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The Results of Mackerel (*Scomber scombrus*) Study  
on the Scotian Shelf in June 1990

by

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ABSTRACT

The results are presented of mackerel (*Scomber scombrus*) study based on trawl-hydrological survey on the Scotian Shelf in June 1990. Works are carried out by the Soviet R/V Evrika according to the Soviet - Canadian program, aimed at the species fishery potential assessment. The survey complex included day/night half-an-hour hauls with pelagic trawl, mackerel biological analysis and hydrological stations. The results of Evrika surveys and of other commercial vessels show that in 1990 the bulk of prespawning mackerel migrated into the Gulf of St. Lawrence before the survey, in April though the first ten days of May and was not retained on the shelf as observed during relatively warm years. In June mackerel aggregations of insignificant density occurred within restricted areas and could not support the fishery. Such behaviour of mackerel during 1990 is supposed to be the result of increased cold water advection into the Scotian Shelf area.

INTRODUCTION

Mackerel studies were included into the Soviet - Canadian program of 1990, based on the agreement between Fishery Department of Canada and Ministry of Fisheries of the USSR concerning the mackerel fishery prospects in the Scotian Shelf area. American and Canadian data on mackerel biology and distribution in NAFO Subarea 4 (Sette, 1950; Mackay, 1967, 1973; Stobo and Hunt, 1974, Moores et al., 1974) and Soviet data on mackerel fishery and distribution over the Scotian Shelf preceeding the Canadian economic zone declaration (Vyalov, Karasyov et al., 1971; Karasyov, 1975). The data available show that the northern population was fished during summer spawning migration into the Gulf of St. Lawrence and during the fall reverse migration. It was revealed that in summer mackerel aggregations were retained on shelf during

warm years for a longer period than usually. It was also revealed that seasonal and interannual variability of mackerel catches from the Scotian Shelf area depended significantly on the temperature conditions of shelf waters.

During the Soviet observation period from 1964 through 1974 the average mackerel catches from 4W zone amounts to 1.8 thous.t. in the years of low water heat content (1964-1967), 7.9 thous. t. in the years of the average heat content (1968-1972) and approaches 18,9 thous. t in the relatively warm years (1973-1974). During cold years mackerel is not retained on the Scotian Shelf and the catches decreased sharply. In warm years the bulk of the northern element stays in the area to feed and spawn and supports the most efficient fishery. The trawl-hydrological survey was designated to assess the prospects of this species fishery in summer 1990 and to collect biological and environmental data. The survey was supposed to be the exploratory one, as the time period for it had not been scheduled separately, but was included into the cruise time, devoted mainly to hake study. Researches on the shelf was begun on 15 May, and the mackerel survey has been scheduled for the period from 7 to 19 June. In normal conditions it coincides with the completion of mackerel migration into the Gulf of St. Lawrence. In this connection it could be suggested that survey results would clear up the mackerel distribution pattern.

#### MATERIAL AND METHODS

The commercial pelagic trawl (RT/TM 70/370) was used to carry out the survey. Half-an-hour exploratory hauls were carried out on day-and-night base taking into consideration daily feeding migrations of mackerel. Night hauls were made in the layer of 10-50 m, and day hauls in the near bottom layer. Hauls were carried out in predetermined points, located in deep-water shelf area, and in the intervals between those points with distinctive echorecordings available. The actual trawl stations location and survey route are presented in the Fig. 1. The intervals between stations never exceeded 20 miles. The trawling speed varied within the range of 3.5-3.8 knot. At each station hydrologi-

cal observations were carried out with a probe of STD type. The total station number amounted to 67, including 7 stations with only hydrological observations available, where trawling was not carried out. During the survey 5 biological analyses of mackerel were performed and 3554 specimens were measured. Of the 200 otolith pairs collected only 165 pairs appeared to be suitable for age estimation.

The results of researches enable to determine age-length key and age composition of mackerel in exploratory catches.

The data were obtained on hydrological conditions of mackerel distribution over the Scotian shelf in June 1990.

### RESULTS

Figure 2 shows the night catches and surface temperature distribution. It can be seen that mackerel occurred only in catches from 8 stations. Catches amounted up to 600kg for 30 minute hauls. The most of efficient night hauls occurred in the southern part of survey area around Emerald Bank and westwards at water temperature of 7,5-8°C. Catch size shown in the figure suggests that the species could not be recommended for fishery.

Figure 3 shows day catches, which appeared to exceed significantly the night ones, and near-bottom temperature. Catch distribution revealed the distinct division of the survey area into eastern and western parts and intermediate area with no catches observed.

At 6 stations catches reached over 100 kg per half-an-hour with the maximum of 1900 kg per half-an-hour. However those results also could not be considered as a base for directed mackerel fishery during this period. It should be noted that the most efficient catches occurred in temperature gradient zones both in the eastern and western parts of the survey area. One peculiarity was revealed in mackerel distribution relative geostrophic circulation field. The most catches were taken in the flow moving northwards and northeastwards. i.e. in the path of migration into the Gulf of St. Lawrence to spawn.

Biological analysis of mackerel showed that specimens ranging from 20 to 43 cm in length with pronounced modal group of 28 cm occurred in catches (Fig. 4). Mean weight amounted to 256 g,

mean length 29.1 cm. Males had gonads of maturity stages 3 and 4, and females- of stages 2 and 3. Females of maturity stages 5 and 6-2 occurred in insignificant numbers. It could be supposed that the larger specimens had migrated into a spawning area before survey started. The stomach filling index varied within 1-3 points. Calanus was the major food item. Fat content on the inner organs was estimated as 0.

Data on mackerel occurrence frequency and mean ~~weight and length~~ <sup>weight and length</sup> by age are presented in Table. The data revealed, that mackerel in catches was represented mainly by specimens of age 2 and 3. The number of older specimens was insignificant in contrast with the previous years, when the high percentage of mackerel of age 5-8 was observed in catches from the same fishing area (Hunt, 1975, 1976; Isakov, 1976; Stobo and Hunt, 1974). Mackerel size in catches for 1990 were respectively lower with the pronounced peak for specimens 27-33 cm in length. The differences mentioned seem to be explained by the earlier actual migration of large mature mackerel for spawning in 1990. As for the mean length and weight-at-age, no significant differences in age groups 1-5 were revealed as compared with the previous year.

Two Soviet vessels performed successful mackerel fishery with daily catch of 47-77 t from 8 to 17 May, just before Evrika had begun to work on the Scotian shelf. Later on during the second ten days of May catches decreased to 21 t and never exceeded 20 t till the fishery ceased in 23 June. Besides the catches were unstable and their size varied significantly. During the beginning of the third ten days of June the fishery was ceased due to the extremely poor fishery situation. Only 3.6 thous. t of mackerel were realized of the USSR quota of 10 thous. t. To summarize the results of Evrika survey and exploratory fishery it may be concluded, that the bulk of the mackerel northern component migrated into the Gulf of St. Lawrence in April-first ten days of May 1990 and was not retained on the shelf as in relatively warm years. Thus in 1990 mackerel distribution appeared to be of cold year pattern. The year of 1990 may be considered as a relatively cold one based on negative anomalies of water bounds, surface water temperatures

and enhanced advection of cold water over the shelf (Sigaev, 1991).

#### DISCUSSION AND PROPOSALS

The results of Evrika survey seem to provide no comprehensive answer to the question on mackerel fishery prospects over the Scotian shelf during prespawning migration due to several causes. First, the survey was not specially planned but was included into the program of hake researches. Second, survey covered the period of completion of the mackerel migration into the Gulf of St. Lawrence, which was confirmed by small number of efficient hauls (only 23 from 67) and occasional echorecordings of mackerel aggregations. Third, data on distribution and aggregation size are confined to the catches at stations carried out either in the day time or at night depending on survey schedule. Thus the distribution pattern obtained is not uniform by time. In this connection it is reasonable to determine more impartial and correct conditions for future researches according to a special program.

First of all, the beginning of survey is to coincide with mackerel migration start (in April). Hence mackerel is a pelagic fish it is desirable to use hydroacoustic method of inventory survey and distribution research in addition to trawl survey. In such a case it is necessary to perform hydroacoustic survey of the study area outlined according to predetermined scheme of tacks with control hauls in aggregation location, and then to carry out a trawl survey with hydrological observations and stations, which is to be determined based on hydroacoustic survey results. Both survey routes preferably is to be originated in the northwestern part of the area to meet migrating mackerel while moving southwestwards.

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Table

Mackerel average length, weight and percentage at age in R/V Evrika catches in June 1990 (zone 4W)

Age								
Average length (cm)	22.1	27.8	31.4	33.4	36.7	37.0	-	42.5
Average weight (kg)	0.086	0.210	0.325	0.401	0.584	0.545	-	0.845
%	0.1	61.8	30.1	6.9	1.0	0.1	-	+

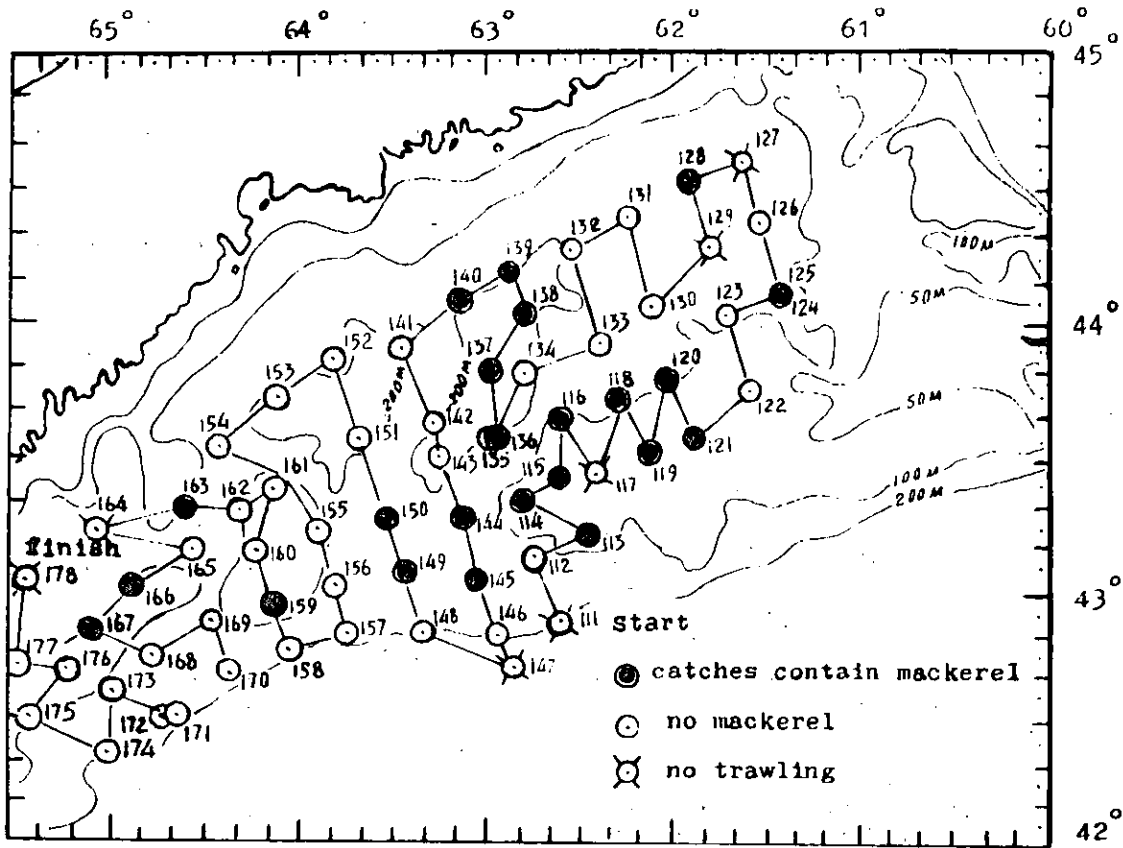


Fig. 1. Stations location and survey route, 7-19 June, 1990.

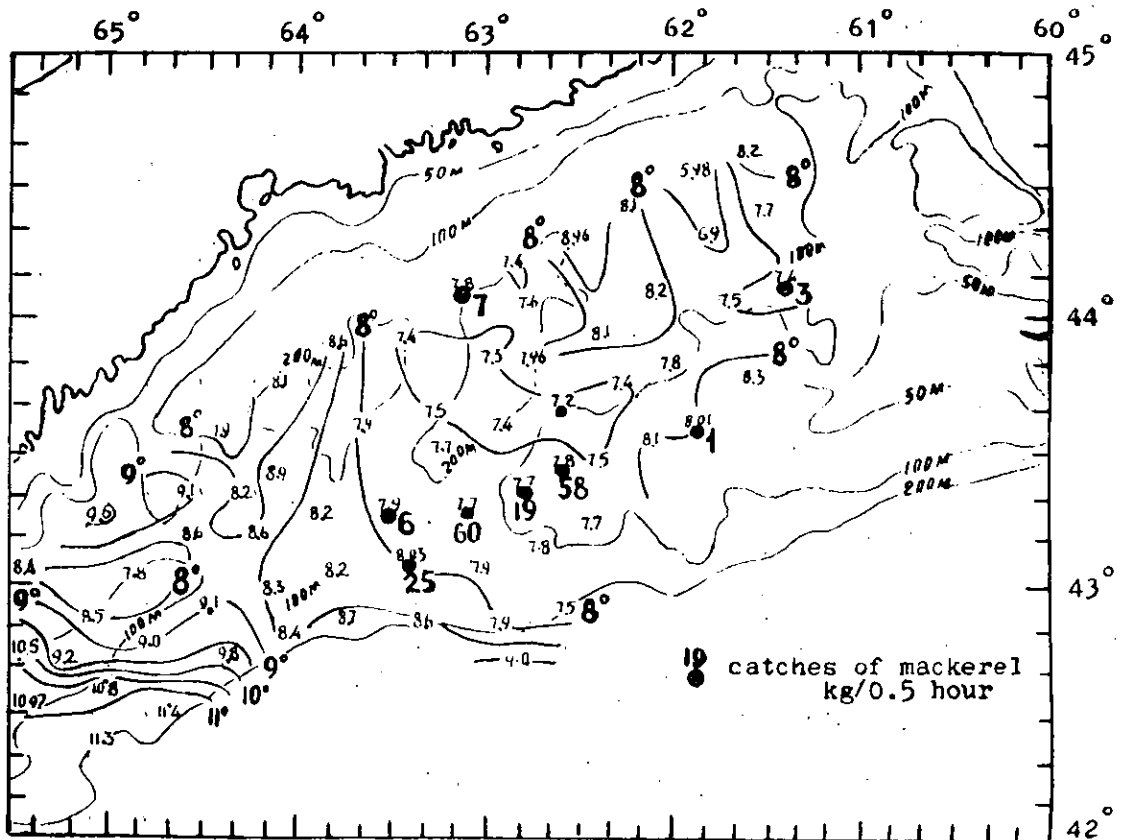


Fig. 2. Night mackerel catches and surface water temperature distribution.

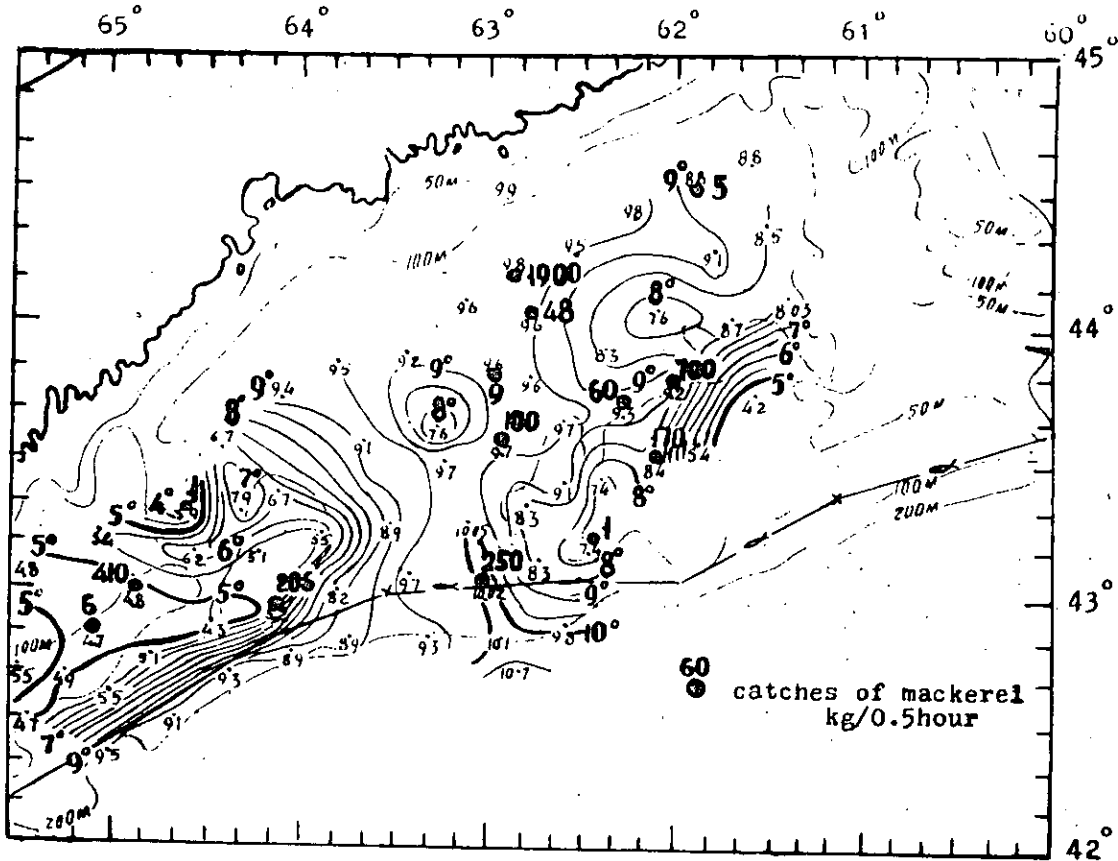


Fig. 3. Day mackerel catches and near bottom water temperature distribution.

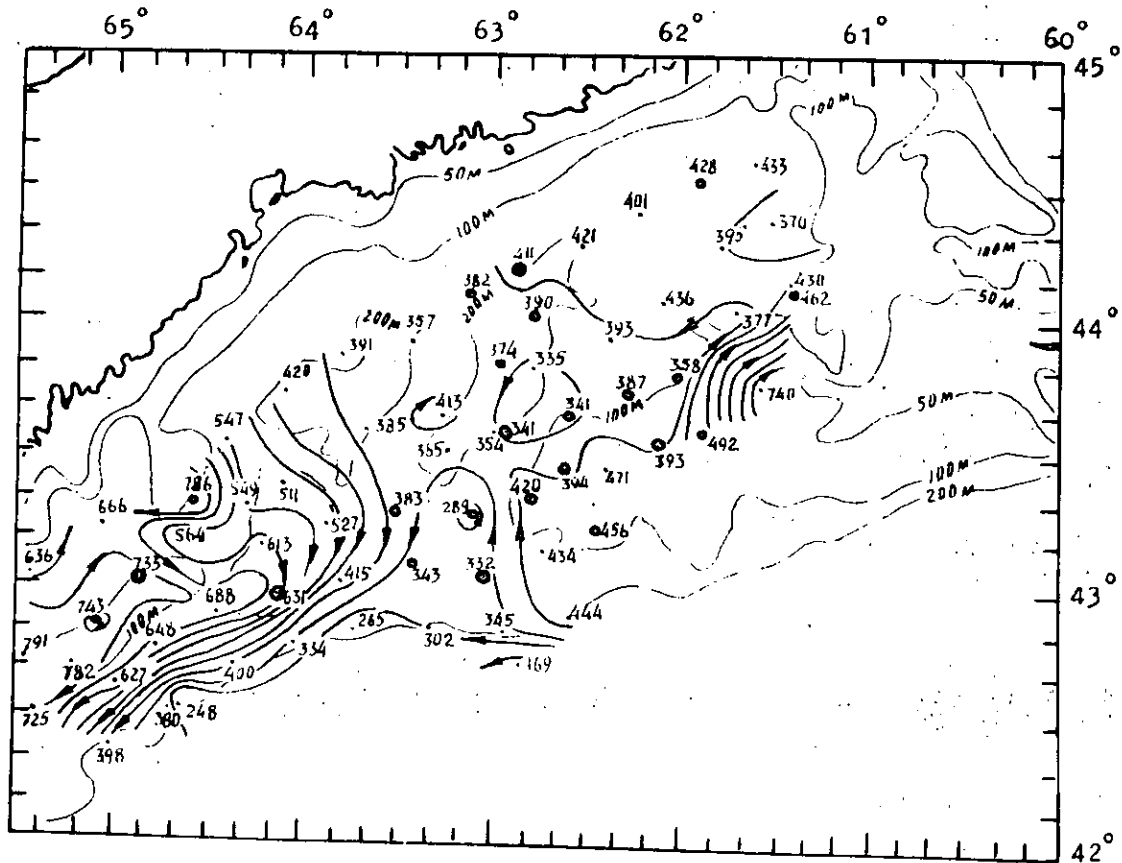


Fig. 4. Mackerel catches distribution in the geostrophic circulation field.



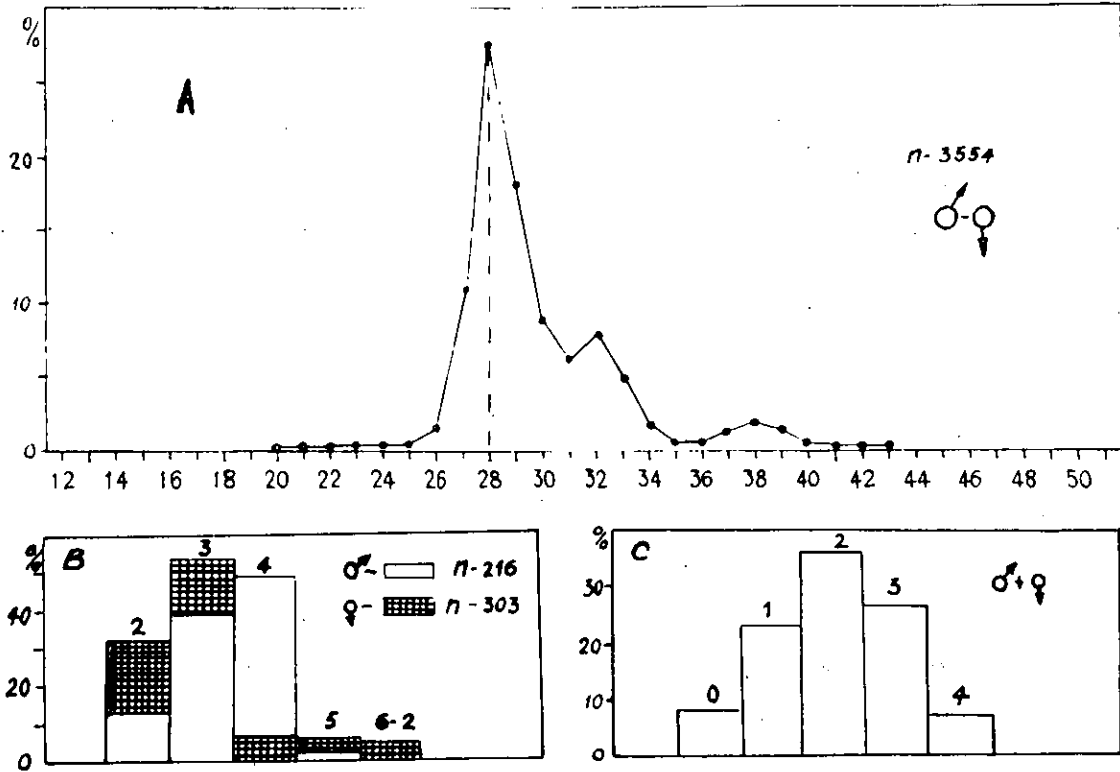


Fig. 5. Mackerel size composition (A); maturity stages (B); and stomach filling indices (C) in zone 4, 7-19 June, 1990.