

Excerpts from

REPORT FOR 1950 OF THE
NEWFOUNDLAND BIOLOGICAL STATION, ST. JOHN'S, NFLD.
BY W. TEMPLEMAN, DIRECTOR

The Newfoundland Biological Station is at the present time devoting its major efforts to research on the Groundfishes. Work is directed chiefly toward cod, haddock, rosefish and American plaice which are the chief groundfishes of the area. All other species of fish or invertebrates brought up by line or otter trawl receive as much attention as their importance warrants, whether of commercial use, as food for our principal fishes or as predators or competitors of fishes. Thus some attention is being given to witch flounder, halibut, caplin, lance, Greenland halibut or turbot, skates, wolffishes, and all other species of fish and commercial invertebrates such as shrimp, squid and scallops on which our exploratory fishing yields information.

In view of the lack of detailed information on fish distribution in the Newfoundland and Labrador area and the early stage of the fisheries for all groundfishes other than cod in the area the chief emphasis is, and will be for some time to come, on exploration. We shall be concerned with the relation of the numbers of various species and sizes of fish to locality, depth and light, and to bottom temperatures, food and other factors which influence their abundance. At the same time particularly in species other than cod, we have the opportunity to study conditions at the beginning of a fishery and to lay a groundwork by which future changes in the fishery due to a high intensity of fishing and climatic or other changes can be recognized.

The study of hydrography in its relation to the abundance of the different species of fish in various places from month to month and year to year is a basic part of the groundfish studies.

A limited amount of technological work is being carried out on the Vitamin A value and yield of liver oils of the various species of Newfoundland fishes particularly the cod and on the jellied condition in American plaice or flounders which is at present a considerable problem to the industry. In both of these cases the study is one in which the chemical results are related to the life history of the fish.

Salmon research is being expanded. The salmon fishery is one in which the public is very interested. It is a fishery whose whole existence depends on the maintaining of suitable water conditions in the rivers to raise a large population of young fish and is one in which the chief limiting local factor appears to be the amount of river space available to salmon.

RESEARCH IN 1950

Groundfish

General Operations Research Vessel Investigator II. The provision of a larger winch for the Investigator II allowed fishing to be carried on successfully between 100 and 200 fathoms, while the addition of a Loran navigating set allowed accurate charting of positions. A large offshore area between 120 and 200 fathoms was explored from the northern part of the Grand Bank to the latitude of Cape Chidley in Labrador, to the north-east of the Grand Bank and on Flemish Cap. Over a great part of the area explored there is little or no fishing at present. During these deep water investigations however, fairly good supplies of large rosefish were found in many areas.

A number of exploratory trips were made to St. Pierre Bank and the Southern Grand Bank, continuing the studies of the relation of haddock and rosefish and American plaice to location, depth and temperature. A considerable amount of hydrographic work was also carried out.

Rosefish. During the exploratory fishing of the Investigator II, rosefish in good commercial quantities were found at the Flemish Cap Bank and in most areas fished from the north-eastern edge of the Grand Bank to near Hamilton Inlet Bank on the southern Labrador. Since previous knowledge of the availability of rosefish in commercial quantities extended only to latitude $44^{\circ} 30'$, these discoveries extend the range of rosefish, numerous and large enough for some commercial success to be expected, northward over eleven degrees of latitude and over six hundred nautical miles. The depth of the rosefish population increases from 80 to 140 fathoms on the southern Newfoundland areas to 160 to 190 fathoms north of the Grand Bank and to 200 fathoms off Labrador.

Studies of the rosefish copepod parasite, Sphyrion lumpi show a discontinuous distribution, with percentages high enough to give considerable trouble in the filleting plants, only in fish of the Labrador and the New England areas. Rosefish in the Gulf of St. Lawrence and Newfoundland Bank areas possess very few of these parasites and in some areas such as the Nova Scotia Banks, the parasites have not yet been found.

Haddock. The 1942 year class, eight years old in 1950 is the chief support of the present haddock fishery on the Newfoundland Banks. The 1946 year class is present in large numbers especially on the Grand Bank. Now largely discarded, this year class should form a great part of the commercial fishery beginning in 1952. Very few of the young haddock born in the years 1943 to 1945 survived in the Newfoundland area.

As in 1949 estimates were made of the quantities of haddock discarded at sea by Newfoundland trawlers. In five trips to the Grand Bank, 35, 65, 36, 61 and 62 per cent respectively of the numbers of haddock caught were discarded dead at sea. These losses indicate that some effective net mesh law is needed to allow the escape of more small fish. The matter is an international one and there may be many difficulties in reaching an agreement in that our fishermen do not wish to retain haddock under 45 cm. while in Europe haddock as small as 30 cm. can be sold.

Cod. Studies of cod migrations are continuing, about forty-eight hundred cod being tagged in 1950 at Fogo and St. John's. Further results are available for the 1948 cod tagging where the bachelor button type opercular tag and a two inch red celluloid belly tag were compared. In the year of tagging there was little difference between the percentage returns of the two types of tags. In the second year the percentage of belly tags recovered was 67 per cent greater, while in the third year the percentage recapture of belly tags, although only 2.0 per cent of the original number, was six times as great as that of the opercular tags.

In the 1950 tagging a small 13/16" tag designed for salmon smelts and attached to various parts of the body with a nickel wire was compared with the bachelor button type and with 2,3,4 and 5 inch celluloid belly tags. Up to the present time the small smolt tags, particularly when attached to the head region, have been considerably more effective than the other tags. Recaptures of all sizes of belly tags and of the opercular tags have been approximately equal.

Comparisons of round with gutted and gilled length in haddock and cod show an increase in the gutted as compared with the round lengths of 0.28 per cent in the cod and 0.51 per cent in the haddock.

In addition, in cod, haddock, rosefish and American plaice large numbers of fish measurements are being taken to form a basis for future studies of size changes due to greater exploitation or to the appearance of large new year classes. On these fish, also, studies are being carried out on times and places of spawning and size at maturity, age and growth of cod, food of cod, sizes of cod, haddock, rosefish and plaice in relation to location, depth and temperature; on numbers and location of the commercial and other fishes and the relation of these numbers and type of bottom, depth and temperature and general hydrography of the area. Vertebral counts of cod, haddock and rosefish and vertebral and fin ray counts of plaice and witch are being taken for racial studies to determine the relative degree of separation or mixing of the different parts of the population of each of these species of fish.

Appendix No. 4

HADDOCK. SURVIVAL OF YEAR CLASSES

The table given below shows the percentage of haddock of different year classes in the main Newfoundland haddock areas from 1946 to 1950. The 1950 work is incomplete, representing only the ages read up to September 30.

It will be noted that the 1942 year class, eight years old in 1950 is at present the mainstay of the fishery in all Newfoundland areas forming about fifty to eighty per cent of the haddock over five years of age in the area. The 1946 year class, four years old in 1950, is now being caught in large numbers and is almost entirely discarded at sea, not yet entering the commercial fishery except to a small degree on St. Pierre Bank. This year class appears certain, on the Grand Banks, to form the main support of the commercial fishery for a number of years beginning about 1952. On this bank the year classes, 1943 to 1945, possess very few survivors. The 1947 year class survival was probably small also. On St. Pierre Bank the years 1943 to 1945 produced very few survivors, the year 1946 a good survival and it is possible, on the basis, however, of a very small sample, that the 1947 year class may be large also.

Haddock. Survival of Year Classes. Per cent of Total at each Area.

Year Class	Grand Bank-Unselected					St. Pierre Bank-Unselected					Gully S.E. of Green Bank -Unselected				
	1946	1947	1948	1949	1950	1946	1947	1948	1949	1950	1946	1947	1948	1949	1950
1949				0.3	0.5										
1948				0.3	0.3			11.7	1.4	5.1					3.9
1947				1.3	1.3			12.0	19.0	50.0					15.7
1946		0.2	12.7	28.2	46.5					24.5					
1945			0.5	0.5						0.9					
1944			0.4	0.1	0.8			1.6		1.8					
1943		1.2	3.9	3.4	2.8			4.7	7.2	2.7					1.8
1942		26.9	45.9	42.7	39.9			40.2	49.3	8.2					64.0
1941		24.8	16.4	11.4	4.0			0.9	1.8	0.9					5.4
1940		18.0	9.3	5.4	2.5			1.6	1.4						3.6
1939		14.8	5.2	3.0	0.5			0.9	3.2						7.2
1938		10.5	4.2	1.6	0.3			4.2	4.5						3.6
1937		2.9	1.2	0.8	0.3			5.4	5.9	0.9					3.6
1936		0.5	0.2	0.3	0.3			10.1	4.1						7.2
1935		0.1	0.1	0.1				4.7		0.9					2.7
1934			0.1	0.1				1.4							
1933					0.3			0.2	0.5						
1932		0.1						0.2							
Total Fish	603	1291	829	1429	396	92	153	426	221	110	111	51			

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Appendix No. 5

LOSSES OF YOUNG HADDOCK IN COMMERCIAL TRAWLING
ON THE NEWFOUNDLAND BANKS

During 1950 as in 1949, observers were placed on board Newfoundland trawlers to take random measurements of a large quantity of haddock as they were caught. When the catch was landed random measurements were taken of the landed catch. In the Newfoundland fishery some haddock are often thrown away up to a size of 48 or 49 cm. Using the ratio of total numbers of haddock in the 50 cm. and up sizes in the ship and in the shore samples in each case, the numbers measured on shore were equated with those measured on ship. Usually between four and five thousand haddock were measured on board ship and about a thousand on shore.

In trips from the Grand Bank, in January and February, March, June, July and August the following percentages of haddock caught were discarded at sea, 35, 65, 36, 61 and 62 per cent. These compare with percentages of 47, 71 and 49 per cent discarded during three trips to the Grand Bank in 1949.

These discarded haddock were all dead and the losses point to the necessity of some effective net mesh law which by preventing the use of small mesh would allow the escape of large numbers of small fish. These matters are international in scope and there may be considerable difficulties in agreement in that our fishermen wish to retain very few haddock under 45 cm. while in Europe haddock as small as 30 cm. can be sold.

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Appendix No. 34

HYDROGRAPHY OF THE SOUTHERN GRAND BANK AREA IN SPRING OF 1950

During the month of March temperatures and salinities were taken during hydrographic cruises of the Investigator II. The usual large number of stations were taken up particularly on the southern part of the Grand Bank. The unusual condition was found that while in the line of stations in 40 fathoms (73 metres) near the south-west edge between longitudes 50° and $52^{\circ} 30' W$ the temperatures were relatively high, being above zero centigrade and mostly between 1 and $2^{\circ} C$ from surface to bottom, whereas this same group of stations gave mostly below zero C. temperatures from surface to bottom in March 1948, along a line of stations in the deep water at the south-west edge of the bank in about 280 metres, temperatures at 200 metres from south to north were -0.49 , -0.63 , -0.13 , 0.01 and $1.76^{\circ} C$ as compared with temperatures of 1.10 , 5.04 , 2.05 , 4.41 and $5.87^{\circ} C$ at the same stations and depths in 1948. Temperatures above 200 metres at these stations were correspondingly lower in range in 1950 than in 1948. In 1950 as compared with 1948 very cold weather with many northerly gales occurred in March. The cold water of the deep layers appeared to be largely derived from the branch of the Labrador Current running along the eastern edge of the Grand Bank rather than coming over the bank. Thus a very cold layer existed mostly from surface to 200 metres or more on the south-western edge of the bank and was more extensive toward the south than to the north. This cold layer encircled a warmer layer which existed to the north-east of the cold layer in the shallower water below 100 metres on the south-west edge of the bank.

As a result of this distribution, unusual since 1946, of low temperatures over the usual spring haddock fishing grounds on the south-west slopes of the bank, haddock fishing was much more sporadic than usual and the trawlers did not find the pre-spawning haddock in their usual quantities and concentrations in the area during March to June 1950. On the other hand haddock spawning on the Grand Bank appeared to be delayed for several weeks beyond the usual date with good haddock fishing being produced several weeks beyond the usual date. As discussed elsewhere larvae and adult caplin were much more numerous than usual in the southern Grand Bank area in the spring and summer and a very large amount of caplin spawning occurred on the South-east Shoal of the Grand Bank.

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Appendix No. 35

HYDROGRAPHY OF NORTHERN GRAND BANK AND LABRADOR AREAS, 1950

During June and early July a series of hydrographic stations was taken up at latitude 47° from the coast of Newfoundland out over the northern part of the Grand Bank and Flemish Cap. The channel between the coast and the Grand Bank, apart from the warm surface layer of 25 to 50 metres to the surface was filled to the bottom with water below -1 and mostly below -1.5°C . The below -1°C water covered the bottom of the Grand Bank at depths of 75 to 100 metres and on the eastern Grand Bank extended to 150 metres. The Labrador Current water layers below -1°C and below zero ended almost together and abruptly a little beyond the eastern edge of the bank at about $46^{\circ}45'$ west longitude. The Flemish Cap and the slopes of Flemish Cap from 160 to 350 metres and longitudes $46^{\circ}00'$ to $44^{\circ}20'\text{W}$ were covered with water all between 2.92 and 3.68°C .

In July a hydrographic section was taken across the Labrador Current from Cape Bonavista to Latitude $50^{\circ}00'\text{N}$ and Longitude $50^{\circ}00'\text{W}$. At the outer station the depth was over 500 metres. Temperatures and salinities were taken at successive 25 and 50 metre depths to 450 metres. The superficial layer of water above 0°C was less than 50 metres deep and at places less than 25 metres. The below zero layer extended at the inshore stations from about 40 metres to almost 350 metres. This typical Arctic layer of the Labrador Current thinned toward the east until at Longitude $51^{\circ}00'$ it extended only from about 30 to 115 metres and at Longitude $50^{\circ}00'$ it had disappeared entirely all temperatures from surface to bottom being above 1.4°C and all temperatures from 200 to 450 metres being between 3.30 and 3.45°C .

Three hydrographic sections were taken across the Labrador Current in the Labrador region between August 11 and 20. These were off Domino, Hopedale and Nachvak Fjord, in each case out to deep water over 450 metres, temperatures and salinities being taken at 25 and 50 metre intervals down to 450 metres.

The surface layer of water from 0 to 7.3°C in all except the outer stations usually ended between 25 and 50 metres with water below zero centigrade extending to about 200 metres inshore, and even below 300 metres off Hopedale where the inshore water is over 400 metres deep. As in the Bonavista section, in accordance with the tendency of the Labrador Current to swing to the right toward the shore, the Labrador Current water below 0°C is thicker inshore and thinner offshore. This seaward attenuation of the Arctic layer of the current is particularly noticeable in the Domino section as the current proceeds southwards.

From south to north, the Labrador Current water below zero centigrade, extended seaward about 90 nautical miles from Nachvak, 75 nautical miles from Hopedale where the presence of very deep water close to the shore allows the current to proceed more deeply and does not compress it horizontally, about 110 nautical

miles from Domino and about 105 nautical miles off Bonavista. The band of below -1°C water was of very little volume off Nachvak extending only about 15 miles from the shore, while at Hopedale and at Domino the below -1°C water extended out to fifty or sixty nautical miles from the shore. At Bonavista in July the below -1°C layer could be found from the inshore region out as far as 105 nautical miles offshore. It is indicated that during August there was very little volume movement southward of below -1°C water from the northern part of the Labrador Current.

In accordance with the temperature distribution the inshore Labrador and Bonavista summer fishing is carried on in the immediate inshore area, at Bonavista mostly shallower than 40 metres and in Labrador mostly less than 25 metres. There is also a population of rosefish and cod, also halibut and Greenland halibut in the deep water under and outside of the cold below zero layer. These rosefish populations were particularly explored by the Investigator II in 1950, and the cod by the Investigator II in 1948 and 1949 and at Bonavista during the long-lining investigation of 1950. The halibut and Greenland halibut await investigation in future years although a beginning was made by the Investigator II in 1946.

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Appendix No. 36

HYDROGRAPHY AND INSHORE FISHERIES 1950

In addition to the hydrographic surveys discussed above, the Station has taken, usually monthly since 1946, a temperature and salinity series from surface to bottom at an inshore station 5 miles off Cape Spear near St. John's, in about 176 metres. At this station in January, temperatures ranged from -0.55 at the surface to -0.75 at 75 metres and to -1.43°C at the bottom. In March the temperature range was from -1.74°C at the surface to -1.47 at the bottom. This bottom temperature has not changed significantly throughout the year to September. On April 10 all temperatures were still minus while by April 29 the surface temperature was 0.69 and the temperature at 25 metres 0.02°C . Throughout the summer and even in September, water below zero centigrade existed at 50 metres, while the temperatures at 25 metres ranged between 3.20 and 7.14°C and at the surface between 4.51 in June to 12.31 in September. This lack of mixing was apparently due to the unusual absence of very strong onshore winds during this whole summer and September period.

Coinciding with the shallow warming of the water, cod on the east coast were caught in shallow water and even in September did not go as deep as usual. Lobsters which on the east coast are caught near shore in very shallow water were caught in this area

in larger numbers than usual. Squid, Illex illecebrosus, appeared in greater quantities than for many years after being very scarce since 1947. We merely mention the squid appearance for purposes of record since we have no direct evidence that the 1950 shallow warm water layer and the squid appearance were related.

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