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Distribution and Abundance of the Young Silver Hake (*Merluccius bilinearis*) from Data  
of Trawling Surveys Conducted on the Scotian Shelf in October-November 1978-1983

by

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Introduction

The silver hake, one of the most abundant fish species ranging in the Nova Scotia area, is of great importance in the international fisheries. Its stocks are subject to large fluctuations due to variable year class recruitment. For the purpose of studying the factors influencing the year class strength the surveys on abundance and distribution of the silver hake eggs, larvae and youngs were conducted annually from 1978 to 1983 in the framework of the joint USSR-Canada research program. The research work also involved hydrometeorological observations, the studies on the zooplankton distribution and abundance, and on the other environmental factors. The results of the studies on the distribution and abundance of the silver hake eggs, larvae and youngs, and on environmental conditions over the 1978-1980 period were presented in the report (Noskov et al., 1982). In the given paper further results of the study on the distribution and abundance of the young silver hake in 1981-1983 are discussed.

Materials and Methods

Trawling surveys on abundance of 0+ group silver hake were conducted in October-November 1978-1983 covering 100 stations on the Scotian Shelf. The investigation area was divided by sec-

tion (depth layers), according to the scheme suggested by Canada, USA and USSR scientists in October 1969 (Doubleday, 1981). The trawling was made at 53 to 81 m depths (fig.1). Number of hauls for each depth layer was proportionate to the square (approximately one haul per 200 miles<sup>2</sup>).

1978-1980, a 13.6 m fry trawl (the AtlantNIRO design) made of kapron netting with the mesh size of 42 to 20 mm, 5 mm in the codend (vertical and horizontal opening 6 and 8 m respectively), was used. The trawling was made on the 24-hour basis, 1-2 m off the bottom, at a towing speed of 3.5 knots and 30 minutes duration. Beginning in 1981, on agreement with the Canada side, the fishing gears and methods for the young hake were changed. The international "IGYPT" trawl was adopted for fishing for the young gadoid fish species. This trawl is also made of the netting with 50 to 20 mm mesh size, 5 mm in the codend (vertical opening of 6-8 mm, and horizontal opening of 10-12 m). In 30 minutes the 13.6 m trawl covers the area of 25928 m<sup>2</sup>, and the "IGYPT" trawl - 35651 m<sup>2</sup>. The duration of each haul is 30 minutes at the towing speed of 3.5 knots. Using this trawl the hauls were made only at night, by step: off the bottom, in the water column and at the surface. To check the given depth, the echo depth meter (IGEK) was used, which was fixed on the headline.

The catch was sorted out by species, and measurements of the young hake and other species were made to the nearest mm.

The results of the catch analysis were entered on the trawl cards. Some samples of the young hake were preserved in 4% formalin for chamber processing.

During the trawling surveys meteorological observations were made at station at standard time, and hydrological observations involving the water temperature measurements were made using XBTs.

In addition, the facsimile charts of the near-earth atmospheric pressure and the distribution of the water temperature on the surface were used for the analysis of hydrometeorological conditions.

For comparison of the abundance indices for the 0+ group silver hake catches taken with the 13.6 m trawl in 1978-1980 and with the "IGYPT" trawl in 1981-1983 comparative trawlings were made in October 1983. The obtained data appeared to be not representative enough, and for the time being it has been acknowledged that the catches taken with the 13.6 m trawl constitute 0.8 of the catches taken with the "IGYPT" trawl.

### Results

#### Distribution of 0+ group young silver hake

In the given report a comparison is made between the distribution of the young silver hake in 1981-1983 and 1978-1980. In 1981 and 1983 the young hake had a wider distribution range than in 1982 (fig.2). Significant aggregations (100 sp. or more per haul) were recorded everywhere westward of Sable Island, while in 1982 the largest observed aggregation was off the bottom in the La-Have depression. As in 1978-1980, extremely dense aggregations of the young hake were found in the area of the Nova Scotia through, along the boundary of the upwelling and sinking water zones. The presence of abundant aggregations of the silver hake eggs and larvae in the shoal waters westward of Sable Island (Noskov et al., 1982) suggests that they drift there, and that the youngs are most likely to actively migrate to the above-mentioned deep-water regions.

The studies on the vertical distribution of the young hake conducted on board the SRTM-8072 "60 Let VLKSM" in October-November 1980 (Koeller, 1981) showed that:

- 1) catches of the young hake in the water column sharply increase before sunrise, drastically decline in the day-time, increase after sunset, and again decline at night;
- 2) at night the young hake distribute uniformly in the entire water column, and in the day-time they probably keep near the bottom.

Thus, it has been found that the fishing for the young hake on the 24-hour basis near the bottom is not representative

and leads to inaccuracy in calculation of the abundance index. Step hauls made at night throughout the water column proved to be more successful. Therefore the USSR and Canada scientists came to an agreement, that beginning in 1981 the trawling be made throughout the water column at night-time.

The distribution of the young hake by body length is shown in fig.3. In the catches taken with the 13.6 m trawl in 1978-80 the larvae 15-20 mm in length were also found. The mean length of the youngs was about 3 cm. In 1981 and 1983 the mean length was 2-2.5 cm greater than in the previous years. From the difference between the mean length values it can be suggested that in the recent years the massive spawning of the Scotian hake took place 2-3 weeks earlier than usual.

Fat condition values for the young hake were the highest in 1978-1980 and 1983, and lower values were observed in 1981, especially so in 1982 (table 1). So, in 1982, the mean weight for the youngs of 26-30 mm constituted only 30% of the mean long-term value, and for the larger specimens it made up 62-87%. Thus, the feeding conditions appeared to be extremely unfavourable, especially for the smaller fish, which might have influenced survival of the youngs.

#### Abundance of the youngs

The number of the young hake per hauling fluctuated from 0 to 4480 sp. over the 1978 to 1983 period, and averaged to 92 sp. in 1978, 101 sp. in 1979, 27 sp. in 1980, 517 sp. in 1981, 8 sp. in 1982 and 229 sp. in 1983. The largest recorded abundance was in 1981 -  $110.9 \times 10^7$  sp., and the lowest in 1982 -  $1.7 \times 10^7$  sp. (Table 2). Judging by the catches of the 1982 year class hake, in 1983 it was relatively strong, while the 1979 and 1980 year classes were rather poor. It should be also mentioned that no significant differences in numbers of the hake eggs and were observed over the 1977 to 1982 period. The abundance of the larvae fluctuated by year from  $10.10^{11}$  (1977) to  $41.10^{11}$  sp. (1978, 1982),

and that of the fry, from  $33 \cdot 10^{11}$  (1980) to  $103 \cdot 10^{11}$  sp. (1979). Since in 1982 the abundance of the hake eggs and larvae did not differ considerably from that in the previous years, the low abundance of the year class of that year can be explained by unfavourable hydrological conditions. In spring and summer 1982 anomalously low water temperature values resulted from the drift of the cold Labrador waters under the influence of persisting north-eastern and northern winds. In all likelihood, the 1982 year class, which will enter the fishery in 1985 at the age of 3 years, will be poor.

Thus, from the assessment of the young hake abundance in October-November the recruitment to the commercial stocks can be estimated 2 or 3 years in advance.

#### Conclusions

1. The largest abundance of the Scotian silver hake youngs over the 1978-1983 period was observed in 1981 and amounted to  $110.9 \times 10^7$  sp., and the lowest - in 1982 and amounted to  $1.7 \times 10^7$  sp.

2. No significant differences were observed in the abundance of spawning specimens or in numbers of eggs and larvae over the entire investigation period. Therefore, the large abundance of the youngs in 1981 and low numbers in 1982 can be explained by variable survival at the larval development stage.

#### References

1. Doubleday W.G., 1981. Manual on Groundfish Surveys in the Northwest Atlantic. Scientific Council Studies N 2, NAFO, Canada.
2. Koeller P.A., 1981. Vertical distribution and optimum sampling strategy for 0-group silver hake (Merluccius bilinearis) surveys on the Scotian Shelf. NAFO SCR Doc.VI/21, pp.1-13.

3. Noskov A.S., Vinogradov V.I. and Sherstyukov A.I., 1982.

Results of Ecological Surveys Conducted on the  
Nova Scotia Shelf in 1974 and 1977-1980 to Study  
the Spawning Efficiency of Silver Hake. NAFO SCR  
Doc.VI/33, pp.1-28.

TABLE 1. Length and weight of the young hake on the Scotian Shelf in October-November 1978-1983, % of the mean value.

Length, mm	1978	1979	1980	1981	1982	1983	1978-1983	
							g	%
26-30	100	93	106	84	30	100	0.15	100
31-35	119	109	114	90	62	105	0.21	100
36-40	119	113	106	97	68	106	0.31	100
41-45	117	104	100	87	87	104	0.48	100
46-50	119	111	108	83	78	110	0.64	100
51-55	123	114	95	86	84	106	0.86	100
56-60	111	120	101	87	82	112	1.08	100
61-65	102	119	96	82	-	100	1.57	100
66-70	-	-	107	93	-	127	1.69	100

TABLE 2. Total abundance of the Scotian silver hake youngs in October-November 1978-1983.

Years	Abundance . $10^7$
1978	48.2
1979	12.2
1980	5.3
1981	110.9
1982	1.7
1983	34.3



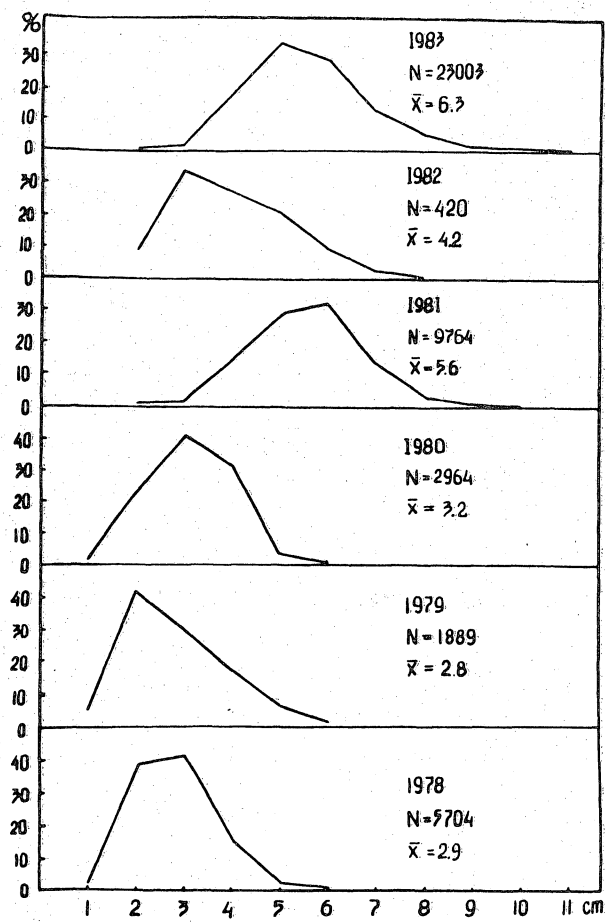


Fig. 3. Distribution of the young silver hake by body length in 1978-1983.