THE BIOLOGICAL BOARD OF CANADA
UNDER THE CONTROL OF
THE MINISTER OF FISHERIES

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OBSERVATIONS ON THE COD-FISHERY IN THE STRAIT OF BELLE ISLE

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Data on the cod-fisheries of Newfoundland are strikingly lacking. From 1889 to 1893 Mr. Adolf Nielsen was employed by the Newfoundland Fisheries Commission to run a cod egg fishery in Trinity bay and, although not primarily concerned with systematic investigation, his conclusions regarding the spawning season of the cod must be considered as being fairly reliable. His evidence "goes to show that there is both spring and autumn spawning sometimes, but the autumn spawning is by no means so general as the May and June spawning." (*Rept. Newfoundland Fish. Comm.* **1888-1893,** 1893).

In 1916, Mr. W. A. Munn wrote an article (Our winter cod-fishery at Rose Blanche and Channel, *Colonial Commerce Newfoundland*, March, **1916**) in which he contended that after the ice leaves the Cabot strait in the spring the cod move northward through the strait of Belle Isle and thence along the coast of Labrador. Captains of banking schooners have corroborated Munn's statement that "in a day or two you hear of good fishing at Codroy, the next day at St. George's, and in a few days they are found at Bonne Bay." In the strait of Belle Isle the fishermen lose track of the fish, hence we are not so sure of the latter part of Munn's conclusions that the migration continues up the Labrador coast and that later the cod return south through the strait.

During the summer of 1922, Mr. Michael Graham, of the Lowestoft Fisheries Laboratory, made a brief study of the cod around the southern part of the island. This writer confirmed Nielsen's observations as to the spawning season, and by studying the morphology of the younger fish (the so-called "tom-cods"), suggested a racial difference between the young cod taken in Trinity bay and those taken around St. John's (GRAHAM, MICHAEL. Observations on the natural history of the Newfoundland shore cod. *Ann. Rept. Mar. Fish. Nfld.* **1923**.)

The Strait of Belle Isle Expedition, carried on in 1923 "by the Biological Board of Canada under the auspices and with the support of the Canadian Department of Marine and Fisheries and of the Newfoundland Government" demonstrated that the cold water of the Labrador current enters the strait on its north side and in general hugs the Labrador coast south through the strait. On the other hand, the warm gulf water enters the strait on its south side and holds the Newfoundland coast until it empties into the Atlantic in the region around cape Bauld. Some of the cold water of the Labrador current, however, finds its way across the strait at its northern entrance to mix with the warmer gulf water as it leaves the strait, and in a somewhat similar manner, some of the gulf water crosses the strait at its southern end and mixes with the cold water of the Labrador current where the latter leaves the strait. (HUNTSMAN, A. G. The ocean around Newfoundland. *Can. Fisherman*, January, **1925**). (See figure 1).

In the strait then, for the most part, the water on the north (Labrador) side is cold while that on the south (Newfoundland) side is warm—either too cold or too warm, as a rule, for cod, which seem to prefer temperatures between 40° and 50° F. (5° and 10° C.). However, in those regions where the cold and

warm waters mix, that is, the Blanc Sablon region and the cape Bauld region, the resulting water during a large part of the summer season is of such a temperature as cod will tolerate. These two regions, therefore, usually enjoy a good cod-fishery, and it is not unusual to find cod plentiful here and the fishery a failure at the intermediate districts.

Raleigh, formerly Ha Ha bay, situated as it is on the east side of Pistolet bay, about midway between cape Norman and cape Bauld, is within one of these good cod regions. For three summers (1927, 1929, and 1930) the writer has been stationed there investigating another problem for the Biological Board of Canada and has had an opportunity to observe the fluctuations in the catch of cod and to correlate these with variations in the temperature of the water. These observations are presented in the present paper.

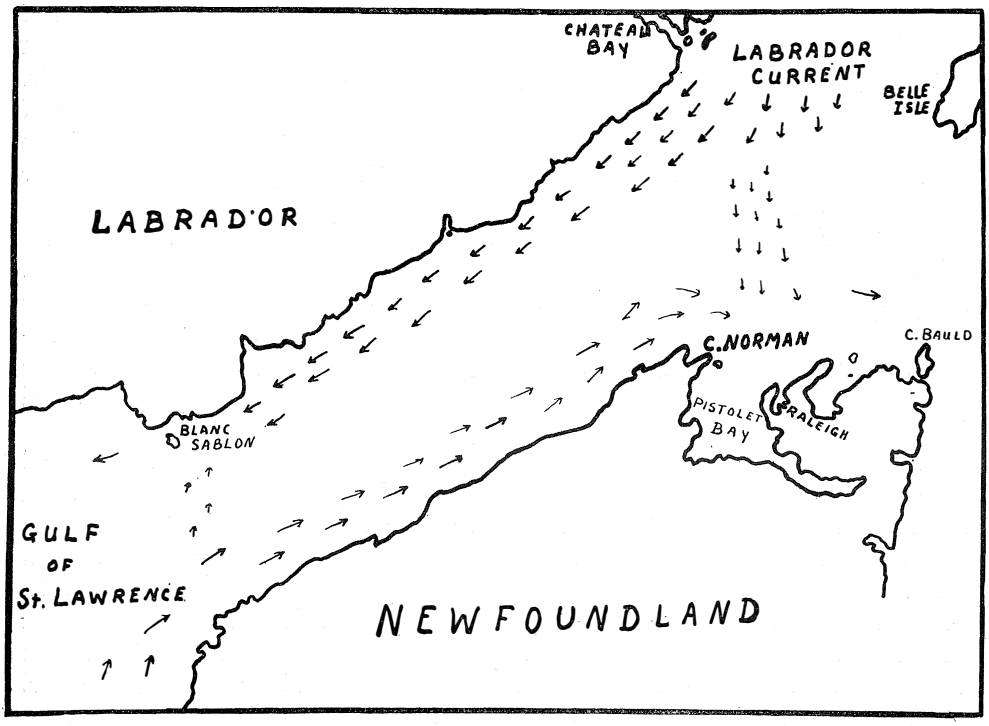

FIGURE 1. The circulation of the water in the Strait of Belle Isle.

The temperature of the atmosphere and of the water was taken twice each day, at 8 a.m. and 8 p.m. The average of the two daily readings was found, and these averages are plotted in the accompanying graphs (figures 2, 3, and 4) as the "mean daily temperature". The broken line represents the temperature of the air, the solid line that of the water. The rectangular graph at the bottom of each figure represents the number of tubs of cod split each day by the crew of Mr. Thomas Elliott, a tub being roughly one quintal. "Skipper Tom", as

he is familiarly known, is one of the "biggest fish killers" on the French shore. Ignoring for the moment two of his sons who are now prosecuting the fishery on their own behalf, his fishing force consisted of two boats' crews of six men each, and together they worked seven traps (eight in 1930). The amount of cod taken in these seven traps is shown here. When the daily catch was less than ten tubs (quintals), it is omitted.

The quantities here shown may serve as an index of the results not only for Raleigh as a whole but for the entire region between cape Norman and cape Bauld. There are approximately thirty other cod-traps at Raleigh, besides several trawls. In addition, from twenty to twenty-five schooners have fished there during the three seasons under consideration, not more than ten of which were trawlers. It is evident that these "floaters" take nearly as much fish as the shore crews, for although they are at somewhat of a disadvantage in not always being acquainted with the fishing grounds, etc., their aggregate, men and equipment, is usually in excess of that of the shore crews.

To get a fairly accurate estimate of the total catch for Raleigh, shoremen as well as floaters, it is only necessary to multiply the catch represented by ten. Since small catches are disregarded the estimate will always be a conservative one. Moreover, if we multiply the catch by thirty we get a rough estimate of the total catch for the region under consideration, for between cape Norman and cape Bauld there are two other important harbours, namely Cooks Harbour and Ship Cove, each of which secures about the same quantity of cod as Raleigh and has approximately the same number of schooners during the fishing season.

The temperatures were all taken at a spot on the shore (station 1) that opens directly on the strait about one-half mile from the principal trap berths (station 3). This procedure made for continuity and gave readings that should approximate the temperatures on the fishing grounds, at least during the fishing season, for the water is everywhere quite shallow. During the early part of the summer when the water is warming up the temperature at station 1 is generally much too high, but by the time the fish arrive the difference between the two is rarely more than a few degrees. The accompanying table gives readings for the shore station (1) and for different depths at the trap station (3) on different days during the progress of the fishing season in 1929. It will be seen that the deeper water at the trap station may be as much as 6° lower than the shore water, and this must be kept in mind in considering the relation between the temperature of the shore water and the occurrence of cod in the vicinity.

TABLE I.—Comparative temperatures in degrees Fahrenheit for Station 1 and Station 3 during the period of active fishery 1929

Date	Station 1 Mean daily temp.	Station 3		
		Surface	5 m.	10 m.
July 8	49.1	45.1	43.2*	43.2
" 15	50.7	48.7	47.7	47.7
" 25	51.1	50.9	50.1	49.7
August 1	54.1	53.4	52.2	51.8

*All subsurface temperatures have been corrected.

1927. Figure 2 shows the conditions for the summer of 1927. Up to June 18 not a single cod had been taken. Weather conditions were very backward with plenty of drift ice still in the harbour and scattered icebergs in the vicinity. Two days later with the ice still around, a trap was put out. When it was taken up later in the day on account of ice it held about fifteen barrels of cod. Practically no more were taken until June 27 by which time the loose ice had disappeared. The very next day, June 28, a northeast gale set in and some traps were destroyed. Fish continued scarce after the gale until July 9 when an improvement was noted; by the twelfth prospects were excellent, but the next day another gale set in which hampered operations for two days. From the fifteenth to the end of July cod were as plentiful as people had ever seen them, and most crews ran out of salt.

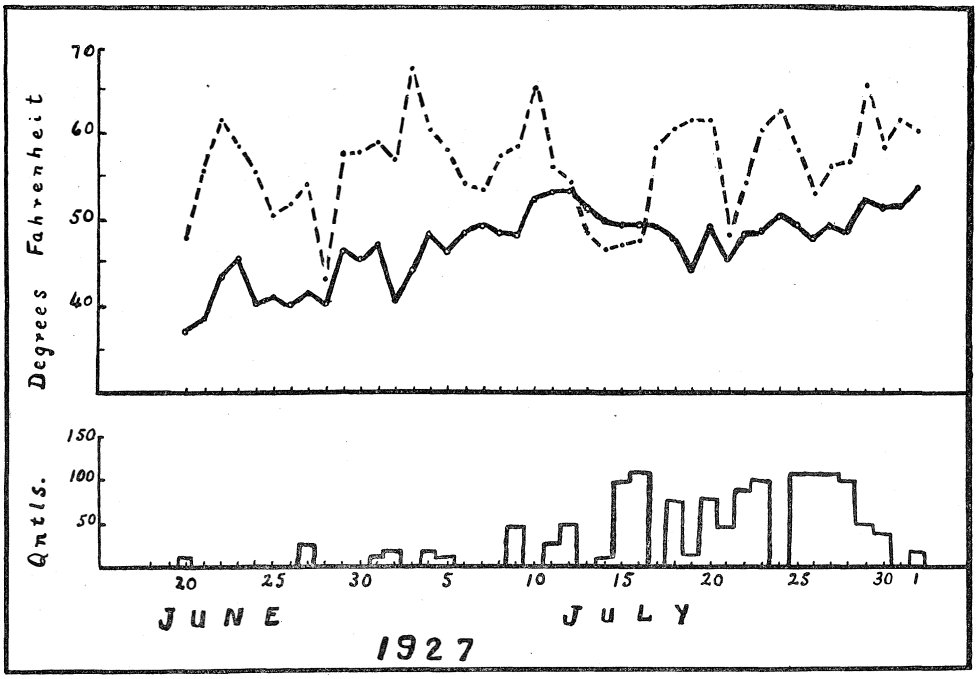

FIGURE 2. Summer of 1927. The mean daily temperature of the atmosphere (broken line) and of the shore water (solid line). The daily catch of cod is shown at the bottom.

The adjacent harbours did equally well, and it is to be noted that there was good fishing at Cooks Harbour (cape Norman) for two days after it was over at Raleigh. Evidently the fish were leaving Pistolet bay on its western side.

The fishery was poor until the temperature of the water at the shore was well above 43° F. (6° C.). The northeast gale of July 12 and 13 was evidently a fortunate event for it served to keep down the temperature that had been mounting all too rapidly, and it was seen that by the time the water again became warmer than its previous high of July 12 the fish had gone permanently.

1929. Ice disappeared from the coast much earlier than in 1927. People reported that the month of May had been particularly fine but that June had been backward—certainly the weather was very poor during the two weeks of June following the arrival of the writer. Cold, easterly winds prevailed until July, during which month the weather was uniformly pleasant.

At first the water was very cold but it warmed up gradually, much slower than in 1927, until it was around 50° F. (10° C) by July 15, and fluctuated around this figure until the end of the month. This gave a longer fishing season than is usual. The first cod were taken on the first of July; the very next day the water reached °14 F. (5° C.) for the first time and did not fall below this figure again during the summer.

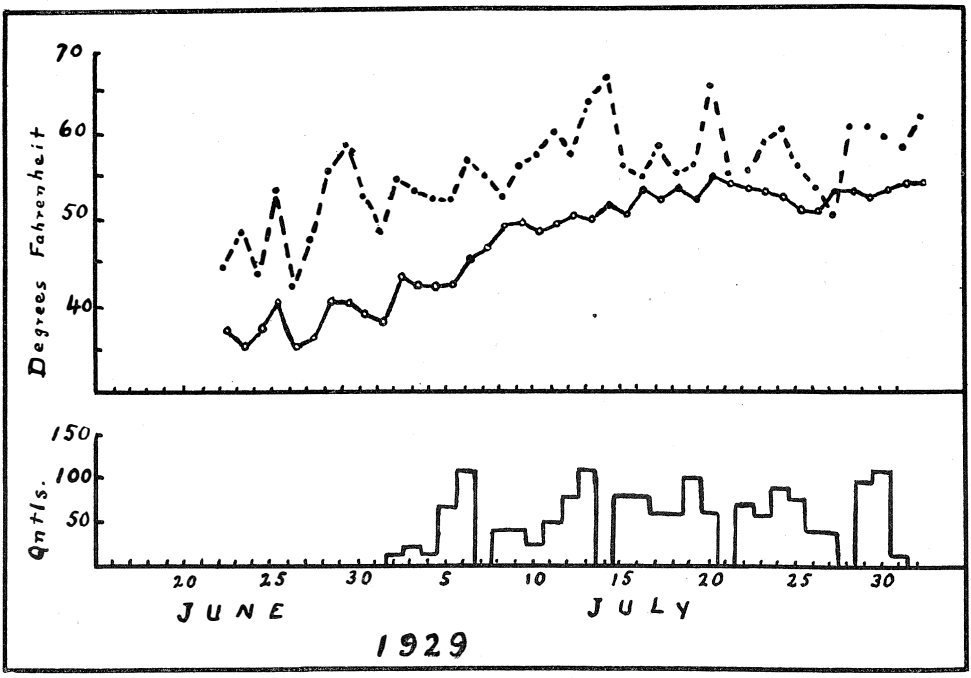

FIGURE 3. Summer of 1929. The mean daily temperature of the atmosphere (broken line) and of the shore water (solid line). The daily catch of cod is shown at the bottom.

1930. This summer was exceptionally warm, and the season opened early. On June 14 the water had already reached 44.6° F. (7° C.)—almost a month sooner than the previous year. No traps were set until June 14 and on the nineteenth fishing was good. This spurt lasted only three days. After that it fluctuated until the week of July 7, which was the best week of the season.

The water was in all probability warm enough for cod early in June and doubtless good catches would have been secured if traps had been put out sooner. As it was, fishing was practically over by July 12, which date is really the commencement of good fishing in a normal year (see figures 2 and 4). The steep

drop below 50° F. (10° C.) on July 12 is doubtless a superficial one affecting the surface water only, for the bottom water at station 3 had already reached 49.8° F. (9.89° C.) on July 8 and all subsequent temperatures in the vicinity were considerably above fifty degrees. Clearly the termination of fishing was concomitant with the high temperatures. The unfortunate aspect of 1930 was that fishermen evidently made a mistake in holding too rigidly to the calendar in setting their traps.

The catch for 1930 was not as good as that of either 1927 or 1929. Nevertheless it was not a failure. In Newfoundland when a crew averages one hundred quintals per man the voyage is considered an average one. Several crews at Raleigh approximated this figure in 1930 whereas for the other two years under consideration the average per man was nearer 150 quintals.

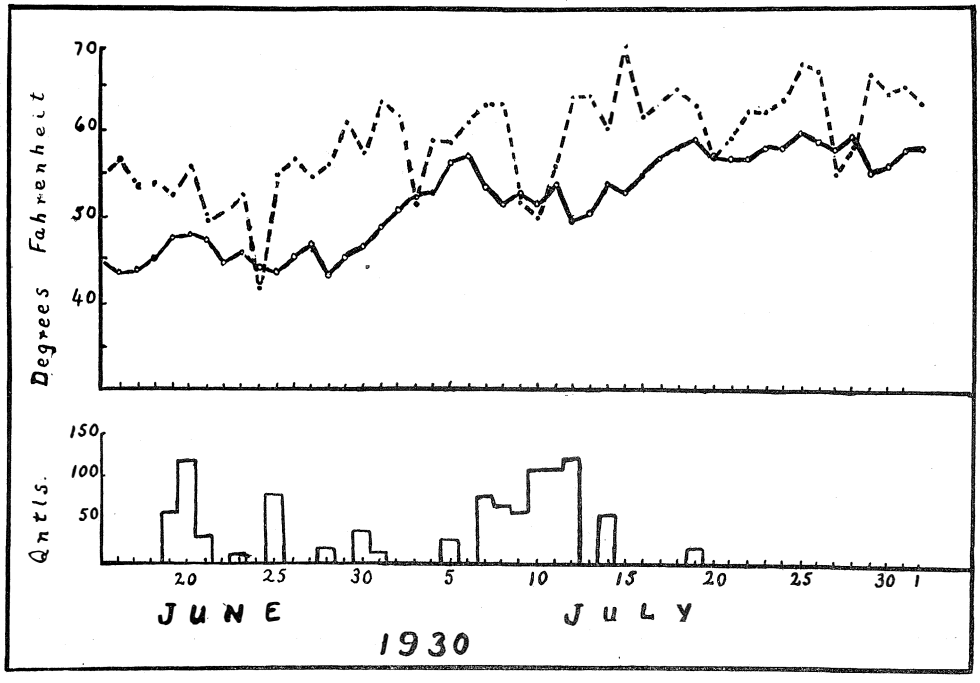

FIGURE 4. Summer of 1930. The mean daily temperature of the atmosphere (broken line) and of the shore water (solid line). The daily catch of cod is shown at the bottom.

This summer, too, witnessed a large number of banking schooners fishing in the strait region. It is not unusual for an occasional banker to come here in August, but the number this summer was unprecedented. The reason, of course, was the scarcity of cod on the Grand Banks which some fishermen even attributed to the earthquake and tidal wave of last November. It is more than likely that unusual temperature and other conditions similar to those obtaining in the strait were likewise responsible for the poor fishery on the Grand Banks.

DISCUSSION

Fishermen along the strait of Belle Isle hold varying opinions regarding the movements of cod in that vicinity. One prevalent opinion is that cod move in from the east in spring because, they affirm, fish are taken at St. Anthony in early spring, a little later at Quirpon, and finally reach Ship Cove and Raleigh. Moreover, cod strike the east side of Belle Isle first and gradually surround the whole island. Likewise, it is argued that cod return eastward because there is always good fishing around Quirpon and St. Anthony in August and September after fishing is all over west of cape Bauld.

Tentatively the writer would say that the cod taken east of cape Bauld in early spring constitute a more or less local school that evidently does move in from the deeper water adjacent to that coast. They seem to be distinct from the migratory school that moves up from the gulf of St. Lawrence. The spring fishery around St. Anthony rarely lasts long enough for people to secure a saving voyage and it is followed by a summer fishery that is more frequently small than large, depending on the conditions.

Where the school that migrates up the strait goes after the shallow water around Raleigh becomes too warm it is impossible to state at present. Doubtless part of it at least finds its way around cape Bauld to make up part of the good fall fishery that is so frequent around Quirpon. It should be pointed out that the water east of cape Bauld is considerably deeper than the water in the strait itself. This fact alone would cause the water here to warm up more slowly and hence be suitable for cod in August and September.

The opinion is well-nigh universal that winds are of particular importance in determining the movements of cod. "Cod is a lee-shore fish" and "cod always run before the wind" are expressions frequently heard. In 1927, the prevailing winds were westerly until around the middle of July after which easterlies prevailed. In 1929, west winds prevailed all summer, and yet cod were just as plentiful as in 1927. In justice to the view of the importance of winds, however, it must be admitted that the west winds were at no time heavy. Moreover, this same summer differed from 1927 in one or two other important respects. First of all, practically no fish were taken in Pistolet bay and it is assumed that the school did not enter the bay as was the case in 1927 and as was expected. Again, it was observed that traps on the east side of Ha Ha bay did noticeably better than those on the west, which again is unusual. Furthermore, very small hauls were made at times other than the morning. These facts suggest that the local distribution of water of the proper temperature was not the same during the two summers.