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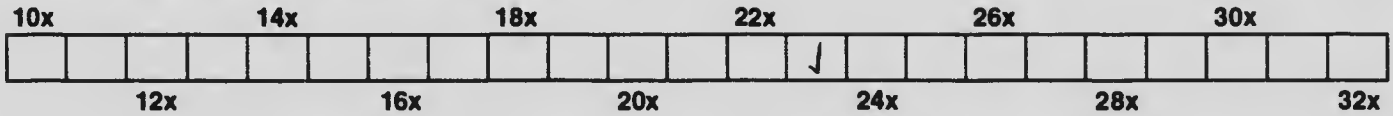

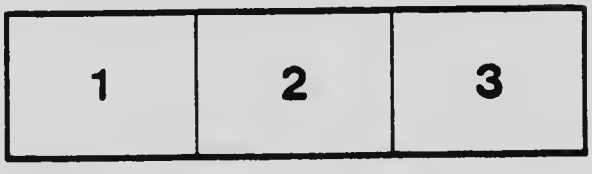

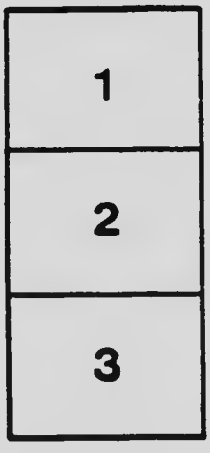

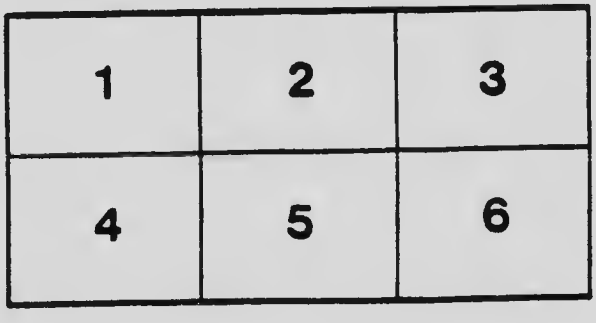

Bulletin of the Biological Board of Canada No. 4

Histories of New Food Fishes

IV. THE MUTTONFISH

By
WILBERT A. CLEMENS
Professor in the University of Toronto

OTTAWA
THOMAS MULVEY
PRINTER TO THE KING'S MOST EXCELLENT MAJESTY
1920

202

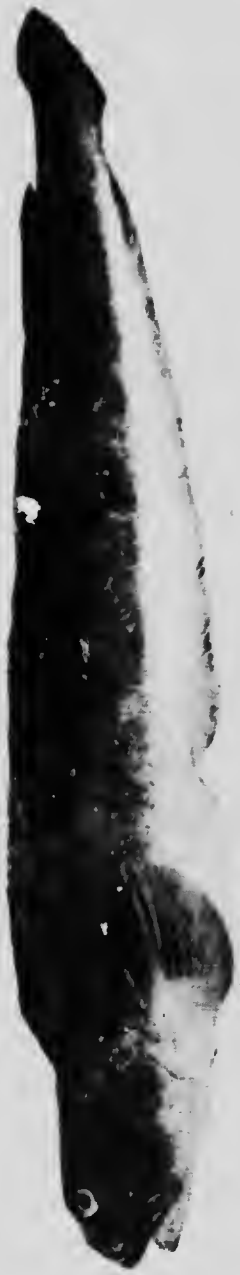

Fig. 1—Muttonfish sixteen and a half inches long from Bay of Fundy.

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202—1½

THE BIOLOGICAL BOARD OF CANADA

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INTRODUCTION.

THIS investigation of the muttonfish was begun in order to obtain some definite information in regard to its life-history and abundance, relative to the possibility of placing the fish on the market for the purpose of augmenting the food supply during the war. Before the study was completed the situation in respect to the war was changed. However, in view of Canada's future increase in population and the probable diminution in quantity of sea food supplies from present sources, it is of importance to consider possible future sources whether for immediate or future use. This is important in connection with the increase in cost of living, for the cost of sea foods should remain comparatively low at least for a very long time, because of the lower cost of production. The muttonfish, for example, occur along the Atlantic coast in considerable numbers and are taken by fishermen on the set lines (trawls) along with haddock, cod, etc., and in lobster traps, but are thrown back into the water since there is at present no market for them. Professor Prince, Dominion Commissioner of Fisheries, in speaking in 1915 before the Commission of Conservation in Canada on "Unutilized Fisheries Resources," said concerning this fish; "In regard to this utilization of these lesser-known fish or fish not valued, I may say that the staff at the biological station at St. Andrews, N.B., have for the last two or three seasons been trying on the mess table all kinds of fish and you would be astonished at the result in the case of some fish that people threw away and did not regard as edible at all. There is one fish called the rock-eel or mother-of-eels, a green eel-like animal. It is viviparous, that is, produces its young alive, and is altogether a peculiar fish. A large one may weigh a couple of pounds. We found that the rock-eel (*Zoarces*) had white flesh of splendid flavour and our staff declared it one of the best fish they had had on the table. That is a fish that could be utilized; there are great quantities along the shores and it is a product the food value of which has not been realized at all."

DESCRIPTION

The body of the muttonfish is compressed and tapers posteriorly to a point around which is a very narrow pointed tail fin. The head is slightly depressed and relatively large and heavy in the older specimens. The sexes are indistinguishable externally except in the older specimens where the head appears to be somewhat larger and heavier in the male. The mouth is large and the strong jaws bear strong blunt, conic teeth. The dorsal fin is very long.

The narrow tail fin extends forward on the underside about one-half the body length. The scales are very small, inconspicuous and do not overlap. The colour is brownish, mottled with olive and black, with the scales appearing as small light dots. In the young specimens the olive predominates and the black is pronounced, appearing as reticulations. The dorsal fin is also marked with black, particularly in the young.

NAME

The scientific name of the fish is *Zoarces anguillaris* (Peck). *Zoarces* is a Greek word meaning viviparous, that is, giving birth to living young. *Anguillaris* is the Latin equivalent for "like an eel." Various common names such as muttonfish, eelpout, conger-eel, rock-eel, ling, etc., have been given. For market purposes it is suggested that the name muttonfish be used. The word eel is applied because of the somewhat superficial resemblance of the body to that of an eel, in the gradual tapering of the body posteriorly and the long, low dorsal fin; possibly also because of the twisting eel-like movements which the fish goes through when brought out of the water on a hook. The head, at least in the older individuals, bears no resemblance to that of an eel and the two fish are in no way related.

DISTRIBUTION

The muttonfish is found along the Atlantic coast from the gulf of St. Lawrence to New Jersey and occasionally as far south as North Carolina. During the summer it is abundant along our Canadian coast on the north coast of New Brunswick and the outer coast of Nova Scotia, and fairly abundant in the Bay of Fundy and Passamaquoddy bay. It comes close in shore during the summer and may be taken with hand lines, seines, trawls, etc. Great numbers have been reported in lobster traps in Miramichi bay. In the fall it apparently migrates into the outer deeper waters, as do many other fish, for example, flounders, for set lines put out in Passamaquoddy bay throughout the winter of 1918–19 failed to secure any specimens. Further evidence of this is given by the record of a specimen 25 inches long taken in a shrimp trawl in the bay of Fundy at a depth of 50 fathoms on April 9, 1918. During the summer the muttonfish are generally taken at depths up to 15 fathoms and even to 30 fathoms in some localities, on every variety of bottom.

LIFE-HISTORY

The European muttonfish or viviparous blenny (*Zoarces viviparus L.*), gives birth to living young during the winter months. It is presumed that our American muttonfish has similar habits

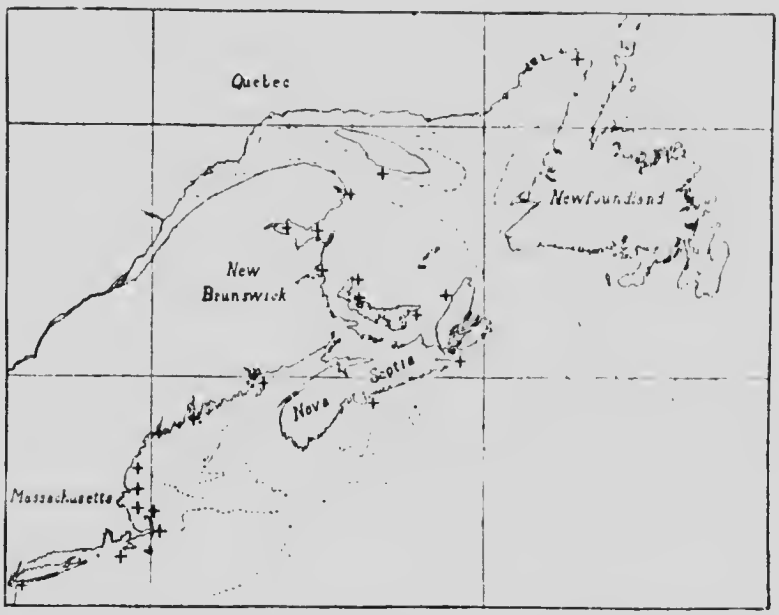

Fig. 2—Atlantic Coast with the localities from which the muttonfish has been reported shown by crosses.

but absolute information is as yet lacking. Females taken from May 31 to October 15, 1918, contained eggs of various sizes but none contained young. As stated above no muttonfish were taken in Passamaquoddy bay during the winter of 1918 19, and apparently they had migrated into the outer deeper waters. On April 5, 1919, there was taken in a seine in St. Andrews harbour a small sculpin which contained in its stomach a muttonfish 1½ inches long. This specimen doubtless was born during the winter. These facts indicate rather conclusively that the reproductive period is in the winter months while the fish are in the outer waters. The young of the first summer come close inshore during flood tides, and may be taken in traps as the tide ebbs. They have also been found around rocks uncovered at the time of low tides.

A study of the age of the fish has been made by means of the otoliths (ear stones) and the vertebræ. The scales which are usually used for the determination of the age of a fish were found unsuitable. In this study the ear stones have been found quite satisfactory but the vertebræ not reliable in the higher years though serving as a rough check on the otolith determinations. About eighty specimens ranging in size from 3 inches to 28½ inches

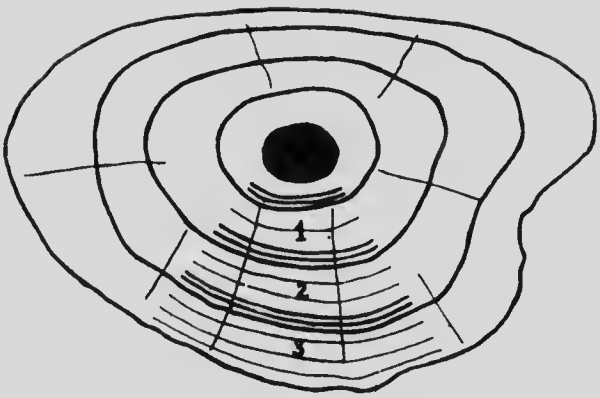

Fig. 3—Drawing of an otolith from a muttonfish 8 inches in length. For explanation see text.

were examined. A drawing of an otolith is shown in fig. 3. The otolith is a small compact mass of calcium carbonate. The stone drawn was 4mm. long, and 2.6 mm. wide. It is found in the internal ear which is an organ of balance not of hearing. The otolith increases in size as the fish grows and this increase takes place by additions of thin layers which show on the stone as fine lines. During the colder season of the year the amount of material laid down is small and the lines appear close together, resulting in a dense opaque area. In the warm season more material is laid down than in the cold season, resulting in the lines being farther apart and producing a lighter, less opaque area. It has been assumed that the muttonfish gives birth to living young, probably in January. The method of computation used in the determination of ages has been the same as that used for its European relative, *Zoarces viviparus*. The dark centre or kernel has been taken as the embryonic beginning, and the narrow light band following as representing the short period in the body of the mother. The first dark band represents the remaining part of the winter period following birth, and the next broad light area, the first summer. From this on the dark and light areas represent the succeeding winters and summers respectively. For example in the illustration (fig. 3) the otolith shows the fish from which it was taken to have

been in its third summer. The following table shows the determinations made for the eighty specimens examined:—

No. of Specimens	Age	Length in inches	Estimated average growth limit in each year, in inches	Increase in length per year, in inches.
6	In 1st year	1½-4	0-4	4½
2	" 2nd "	4½-5	4-6½	2½
6	" 3rd "	7-8	6½-8½	2
3	" 4th "	8½-9	8½-10½	2
3	" 5th "	10-12	10½-12½	2
5	" 6th "	12½-14	12½-14	1½
2	" 7th "	14	14-15½	1½
6	" 8th "	15-19	15½-17	1½
10	" 9th "	16½-20	17-18½	1½
21	" 0th "	17½-21½	18½-20	1½
5	" 10th "	18-22½	20-21	1½
2	" 12th "	20½-23	21-22	1
1	" 13th "	24	22-23	1
1	" 14th "	23½	23-24	1
2	" 15th "	23½	24-25	1
4	" 16th "	24-29	25-26	1
3	" 17th "	24½-27	26-26½	½
0	" 18th "		26½-27	½
1	" 19th "	27	27-27½	½
0	" 20th "		27½-28	½

The first column shows the number of mutton fish of each age.

The second column gives the age as determined by the otoliths.

The third column shows the smallest and greatest lengths found for each age.

The fourth column gives the estimated average growth limits for each year. For example a muttonfish is 4 inches long at the end of the first year, $6\frac{1}{2}$ inches at the end of the second, $8\frac{1}{2}$ inches at the end of the third year, etc. At $2\frac{1}{2}$ years of age it would probably be $7\frac{1}{2}$ inches in length.

The fifth column gives the average growth in inches for each year.

These results are shown graphically in fig. 4. The dots represent the actual determinations while the curve represents the estimated average rate of growth. This diagram can therefore be used to determine the probable age of any muttonfish when the length is known. For example, if a muttonfish is found to be 14 inches long, then following the horizontal line to the left from where the 14-inch line meets the curve, shows the fish to be 6 years of age. A diagram of a fish has been drawn in to illustrate this. It must be remembered that these calculations are only approximate because temperature, food and other conditions affect the rate of

growth very profoundly. For example, one specimen recorded was 23½ inches long, but was only 8 years old, whereas the average age for that length is about 14 years.

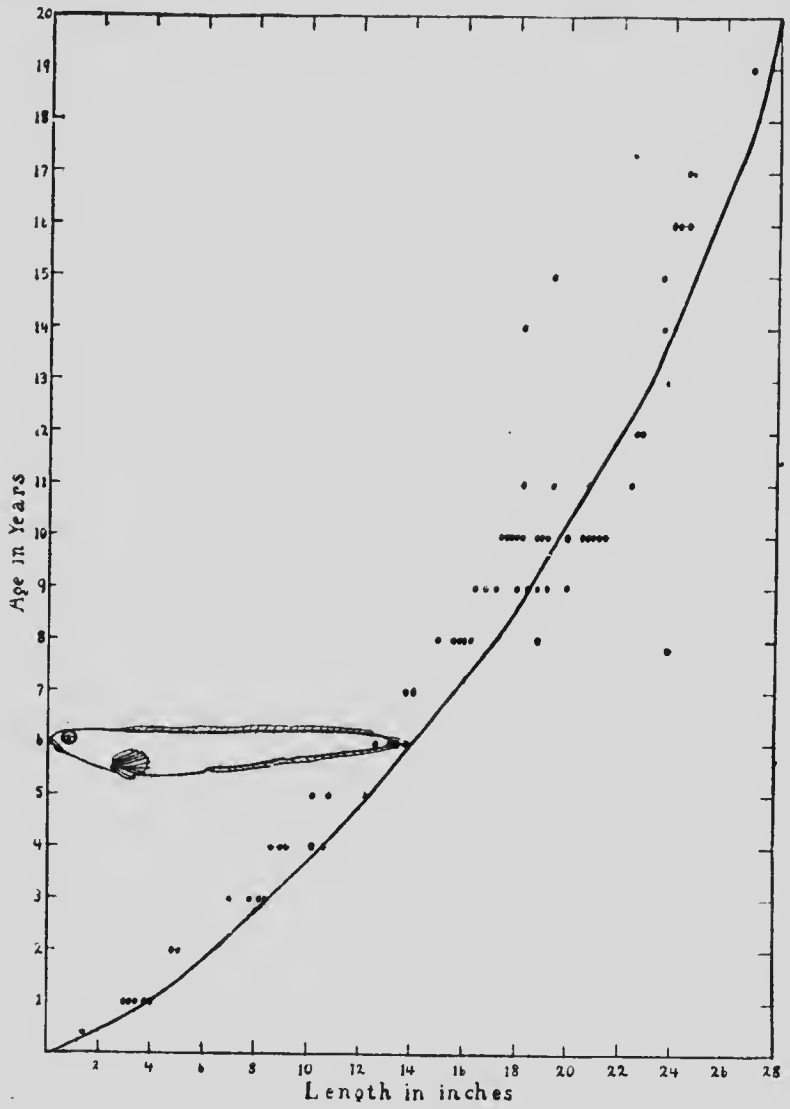

Fig. 4—Curve illustrating the average rate of growth of the muttonfish.

WEIGHT

In the consideration of a fish from the economic standpoint, the weight is of importance. The records for Passamaquoddy bay

Age in years	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Number of specimens	5	3	2	5	2	4	9	17	5	2	1	1	2	4	3		1
Calculated—average weight in oz	$1\frac{3}{16}$	$1\frac{1}{4}$	4	6	$6\frac{1}{4}$	$14\frac{1}{4}$	18	25	28	35	$44\frac{1}{4}$	44	49	54	59		73
Estimated—average increase in weight in oz		1	2	2	3	4	5	6	6	5	5	5	5	5	5	5	5
Estimated—average weight in oz	1	2	4	6	9	13	18	24	30	35	40	45	50	55	60	65	70
Estimated—average length in inches	$8\frac{1}{4}$	$10\frac{1}{2}$	$12\frac{1}{4}$	14	$15\frac{1}{4}$	17	$18\frac{1}{4}$	20	21	22	23	24	25	26	$26\frac{1}{4}$	27	$27\frac{1}{4}$

seem to indicate that the muttonfish is not a heavy fish in relation to its length, and the increase in weight per year is not great. The preceding table shows the relations of weight to age and length.

REPRODUCTIVE CAPACITY

Counts of the number of eggs in the ovaries of female muttonfish show an average of 1,800 eggs per individual. This number is small in comparison with the egg production of spawning fish which give no care to their eggs or young, for giving birth to living young eliminates the ordinary immense egg wastage. This is but another illustration of the biological principle—the better the nurture, the fewer young necessary to maintain the race. The enemies of the muttonfish are probably numerous, especially in its early years. Sculpins, sea-ravens, and skates are known to feed on them.

FOOD

Examination of the digestive tracts of 70 specimens taken from May 31 to October 15, 1918, in Passamaquoddy bay region shows that the chief article of food is sea-urchins. One specimen 24 inches in length taken in the St. Croix river had eaten over 51 small sea-urchins. Other forms found in abundance in the digestive tracts were barnacles, snails and small clams. Some of the less abundant forms were hermit crabs, whelks, serpent stars and annulate worms. This shows that the muttonfish is a bottom feeder but is not a scavenger.

CAPTURE

The muttonfish is regularly taken on set lines put out for haddock, cod, etc. In the Passamaquoddy bay region in a catch of from 80 to 100 haddock there may be from 6 to 12 muttonfish. The following are the available records of set line catches:—

1917—Off Cheticamp (Cape Breton,)	3 sets	squid and mussel bait,	aver. 6 per	3000 hooks.
1917—Passamaquoddy bay,	1 set	herring bait	average 105 per	3000 "
1918	1 "	" "	" 6 "	3000 "
1918—St. Croix river,	10 sets	" "	" 12 "	3000 "
1918— " " "	19 "	clam bait	" 30 "	3000 "
1918—Wolves islands (Bay of Fundy),	1 set	herring bait	" 1 "	3000 "
1918—Miramichi bay,	5 sets	gaspereaux bait	" 9 "	3000 "

In 1918 in Miramichi bay lobster traps usually contained one or two specimens. No records have been obtained for the trawling vessels off the Nova Scotia coast.

MARKETING

The large head which might be considered objectionable by some purchasers would probably have to be removed before placing the fish on the markets. Removal of the head and internal organs

means a loss in weight of about 40 per cent. This calculation is based on 50 specimens ranging in size from 12 to 28 inches.

Average weight	1	specimens,	12-16	inches,	13 oz.;	dressed		8 oz.
"	"	20	"	16-20	"	1 lb. 3 oz.;	"		12 oz.
"	"	19	"	20-24	"	2 lbs. 1 oz.,	"	1 lb.	5 oz.
"	"	7	"	21-28	"	3 lbs. 8 oz.,	"	2 lb.,	

The internal organs should not be allowed to remain in the fish for any great length of time after capture because of the development of a peculiar odour probably due to the character of the food. The flesh is solid and when properly handled there is very much slower deterioration in quality than in the case of fish with much softer flesh. This means that there should be no difficulty in shipping the muttonfish to distant markets.

PALATABILITY

The flesh of the muttonfish is white, solid, of good appearance and fine flavour. It is not oily and not more bony than the ordinary fish. It has been placed on the table at the Biological Station, St. Andrews, frequently, and all who have eaten it have pronounced it very good. Bean in "Fishes of New York" says: "It affords a very savory food." The flesh of some of the older fish may be slightly tough when fried, but is quite tender when boiled. The skin can be removed without much difficulty before cooking if desired.

PARASITES

During the summer of 1918 a considerable number of muttonfish taken in the Passamaquoddy bay region were found to be infested by round worms in the body muscles. From May 31 to July 23 the extent of this parasitism was not realized and no record was kept, although a few cases were noticed. After the latter date, of 41 specimens examined 25 individuals were found to be parasitized, which is a percentage of 60. The worms are about an inch in length and not more than three have been found in a single fish. Similar worms have been found in the muscles of flounders and cod taken in the same region and possibly this parasitism may be only local and only occur to any extent in certain years. Authorities on fish parasites are agreed that there is no evidence that these round worms can live in the human body, and when the fish is cooked there is absolutely no danger. The worms do not render the fish unfit for food and if flounders and cod so parasitized find ready sale, the muttonfish need not be condemned.

CONCLUSION

The European muttonfish has been on the European markets for many years. Our American muttonfish is reported in the New York markets from time to time and might well be introduced into our Canadian markets. The numbers in some regions, as for example Passamaquoddy bay, are not great, and the number taken in a day by a fisherman would be comparatively small, but the aggregate for the whole fishing region of the Atlantic coast would be surprisingly large. A fisherman taking from ten to twelve a day would have no small total at the end of the season and even if the market price was relatively low, he would find an appreciable addition to his income at the end of the season. Moreover, if the muttonfish can be placed on the market it will mean an addition to our food supply of a meat of moderate price, fine palatability, and good nutritive value, which is at the present time entirely discarded.