



ANNUAL MEETING - JUNE 1954

SUMMARIES OF CANADIAN GROUND FISH RESEARCH
IN THE CONVENTION AREA DURING 1953

Subarea 2

By W. Templeman

Between September 7 and 18, 1953, Hamilton Inlet Bank was explored by the Investigator II using a No. 36 otter-trawl. Forty sets were made, all on different parts of the bank and well distributed over the bank and its slopes.

Cod. On the western slope of the bank cod catches were usually low and the bottom was rough. Cod fishing on the bank itself, at depths between 150 and 183 metres, was good in many areas. On the eastern slope there were excellent catches in several areas from 183 to 208 metres with moderate catches down to 247 metres. There were a few minus temperatures but none below -0.5°C . and in the areas where cod were plentiful no temperatures over 2.7°C . Of the largest two catches per hour's dragging the 3700 kg. catch was at 0.1°C . and the 3000 kg. catch at 2.7°C . The six catches of 1500 to 1700 kg. per hour were at temperatures between -0.5 and 0.9°C ., and 6 of 1000 to 1100 kg. at temperatures between -0.3 and 1.9°C . In the deeper water, 310 to 350 metres to the east of the bank and with higher temperatures of 3.1 to 3.4°C . cod were scarce and redfish more abundant.

The Hamilton Inlet cod are of medium but mostly commercial size. In the autumn they are in good condition with very fat livers.

American Plaice (*Hippoglossoides platessoides*). While there were some American plaice everywhere on the bank, in only one locality were they plentiful enough to supply a commercial fishery for plaice alone. This was at 179 to 183 metres in latitude $54^{\circ}22'00''\text{N}$. and longitude $54^{\circ}48'00''\text{W}$. where plaice were obtained at the rate of 2800 kg. per hour's dragging. The bottom temperature was 0.4°C . In 1952 the one large catch of plaice was only 12 kilometres from this point in 183 metres and -0.30°C . where plaice were caught at the rate of 3700 kg. per hour's dragging. The good American plaice grounds on this bank therefore are probably limited in area.

Hydrography. Between July 31 and August 1 a hydrographic section was taken across the Labrador Current off Domino Point and south of Hamilton Inlet Bank.

Subarea 3

By W. Templeman

Cod and Haddock. Recaptures are still being made from the 4715 cod tagged at St. John's and Fogo in 1950. Eliminating the unsuccessful bachelor-button tag the average percentage returns per year have been 1950 - 6.7, 1951 - 12.8, 1952 - 4.5, 1953 - 1.6. During the first year tagging was deliberately delayed until most of the fishing was over. The most effective

tags have been a two-inch red tag of cellulose nitrate attached to the pre-opercular by nickel wire - 38.7% return, a 13/16-inch pink cellulose nitrate tag attached below the anterior base of the first dorsal - 33.0% return, and a five-inch orange vinylite plastic body cavity tag with a 32.1% return. In returns subsequent to the tagging year the best tags gave 25-32% recapture and the poorest (the bachelor-button type) only 4.6%.

In May an otter-trawl survey of cod and haddock populations on the southern half of the Grand Bank was carried out by the Investigator II. In a good part of the area examined, namely the northern half of the southwest slope of the bank, there was at depths of 71 to 82 metres a well marked contrast in bottom temperatures between adjacent sets only a few kilometres apart from north to south. The large concentrations of haddock were on the southern high temperature side of the temperature break, in temperatures between 2 and 7 1/2°C. and depths between 75 and 93 metres. Where the high temperatures of 4 to 8°C. were present in deeper water of 110 to 180 metres haddock were scarce, showing that by May the haddock were moving toward shallower water and that both depth and temperature were factors. The cod were not in abundance but were considerably more plentiful on the lower temperature northern side of the break in temperature, at temperatures from 2.0 to less than one degree centigrade and depths from 80 to 59 metres.

On both the Grand Bank and St. Pierre Bank the most plentiful group of haddock was the 1949 year-class with a peak length of 36-37 cm. and this year-class, except for the largest specimens, was discarded by Newfoundland trawlers. The haddock landed at St. John's and Burin from the Grand Bank had a peak size of 50-51 cm. and consisted mainly of the 1946 year-class with a significant number of the 1942 year-class and with very few of the intervening year-classes. The 1949 year-class is a very great one which should provide good fishing for several years on both the Grand Bank and St. Pierre Bank.

In two Grand Bank commercial trips investigated, 67% of the haddock by number were discarded as compared with 18% in 1952. The high proportion thrown away in 1953 was due to the large numbers of four-year-old 34 to 40 cm. haddock which were caught this year for the first time but were too small to land. On St. Pierre Bank during one commercial trip the number of haddock discarded was 74% of the total catch. The weight of haddock discarded in the three trips as estimated from length frequency data was 42% of the weight of the total catch. In 1952 it was estimated that only 9% of the haddock by weight were discarded.

Redfish. In the past few years commercial development has been proceeding over much of the redfish area explored by the Investigator II between 1946 and 1950. During July, 1953, commercial development began of the plentiful stocks of large redfish found by the Investigator II in 1950 in 290 to 365 metres off the northeast corner of the Grand Bank. Since late summer to early autumn, 1951, trawlers (mostly United States, but with some Nova Scotian and a few Newfoundland) have been engaging in successful commercial fishing for large redfish in the deep

water channels of the Gulf of St. Lawrence where general redfish abundance was indicated by the explorations of the Investigator II from 1947 to 1950. The larger vessels of the United States fleet have been carrying out a good deal of fishing during the past three years on the southwest slope of the Grand Bank which had been successfully explored for redfish down to 365 metres by the Investigator II between 1946 and 1951. The east coast Newfoundland redfish vessels concentrate on the larger redfish of the eastern edge of the Grand Bank. It is evident that overexploitation of redfish in one favourable area can occur. The formerly abundant redfish population within a few kilometres of Ramea from which many millions of pounds of redfish have been taken since 1946 has apparently been reduced below the level of profitable fishing.

In 1953 the Investigator II carried out in two areas an exploration for redfish in 275 to 595 metres. Unsuccessful attempts were made to drag to 730 metres. An otter-trawl was used with both otter-boards attached to a single wire. In a July trip to the southwest slope of the Grand Bank redfish were most numerous between 275 and 365 metres and with no commercial amounts below 365 metres although there were some redfish in drags at least as deep as 455 to 550 metres. There was a general increase of size in both sexes with depth. In October a similar exploration was carried out in an area northeast of Bonavista. Due to bad weather only 9 drags could be made between 300 and 730 metres. The net was apparently not on bottom below 595 metres. The best catch of 1850 kg. of redfish per hour's dragging was made at 350 metres and catches of 40 to 110 kg. per hour's dragging were made at 520, 550 and 605 metres. In the successful drags in these three latter depths numbers of large grenadiers (*Macrourus*), which are bottom fish, were obtained showing that the net was fishing near the bottom. It is unlikely that the redfish in the 520 to 605 metre sets were caught as the net was passing upward through shallower layers since in the two drags when the net was fishing at 695 to 730 metres and was not on bottom but was deeper than 605 metres no redfish were caught. There was little or no significant difference in size of the redfish at the various depths.

Redfish otolith age readings are well under way and some differences in growth-rate in various areas are evident.

Examination of redfish stomachs has shown the percentage stomach eversion increasing with depth from 32% at 295 to 345 metres to 65% at 600 metres. In 142 stomachs containing food the total volume of food present was made up of 67% amphipods, 18% fish, 13% copepods, 2% squid and 1% euphausians. Numerically 84% of the stomachs contained amphipods, 74% copepods, 16% euphausians, 12% fish and 7% squid. The food generally consisted of free-swimming and not bottom organisms.

American Plaice (*Hippoglossoides platessoides*). Estimations of the age of American plaice from their otoliths show a considerably higher rate of growth for the Grand Bank than for the inshore Notre Dame Bay area. The rate of growth in general appears to be slow and some plaice were over 35 years of age. The numbers of eggs in the ovaries of 9 American plaice ranged from 156,000 at 45 ca. and 12 years to 1,412,000 at 74 cm. and 37 years of age.

Population Identification and Study. Studies of vertebral and fin-ray number were continued on all the main groundfish species. Offshore landings were measured, and scale and otolith samples collected continually at St. John's and Burin. Amounts and location of catches and also effort statistics were obtained from almost all trawlers, also for long-line vessels and Danish seiners. Age estimations were carried out on cod, haddock, redfish, plaice and witch flounder (*Glyptocephalus cynoglossus*).

In the various exploratory fishing operations and in the statistical study of commercial fish landings 72,000 cod, 20,000 redfish, 31,000 haddock and 14,000 American plaice have been measured during 1953.

M.V. "Marinus". In early November a new 19 metre research boat, the *Marinus*, built at Caraquet, N.B., became available to the Station. This boat is equipped to otter-trawl to three hundred and fifty metres and will also be fitted with long-lining gear.

Hydrography. Three hydrographic sections across the southern part of the Grand Bank were occupied in April. These were repeated in July-August together with two additional lines of stations across the Labrador Current, off Bonavista and from St. John's along the 47° latitude line to beyond Flemish Cap.

Subarea 4

By W. R. Martin

At the third Annual Meeting of the Commission a group of "Scientific Advisers to Panel 4" was established to review the status of the groundfish stocks and to determine research and conservation requirements in Subarea 4. Canadian groundfish research in the subarea was reviewed at meetings of this group held at Copenhagen in October and at St. Andrews in December, 1953.

Identification of Stocks - A manuscript has been prepared for publication describing the results of vertebral counts on some 38,000 cod in 375 samples made in 1933 to 1941. The conclusions are in agreement with the results of tagging carried out during the same period, but more detailed information has been provided on the different cod populations in Subarea 4.

Returns from more than 7,000 haddock tagged between 1935 and 1940 have been described in manuscript form for publication. Deep channels, water temperature, spawning and feeding proved to be important factors controlling the movements of haddock populations. A number of discrete populations have been recognized within Subarea 4.

The M.V. "J.J. Cowie" was used during the months of May to October 1953 to study the distribution and movements of redfish along the upper Laurentian channel in the Gulf of St. Lawrence. Redfish were most plentiful off the eastern tip of the Gaspé at depths of 175 to 300 metres; the size modes

for males and females were 35 to 36, and 38 to 40 cm. respectively. Larger fish of both sexes were found in deep water. Mature females were 50% spent in June with the largest females spawning first. Both sexes were feeding well in June and early July but from August to October the females were eating less and all males were empty. Fifty percent of the redfish were mature at 25 cm. The appearance of small redfish (down to 20 cm.) in much greater numbers in the St. Pauls - Bird Rocks area of the southern Gulf suggests that redfish larvae liberated in the Gulf are carried south toward Cabot Strait with the resultant outward movement of Gulf water.

Seasonal changes in catches appeared to be related to changes in vertical distribution rather than extensive movements of redfish. There was a consistent decrease in catches after dark with males showing a more pronounced movement off bottom. At spawning time females tended to be off bottom as demonstrated by greater catches of males in bottom dragging.

A manuscript describing "The Seasonal Distribution of the Winter Flounder (Pseudopleuronectes americanus) on the Atlantic Coast" describes changes in depth distribution in relation to environmental factors, particularly temperature and light.

Statistics - Four field technicians collected (1) detailed statistics on area fished and fishing effort for a large proportion of offshore landings; (2) samples for length and age composition of both inshore and offshore landings; (3) measurements of quantities of haddock discarded at sea. These observations, together with statistics of landings collected by the Department of Fisheries, provide essential information on yield, indices of abundance, recruitment, growth and mortalities.

Total groundfish landings decreased during 1953, the most pronounced change being a 27% (23,000 metric tons) reduction in landings of cod from Subarea 4. The decreased cod landings were compensated in part by increased landings of redfish from Subarea 4, and of haddock and flounders from Subarea 3. The drop in cod landings is partially related to the decreased abundance of large steak cod, but a change in economic conditions, involving a 25% decrease in price and buyers' quotas on landings, was the dominant factor in the reduced landings.

In the haddock fishery the 1948 year-class was dominant in landings by Western Nova Scotia boats. In the landings from offshore banks and the Cape Breton area the 1947 year-class was dominant. The 1949 year-class has become important to the haddock fishery in the southern Gulf of St. Lawrence and on Banquereau. In the cod fishery the 1948 and 1950 year-classes were important in the western Nova Scotia area. The 1947 year-class was dominant in landings from offshore banks and the Gulf of St. Lawrence.

Tagging - 1,804 cod and 580 haddock were tagged off Lockeport, Nova Scotia, between May 27 and October 20, 1953. The fish were taken by hook and line fishing from the M.B. "Mallotus", with holding tanks and tagging troughs used to facilitate release of fish in good condition. All tags other than strap tags were attached by stainless steel wire between the first and second dorsal fins. The strap tags were clamped on the lower fleshy portion of the tail.

1953 Groundfish Tagging off Southwestern Nova Scotia
with Recoveries to December 31, 1953

<u>Type of Tag</u>	<u>Cod</u>			<u>Haddock</u>		
	<u>No.</u>	<u>No.</u>	<u>%</u>	<u>No.</u>	<u>No.</u>	<u>%</u>
Hydrostatic	933	229	24	276	13	5
Red and white disks	305	114	37	98	6	6
Yellow disks	303	92	30	87	8	9
Strap	<u>263</u>	<u>32</u>	<u>12</u>	<u>119</u>	<u>5</u>	<u>4</u>
Total	1,804	467	26	580	32	6

Early returns of tagged cod suggest a relatively high fishing mortality. Recoveries of tagged haddock were low in 1953 but the number of recoveries increased early in 1954. In both species most recaptures have come from the tagging region.

Population Dynamics - Analysis of records of the fishery and of tagging experiments on a distinct population of the winter flounder (*Pseudopleuronectes americanus*) in St. Mary Bay, Nova Scotia, provided good estimates of growth, natural and fishing mortality, and recruitment for the construction of yield- and value- isopleths based on the method described by R.J.H. Beverton. Results provide a basis for judging the desirability of any regulation of this fishery and indicate that under present conditions any restriction of fishing will tend to reduce landings and value. This study has served to demonstrate the usefulness of this method of analysis, and cod and haddock stocks will be studied along similar lines.

Mesh Selections - Experiments with large-mesh cod ends on three commercial otter-trawler trips demonstrated that small haddock and cod are effectively released and as a result the industry is voluntarily adopting large-mesh cod ends of about 4-1/2" inside measure after use. Five mesh sizes from 4-1/2" to 5-1/4" inside measure were compared with the standard 2-7/8" mesh by covered net and comparative tow experiments. Mesh sizes larger than that now in use on Georges Bank gave 50% selection points for both cod and haddock which were in line with results of earlier mesh experiments (fig. 8, p. 31, 2nd Annual Report ICNAF). Large catches dampened the selection effect of the meshes.

Hydrography - Canadian hydrographic investigations by the Atlantic Oceanographic Group continue to lay the basis for a better understanding of the natural factors causing changes in the abundance and movements of groundfish and other species.

Seasonal cruises over the Scotian Shelf, Bay of Fundy and Gulf of St. Lawrence were carried out in September and November. Temperature and salinity data from seasonal cruises between 1946 and 1952 have been prepared in the form of plots of temperature and salinity distributions in sections.

A report has been prepared on the bottom temperatures on the Scotian Shelf from the data obtained during seasonal cruises. The three layer stratification of the waters, the influence of the slope water, and of cold waters to the northeast, make bottom temperature a complicated function of depth, location and time. In general, the lowest bottom temperatures are found in the northeast sector and the highest on the shoal banks and in the deep areas of the Scotian Gulf. Maximum bottom temperatures have been observed to be as much as two degrees higher than those recorded over the area in pre-war years.

Continued observations of surface water temperatures, taken twice daily at strategic points along the Canadian Atlantic coast, have shown a general warming of the waters during the last 13 years. The period 1949-52 is recognized as being the warmest quinquenniad on record with peak temperatures occurring in general in 1951. The peak temperatures were equalled or closely approximated in 1953, particularly in the early months of the year. The late fall observations show a considerable abatement towards lower temperatures.

A better appreciation has been obtained of the rapidity with which major changes can occur. In November, 1952, for example, a large-scale replacement of Bay of Fundy water took place in three weeks. An important study has been made of the "slope waters" lying between the coastal waters of the Scotian Shelf area and the Gulf Stream. Incursions of this water are responsible for sudden changes in conditions on the banks, with greatest influence around Emerald, LaHave and Western Banks.

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