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No. 913

TITLE

Canadian Atlantic Offshore Exploratory
Fishing, 1966

AUTHORSHIP

R.A. McKenzie

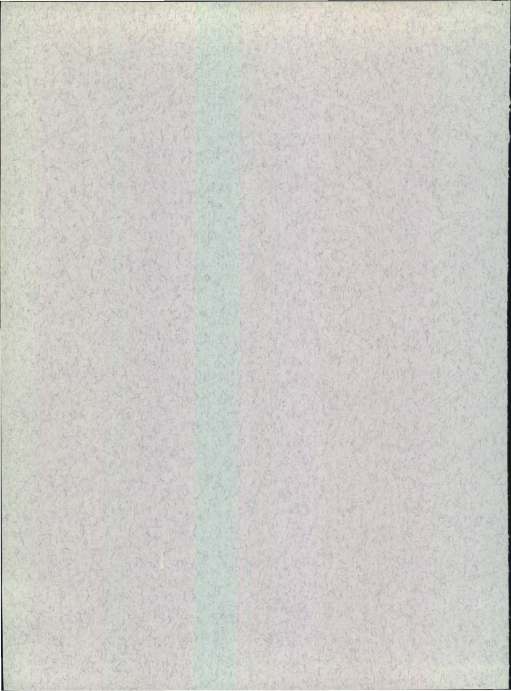
Establishment

Biological Station
St. Andrews, N.B.

Dated March 1967

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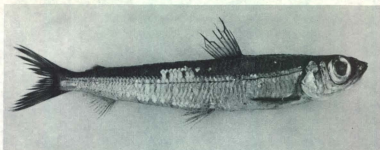
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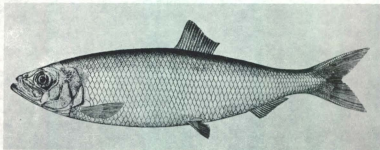
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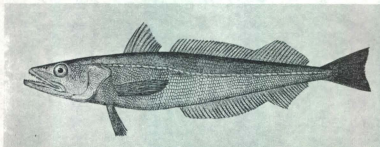
P.J. Lawrence off Fisheries Research Board Station,
St. Andrews, N.B., June 1966



Argentine, Argentina silus



Herring, Clupea harengus



Silver hake, Merluccius bilinearis

CANADIAN ATLANTIC OFFSHORE
EXPLORATORY FISHING, 1966

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CANADIAN ATLANTIC OFFSHORE

EXPLORATORY FISHING, 1966

by R.A. McKenzie

INTRODUCTION

During June and July 1966, the Fisheries Research Board of Canada and the Industrial Development Service of the Department of Fisheries cooperated in carrying out three offshore exploratory fishing cruises off Nova Scotia. The purpose of the survey was to study the distribution, abundance and size composition of argentine, herring, silver hake, lobsters and red crabs (Geryon quinquedens) in relation to hydrographic conditions.

A detailed report of the results for argentine, herring and silver hake is on file at the St. Andrews station of the Fisheries Research Board of Canada as Original Manuscript No. 1052. An appendix to this report contains the details of station locations, depths and temperatures, and summary tabulations of the catches of about 65 other species (cod, haddock, grenadiers, eelpouts, etc.), along with the information that was recorded concerning them. A separate report (MS Report No. 895) was prepared on lobsters and red crabs. The present report summarizes the information obtained for argentine, herring and silver hake.

Dates and Area of Operations

Figure I - shows the general cruise areas.

Cruise I - June 21 to July 2, 1966. 75 thirty-minute tows, 27 using Dutch herring trawl, 48 with #41 Yankee trawl.

Cruise II - July 5 to July 15, 1966. 90 thirty-minute tows, 88 with Dutch herring trawl, 2 with #41 Yankee trawl.

Cruise III- July 18 to July 30, 1966. 65 sixty-minute tows, all with the #41 Yankee trawl.

Gear, Methods

To carry out this exploratory fishing the 103.8-foot side trawler P.J. Lawrence was chartered from Lawrence

Enterprises Limited of Lockeport, Nova Scotia. This ship of approximately 233 gross tons and 675 hp had a crew of eleven under the able direction of Captain John Lawrence.

The #41 Yankee trawl was equipped with rubber rollers and the lengthening piece and codend were lined with 1½-inch mesh netting--all mesh sizes are stretched mesh between knots. During Cruise III, the #41 Yankee trawl was used minus the rubber rollers on the footrope and 8 floats on the headrope, but equipped with a "redfish" belly and lengthening piece, and a 3-inch mesh double codend. Both these sections had a 1½-inch mesh liner. The Dutch herring trawl had no rollers and the mesh size decreased from 4½ inches in the forward part to 1-5/8 inches in the codend.

In general the tows on Cruises I and II were of 30-minute duration and on Cruise III 60-minute duration.

Hydrographic observations, consisting of temperatures and water samples at surface and bottom together with bathy-thermograph casts were usually made at the end of each tow. No observations were made deeper than 300 metres (165 fathoms). Trouble with the hydrographic winch on Cruises I and II prevented taking bottom temperatures and samples on many occasions, but on Cruise III all this work was accomplished. The results of the hydrographic observations are being analyzed, etc. and will be reported later.

Plankton collections were made with a Neuston nitex plankton net; underwater bottom photography was tried on Cruise III, but was successful on only one of five attempts; squid were collected for the Fisheries Research Board of Canada, Biological Station, St. John's, Nfld., and a special collection of 100 haddock scale and otolith samples for age and growth studies was made.

RESULTS

Argentine

The total argentine catch was 32,258 lb, 11,874 lb (62%) caught on Cruise I, 467 lb (1%) on Cruise II and 11,917 lb (37%) on Cruise III. The catches on Cruise III were adjusted from tows of 60-minute duration to 30-minute duration for uniformity throughout. A comparison of the results shows that 265 lb per tow were taken on Cruise I, 5 lb on Cruise II and 92 lb per tow on Cruise III. Up to 3,780 lb (herring trawl) were caught per tow along the southeast edge of Sable Island Bank, and 2,400 lb (herring trawl) on southeast Banquereau (Cruise I). No good catches were made (Cruise II) in the shallower waters of Sable Island Bank, and only one (2,650 lb) was

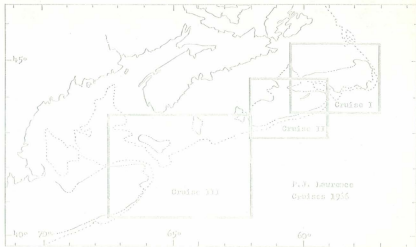


Figure 1. General area of the three cruises of the P.J. Lawrence June-July 1966

made on Cruise III--off southern Browns, with the #41 Yankee trawl.

Comparing the effectiveness of the lined #41 Yankee trawl with the Dutch herring trawl shows that the former took 116 lb per tow and the latter 113 lb per tow--an insignificant difference. The best catches with the #41 Yankee trawl were made in 150-159 fathoms (Cruise III) south of LaHave and Browns Banks while the best catches with the Dutch herring trawl were made in depths of 90-109 fathoms southeast of Sable Island and along the southern edge of Banquereau (Cruise I).

Argentines were caught in temperatures ranging from 1.3 to 9.2 C. The major peaks in the catches with both types of gear, occurred in bottom temperatures of 8.5-9.4 C where catches 6-7 times greater were made than at the minor peaks which occurred between 4.5 and 5.9 C.

During the three-cruise survey, argentine from as small as 8 cm to as long as 47 cm were caught. The average size per cruise varied from 22.2 to 30.0 cm. In general the average length declined from Corsair Canyon eastward to Sable Island (33.5-22.2 cm), but increased somewhat from there to northeast Banquereau (27.9 cm).

The average length of the argentine varied directly with depth (25.8 cm in 50-99 fathoms to 36.5 cm in 200-249 fathoms), the increase resulting mainly from a decrease in the number of smaller fish in the deeper water.

The average size of the argentines varied inversely with bottom water temperatures, i.e., the average size was greater in the colder (and deeper) waters.

Females (overall average) were 2.4 cm longer than the males and were more numerous (59% of the total).

A comparison of sexes showed that the majority of males were immature while the majority of females were ripening. Maturity is reached for the first time at lengths between 26 and 33 cm. Development was more advanced in both sexes in the more western part of the survey area than in the eastern part--eastern Sable Island Bank and Banquereau.

Crustacea (chiefly amphipods) made up 64 to 80% of the argentine food. Sexual differences in feeding habits included a scarcity of copepods in the male stomachs and squid in the female stomachs.

Herring

Most (86%) of the 2,238 lb of herring caught during the three cruises was taken on Georges Bank. Adjusting Cruise III catches to a 30-minute-tow basis to match Cruises I and II reduces the above percentage taken on Georges Bank to about 76% and practically all of this was taken near Corsair Canyon.

Comparing catches by the two types of trawl (115 tows with each) on a 30-minute-tow basis shows the Yankee trawl catch was 1,139 lb and the Dutch herring trawl catch 133 lb--Yankee trawl catch being about ten times as good. However, this is not a fair comparison as the Dutch herring trawl was not used on Georges Bank where over 75% of the herring were caught.

In respect to catch vs depth, the Dutch herring trawl catches were insignificant. With the Yankee trawl the better catches were made in depths of 80-149 fathoms although the 110-139 fathoms range yielded nothing.

Though caught in varying quantities throughout a 1.0-8.7 C bottom water temperature range, the best catches were made (Yankee trawl) in 6.0-8.5 C.

Lengths ranged from 21 to 42 cm, the overall average being 32.4 cm and 82% being 30-36 cm long. In general herring increased in size from west to east, averaging 32.1 cm around Corsair Canyon, 31.1 cm on Sable Island Bank as a whole, but 34.0 cm on the southeast part of this Bank as well as on Banquereau.

On the average the larger individuals were found in the deeper water--29.0 cm in <65 fathoms and 32.4 cm in >65 fathoms.

Though sampling was restricted in range of bottom temperatures, there was a tendency towards an increase in size with an increase in temperature--30.6 cm in 1.5-3.9 C and 32.1 cm in 6.5-8.9 C.

There was no appreciable sex size difference, but males made up about 53% of the catch.

Over 90% of the herring had maturing gonads, but only 1% or less were spent and none were found in a ripe and running condition.

The immature herring were 26.2-28.3 cm long on the average.

Silver Hake

Of the total 1,552 lb of silver hake caught during the three cruises, 53% was taken on Cruise III, 37% on Cruise I and 10% on Cruise II. At least some silver hake were caught in 54 (23%) of the 230 tows in the complete survey. Thus, while silver hake were distributed all along the general 100-fathom contour off Nova Scotia and the outer eastern part of Georges Bank the numbers were small, the maximum catch being 253 lb and only two others over 100 lb. Two of these three catches were south of Sable Island on Cruise I and the third south of LaHave Bank on Cruise III.

Both the lined #41 Yankee trawl and the Dutch herring trawl were used south of Sable Island. Silver hake catches in this area averaged 8 lb per tow in the former trawl and 4 lb in the latter.

Silver hake were caught over a depth range of 70-209 fathoms though most of them were taken between 80 and 159 fathoms.

Bottom temperatures ranged from 2.8 to 8.8 C where silver hake were caught, but over 95% of the Yankee trawl catches were made between 6.0 and 8.8 C and 90% of the Dutch herring trawl catches between 5.0 and 7.9 C.

The overall length range of the silver hake was 23-73 cm with 75% between 26 and 37 cm. Average size declined from east to west being 35.8 cm on Banguereau and southeast Sable Island Bank (Cruise I), 32.2 cm on Sable Island Bank (Cruise II) and 30.5 cm off Emerald-Browns-Georges Banks (Cruise III). However, dividing Cruise III at the Fundian Channel shows average lengths of 29.4 cm from Emerald Bank to the Fundian Channel and 32.0 cm along the eastern outer edge of Georges Bank immediately west of the Fundian Channel.

With increased depth of water the overall average size of the silver hake also increased--31.5 cm in 50-99 fathoms, 38.5 cm in 100-149 fathoms and 40.8 cm in 150-199 fathoms.

However, average size varied inversely with bottom water temperatures--29.0 cm in 6.5-8.9 C and 38.1 cm in 4.0-6.4 C.

Females, outnumbered males in the overall catch (71-29%) and were, on the average, 7.9 cm longer than the males (38.7 cm vs 30.8 cm).

Over 90% of the silver hake had ripening gonads, the males being slightly more advanced than the females. A few males but no females were ripe and running.

Fish (lanternfish and sand lance) and euphausiacea made up 55% and 33% respectively of the food eaten. The males, on the whole, were lighter eaters than the females.

DISCUSSION

Argentine

Abundance comparisons are difficult when different ships are used in different years. However, three areas of argentine concentration were found in 1966: (1) southwest edge Banquereau, (2) south of Sable Island, (3) south of Browns Bank, and four areas in 1965: (1) 25 miles northeast Corsair Canyon, (2) south of Browns Bank, (3) south of LaHave-Emerald, (4) south of Sable Island. Comparing these concentration areas with those of Emery and McCracken (Fig. 3, p. 1149, J. Fish. Res. Bd. Canada, 23(8), 1966) shows (1) northeast of Corsair Canyon, (2) south of Browns Bank, (3) south-southeast of Sable Island and (4) southwest edge Banquereau to be possible new argentine summer fishing grounds.

Good catches in both 1965 and 1966 were made in 80 fathoms and deeper with the best in about 100-160 fathoms agreeing in this with Emery and McCracken.

Though the overall bottom water temperature ranges in which argentine were caught varied, still our 1965 and 1966 results compared well with Emery and McCracken in that the best catches were made in water of about 4-10 C.

Average lengths were quite similar in 1965 and 1966 and declined from 33.5 cm around Corsair Canyon northeastward to Sable Island.

In both years, an increase in size (agreeing with Emery and McCracken) was found with increasing depth and decreasing bottom temperature. In both years also females dominated the catch and were larger on the average than the males.

Crustaceans, mainly amphipods, made up the bulk of argentine food in both years.

Herring

In both 1965 and 1966, herring were taken in small numbers along the 100-fathom contour east of the Fundian Channel and though there was not as much fishing on Georges in 1966 as 1965 still practically all the herring were taken in the general Corsair Canyon region in both years.

A general comparison of catch by gear shows the Yankee trawl catch to have been ten times greater than the Dutch herring trawl. However, the herring fishing ability of the two types of gear was not properly tested as the Dutch herring trawl was not used where the herring were most numerous on Georges Bank.

In respect to depth, over 90% of the herring in 1965 were caught in 30-80 fathoms while in 1966 the better catches were made deeper than 80 fathoms.

The best fishing in 1965 occurred in temperatures of 7.5-9.5 C with good fishing in 12.0-13.5 C also. In 1966, however, most of the herring were caught in 6.0-8.5 C, that is, in the lower part of the 1965 temperature range.

The herring sampled in 1966 were larger on the average (32.4 cm) than those sampled in 1965 (29.7 cm). In both years, on the average, the herring were larger in deeper water. However, the size and bottom water temperature relationship was not the same in both years--size decreased as temperatures increased in 1965, whereas the reverse was observed in 1966.

No appreciable difference in size was found between the sexes though males outnumbered females slightly. In both years over 90% of the herring had maturing gonads during the late June to late August period.

Silver Hake

Concentrations of silver hake were found around the middle of the Bank northwest of Sable Island as well as along the northern edge of Georges Bank in 1965. In 1966 no large concentrations of this species were found.

Comparisons of catch vs depth are not really merited because of the small catches.

In 1965 there was no size trend either between areas or cruises, but in 1966 the average size decreased from Banquereau (35.8 cm) westward to the Emerald-Browns Banks area (30.5 cm).

An increase in the average size of silver hake occurred with increased bottom temperatures as well as increased depth in 1965. However, in 1966 an increase in size occurred with decreasing bottom temperatures and with increasing depths.

Females dominated the catches in both 1965 and 1966. (60 and 71% respectively) and were, on the average, about 4 cm and 8 cm longer respectively.

August in 1965 was concluded to be the silver hake spawning period in the Browns-Georges Banks region. Confirmation of this, at least to some degree, was found in 1966, for over 90% of the fish had ripening gonads in late June and July.

The silver hake food was mostly crustaceans in 1965 with only 7% fish. In 1966, to the contrary, fish (lanternfish and sand lance) made up 55%.

CONCLUSIONS

Argentine

The Dutch herring trawl and lined #41 Yankee trawl appeared to be about equally efficient in capturing argentinines.

This species was taken almost everywhere along the outer edges of the offshore banks of Nova Scotia, and three areas in 1966 yielded over a ton per half-hour tow--(1) southwest edge Banquereau, (2) southeast edge Sable Island Bank, (3) south of Browns Bank. Catches of this magnitude should support an economic fishery if a market becomes available.

Herring

Practically no herring were caught east of the Fundian Channel as far to the northeast as Banquereau. West of the Fundian Channel around Corsair Canyon, Georges Bank, only two catches were over 100 lb, but these were under 500 lb--not a profitable operation.

The lined #41 Yankee trawl took most of the herring. However, the Dutch herring trawl was not used around Corsair Canyon where the herring were most numerous.

Silver Hake

No large concentrations of this species were found anywhere, the largest single catch being made south of Sable Island--253 lb in half an hour. This, together with the fact that no Russian fleet was fishing off Nova Scotia during the survey indicates that in the early summer, 1966, there were no concentrations of silver hake large enough to support a fishery between the Eastern Shoals of Banquereau and Corsair Canyon, Georges Bank.

Though the catches were very small, there is some evidence to indicate that the lined #41 Yankee trawl was more efficient than the Dutch herring trawl in taking silver hake.

General

The Dutch herring trawl was reported to be more efficient than the #41 Yankee trawl in taking argentine on Cruise I, but it could not be used safely on rough bottom.

It is believed that small fish such as argentine, herring and silver hake pass through the large mesh in the wings and top square of the #41 Yankee trawl. To prevent this, it has been suggested that mesh similar to that used in the herring trawl be used throughout. Changing from heavy to light rollers might also add to the effectiveness of this net.

Good catches of redfish were made along the southeast edge of Banquereau as well as in the deeper waters off the Emerald to Browns Banks region indicating the possibility of a profitable redfish fishery along the edge of the Scotian Shelf. In fact, on completion of the charter the P.J. Lawrence did make some profitable redfish trips in these waters--two trips yielding 485,000 lb and a landed value of \$15,000.

ACKNOWLEDGEMENTS

The Fisheries Research Board of Canada personnel aboard for the various cruises was as follows:

Cruises

I	II	III
D.N. Fitzgerald, I/C	C.F. Monaghan, I/C	R.J. Beamish, I/C
R.J. Beamish	R.J. Beamish	W.H. Kydd
W.H. Kydd	W.H. Kydd	D.G. Robinson
D.G. Robinson	D.G. Robinson	W.E. Guptill

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