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"Fundy Fishery: The mackerel fishery"

Author

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THE FUNDY SURVEY

THE MACKEREL FISHERY

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THE MACKEREL FISHERY

Scientific Name - Scomber scombrus Linnaeus

Approved Common Name - Mackerel

Local Name - Common Mackerel

"Mackerel" is the approved common name of this fish but sometimes in Yarmouth County, and among the older fishermen in Charlotte County, the term "common Mackerel" is used. This terminology seems to have arisen wherever the spanish or chub Mackerel (Pneumatophorus colias, Gmelin) has occasionally appeared with the ordinary variety.

The long fusiform tapering body of the spanish mackerel resembles the common mackerel very closely although there is a characteristic colour difference between the two. The upper surface of both fish is dark steely to greenish blue and the body is barred with dark transverse bands running to the mid level of the body. The spanish mackerel are mottled with small dusky blotches on the under surface, while the common mackerel are silvery-sided below the median line.

Introduction - The Mackerel Problem

During the early years of Confederation no branch of our fisheries occupied so public a position as that held by the Mackerel fishery. The mackerel is one of the swiftest fish of the sea and generally considered one of the most mysterious erratic and capricious as well. Its habits have been carefully studied and its yearly haunts have been noted and visited by fishermen for generations. Because of the apparent uncertainty of the appearance of schools of the fish many improved methods have been devised for its capture, all of which have tended to centre interest on this fishery.

Mackerel are found in large numbers in the east Atlantic from the Canary Islands to the west coast of Scotland and in diminishing numbers to the northern boundary of Norway. In the west Atlantic they appear annually along the coast from Cape Hatteras to the Gulf of St. Lawrence. Mackerel have been known to visit the coasts of Newfoundland and Labrador. In 1849 they were said to be very abundant along the latter coast although little fished, since the settlers did not have suitable gear for taking them. In Canadian waters they appear annually off the mouth of the Bay of Fundy in early May and at various points on the coast of Nova Scotia as the season advances. In June they swarm into the Gulf of St. Lawrence. From this time on they are found more or less abundantly until late October and November, when they disappear entirely from the Canadian coastal waters.

Despite somewhat divergent hydrographical conditions, the mackerel spawning season seems to be about the same on both sides of the Atlantic. In the southern part of the Western Atlantic, it commences in May and ends about June in the Gulf of St. Lawrence. (Brown - Goode) Mackerel eggs are minute (diameter about 1/25 inch) transparent structures which float on the surface of the sea, a process which is assisted by the presence of a fairly large globule of oil. The incubation period is of about a week's duration, and the newly hatched fish is about 1/10 to 3/20 of an inch in length. These small fish are carried about by tidal currents just below the surface of the water.

The migrations of mackerel have in modern times been the origin of many disputes on the subject of the rights of United States fishermen to take mackerel in Canadian waters, particularly the Gulf of St. Lawrence. By the treaty of Washington in 1873 the privilege of inshore fishing in Canadian waters was granted to American fishermen for a period of twelve years, since they claimed they were only following their own schools of fish as they advanced up the coast. This was in the nature of a barter for Canadians were then allowed to export their fish and fish oil to the United States free of all tariffs. The treaty also provided for a Commission to determine which country was thus given the greater privileges and to assess that country accordingly. The Halifax Commission met for this purpose in 1877 and

it determined that the United States should pay Great Britain five million, five hundred thousand dollars ($5,500,000.) for the privilege of fishing twelve years in the Gulf of St. Lawrence.

One of the first theories regarding the winter disappearance of mackerel is said to have originated in Hamburg, when Burgermeister John Anderson suggested that mackerel migrate to the Arctic Seas during the winter. This was corroborated by vice-admiral Pleville who is said to have seen them in the clear waters about Greenland, hibernating with their heads buried in mud. Mackerel have not yet been recorded this far north, and the theory falls so far as migrations are concerned since they appear first of all in the spring in southern waters.

Hind and Whitchet have expressed the Canadian and now more generally accepted view of mackerel migration. They believe that mackerel of all sizes from yearlings up move offshore in the autumn when the water is cooling rapidly, and in the winter are to be found in deeper and warmer water comparatively close to the coast. Migrations then may be said to be confined to a vertical movement from the shore into deep water in the immediate vicinity and to a return migration from the deep water to the rapidly warming surface near the coast in the spring. Corroborative evidence was given this theory when otter trawlers took mackerel on George's Banks during the winter. Occasionally a few have been caught on cod lines in deep water off Grand Manan in winter, and others have been found near Yarmouth. Small mackerel as a rule appear later and disappear earlier in the season than the large mackerel.

Movements of mackerel have been observed in the Black Sea where the fish keep to the surface because of the quantities of hydrogen sulphide gas. They enter from the Mediterranean and spawn in the Sea of Marmora and keep to the less salt water to the north west. They spread out here and probably retrace their paths on leaving in the autumn, when they school once more because of the decreasing temperature of the water. This is also probably true for our own coast where they appear in large schools at the beginning and end of the fishing season, but tend to scatter during the summer. Dr. Huntsman has shown that the adult fish spawn as they reach the coast from the Gulf of St. Lawrence to the Bay of Fundy but only the physical conditions about the Magdalen Islands are suitable for their development.

The United States at the time of the Halifax Commission maintained that the mackerel shoals moved far out into the Atlantic in the winter (Browne - Goode). The spring migration entailed an advance from the deep oceanic waters to the surface coastal waters with the left wing of the shoals striking first about Cape Henry, the right wing the coast of Nova Scotia at a slightly later date. The Canadian stand has

been upheld in recent years in the light of tagging operations carried on co-operatively by the United States and Canadian Governments. The tag used consisted of a coloured celluloid band around the tail. These have shown that mackerel schools that strike the coast near Cape Cod in the spring remain on the New England coast and do not pass northeastward to Nova Scotia. Schools that strike off Cape Sable, Nova Scotia in the late spring spread out eastward and westward. Some remain in the immediate vicinity, others pass into the Bay of Fundy or westward to the New England coast, and still others travel eastward to Cape Breton. The evidence also indicates that a series of schools strike the various parts of the coast and that these remain fairly distinct although there may be some mixing apparently more particularly during the winter.

From the fisherman's standpoint the fluctuations in the numbers of mackerel making up the schools or shoals is of primary importance. The causes of these variations have long been attributed to the direction of the wind combined with the consequent temperature of the water. It is probable that their seasonal appearance at about the same region of the coast may be attributed to the rise of food to the surface in this region. In the spring, mackerel feed on minute crustaceans called copepods, and these feed on diatoms, a type of microscopic plant. Dr. Allen and Dr. Russell of Plymouth have shown that the quantities of diatoms produced in the sea depends on the amount of sunshine in February and March. The number of copepods in turn depend on the abundance of their diatom food. The greater the quantities of copepods the greater the congregations of mackerel at the coast during May. Absolute proof of this correlation has not yet been made, but further study may yet make it possible to predict the fishery for the year, some months beforehand. Later in the season, mackerel feed largely on small fish of various types such as the herring. Dr. Jensen has shown a relationship also between the water temperature in September at Copenhagen and the number of mackerel landed. While in Europe such a definite relationship has been found to exist between the catch of mackerel and the hydrographical and meteorological conditions, Mr. O. E. Sette of the U. S. Bureau of Fisheries has shown that, while the hydrographical and meteorological conditions may cause local and temporary changes in the catch, the annual catch is definitely controlled by the fluctuating abundance of mackerel in the sea.

General Characteristics of Fundy Mackerel

Mackerel in the Fundy region are typical to the specific type, possessing a fusiform or spindle-shaped body which tapers rearward to a very slim so-called caudal peduncle and forward to a pointed nose. There are two back fins, a single fin on the under surface, and two sets of paired fins. The scales are very small and almost invisible on the belly, but somewhat larger on the shoulders. The upper surface is

dark steely to greenish blue or a blue black. The whole body is barred with 23 to 33 dark bands or stripes running nearly to the midlevel of the body. The lower sides are varied from an iridescent silver white to a copper shade.

Mature mackerel range from nine to eighteen inches in length and weigh from one-half to three pounds. The various sizes receive different names. The large or No. 1's average from thirteen to sixteen inches and weigh from one and one-half to two pounds. The mediums or No. 2's range from nine to thirteen inches and weigh one to one and one-half pounds. In Yarmouth County the smallest fish taken usually appear in the autumn. These are five to six inches long, and are known as "spikes" or "tacks". Similarly those from six to eight inches in length are "blinkers", "blinks" or locally in Abbott's Harbour and vicinity they are called "tolepins". Those about nine inches long weighing under half a pound are known as "Tinkers". On the New Brunswick coast, at the head of the Bay of Fundy and most of the Nova Scotia shore with the exception of Yarmouth County "tinker" is the term used to refer to any small mackerel.

Mackerel generally feed upon small crustacea (copepods, small shrimps, larval crabs) which are plentiful near the surface of the sea and which they appear to follow in their shore migration. Several mackerel opened at Yarmouth in late August were full of Calanus, the "red feed" or "Cayenne" of fishermen. Some of the Yarmouth fishermen have also found in their stomachs young fish of various kinds particularly herring, occasionally hake and less frequently small mackerel.

The mackerel has many enemies including the gannet, porpoises, whales, sharks and dogfish. Squids and cod are also known to prey on young mackerel.

Relative Importance of Fishery

From 1835 to 1850 the Bay of Fundy was considered a very famous mackerel ground, but after that date its value seems to have waned. During the most productive period up to 1850 or 1860 United States fishermen visited the bay in great numbers, but after that date they very seldom fished in this region.

It is unfortunate that we have no statistics for these early years. However, the statistical returns for the sixty-one year period from 1869 to 1930 are available. During the early years, these are given in barrels, pounds fresh and cans. The following conversion factors have been used to reduce all forms to hundred weights:

300 lbs. fresh produce one barrel of pickled.
70 lbs. fresh produce one case (48 cans).

1869-1909-10 inclusive - statistics given in barrels which are taken as pickled and multiplied by 3 to give the fresh round weight in cwt. and in cans which are taken as 48 cans per case and 70 lbs. of fresh round weight per case. Quantities specifically stated in pounds fresh are converted to cwt.

1910-11-1930 inclusive - statistics given in cwt. as caught and landed and this value is used as the fresh round weight.

Table I is a resume of the total quantities of mackerel (in cwts.) landed each year in the Fundy area from 1869 to 1930. The production curve given in Figure 2 shows how a yield as high as 109,749 cwt. in 1891 dwindled in 1894 to 1,966 cwt. Conspicuous features of the curve are the fairly great quantities taken from 1876 to 1893 and the subsequent very small catches throughout the period, outside of 1912, 1913, 1915, 1917, 1919, 1921, 1922, 1923, 1929. All the latter mentioned years, although high compared with those following 1892, are nevertheless considerably below the best yields of the earlier productive period.

An average of 6.2 per cent of the total Atlantic mackerel were caught and landed in the Fundy Area over the period from 1869 to 1930. (See Figure 2). In 1878, 1884, 1891, 1912, 1923, the Fundy landings were fairly high, amounting to 13.9, 17.5, 26.1, 21.8, 10.3 per cent of the Atlantic total respectively, while in 1874, 1902, 1903, 1904, 1905, 1908, .78, .27, .48, .62, .50, .67 per cent only were taken in this area.

Comparatively few mackerel are taken on the New Brunswick shore-line, and indeed an average of 5.9 per cent of the total Atlantic catch over the 1869 to 1930 period were taken off the Nova Scotian shore of the bay.

On the Nova Scotia side of the Bay the sum total for Yarmouth, Digby, Annapolis, Kings, Colchester and the Fundy watershed of Cumberland Counties, over the same period represents 8.9 per cent of the total Nova Scotia catch.

Similarly the mackerel landings for the counties of Charlotte, St. John, Albert and the Fundy shore of Westmorland average 3.5 per cent of the New Brunswick total from 1869 to 1930.

Methods of Capture

Many devices have been invented for the capture of mackerel. In early days the fish-pole, the gaff, the jig and the bob were used. At a later date more wholesale methods including gill nets, purse seines and set-traps were introduced and are almost exclusively in use at the present time. Improvement in craft structure and motive power as well as an increase in the numbers of ice-houses should have materially assisted the fishery in the Fundy area had the fish entered the bay in suitable numbers.

The "mackerel bob" is still used occasionally off Yarmouth County, largely by pleasure parties. It consists of a small tinned hook (No. 16) with a heavily weighted lead-shank (see Figure 4) shaped like a pea-pod. The latter is run in a mold by the fishermen themselves. A six-thread fine

hemp snood about 5 to 6 inches long is used. The bob requires no bait although occasionally a strip of the silvery belly of a mackerel is advantageous. In fishing the bob is kept from six to ten feet under water.

Purse seining when first introduced on the Atlantic coast about 1850 completely revolutionized the mackerel fishery. It was only used to a limited extent in the Bay of Fundy and that largely by American fishing vessels. It consists essentially in surrounding a school of fish by netting. A typical seine (Tressler) varies from 270 to 400 yards in length and 18 to 20 yards in depth and is composed of one and three-fourths inches cotton twine mesh. The vessel cruises over a fishing ground until a school of fish is sighted by a man posted in the crow's nest. The crew mans a seine boat and a dory which acts as a buoy for one end of the seine. The remainder of the seine is cast out over the stern of the seine boat as the latter is towed around the school by the vessel. When the two ends of the seine are brought together enclosing the fish, the seine is pursed. The "tom" attached to the purse lines is dropped overboard to hold the lower edge of the seine in the proper depth. The ends of the net are rapidly hauled into the seine boat as it is pursed, and the mackerel concentrated in one portion of the net are bailed into the hold of the vessel.

Set nets, drift nets, gill nets, or drift gill nets are used to a limited extent along Yarmouth County and were formerly common in St. Mary's Bay. Their use in the latter area has not met with success of late years. As the name indicates, the fish are caught in these nets by becoming entangled in the netting. The mesh varies from two and one-half inches to three inches stretched and permits the passage of the head of the fish, but not the body, so the fish is "gilled". The net (Figure 5) is made of fine net twine and is rectangular in outline with cork floats along the upper hanging line and leads along the lower hanging line. These serve to keep the net distended.

A typical net is fifteen fathoms long by two fathoms deep. The cork floats or buoys are flattened with rounded corners (6" x 4" x 1") arranged four or five meshes apart. The lead sinkers are round or oval in outline (1 1/2" long by 1" thick) pierced in the centre and arranged about two feet apart on the lower hanging line. The nets are frequently set in harbours about half a mile or more from shore. The depths the nets are sunk is regulated by ropes seven or eight yards long sometimes called "seizings". Two of these from each net are made fast to a stout warp, the drift rope, which runs the whole length of the net or nets.

It is not an uncommon practise to tie as many as twenty nets in series by the drift rope to the bow of a boat. A large buoy (tail buoy) is attached to one end of the drift rope by the tail line. The nets are set or "shot" in the evening, and hauled early in the morning. Fishermen consider that

strong breezes from any quarter with the exception of heavy off-shore winds are favourable for netting. Off-shore winds cause a ground swell which has a tendency to cause the fish to strike off for deep water.

Several forms of shore-gear are extensively used for capturing mackerel in the Fundy area. The mackerel trap (see Battle, Weirs and Trap-Nets) is one of the most expensive types of fishery gear in use at the present time. Traps were first instituted in the early seventies, and at that time were considered very harmful to the fishery. For many years they were very profitable despite occasional mishaps when the gear were destroyed by storms. Since mackerel do not frequent the bay in as great numbers as they previously did the number of traps has declined. In 1879 there were thirty-two traps along the Yarmouth County coast, but this present year only four were set out, located as follows: Yarmouth Bar, Cranberry Point, Sandford, Port Maitland.

Mackerel are captured mainly in brush weirs (see Battle, Weirs and Trap-Nets) in St. Mary's Bay, although occasionally gill nets are used. In Annapolis Basin and along the Annapolis and Kings County lines the catch is most irregular and taken almost entirely in herring weirs.

Traps and weirs have certain advantages over hand-lining and purse seining since they are always ready when the fish come inshore, day or night, rough or calm. Sometimes, however, if the fish do not follow the shore line they are only taken in outside traps.

Occurrence in Fundy Area

Localities

The earliest definite accounts of mackerel in the Fundy area indicate that from 1835 to 1850 the whole bay was considered to be an excellent fishing ground. However, Moses Perley, in an account of a fishery survey made in 1852, states, "They were also plentiful formerly in the Bay of Fundy, near Grand Manan and West Isles where but few are now taken."

Knight in 1866 has also given an account of the mackerel fishery as described in Lieut. Lindsay's report to Vice Admiral Seymour:--"the mackerel fishery opens toward the end of June or the beginning of July continuing until late in October; the small or "tinker" mackerel (so-called by the fishermen) at the commencement of the season striking into the bays, harbours, and toward the shores in countless numbers. So plentiful are they, indeed, that along the beach they are taken

most successfully by the common landing-net. The weirs at the head of St. Mary's bay and seines along the shore are, however, the chief means employed for taking mackerel; as many as a hundred barrels are taken at one haul; and instances have been known where from the myriads taken, the larger and finer fish have been removed by the fishermen, leaving the smaller ones in weirs and on the beach to decompose or to be carted off as manure to the nearest farm. This system is much to be deplored and cannot be too soon discouraged as, if carried on to a great extent, it must in course of time tend toward greatly ruining the fishery."

From Knight's account we also learn that mackerel were taken all along the coast of Yarmouth in May. During the summer, however, the Fundy fishermen repaired to the well known localities in the Gulf of St. Lawrence where the fishing was more productive at that time.

The mackerel fishery of the Fundy area seems comparatively unimportant in late years. Many local fishermen say that the fish cannot stem the heavy tides; but they did many years ago. The distribution of the catch of mackerel for a typical year (1929) in this area is shown in detail by figure 6. Solid dots represent an annual catch of 100 cwt. and circles an annual catch less than 100 cwt. Most of this species is taken by traps and by netting in the general vicinity of Yarmouth and should if space had permitted be localized where the traps were situated between Yarmouth Bar and Port Maitland, and on the eastern shore of Lobster Bay. Fair quantities were taken in St. Mary's Bay north of Long Island. Scattered catches were made off Brier Island and Digby Gut and along the shore line of Annapolis and Kings County. But the head waters of the Bay and the New Brunswick side indicate an entire absence of the fish.

Turning back fifty years to 1879 we find a year of moderate abundance. The horizontal distribution of the catches has been charted in figure 7. Mackerel were taken along the whole Yarmouth County coast and were also abundant in St. Mary's Bay around Brier Island and the Fundy shore of Digby Neck. Not only do we find them here but they were also fairly abundant in Passamaquoddy Bay. Small catches were reported off Grand Manan, St. John, Cumberland, Kings and Annapolis Counties.

During 1930 mackerel were reported from Charlotte County. These were taken at "squidding time" in October in an old weir off Campobello. The netting had been removed, but the stakes were sufficiently close to entangle them as they remained stranded at low water. Nine hundred weight of large fish were taken with a twelve foot dip net and retailed at St. Stephen for twenty-five cents each.

With the exception of 1912, 1913, 1921 no catches had been reported for this district since 1901. In St. John County there were no catches from 1869 to 1930 with the exception of

1875 and 1879 to 1886; while in Albert County small catches have been irregularly reported in 1891, 1912, 1913, 1915, 1917 and 1918. In earlier years from 1871 to 1874 the returns for Albert County and the Fundy watershed of Westmorland County were combined. These are the only years in which catches have been noted for this section of Westmorland County. Small quantities of mackerel have periodically been taken in Cumberland County around Advocate and Parrsboro, but comparatively few since 1892 and none at all since 1921.

These fish were only once reported from the Fundy watershed of Colchester County and that in 1921, while no catches have ever been recorded for Hants.

To summarize, the mackerel are, in general, concentrated about the Yarmouth County shore and may also sometimes advance in great numbers into St. Mary's Bay. They are taken in progressively decreasing numbers along the Fundy shore of Digby Neck, Annapolis and Kings County. Occasionally a few mackerel proceed to the head of the bay and are taken in limited quantities off Cumberland, Westmorland, and Albert Counties. The New Brunswick shore line off Charlotte County was at one time an important centre for the fishery, but the fish have seldom appeared in any numbers off St. John County.

Throughout this past summer (1931) mackerel of the tinker size have appeared everywhere in the Fundy area in unexpected numbers. Even at the head of the bay off Cumberland County the water was said "to boil" with mackerel, and off Economy Point, Colchester County as many as two thousand were taken in one weir.

Twenty large mackerel were seined on July 25th in a herring weir off Moose Island near Beaver Harbour. At Dipper Harbour on August 12th they were still appearing in the weirs along with the herring. As many as 200 to 300 were taken at a single seining. On August 14th twenty hogshead were taken from one weir at St. Andrews, and on August 23rd great numbers of these tinkers were seined from the experimental tidal pool at the Biological Station. Throughout the season a few large fish and numerous tinkers appeared in the weirs about Grand Manan, at Long Island and Whale Cove.

The catch on the Nova Scotia shore of the bay has shown a corresponding increase in production. In June, 490 pounds of very large mackerel were taken off Margaretsville, and 2000 pounds in a weir at Deep Brook while tinkers were abundant in St. Mary's Bay. At Grosses Coques, approximately one hundred barrels were stranded on shore in July and oxen teams were brought down to gather them for fertilizer. Often as many as three hundred barrels are taken from one brush weir at a seining.

For Yarmouth County west, there is a remarkably large increase for June and July over that of 1930 as indicated by

the following figures supplied by Inspector C. J. O'Hanley:

	1930 cwts.	1931 cwts.
May	1774	879
June	3175	8816
July	97	2930
	5046	12625

The tinkers also swarmed throughout the summer in Yarmouth County east about Pubnico.

There is a current theory that the horizontal distribution of mackerel depends to some extent on wind conditions. Accordingly when the wind is south west the catch should be good near the Yarmouth shore, since it will drive in the warm surface water. In 1931, however, the traps were full, and yet the winds were prevailingly north east.

Fluctuations in the Fishery

A. Annual Fluctuations

Fundy Area

The mackerel fishery of the Fundy Area has been subject to extreme variations in productivity within the last sixty-two years. The annual catch for this period has been represented in Table I and figure 2. The yields for approximately the first third of the period are in general considerably higher than those for the later period although there is an indication of a return to a greater productivity within the last few years from 1912 on. Analysis of this curve has shown that this general feature is found to occur consistently about the Bay wherever mackerel are taken in fair numbers. However, in various regions, for example, Charlotte County the early years were moderately successful while the fish failed to appear later on. A study of the fishery reports in conjunction with the statistical returns have elucidated some of the fluctuations.

In 1868 the mackerel fishery was largely a shore fishery conducted in small boats since the net fishery was considered to be both too expensive and too uncertain. However, difficulty was met with the former, since the porgy, so excellent for bait, had to be imported from Portland.

Yarmouth County

The statistical returns of the catches beginning with 1869 are given in Table II and the course of the fishery can be seen in figure 8. It indicates from 1876 to 1892 a series of peak years with intervening drops followed by two decades of

progressively decreasing catches, and two succeeding decades of fair catches. However, with the possible exception of 1870, 1890, 1892, 1906 and 1914, when the Digby catch was slightly higher, the Yarmouth catch has far exceeded that in any other county.

In 1869 much of the Yarmouth catch was taken by set-nets in Pubnico harbour. Up to 1876 the hauls were comparatively light and generally considered a failure in comparison to former years, until in 1877 and 1878 there was a remarkable increase all over the bay. Although the size was smaller than in former years, the prices obtained were good. In 1878 thirty traps were put down, but were considered unprofitable, since, owing to a prevailing east wind during the season, the fish did not follow the shore near enough to get into any except the outer traps. They were once more plentiful in 1879, but the trap-net catch was considered poor for the same reason as in the previous season, despite the fact that there were thirty-two of these set out. In 1880 the trap-nets proved more successful, but the following year, while a few traps were successful, unfavourable winds were said to have kept the mackerel too far from shore. For some years after this, the economic trap method met with more favour and was used despite the fact that occasionally gales played havoc with them. 1884 marked an excellent year for the traps, but was followed in 1885 by a marked decline although the quality of fish was exceedingly good. The mackerel were said to have formed large schools which avoided entering bays and coves shaping their course from headland to headland.

The catch became lower still in 1886, but rose slightly in 1887, an increase attributed to the fact that a greater number of traps were set. Lobster traps and pots were thought to be instrumental in breaking up many mackerel schools, since most of them particularly at Chegoggin Bay were placed directly at the mouths of fish traps. The catch fell progressively to 1889, but rose again in 1890 and 1891. About this time the purse seines were prohibited within territorial waters. In 1892 the mackerel schooled in the Fundy area, but failed to come inshore, so that only seiners made successful hauls. Up to and including 1894 the catch was small for spring, summer and fall, all along the coast. Gill-net fishermen attributed their short catch to the effect of putrid lobster bait, but it was shown that where putrid bait was most freely used, the least falling off in the catch of herring occurred. Herring fishing is largely carried on at a season when lobster fishing is illegal, but the same rule applies equally to summer and fall mackerel fishing. The spring mackerel were plentiful in 1895 off Yarmouth and Pubnico, but later catches were light, while in 1896 they continued to be taken in fair hauls throughout the early summer. From this time to 1912 the catches were very light. Their disappearance was attributed to the supposed wholesale destruction of spawning individuals in the large traps, and the pollution of waters with "gurry" from boats or canneries as well as putrid lobster bait near the traps. Sometimes they appeared to be fairly plentiful early in the season when inferior in quality but later on when

they had improved in quality they were scarce. Not infrequently they schooled in the mouth of the Bay of Fundy, but very seldom came within reach of traps or nets although from 1906 onward, the landings commenced to show a very gradual increase, largely from hauls made at Port Maitland and Sandford.

In 1912 the mackerel appeared plentiful all season, and the catch showed a marked increase. In addition, immense schools were reported offshore, and might well have been taken had fishermen possessed the proper gear. The year 1913 paralleled that of 1912, although the fish were of a small size, but 1914 was again a failure. Weather conditions in 1915 combined with poor markets resulted in only a fair catch to be followed by a drop in 1916. During 1917 the fish appeared in larger quantities and increased in 1918 despite unfavourable weather, interference by enemy submarines and the spread of the influenza epidemic.

The 1919 fishery was a fair one since prices were high, but in 1920 the catch fell off owing to rough weather conditions in the early summer. Large schools of small mackerel appeared in the spring of 1921 and were followed by large fish later in the season. The catch increased again in 1922 possibly due to some forewarning from the Mackerel Scouting Service. The spring run in 1923 was large and consisted of small fish for which low prices were obtained since most dealers had a heavy stock in cold storage from 1922. The catch declined to 1925, increased slightly in 1926, decreased again in 1927, and rose again to 1929 to be followed by a 1930 decline. The landings during these latter years were influenced not only by variations in size of the runs of the fish, but also by the demand for mackerel in the American markets.

Digby County

The statistical returns for Digby County are given in Table III and figure 9. The fishery from 1876 to 1892 was in general good, but was followed by a failure from 1893 to 1912. For the next two years the catch was fair, but again declined, and only in 1931 appears to indicate a possible return to its former prosperity.

In 1869 the seat of the mackerel fishery for the Fundy area was located in St. Mary's Bay. Here as many as two hundred vessels, both British and American were employed in September. Each vessel is said to have averaged fifty barrels. In 1870 the fishery was not so productive on the whole, a fact which was attributed to a succession of heavy south-west gales prevailing throughout September and October. The bay is shallow and the water was rendered so muddy that the fish were thought to be driven out. Nevertheless, the catch was a better one than the previous year since American vessels were prevented from entering the bay to compete with the Canadians.

From 1871 to 1874, mackerel were a complete failure in St. Mary's Bay, but in 1875 the fish showed an indication of returning once more and a few were taken near the mouth. In the season of 1876 they reappeared although they were not by any means as productive as in former years. Still they amply repaid fishermen for efforts they made to catch them. 1877 was not a productive year for Digby County, but in 1878 we note a marked increase followed by a decline in 1879 progressively to 1883. The mackerel throughout this period were small and the quantities less than had been hoped for. Part of this was attributed to high winds and to the recklessness of some fishermen, who persisted in throwing the offal from their fish into the shallow waters of the bay. The year 1884 marked a peak in the Digby County curve. The fish were small and the prices low, but they appeared in such quantities that the people about St. Mary's Bay had to utilize many as compost. Many were allowed to die in weirs along Digby Neck and around the bay and this practise combined with the habit of the American seiners of throwing gurry overboard were predicted as a future injury to the fishery. In 1885 mackerel were fairly plentiful in St. Mary's Bay, but tended to keep offshore and refused to take bait, so the returns were much lower than for the previous year. The decline in 1885 continued into 1886, when the fishery was an entire failure in the Bay. About Westport the fish were scarce to late autumn when excellent ones were taken in nets. Most of the small catch of 1887 to 1889 were taken about Weymouth and Gilbert's Cove in traps since very few appeared in the bay. Many eventually abandoned this method in the hope that "something will turn up". In 1890, 1891 and 1892 the mackerel again reappeared in great numbers although in the latter year they did not strike inshore though they schooled plentifully in the Bay of Fundy. The fishery in 1893 was light from May throughout the season, although the fish schooled in June from Point Prim to the Wolves. From this period to 1912 the mackerel occasionally appeared and schooled in St. Mary's Bay and off Digby Neck but the catches were very small.

In 1912 Digby had its first catch of any quantity for many years. Fishermen attributed it to the fact that sawdust was not allowed to pollute St. Mary's Bay. Had the fishermen been prepared the catches might have been considerably greater. The following year showed a further decided increase in catch but in 1914 there was a marked decline which with the exception of 1919, 1922 and 1929 has continued up to the present. Some of the "lean" years were attributable to lack of fishing, some to rough weather, (notably 1920) which prevented the fish from coming inshore in their usual numbers.

Annapolis County

The statistical returns of the catches beginning with 1869 are given in Table IV and the course of the fishery is graphically represented in figure 10. Four years have notably

large catches; two major peak years 1877 and 1891, and two minor peak years 1873 and 1919. For the remainder of the period the catches were all small or lacking.

In early years the mackerel were taken here by hook-fishing, but this decreased by 1880 when all fish were taken in brush weirs and herring net weirs. Since the quantities taken at any time in this county are comparatively small compared to Yarmouth and Digby Counties, we find little reference to the course of the fishery in the annual reports; but from the figure we see that the annual landings for the period resemble those for the aforementioned counties. The early is characterized by large catches, the middle period by a scarcity and the latter part by a return to a fair catch.

Kings County

The statistical returns of the catches beginning in 1870 are given in Table V and the course of the fishery can be seen in figure 11. Peak years for the fishery occurred in 1877, 1878, 1880, 1891, 1906 and 1919, while the remaining years are characterized by very small landings. With the exception of the relatively large catch of 1906, the curve follows very closely that for the other three counties on the Nova Scotia shore at the mouth of the bay.

Hants County

The statistical returns for Hants County over a period from 1870 include no mackerel landings whatsoever.

Colchester County - Fundy Watershed

In the annual statistical returns for Colchester County from 1870 to the present only one hundred weight of mackerel were landed, and that in 1921.

Cumberland County - Fundy Watershed

The statistical returns of the catches beginning in 1870 are given in Table VI and the course of the fishery can be seen in figure 12. The landings have all been small with peaks occurring in 1874, 1878, 1881, 1884 and 1891. For many years they failed to appear at all at the head of the bay here. From 1906 to 1910, 1913 to 1915, and in 1918 and 1921 small quantities were taken. During 1931 they once more appeared here. According to the District Inspectors Report, 30,000 pounds of mackerel were taken on the Fundy shore of Cumberland County in 1921, although the statistics note only three hundred weight.

Fundy Watershed of Westmorland County and Albert County

The statistical returns of the catches from 1869 are given in Table VII and the course of the fishery is

represented in figure 13. Fair catches (considering the location of these counties at the head of the bay) were taken in 1871 to 1874. Smaller landings in 1891, 1912, 1913, 1915, 1917 and 1918 are directly attributable to Albert County.

St. John County

The statistical returns of the catches beginning with 1869 are given in Table VIII and the course of the fishery is shown in figure 14. Light hauls were made in 1875 and 1879 to 1886 with peak years in 1880 and 1886. During the present year (1931) tinker mackerel appeared in weirs off Dipper Harbour, but are the only ones on record since 1886, although occasional large fish are said to have been infrequently taken along with herring.

Charlotte County

The annual statistical returns of the catches beginning with 1869 are given in Table IX and the course of the fishery is represented in figure 15. The latter shows an almost complete lack of fishing after 1893 with the exception of very light hauls in 1912, 1913, 1921 and 1930. In 1869 and 1870 the landings were small but re-appeared in greater quantities about 1875 when several hundred barrels were taken in herring weirs off Grand Manan. The following year mackerel fell off somewhat once more, but by 1878 they were more plentiful. Around Grand Manan the people were said to have been so long out of the fishery that very little effort was made to take advantage of their unexpected return and on this account the catch is scarcely representative of the quantities of fish. Again in 1879 Overseer McLaughlin reported that fish of good quality appear every year and are taken in nets and weirs set for herring and frequently with hook and line by pleasure parties. Mackerel appeared in Passamaquoddy Bay early in 1880 when a large catch was made although the quality was not high. In 1881 the mackerel were small, poor and unfit for export. The few taken around St. Andrews were used for home consumption.

The same state of affairs existed in 1882, but around Grand Manan many mackerel of excellent quality appeared in herring nets and weirs. The progressively decreasing catch continued through 1885. In 1886 the fish re-appeared in great quantities particularly around Grand Manan, where they were considered plentiful for the first time since 1854. Had the fishermen been prepared for this unexpected visit from their "old friends" great catches might have been made, but even in the weirs as many as two hundred barrels were taken at a haul. 1887 up to and including 1889 were lean years, since the mackerel failed to appear in schools and were represented by small scattered groups. In 1890 and 1891 the fish were taken in large quantities in various parts of the county, particularly off Campobello and Grand Manan. The following year schools were again located off Grand Manan, but appeared

to be wild, avoiding nets and weirs so that the hauls were light. The weir owners in 1893 looked forward to the mackerel, but they failed to appear except for a few tinkers along the coast, and from this time the fishery has been almost a complete failure off Charlotte County. Occasionally, as in 1897, light catches were taken in weirs at Bliss Harbour, a few barrels also in herring weirs in 1898 and 1899. In 1900 a light haul was made, part of which appeared off Point Lepreau in late August.

In 1912, 1921 and 1930 light catches were made from herring weirs and a slightly larger one in 1913, and possibly in 1931 considering the large run of tinkers everywhere during the season.

Monthly Catches

Mackerel schools usually strike Yarmouth first early in May and subsequently proceed up St. Mary's Bay and the Nova Scotia coast toward the head of the Bay.

In plentiful years, they are found in June throughout the Bay, but are in greater quantities on the Nova Scotia than the New Brunswick shore and in progressively diminishing numbers from the mouth to the head of the Bay. They seldom reach the head of the bay, and, indeed, one fisherman, Mr. Brien, near Pugwash, has only taken two mackerel in the thirty-one years he has been shad fishing.

Table X shows the average monthly catch of mackerel in the Fundy area from 1926 to 1930. These figures are graphically expressed in figure 16 which shows the peak landings in June with a diminishing catch to October.

The monthly catch of mackerel from 1926 to 1930 is given for the various counties in tables and graphically represented as follows:

Yarmouth	Table XI	Figure 17
Digby	Table XII	
Annapolis	Table XIII	Figure 18
Kings	Table XIV	

The Yarmouth catch uniformly reaches a peak in June and declines to October. The peak for Digby County is delayed to September and August respectively in 1928 and 1929, while Annapolis and Kings County peaks occur either in June or July. During this period only one catch was made in Charlotte County - nine hundred weight in October 1930.

Utilization

Mackerel as a food fish is unexcelled and has been ably described as follows by Goode: "Just from the water, fat enough to broil in its own drippings or slightly corned in strong brine, caught at night and eaten in the morning, a mackerel is unsurpassable. A well-cured autumn mackerel is perhaps the finest of all salted fish ---- Salt mackerel may be boiled as well as broiled and a fresh mackerel may be cooked in the same manner."

The average composition of mackerel is given according to Atwater in Table XVI. The fish have a high percentage of protein, fat and a correspondingly great total nutrient value. He has shown also that what we may call the fuel value per pound of salted and salted canned mackerel is very high. Indeed, of the fish so far analyzed, it is only surpassed by Caviar, which has a fuel value of 1479 calories per pound, and closely approximated by halibut (salted, smoked and dried) and canned sardines both with a value of 916 calories per pound.

Holmes has performed a number of experiments on man to determine the digestibility of fish. Mackerel protein is found to be 93.1 per cent digestible and mackerel fat 95.2 per cent digestible.

Years ago when mackerel were plentiful in the Fundy area some were shipped fresh, but the majority were salted for the American market, and the remainder were canned. In recent years in Yarmouth, most of the catch has been placed in cold storage. The tinker size are used later as lobster bait, while the medium and large fish are removed as the market demands. Forty years ago canning was a common method of preservation for the Digby and Yarmouth catches, while great quantities were shipped fresh from Charlotte County to be canned at Eastport, Maine. Very few are preserved in cans now, although during the heavy run in 1931, this method of preservation was resorted to at Meteghan.

Summer and autumn mackerel are considered much superior as food to the spring catch. During the summer after spawning, the fish feed, the flesh becomes laden with fat and loses its watery constituency. Clark and Almy have shown the seasonal changes in composition of the flesh of the spanish mackerel from June 4th to October 26th. (See Table XVII). It will be noted that both the total quantity of solids and of fats increase as the feeding season advances, rendering the flesh of higher food value.

When the market cannot take care of large runs of mackerel or fishing gear are inadequate to do so, the surplus supply is largely used for lobster bait and fertilizer. Fox farms can make use of a limited quantity. Experience has shown

that probably owing to the high oil content of the fish, it is not satisfactory to use it for this purpose more than once a week.

Future Possibilities

The mackerel outlook for the future in the area is good if we may use as a basis for judgment the 1931 run. This run, which was distributed all over the Bay, was made up largely of tinkers and, if repeated next year, should consist ofmedium size fish.

Legends for Figures

Figure 1. Mature mackerel showing the markedly forked and keeled tail. Note the characteristic finlets between the dorsal fins and the tail fin, and the ventral or anal fin and the tail fin.

Figure 2. Annual quantities (hundred weights) of mackerel caught and landed in Fundy area from 1869 to 1930.

Figure 3. Graph showing the percentage of total Atlantic mackerel catch (hundred weights) landed in the Fundy area from 1869 to 1930.

Figure 4. Mackerel jig used off Yarmouth County.

Figure 5. Mackerel drift net.

Figure 6. Horizontal distribution of Fundy area mackerel catch in 1929. Dots represent 100 hundred weight and outline circles less than 100 hundred weight.

Figure 7. Horizontal distribution of Fundy area mackerel catch in 1879. Dots represent 100 hundred weight and outline circles less than 100 hundred weight.

Figure 8. Graph showing the annual quantities of mackerel (hundred weights) caught and landed in Yarmouth County from 1869 to 1930.

Figure 9. Graph showing the annual quantities of mackerel (hundred weights) caught and landed in Digby County from 1869 to 1930.

Figure 10. Graph showing the annual quantities of mackerel (hundred weights) caught and landed in Annapolis County from 1869 to 1930.

Figure 11. Graph showing the annual quantities of mackerel (hundred weights) caught and landed in Kings County from 1870 to 1930.

Figure 12. Graph showing the annual quantities of mackerel (hundred weights) caught and landed in Fundy Watershed of Cumberland County from 1870 to 1930.

Figure 13. Graph showing the annual quantities of mackerel (hundred weights) caught and landed in Fundy Watershed of Westmorland County and Albert County from 1869 to 1930.

Figure 14. Graph showing the annual quantities of mackerel (hundred weights) caught and landed in St. John County from 1869 to 1930.

Figure 15. Graph showing the annual quantities of mackerel (hundred weights) caught and landed in Charlotte County from 1869 to 1930.

Figure 16. Graph showing the average monthly catch (hundred weights) of mackerel in the Fundy area from 1926 to 1930.

Figure 17. Graph showing the monthly catch (hundred weights) of mackerel in Yarmouth and Digby Counties from 1926 to 1930.

Figure 18. Graph showing the monthly catch (hundred weights) of mackerel in Annapolis and Kings Counties from 1926 to 1930.

TABLE I

Hundred weights of Mackerel landed each year in the Fundy Area.

	'0	'1	'2	'3	'4	'5	'6	'7	'8	'9
186'										8,706
187'	16,059	4,654	5,389	4,539	3,797'	3,865	14,208	41,871	77,184	28,236
188'	56,326	30,355	29,803	29,803	94,919'	36,346	32,731	28,563	14,052	27,833
189'	46,506	109,749	40,002	6,757	1,966'	4,644	14,523	4,147	6,638	7,433
190'	4,313	3,473	356	1,210	685'	783	5,202	1,842	1,517	1,520
191'	2,448	3,606	23,492	32,954	5,094'	15,878	6,293	10,580	14,801	21,404
192'	6,864	10,384	18,515	14,585	6,158'	3,576	5,646	1,403	4,712	12,137
193'	5,430									

TABLE II

Hundred weights of Mackerel landed each year in Yarmouth County.

	'0	'1	'2	'3	'4	'5	'6	'7	'8	'9
186'										1,725'
187'	2,202	2,865	5,016	2,727	2,466	1,041	7,611	30,954	52,218	15,813'
188'	40,117	28,012	27,769	29,443	53,562	25,301	21,088	24,042	13,980	7,785'
189'	19,821	55,455	11,979	4,944	1,713	4,644	14,265	3,955	6,563	6,588'
190'	3,265	3,130	300	900	570	650	1,300	1,350	1,419	1,320'
191'	2,250	3,480	17,560	18,215	2,380	14,060	6,049	10,017	14,369	14,217'
192'	6,461	9,047	16,214	14,261	5,987	3,345	5,538	1,267	4,333	9,431'
193'	5,083									

TABLE III

Hundred weights of Mackerel landed each year in Digby County.

	'0	'1	'2	'3	'4	'5	'6	'7	'8	'9
186'										6,447
187'	13,083	90	60	------	------	1,149	5,550	1,512	16,266	9,888
188'	8,880	528	1,215	------	40,935	10,170	3,825	3,900	24	------
189'	20,733	36,120	26,253	1,733	75	------	------	36	54	653
190'	969	157	36	24	48	76	2,223	239	7	44
191'	------	95	5,705	13,299	2,562	1,566	116	175	141	3,564
192'	28	647	1,711	193	37	97	------	7	351	2,572
193'	140									

TABLE IV

Hundred weights of Mackerel landed each year in Annapolis County.

	'0	'1	'2	'3	'4	'5	'6	'7	'8	'9
186'										9
187'	------	------	------	1,125	------	------	387	3,780	630	225
188'	360	210	9	------	------	210	300	54	18	------
189'	180	3,945	591	80	38	------	180	------	------	170
190'	------	------	------	------	------	------	------	------	20	45
191'	36	------	84	120	50	69	53	150	19	1,824
192'	111	521	431	30	34	66	33	17	16	92
193'	43									

TABLE V

Hundred weights of Mackerel landed each year in Kings County.

	'0	'1	'2	'3	'4	'5	'6	'7	'8	'9
187'	------	------	------	30	150	75	150	4,335	4,440	75
188'	1,350	180	------	------	80	75	30	162	30	18
189'	651	1,953	165	------	------	------	78	9	20	12
190'	------	186	21	287	67	58	1,673	244	63	105
191'	116	31	------	391	89	164	75	234	267	1,799
192'	264	150	159	101	100	68	75	112	12	42
193'	155									

TABLE VI

Hundred weights of Mackerel landed each year in Fundy Watershed of Cumberland County.

	'0	'1	'2	'3	'4	'5	'6	'7	'8	'9
187'	------	19	12.5	57	281	25	------	210	330	60
188'	75	255	75	------	------	------	240	------	------	------
189'	90	552	129	------	------	------	------	------	------	------
190'	------	------	------	------	------	------	6	10	8.5	6
191'	46	------	------	3	3	9	------	------	3	------
192'	------	3	------	------	------	------	------	------	------	------
193'	------									

TABLE VII

Hundred weights of Mackerel landed each year in Albert County and Fundy Watershed of Westmorland County.

	'0	'1	'2	'3	'4	'5	'6	'7	'8	'9
186'										------
187'	------	1,680	300	600	900	------	------	------	------	------
188'	------	------	------	------	------	------	------	------	------	------
189'	------	120(A)	------	------	------	------	------	------	------	------
190'	------	------	------	------	------	------	------	------	------	------
191'	------	------	9(A)	16(A)	------	10(A)	------	4(A)	2(A)	------
192'	------	------	------	------	------	------	------	------	------	------
193'	------									

A - Albert County

TABLE VIII

Hundred weights of Mackerel landed each year in St. John County.

	'0	'1	'2	'3	'4	'5	'6	'7	'8	'9
186'										------
187'	------	------	------	------	------	15	------	------	------	30
188'	234	36	30	45	42	60	90	------	------	------
189'	------	------	------	------	------	------	------	------	------	------
190'	------	------	------	------	------	------	------	------	------	------
191'	------	------	------	------	------	------	------	------	------	------
192'	------	------	------	------	------	------	------	------	------	------
193'	------									

TABLE IX

Hundred weights of Mackerel landed each year in Charlotte County.

	'0	'1	'2	'3	'4	'5	'6	'7	'8	'9
186'										525
187'	774	------	------	------	------	1,560	510	1,080	3,300	2,145
188'	5,310	1,134	705	315	300	330	7,158	405	75	30
189'	5,031	11,604	885	------	140	------	------	147	.6	10.5
190'	79	------	------	------	------	------	------	------	------	------
191'	------	------	134	910	------	------	------	------	------	------
192'	------	15	------	------	------	------	------	------	------	------
193'	9									

TABLE X

Hundred weights of Mackerel landed each month in Fundy Area from 1926 to 1930.

Year	May	June	July	Aug.	Sept.	Oct.	Nov.
1926	282	3774	1520	3	2	83	--
1927	12	1024	367	---	---	---	--
1928	375	2259	1532	305	252	40	4
1929	1843	6685	447	1653	977	41	2
1930	1789	3319	188	1	20	12	--
Average	860.2	3412.2	810.8	392.4	250.2	35.2	1.2

TABLE XI

Hundred weights of Mackerel landed each month in Yarmouth County.

Year	May	June	July	Aug.	Sept.	Oct.	Nov.
1926	282	3765	1408	----	-----	----	----
1927	9	950	308	----	-----	----	----
1928	374	2218	1479	168	54	40	----
1929	1841	6509	401	60	164	22	2
1930	1780	3181	99	----	20	3	----

TABLE XII

Hundred weights of Mackerel landed each month in Digby County.

Year	May	June	July	Aug.	Sept.	Oct.	Nov.
1926	----	----	----	----	-----	----	----
1927	2	5	----	----	-----	----	----
1928	----	----	14	135	198	----	4
1929	----	40	11	1590	812	119	----
1930	----	4	20	----	------	----	----

TABLE XIII

Hundred weights of Mackerel landed each month in Annapolis County.

Year	May	June	July	Aug.
1926	----	6	24	3
1927	1	9	7	----
1928	1	8	5	2
1929	2	82	8	----
1930	1	36	5	1

TABLE XIV

Hundred weights of Mackerel landed each month in Kings County.

Year	May	June	July
1926	---	----	75
1927	---	60	52
1928	---	8	4
1929	---	28	14
1930	2	96	57

TABLE XV

Hundred weights of Mackerel landed each month in Fundy shore of Cumberland County.

Year	June	July	Aug.	Sept.
1926	3	13	----	2
1927	----	----	----	-----
1928	25	30	----	-----
1929	12	8	3	1
1930	2	7	----	-----

TABLE XVI

Approximate composition of Mackerel. (After Atwater)

	Mackerel No. 1 salted	Mackerel canned	Mackerel salt, canned	Mackerel dressed, (fresh)
	per cent.	per cent.	per cent.	per cent.
Refuse, (bone, skin etc.)	19.7	----	19.7	40.7
Salt	8.3	1.9	8.3	----
Water	34.8	68.2	34.8	43.7
Protein (by Factor Nx6.25)	13.9	19.6	13.9	11.6
Fat	21.2	8.7	21.2	3.5
Ash or Mineral Matter	2.1	1.3	2.1	.7
Total Nutrients	37.2	29.6	37.2	15.8
Fuel value per pound	calories 1, 107	calories 708	calories 1,107	calories 354

TABLE XVII

Percentage Composition of Edible Part of Spanish Mackerel.

(After Clark and Almy)

	Date	Solids	Fat	Ash
Fresh Basis	June 4	33.01	12.59	1.20
	Oct. 26	35.70	16.24	1.11
Dry Basis	June 4		38.14	3.63
	Oct. 26		45.47	3.10