Northwest Atlantic Fisheries Organization

Serial No. N340

NAFO SCR Doc. 81/VI/56

SCIENTIFIC COUNCIL MEETING - JUNE 1981

Studies of Atlantic Saury, *Scomberesox saurus* Walbaum), on the Scotian Shelf in October-November 1980

by

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Abstract

In October and November 1980 the Atlantic saury ranged in the Scotian Shelf and continental slope waters. Saury aggregations showing a positive response to artificial light were found in coastal waters above 45-1500 m depths at the water temperatures 9.4-14.8°C. As is evident from the survey data, the saury biomass amounted to 85 thous. tons over 18880 sq. miles. Following a general cooling of the waters from October to November, the saury aggregations migrated in the southward direction. The density of migrating aggregations was high enough to ensure successful fishery.

Introduction

In the Canadian waters the Atlantic saury, Scomberesox saurus (Walb.), occurs between June and November.

As is evident from the Soviet investigations in the Northwest Atlantic, this massive pelagic species migrates to the coastal waters for feeding.

The 1980 studies conducted within the framework of the Canada-USSR agreement were aimed at the assessment of the minimum saury biomass, determination of the mechanism of formation of forced aggregations and their fishing and collection of hydrometeorological and biological data.

Materials and Methods

The materials were obtained on board the SRTM-3015 ANTARES. The oceanographic data were collected using standard hydrological equipment: BM-48 bathometers, deepwater thermometers and bathythermograph. At hydrological stations the temperatures of water samples from standard depths were measured in Centigrade and the salinity determined in ‰ uding the method of titration for chlorine content.

Hydrometeorological and searching works involved the analysis of the data on the near-surface pressure and distribution of the surface water temperatures. Weather, temperature and pressure charts were received by the facsimile apparatus.

In search of saury aggregations and in order to determine their abundance a searchlight S-60 (3 kw, used in the Pasific saury fishery) and lamps PKN-1500 (1.5 kw) were mounted aboard the ship. In addition, an illuminating device KKU 1x 20000 (20 kw) was installed. The observations of the saury behaviour and fishing were made at the light stations. Dip nets (10 mm mesh size) and side traps (10 mm mesh size) were used as fishing gears. Detailed information concerning the methods of route survey on abundance is given in the paper by Nesterov and Grudtsev (1980). The factor of "distribution by depth" is estimated at $1 \frac{)o}{o} 5$.

The estimation of the saury biomass was based on the mean weight of the single specimen taken as 58.1 g. The duration of the light stations varied between 1.5 and 6 hours. A total of 3100 specimens were measured and 1300 examined. The survey covered the area of 21800 sq. miles. Records were made of 57 hydrological, 54 BT and 113 light stations, of 620 salinity determinations and 18 casts of side traps. The abundance of the fish, their behaviour pattern and the surface temperature were recorded at each light station.

Results

In October, on Scotian Shelf the saury was found everywhere between the Browns Bank and Banquereau and Middle Banks within the 200 m-isobath (fig.1) at the water temperatures 9.4-14.8°C. Most dense forced aggregations were formed over 50- 200 m depths at the temperatures 11.8-14.8°C. Natural distribution of the fish can be described as extensive "fields" 6 miles long numbering 18 thous. specimens per mile of the ship's course in a band 5 m wide. Besides, single schools of approximately 1000 specimens occurred. At the end of October no natural saury aggregations were observed near the frontal division between the coastal and slope waters. However, throughout the month, the fish concentrated in the illuminated zone near the ship and the catches amounted to 0.1-5 tons per side trap cast.

The results of the oceanographic studies showed that in October the saury aggregations were associated with the coastal waters forming the largest concentrations along the frontal zones in the places, where the tongues of coastal waters mix with the cold underlying waters of the Labrador origin. The density was low in the regions, where the upper border of the thermocline coincided with the 20-25 m depth and the lower with the 30-35 m depth. Vertical temperature gradients ranged between 7.1 and 9.6° per 10 m.

In November, the same area was studied including the continental slope waters. The surface temperatures were 8.6-11.8°, the saury occurred south of Sambro and Emarald Banks and on Browns Bank. In this region the abundance of the saury recorded at the light stations was the highest. In more northern areas the fish was absent (fig.2). The saury catches taken with side traps did not exceed 5 tons per cast at the temperatures 9.4-11.8°.

In November, the intensified cyclonic activity in the atmosphere and convection - wind mixing of the water resulted in significant changes in hydrological conditions. The thermocline was practically absent above the shallow waters and was re-

pidly destroying above the depths of 100 m or more. The intensified inflow of cold Labrador waters and movement of the surface waters above the shallow water regions (50-100 m) are also worth noting. All these processes led to an overall drop of the water temperature from the shallow water regions to the continental slope and to migration of the saury to more southern regions compared with October. The salinity of the waters during the entire investigation period varied between 31.00 and 33.50‰, which is characteristic of the coastal and Labrador waters of the Northwest Atlantic.

In the first half of October two surveys -oceanographic and of saury abundance -were conducted simultaneously on the Scotian shelf and continental slope between 65°30' and 58°00'W. The weather conditions were favourable during the survey, with prevailing westward scant winds (4-6 m/sec) and the moderate sea. The survey covered the area above the 45-1500 m depths with the surface water temperatures 13.0-16.0°. The quantitative saury distribution in the investigated area was not uniform (fig.3), the fish was absent from separate regions. The highest abundance (18 thous. specimens per mile of the ship course) was recorded north of Browns Bank and between Sambro and Middle Banks above the 100-200 m depths at the water temperatures 13.8-14.8°. Over a vast area in the surface depth levels the saury was dispersed occurring individually. In separate regions the schools numbering several thousand specimens and the "fields" some miles in length were found.

From the survey data the mean biomass was estimated at 85 thous. tons over the area of 18880 sq. miles (table 1).

In October the saury length in the catches taken with a side trap ranged between 18 and 38 cm, the weight between 17 and 165 g, the mean length and weight were 27.0 cm and 58.2 g respectively. The gonads were mainly (93.9%) in maturity stage II, the mean index of fat content was 1.9 and of stomach filling 1.6.

In November the saury was 22-36 cm in length (27.2 cm)

and 34-140 g in weight (58.7 g). The fish in maturity stage II predominated (95.9%). As in October, the gonads of some fish were in maturity stage III. The mean index of fat content was 2.2 and of stomach filling 1.9.

During the investigations the response of the saury to the artificial light was positive on the whole. At the light stations the fish approached the ship in a few minutes following the switching on the lamps. The dispersed fish formed small shoals which moved along the illuminated zone, then, in 20-30 minutes, they merged into a single school. The shoaling fish needed less time to concentrate in the illuminated zone. The school depth fluctuated from 2 to 30 m depending on the amount of the fish. With successive switching of the lamps the school moved to a new position of the illuminated zone.

In the second half of November the response of the dispersed saury to the light was not altogether positive or neutral. The efficiency of the saury concentration in the illuminated zone was determined by hydrological and weather conditions, the moonlight intensity, the availability of the predators. The cloudy sky or fog, the time before the moonrise and after the moonset, the new moon or moderate sea promote the positive response of the fish to artificial light.

Discussion

The results of the studies conducted on the SRTM-8015 ANTARES indicated that in 1980, in October and in the first half of November, the saury formed exploitable aggregations on the Scotian Shelf and slope, as on Georges Bank. From the survey data the density of the fish aggregations in the area was estimated at 3500 kg per sq. km. This value is quite compatible with the estimate given for Georges Bank - 1000-5000 kg per sq. km - in the fishing period of 1973.

Since in October-November the saury shows a positive response to artificial light the light fishing can be tried there. From the survey data obtained in August 1973 on Middle Bank the

saury biomass over the area of 960 sq. miles was 2.4 thous. tons, which corresponds to 1500 kg per sq. km. This extra information suggests that the saury aggregations may be present in the areas in question in September.

The data on the spatial and quantitative distribution of the fish shown in figs. 1 and 2 are indicative of the southward movement of the saury thus confirming the fact of migrations.

Table 1 Results of visual sighting of the saury on Scotian Shelf on 1-15 October 1980

Abundance classes (sp/mile)	Occurrence value (sp/mile)	Area of fish concentration (sq. miles)	Abundance of saury on the surface ($sp.10^3$)
0.1-5	1.30	7975	3842
5-10	6.50	625	347
10-15	12.05	1305	5828
15-20	17.70	750	4920
20-25	21.66	425	3412
25-35	33.50	2075	25462
35-45	42.00	200	3114
45-60	54.80	2425	49381
60-75	60.00	500	11118
75-100	82.00	175	5319
> 100	407.33	2425	366070
	$\sum$	18880	$\sum$ 478313

The biomass = 28 ÷ 139 thous. tons, 85 thous. tons on the average, at the mean weight of a specimen of 58.1 g.

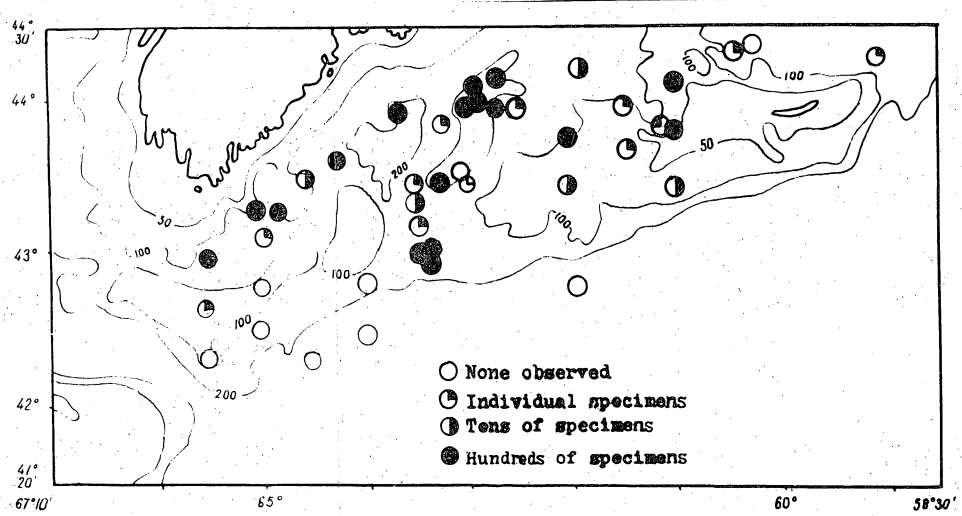

Fig. 1. Quantitative saury distribution at the light stations in October 1980.

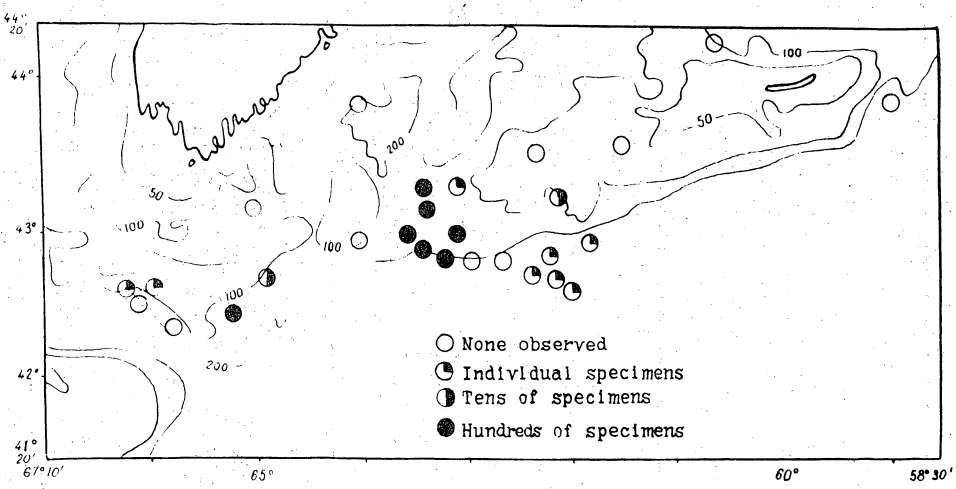

Fig. 2. Quantitative saury distribution at the light stations in November 1980.

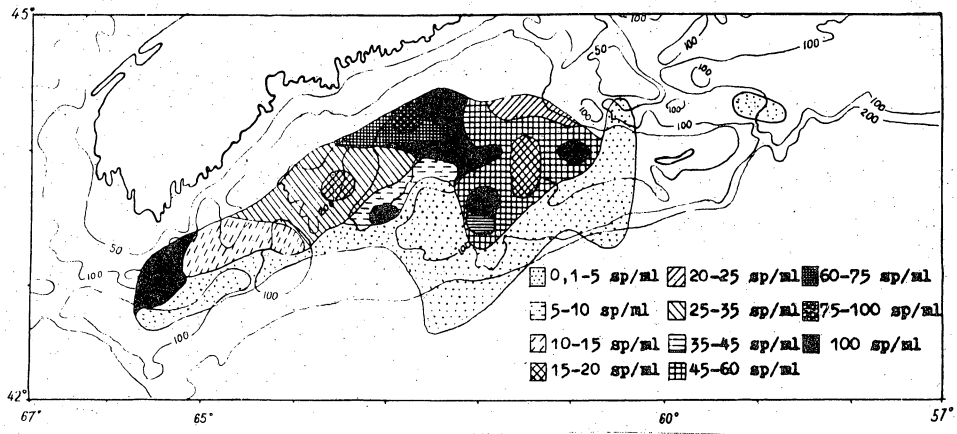

Fig. 3. Quantitative saury distribution on Scotian Shelf on 1-15 October 1980.