from the 1992 year-class were predominant as the age group in the catches taken in the same years by the EU countries.

In the year 2000, the proportion of the 1994 and 1995 year-classes significantly increased in Russian catches. Thus, if their proportion in catches constituted 18.0 and 4.1% in 1999, then it increased to 39.4 and 29.6%, respectively, in 2000.

### Discussion

The mentioned data indicate that small- and mean-size halibut from young age groups, prevailing with females, made up the bulk of catches. Occurrence of large-size halibut in the Spanish catches for 1999 can be explained by a large fishing depth (1 100-1 700 m). According to the previous investigations, the prevailing lengths and mean length of halibut increase with an increased fishing depth (Junquera and Zamarro, 1994; Igashov, 1999). Appearance of small-size halibut in Russian catches taken in 2000 is explained by a significant increase in the proportion of recruits in 1994-1995.

A 1-2-year difference in age of halibut from Russian samples and those of the EU countries can be explained by the different methods of age reading used, as well as by different reading of age by age readers. Variability in age estimates derived by different specialists defies accurate determination of a year of a strong year-class. This can adversely influence a creating of models by which the decisions are made for the stock management. Comparative analysis of the methods applied to determine Greenland halibut age has been already done earlier (Krzykawski, 1976) with the conclusion drawn that scales were the most suitable for age determinations. However, these investigations were carried out in the 1970s, when the method for age reading, using a polished and finally baked cross cut of the otolith (Chilton and Beamish, 1982) that is mostly used at present was not widely practised. In connection with this, efforts of all the researchers concerned should be pooled to search for the most optimum methods for age determination and to apply the agreed methods in future.

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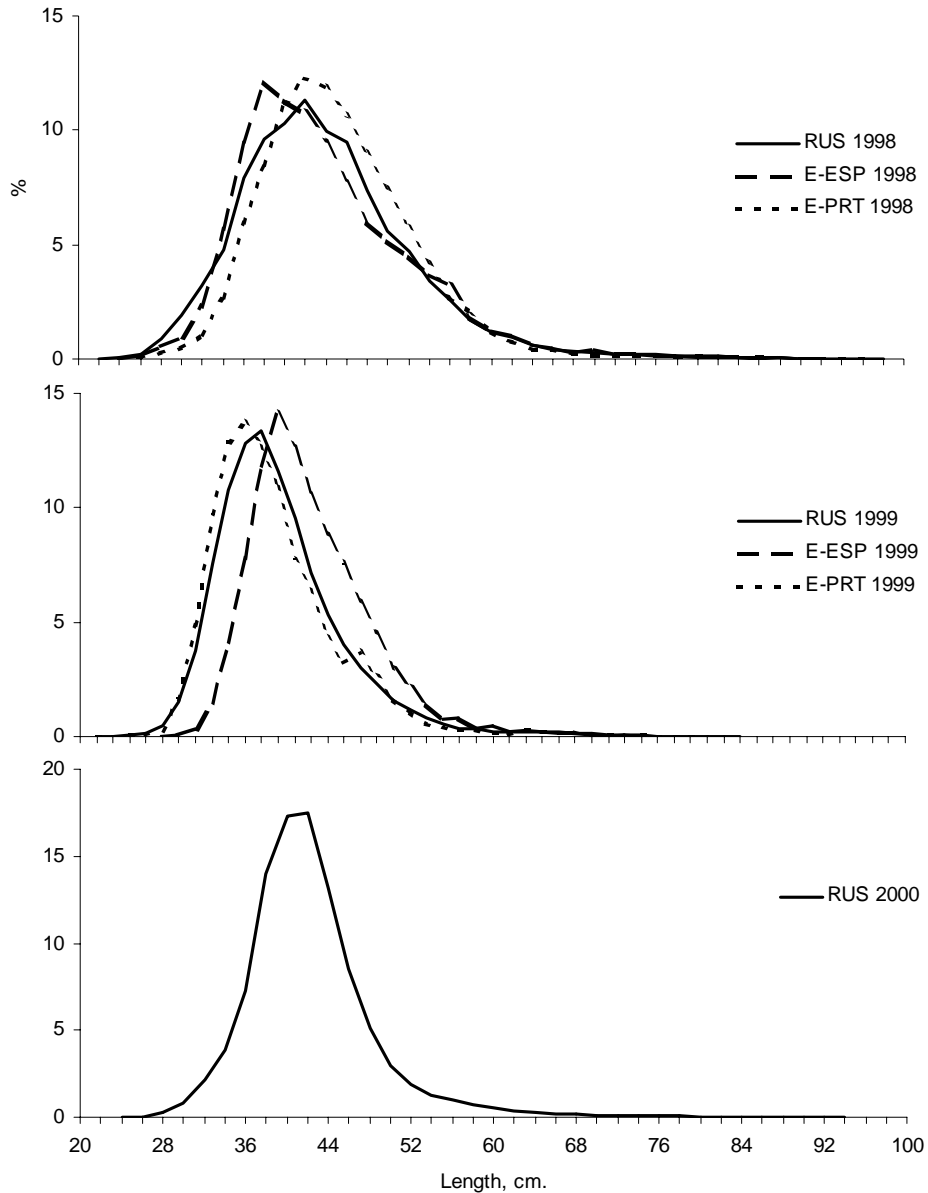
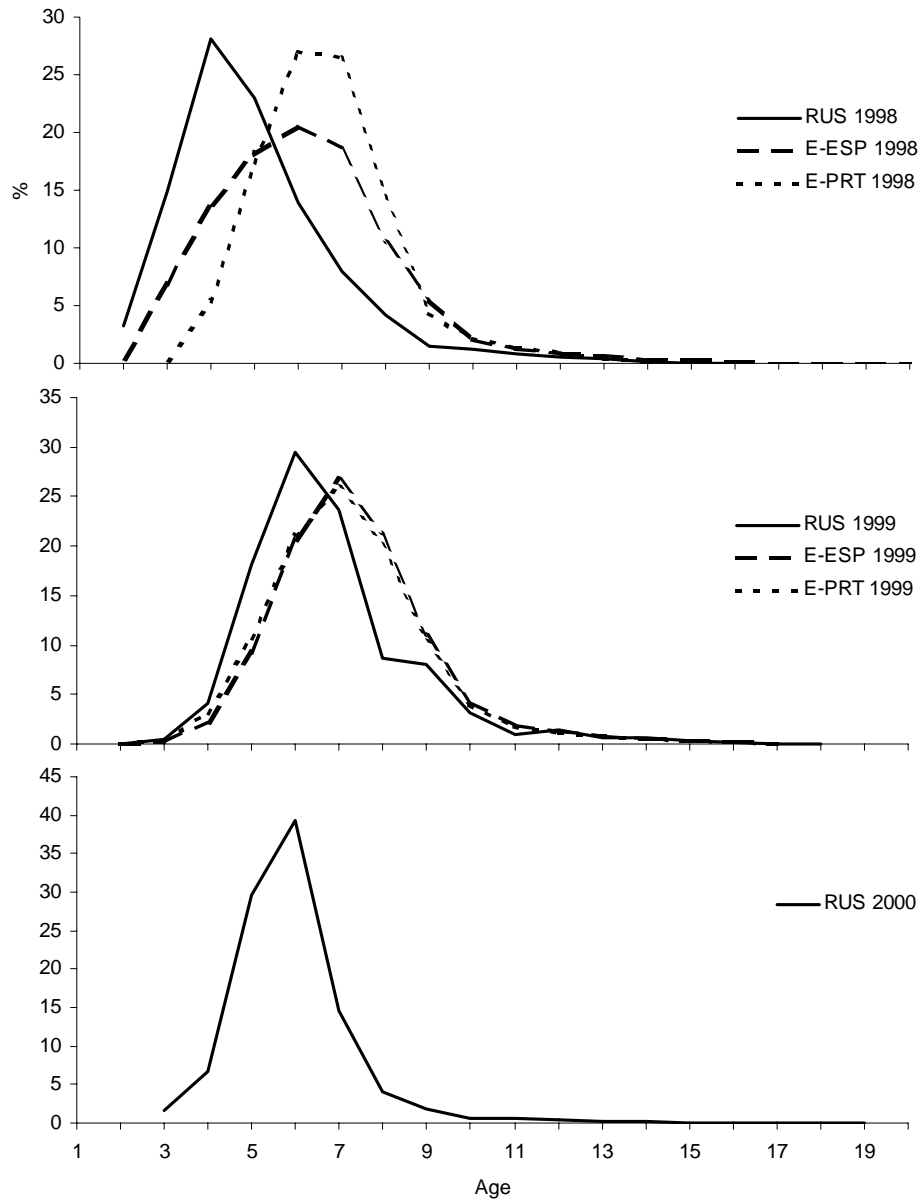


Fig. 1. Length composition of catches taken by Russia (RUS), Spain (E-ESP) and Portugal (E-PRT) in 1998-2000



**Fig. 2.** Age composition of catches taken by Russia (RUS), Spain (E-ESP) and Portugal (E-PRT) in 1998-2000