

Northwest Atlantic



Fisheries Organization

Serial No. N347

NAFO SCR Doc. 81/VI/63

SCIENTIFIC COUNCIL MEETING - JUNE 1981

Some Data on Distribution of Groundfish and Short-finned Squid
Along the Oceanic Slopes of the Scotian Shelf
(Division 4WX) in Spring 1979

by

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Introduction

The studies of the distribution of silver hake and other species have been carried out since the beginning of the Soviet fishing for the groundfish on the Nova Scotian Shelf in 1962. However, prior to introduction of the 200-mile zone in 1977, the investigations were not aimed at a detailed study of the species composition on a catch basis, and were generally limited to visual sighting, which had yielded inaccurate and incomplete data.

At present the distribution of abundant fish and squid species is studied in detail. In the present paper the results of such studies carried out in May 1979 according to the joint USSR-Canada program are given.

This period was selected because of the representativeness of the data acquired in May 1979 and because of peculiarities of the distribution of silver hake (the major commercial species in the Soviet fishery), which usually form dense aggregations on the slopes of Scotian Shelf.

Materials and Methods

In May 1979, the R/V 7052 BIMOCOBISK conducted a trawl survey and made daily stations aimed at the studying of catch composition and distribution of the shortfin squids on the slopes of Scotian Shelf in spring (fig.1). Besides, the data obtained by the Soviet observers in the same period of 1979 on a fishing vessel were used.

Trawl stations of 30 min. duration were made in pre-selected positions during daylight hours along the shelf slopes at depth levels 100-140 m, 150-190 m, 200-240 m and 250-290 m provided that the ground was suitable for the hauling.

At the end of the hauling the water temperature was measured with bathythermographs, and at depths greater than 200 m disposable IBT's were used. A trawl "Hake-215" with a small-mesh codend (93.5/3 x 10 mm) was towed at a vessel speed of 3.5 knots. All organisms taken with the trawl were recorded. Three daily stations were occupied on the slopes of Emerald, Sable Island and Burin-Broom Banks to study the behaviour and vertical distribution of massive fish species and shortfin squid. The stations were made at 2 hour intervals. The sampling on a fishing vessel followed the NAFO recommendations and methodical directions of the ATLANTICO. The haulings on a 3-hour interval basis were distributed as follows: those with the duration of at least 90% of the total hauling time were considered as relevant to the given interval. No observations were made between the midnight and 4 a.m.

General Features of Distribution of Massive Fish Species and Squids in May 1972 from the Trawl Survey Data

Silver hake.

Silver hake aggregations formed a narrow stripe along the slope between 60° and 63°W at depths ranging between 130 and 250 m at the temperature of 7.8-10.7°. Most dense recorded aggregations were in the area of continental slope south of Emerald Bank and southwest of Sable Island between 60 and 61°W at 140-200 m depths at the temperature of 9.3-10.5°C.

The catches amounted to 200-300 kg per hauling (fig.2). The location and density of the hake aggregations considerably varied during the day and the entire investigation period. The size composition ranged between 10 and 53 cm. The modal length was 17 cm for the young, 32.0 cm for the mature males and 33.55 cm for the mature females. Mean lengths were 15.9, 30.0 and 32.0 cm respectively at mean weights 28.0, 216.0 and 296.0 g.

The bulk of the catches was made of the mature fish. The feeding intensity of the hake was low, approximately 40% of the examined stomachs were empty.

In fig.3 the distribution of the hake from the data of the observers is shown. As is evident from the data, in May the hake occurred between $60^{\circ}30'$ and $64^{\circ}00'W$ at depths between 110 and 400 m. Most dense aggregations were reported from the 150-250 m depths.

Haddock.

From the trawl survey data (fig.4) the haddock occurred at the 120-250 m depths at $4.9-10.8^{\circ}C$. The maximum catches did not exceed 400 kg and were taken in the Browns Bank and Sable Island area at the 120-140 m depths at the temperature of $7.4-8.7^{\circ}C$. The distribution of haddock aggregations varied with the temperature. Along the 100 m isobath of the southern slope of Banquereau Bank (Div.4V) the haddock was caught at the temperature of $4.9-6.4^{\circ}$.

According to the observers data the haddock ranged between $60^{\circ}30'$ and $63^{\circ}W$ at the 100-200 m depth (fig.5).

Shortfin squid.

The data of the trawl survey conducted from 12 to 20 May indicate that the catches of the shortfin squid fluctuated between 10 and 200 kg all over the investigation area between the Browns and Sable Island Banks (fig.6). The only large catch was taken in the Emerald Bank area. All the hauls were made with the bottom trawl during daylight hours between 5 a.m. and 5 p.m. Depth levels of 100-150 m were most productive, yielding 70 to 130 kg. The maximum catches from the shelf were related to the areas with clearly pronounced zones of the temperature gradients. Between 26 May and 1 June the shortfin squid catches per half an hour hauling on Emerald, Sable Island and Banquereau Banks fluctuated from 10 to 500 kg. The maximum catches were taken in the Banquereau Bank area. The highest density of the squid aggregations in the near-bottom layers was recorded in the dark morning and evening hours. In the end of May the squid catches were taken at the 120-140 m depth. At depths exceeding 170 m the catches decreased. Most dense aggregations were associated with the zones of the influx of the Gulf Stream waters.

to the shelf.

Argentine.

The species occurred incidentally and individually in the Sable Island and Bonneron Bank area (fig.7). The maximum catches (the largest of 1 ton) were obtained in the Browns Bank area at depths 230-250 m at the near-bottom water temperature of 6.0-6.3°. The size composition ranged between 16 and 35 cm with the mode 23-27 cm. The mean size was 25.3 cm, the mean weight 146 g.

Mackerel.

The species occurred in the catches taken between Browns and Bonneron Banks (fig.8). The largest catches (around 500 kg) were taken in the continental slope area to the south of Emerald Bank and La-Have Bank (around 1000 kg or more at large depths). In Div.4I the temperatures were 5.3°-5.9°, and in Div.4W - 10.0°-10.5°. The size composition varied between 33 and 49 cm with the mode 37 cm. The mean size and weight were 37.8 cm and 136.0 g respectively.

The bulk of the mackerel was in pre-spawning and spawning conditions.

The Distribution of Massive Fish and Squid Species
During the Day

The observers data, as summarized on a month's bases (table 1), give a rather clear idea of the distribution and behaviour of the studied species during the day. These data indicate that, beginning from the second half of the day (4 p.m.) the by-catch of all the species reduced to zero in the dark, while the silver hake catches increased between 4 and 8 p.m. A certain difference is observed in the distribution of the hake, squids, haddock and redfish by depth. The silver hake is not found below 400 m, squids below 350 m, haddock below 220 m and redfish below 390 m. The mean depths of occurrence of each species were 227, 170, 140 and 260 m respectively. Generally, the hake stocks keep to greater depths than the squids and particularly haddock. There has been a certain coincidence between the data from the daily station and the observers data in that the squid and haddock by-catches decreased in the dark (table 2).

Nothing definite can be said concerning the other species because of their incidental occurrence in the catches. As is evident from the daily station data, the maximum silver hake catches were taken at night, between 2 and 6 a.m. Any conclusions, however, would be premature because of the absence of the similar data from the commercial ship.

Discussion

The data on the distribution of the silver hake on Scotian Shelf can be found in the papers by a number of authors: Vyalov and Krasnov, 1967; Vyalov and Yakovlev, 1969; Sarnits and Sauskan, 1967; Sauskan, 1964.

The Canadian and Cuban scientists, such as Clay, 1970; Halliday, 1973; Hunt, 1978 b; Leim and Scott, 1966; Waldron, 1978; Waldron, 1979 and Mari, 1980 also deal with the problems of the silver hake distribution on Scotian Shelf.

Nevertheless, no detailed analyses of the distribution and behaviour of this species on the slopes of Scotian Shelf in spring has been made. Only some papers contain the fragmentary data indicating that in previous years the hake also concentrated in spring on the shelf slopes between Browns and Panquebec Banks at the 140-250 m depths. We believe that the data given in this paper present a rather typical picture of the distribution and behaviour of this species on Scotian Shelf in spring. As regards the other species (particularly haddock and squids), we have no evidence that the considered aspect of their distribution (the maximum decrease of the by-catch in the directed silver hake fishery) had been studied before.

Conclusions

1. In May 1979 the silver hake aggregations occurred along the oceanic slope of the Nova Scotian Shelf between 60°30' and 64°W south of the limitation line within the depth range of 110-400 m. No considerable aggregations of other species were recorded during this period on the shelf slope.

2. Most dense hake aggregations were observed between 4 and 10 p.m.; at the same time the by-catch of the haddock and squids as well as of other species, taken in the dark actually reduced to zero.

3. The hake, haddock and squid catches considerably differed by depth. The hakes in numbers kept to much greater depths than the haddock and squids.

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Table 9 Daily distribution pattern in Div. 4 (May 1979, observed data)

Lower depth
level, n
Mean depth
during the day.

330 400

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by day because these species occurred in the catches incidentally.

Table 2

Daily distribution pattern in Mv.4 (May 1979, daily station, RV BELYOVSK)

Hauling time	Squid	Silver hake	Mackerel	Haddock	Saithe	Patch	American plaice			Yellowtail flounder			Cod			Other species			Total	
							Catch per haul.	% per haul.	% per haul.	Catch per haul.	% per haul.	% per haul.	Catch per haul.	% per haul.	% per haul.	Catch per haul.	% per haul.	% per haul.	Catch per haul.	% per haul.
16-18	241.6	40.3	324.0	54.8	18.2	3.1	5.4	0.9	-	-	-	-	1.7	0.3	0.7	0.1	531.6	100		
18-20	48.3	24.5	12.1	6.1	127.8	64.0	5.6	2.8	-	-	-	-	5.3	2.6	-	-	133.7	100		
20-22	11.8	2.3	1.0.1	27.4	20.8	5.2	6.1	1.5	202.3	50.4	-	-	40.0	10.0	10.5	2.6	401.6	100		
22-24	13.5	20.0	42.5	63.1	-	-	3.1	4.6	-	0.5	0.7	0.4	0.6	0.6	0.9	6.8	10.1	67.4	100	
24-02	15.3	10.0	132.3	83.6	-	-	4.3	2.7	-	-	-	-	4.3	-	2.7	1.6	1.0	153.4	100	
02-04	10.3	1.5	7.29	38.3	3.0	0.1	-	-	-	-	-	-	-	-	-	0.2	0.1	742.5	100	
04-06	4.9.3	3.8	124.8	534.6	20.7	1.6	-	-	-	-	-	-	-	-	-	6.4	-	1325.5	100	
06-08	228.8	70.7	31.0	25.0	-	-	8.4	2.6	1.3	0.6	-	-	3.2	1.0	0.2	0.1	323.5	100		
08-10	6.8	0.7	920.3	38.8	-	-	1.1	0.1	-	-	-	-	3.5	0.4	0.4	-	332.7	100		
10-12	2.7	1.5	172.3	35.5	-	-	4.7	2.6	0.3	0.2	-	-	-	-	0.3	0.2	180.3	100		
12-14	3.8	2.9	327.4	34.5	-	-	2.5	0.7	2.3	0.7	-	-	-	-	4.0	1.2	346.1	100		
14-16	66.2	40.6	60.7	37.2	-	-	30.6	18.8	-	-	-	-	-	-	5.5	3.4	163.0	100		

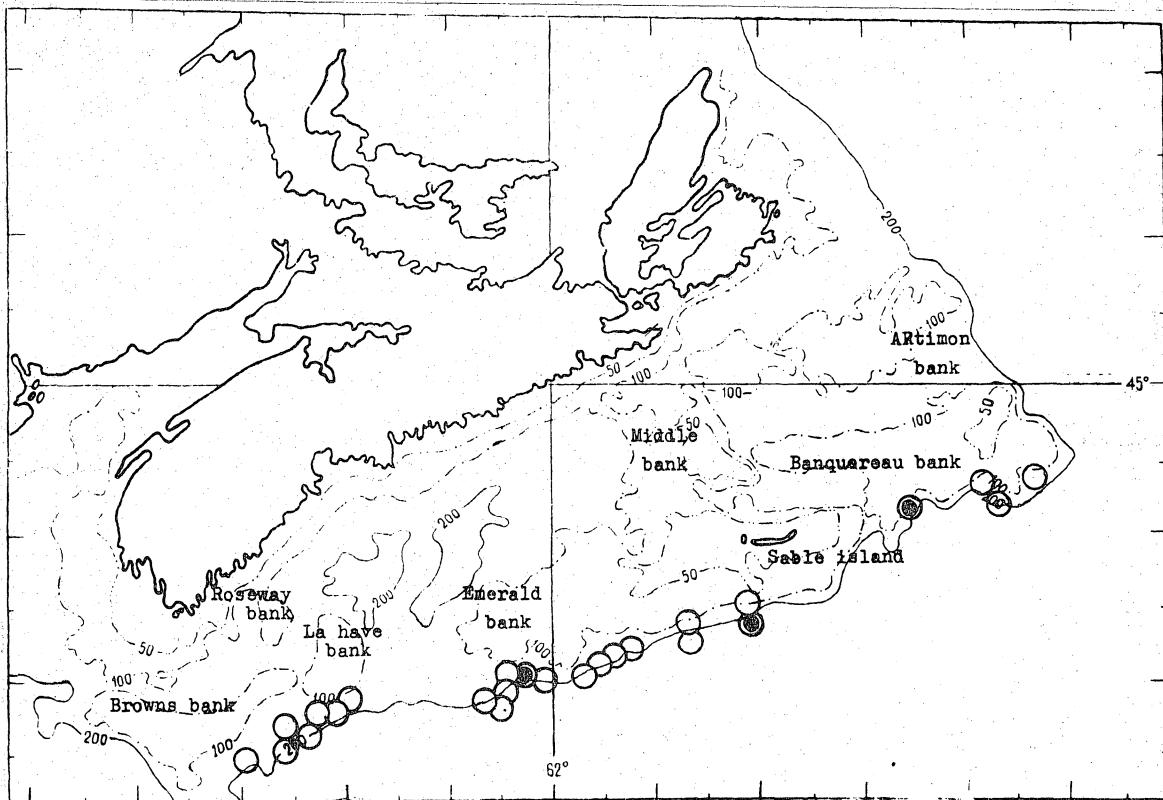


Fig.1. A scheme of trawl survey stations in May 1979. Black circles show daily stations.

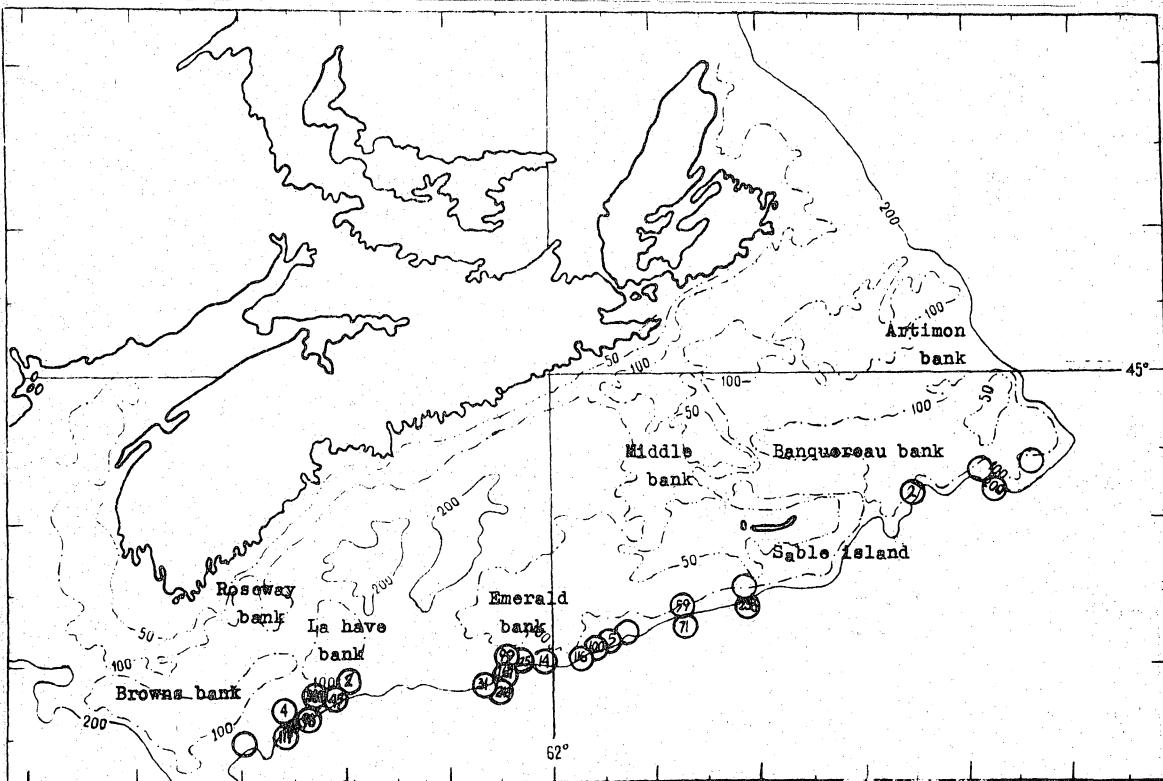


Fig.2. Distribution of silver hake catches (kg_h) per haul from the survey data.

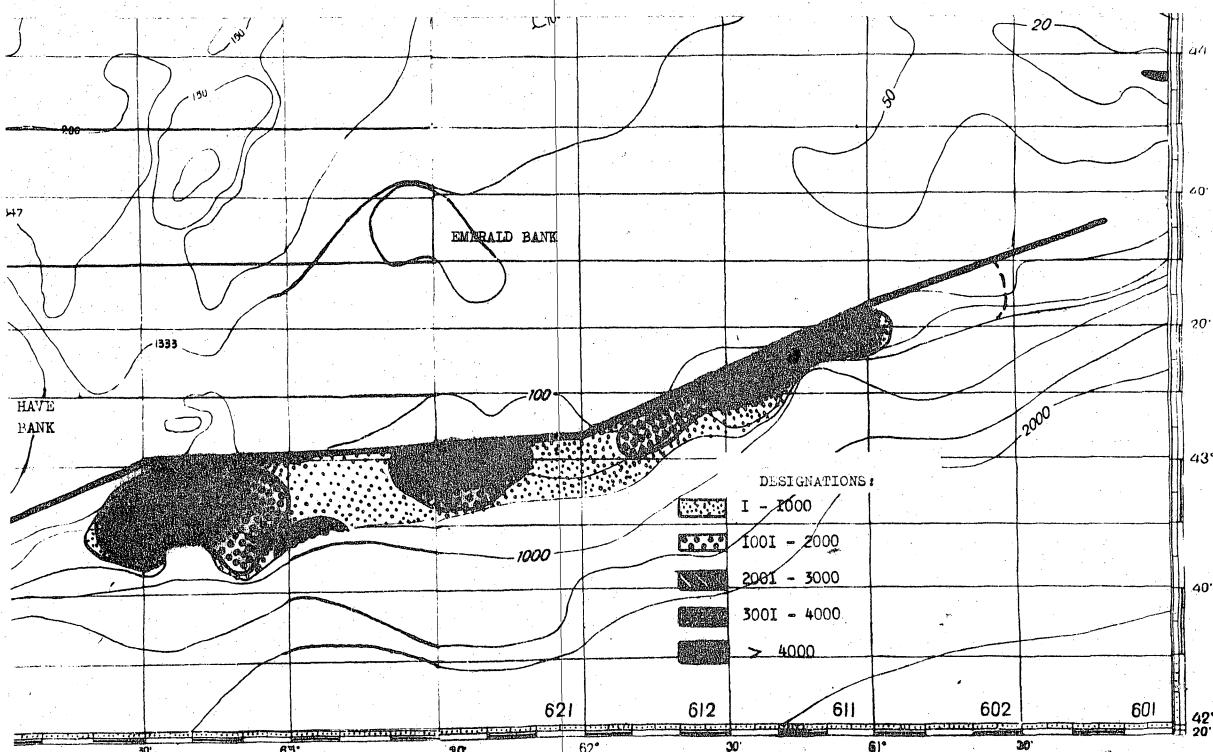


Fig. 3. Distribution of silver hake catches (kg) per haul from the observers data.

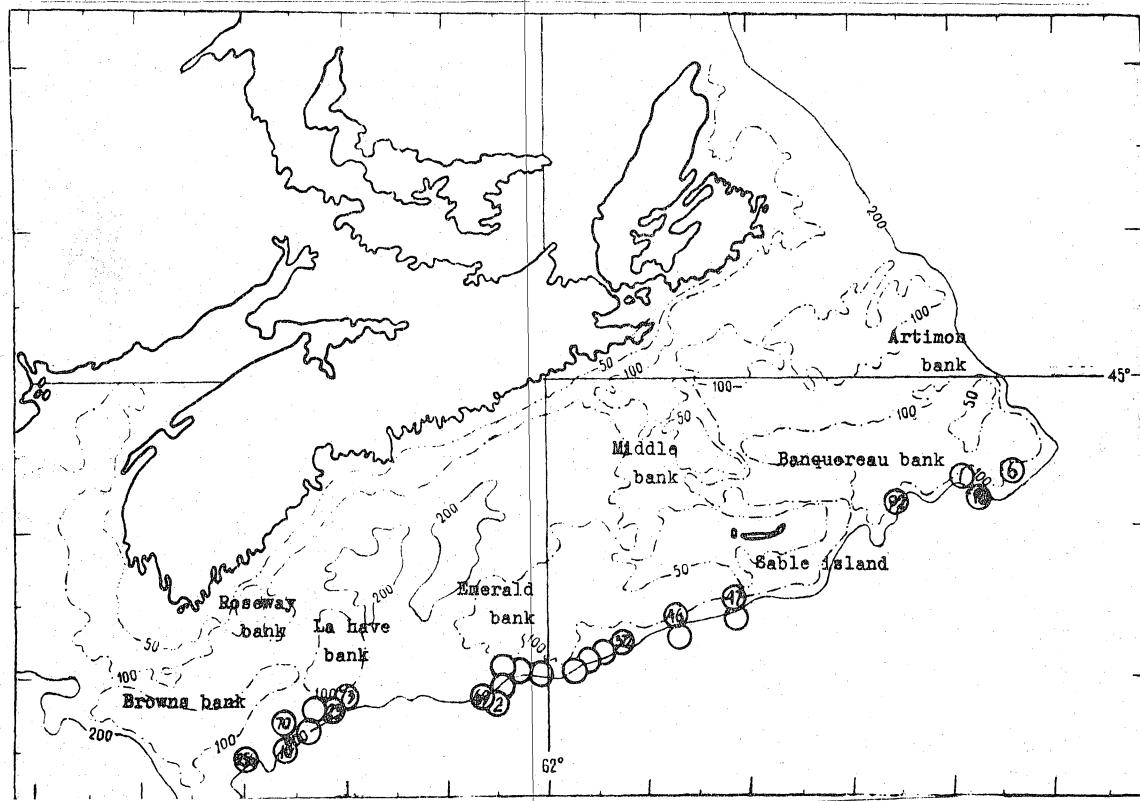


Fig. 4. Distribution of haddock catches (kg) per haul from the survey data.

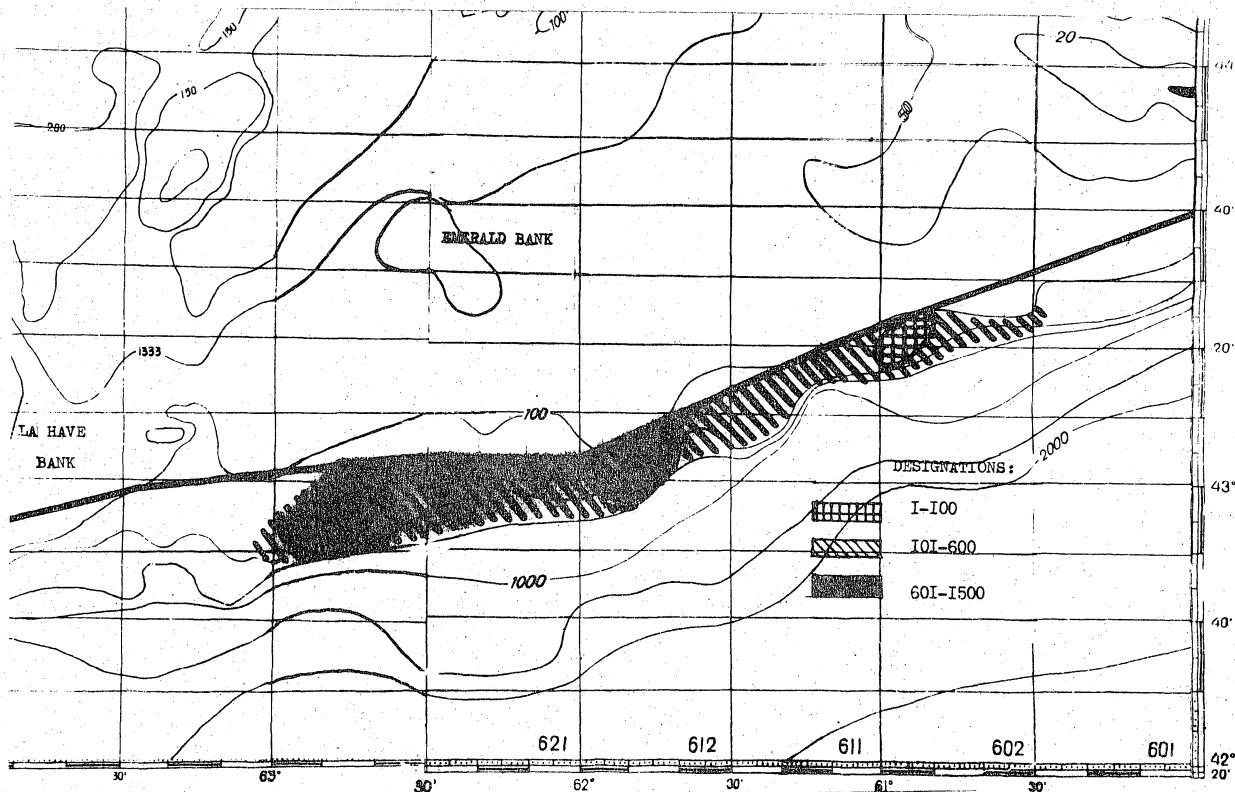


Fig.5. Distribution of haddock catches (kg) per haul from the
observers data.

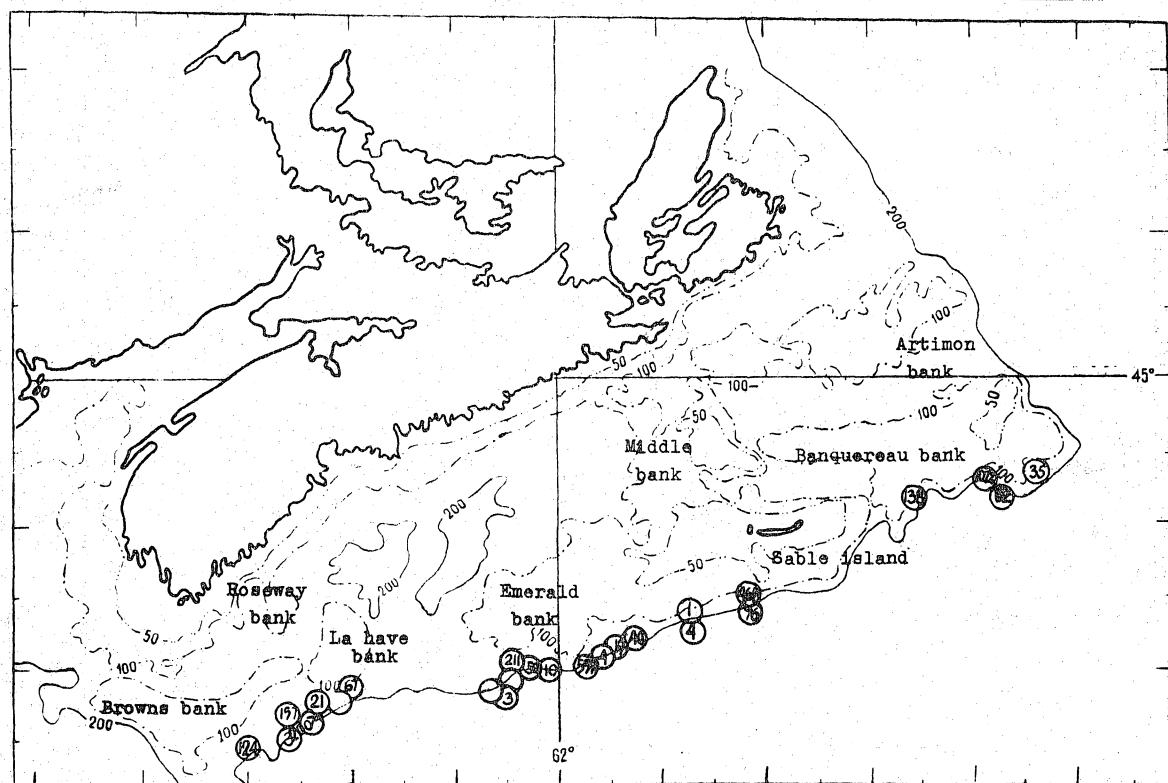


Fig.6. Distribution of shortfin squid catches (kg) per haul
from the survey data.

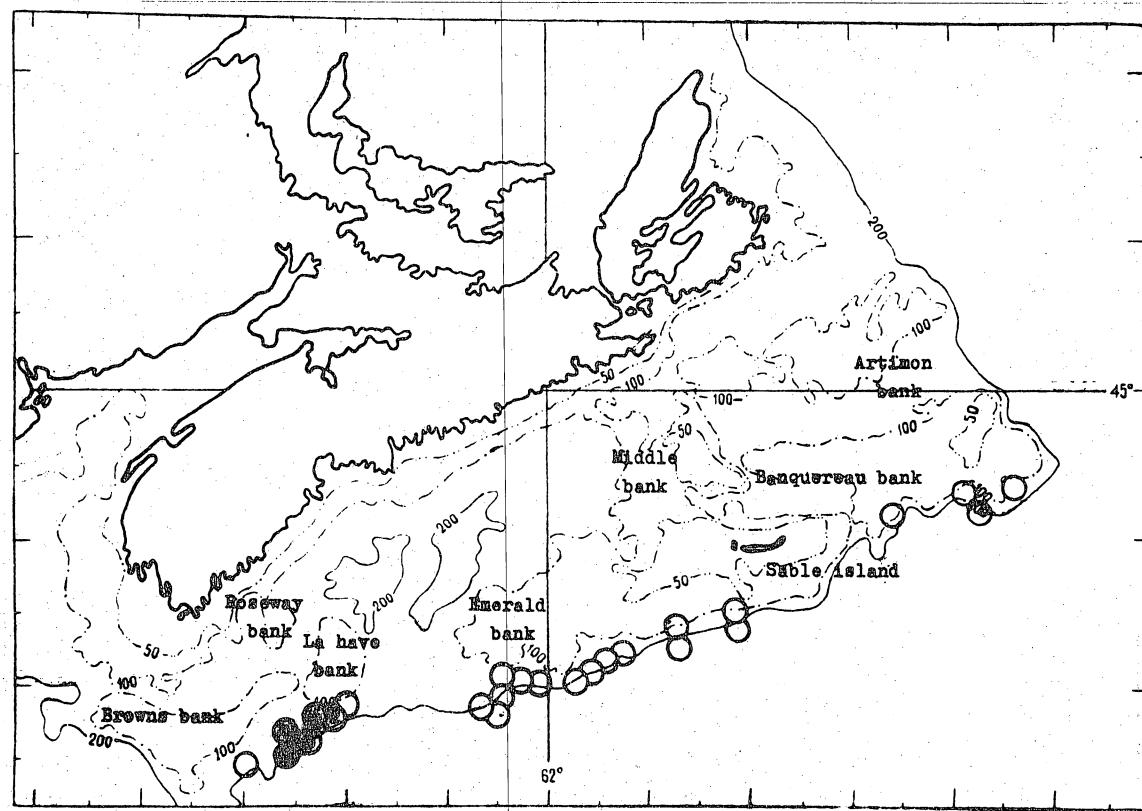


Fig.7. Distribution of argentine catches (kg) per haul from the survey data.

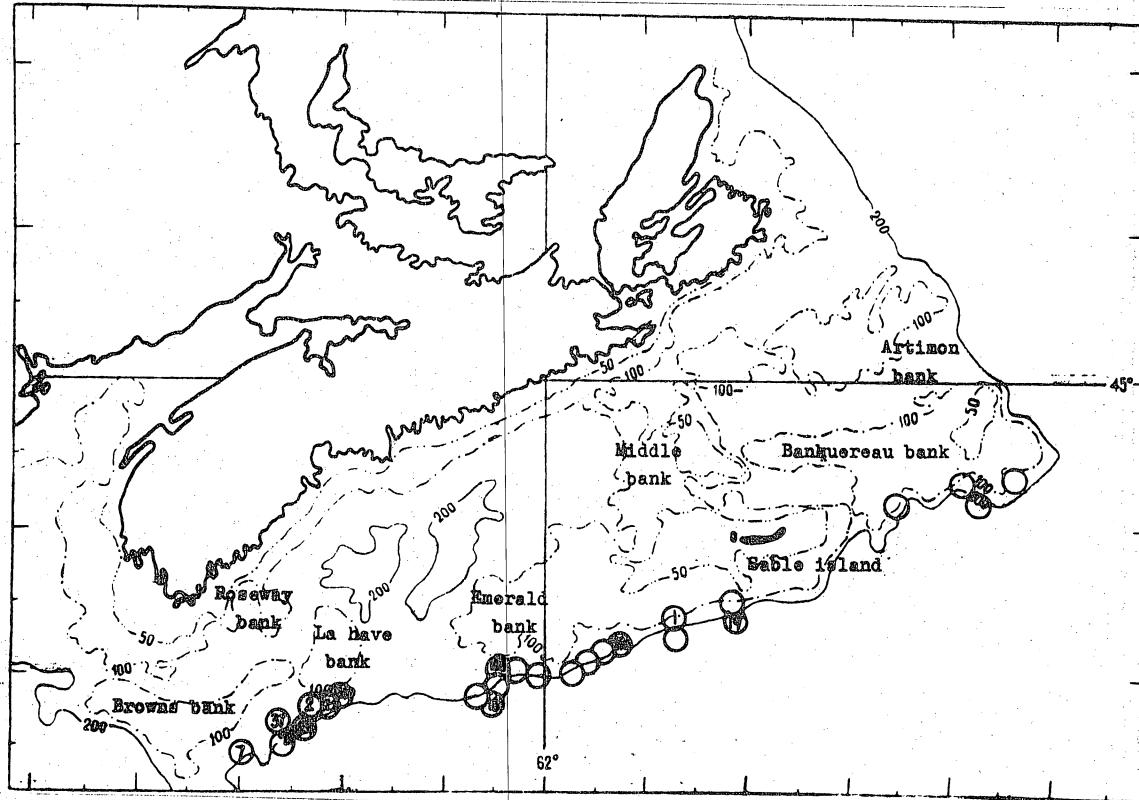


Fig.8. Distribution of mackerel catches (kg) per haul from the survey data.

