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Title

EXPLORATION IN THE DEEP WATER OF HILLSBOROUGH AND WEST RIVERS IN THE VICINITY OF CHARLOTTETOWN, WITH A VIEW TO FINDING THE ABUNDANCE AND DISTRIBUTION OF OYSTERS, 1931.

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Exploration in the deep water of Hillsborough and West rivers in the vicinity of Charlottetown, with a view to finding the abundance and distribution of oysters, 1931

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In 1929 Captain Wallace MacLeod, then in charge of the "Ostrea" discovered certain beds of small oysters in depths of 25 feet or more in Hillsborough river between McNally's wharf and Scotchfort (Cranberry wharf). These were used in experimental transplantations to shallower areas in the upper parts of Hillsborough (= East) river above Scotchfort and were found to grow well in those situations although they seemed all to be somewhat stunted when first fished. They showed markings indicative of considerable age but were almost all well below marketable size. It was thought that these oysters might prove of great value if transplanted to shallower areas and could be regarded as a source of seed stock. The information below was brought together with the end in view of finding how great was the supply and where it was to be found. For this purpose special trips were made with the "Ostrea II" in addition to information gained from the search for the stunted oysters used in transplantation experiments. The growth of the oysters before and after transplanting and the results of the transplanting experiments are given elsewhere. Only the exploration of the deep waters of the two rivers (Hillsborough or East and West or Elliot) is reported here.

Summary of information previous to the special exploring trips

From the experience of the captains of the "Ostrea" and from short trial trips in the autumn of 1930 and 1931 it has been found that there are small oysters in good quantities in the channel commencing shortly below Cranberry wharf and continuing to the neighborhood of McNally's wharf. The greatest abundance is to be found in the middle of this stretch and by the time McNally's wharf is reached the oysters become few in numbers.

These small oysters have been used in considerable quantities for planting in the upper parts of the river, and the area above McNally's wharf is limited. The total length of the channel between Cranberry and McNally's wharves is three miles. Subtracting that part just below Cranberry wharf where public fishing is in progress and where the oysters are not so abundant in mid channel, and there is left not more than two miles of channel in this area in which the small stunted oysters can be dredged in good quantities. The width of the channel does not average much over 150 yards in this stretch and as not all of the channel is occupied by oysters there cannot be more than $1/10 \times 2$ square miles of them or about 125 acres. The actual area where they are abundant must be less than this as they are not uniformly distributed.

It is obvious then that the quantities are far from being unlimited in this area between McNally's and Cranberry wharves.

Exploration of the channel of East river below McNally's wharf.

East river. September 25. In the afternoon the "Ostrea II" left Mount Stewart shortly after 1 P.M. There was a strong north-west wind. High water 9.36 A.M. Low water 4.06 P.M. Steaming directly down the inlet to the railroad bridge at Charlottetown successive drags with the dredge were made on the way back up the inlet. The drags were commenced just above the bridge and continued at intervals as far as McNally's wharf. All were made in the channel, although a certain number were made towards the sides. Rough weather prevented too close approach to the sides of the channel. Each drag occupied from one to two minutes depending on the kind of bottom and the nature of the hauling. Each drag, then, covered from 125 to 200 yards. The greater number were made near 125 yards in length. In all 22 drags were made on this trip.

Detailed results of each drag are given below.

1a, b, and c. Three drags made in mid-channel between the bridge and the asylum at Charlottetown. 3.00 to 3.10 P.M. Depth 40 to 50 feet. Drags contained chiefly rocks, a little seaweed and a few shells. No living molluscs were observed. No mud.

2. Mid-channel, off Fullerton's creek. Completed 3.15 P.M. No oysters. Rocks and a few dead scallop (Pecten) shells. A little dead eel-grass in all hauls, thus far. Depth about 45 feet.

3. North part of channel, off Fullerton's creek. Completed 3.20 P.M. No oysters. Red rocks and a few crabs (Cancer). One or two dead quahaug (Venus) shells. Barnacle marks on stones. D. 35'.

4. Off point northeast of Fullerton's creek. South side of channel. Completed 3.27 P.M. No oysters or shells. Drag full of eel grass and a few small stones. Depth 20 feet.

5. Mid-channel off Munn's cove. Completed 3.41 P.M. Depth 35 feet. No oysters. Small stones, a little eel-grass, a few shells (scallop, oyster and razor), a starfish.

6. Mid-channel off ^{South of} Munn's cove. Completed 3.33 P.M. Depth about 40 feet. 1 live oyster, thick-shelled, round, 4". Eel-grass, a few small stones, large razor shells.

7. North part of channel. Completed 3.48 P.M. No oysters. Small stones and a few shells.

8. Mid-channel. Below Red point (on south side). 3.55 P.M. No oysters. Stones and mud, starfish and some eel-grass. Sponges and a few shells.

9. Mid-channel off Red point. 4.03 P.M. Chiefly small stones with some mud, shells and shell fragments and a few starfish.

10. North part of channel, off old ("Apple tree") wharf. No oysters. Largely small stones. Some sponge, large clam shells, starfish etc.

11. North part of channel off Red point wharf. Depth 15 feet. 4.10 P.M. A few stones and a crab (Cancer). No oysters.

12. Same as 11, a little east. 4.15 P.M. No oysters. Many small stones and some sponge (red).

13. Mid-channel. Off mouth of Johnson's river. 4.25 P.M. A few oysters, one of marketable size: round and thick-shelled. Bag full of small stones with some mud, grass and sponges.

14. Mid-channel. 4.35 P.M. One cluster of small oysters. Shells, sods, mud and grass. Large "cockle" (Polynices) shells.

15. North side of channel, next to black buoy just south of Ram island. 4.45 P.M. One small cluster of small oysters.

Mostly shells and small stones, some mud. Depth about 10 feet.

16. Mid-channel, off Ram island. 35 feet. A few spherical oysters, - probably very old, very thick shelled with small bodies, some considerably bored by sponge. Pretty full drag, mud, stones and shells. Red sponge on shells.

17. Mid-channel, above Ram island. 35 feet. 4.55 P.M. Only one oyster, about 2" long. With Crepidula. Full drag of mixed stones, mud, shells and sods.

All oysters seen so far on this trip were round.

18. Mid-channel. 35 feet. Largely grass (Zostrea), some "sea lettuce", shells, mud and red sponges. Full drag. No oysters.

19. Mid-channel. Just below McNally's and Hickey's wharves. 35 feet. 5.07 P.M. About 40 small round oysters mostly in clusters. Drag full. Largely sods, some mud and shells.

20. Mid-channel between the two wharves. About 2 peck of small oysters. Sods, mud and shells. Much large red sponge. Crepidula, crabs, grass etc. Many barnacles on oysters.

In lower reaches Crepidula plana more abundant than C. fornicata. In upper reaches latter more abundant.

Between September 25 and October 14, Captain Doucette with the "Ostrea II" made drags along the edge of the channel about Ram island and thence upstream towards McNally's wharf. He found few oysters or none. No worth while quantities. He states that even above the wharves there are places where there are few or no small oysters and that they are getting scarce on some of the better grounds from which the "Ostrea II" has been taking them for transplanting.

East river, October 14th. Most of the trial drags made on September 25 were made in mid-channel and it was thought that in this way large quantities of oysters along the edges of the channel might have been missed. It will be noticed that, in the lower reaches especially, the bottom in mid-channel is clean - sometimes with little but stone coming up in the drags. This was thought to be due to the action of the current which is very strong, the inlet being long and narrow. It was further thought that such currents might very well be too great for the oysters. The first oysters which were found, proceeding up the river, were small and had very thick shells. The writer believes it probable that these oysters were quite old and that their small size and strange shape were due to continual breaking of the edge of the shell as the oysters were rolled on the clean rocky bottom. This is further evidence of the unfavourable conditions in the middle of the channel as the current increases as we proceed down stream. It is quite possible that considerable quantities of oysters have been missed but the trials made on October 14 were intended to explore both the edges and middle of the channel to compare the conditions. For this purpose drags were taken from side to side of the river along three sections.

Section across the river in the wide part between Ram island and McNally's wharf.

A 1. Along south side. Depth 14 feet and slightly over. Hard mud bottom. Long drag. About a peck of small oysters. Grass, black mud and shells. (Neopanope, small bivalve (quahaug?)).

2. Continuation of 1. Depth 12 to 15 feet. A few small oysters. Sods, a little eel-grass and some oyster shells.

3. Along south side farther out. 4 to 4½ Fm. (24 to 27 feet) One old stunted oyster. Sods, shells, grass. One or two live quahaugs. (Two kinds of crabs).

4. Mid-channel. 30 feet. A few small oysters. Stones. Red sponge.

5. Along north side of channel. 12 to 24 feet. Catch grass and practically nothing else. (Zostera). Some black mud. (Small crabs hiding in red sponges).

6. Along north side of channel. 10 to 18 feet. Bottom muddy to pole at ten feet. Long drag. Eel-grass and some black mud, some sods, few shells. No oysters.

7. Along north side of channel. 6 to 15 feet. Black mud mixed with a lot of shells. No oysters. (Small flatfish)

B Section across river in narrow part off Ram island.

1. South side going east. 12 to 20 feet. Drag empty.

2. South side going east. 12 to 20 feet. Mud, shells, grass etc. No oysters.

3. Mid-channel. 33 to 36 feet. Shells, stones, some small oysters (thick), red sponges and yellow sp., sculpin (*M. aeneus* ?).

There had been *Crepidula fornicata* in previous hauls with only one or two *C. Plana*.

4. Mid-channel. 36 to 39 feet. Stones and eel-grass largely. (Red and yellow sponges, crabs, two kinds of worms, a few shells, more barnacles than farther up river.) No oysters.

5. North side of channel. 18 to 24 feet. About a bushel of small oysters, shells and mud. One spiny sculpin (*M. octodecimspinosus*).

6. North side of channel. 6 to 15 feet. No oysters. Black mud and shells.

C Section across river just below Red point wharf.

1. South side of channel. 12 to 20 feet. Soft black mud and eel-grass. (Several *Nereis* and some other worms).

2. Towards south side of channel. 35 feet. Stones only.

3. Mid-channel. 24 to 27 feet. Several oysters, thick cups mostly small. Full drag of mixed mud and shells. (Cancer).

4. North side of channel east of black buoy. 10 to 20 feet. Two or three stones, a sod and some eel-grass.

5. North side of channel off black buoy. 18 to 30 feet. Stones, black mud and a few shells. (Some small crabs, *Neopanope*).

Crepidula plana just beginning to be more abundant than *C. fornicata*. c.f. farther up inlet.

Work done in afternoon, leaving Charlottetown at 1.30 P.M. (delayed to wait for draw-bridge), commenced drags above Ram island 2.45 P.M. and finished drags off red point wharf 4.45 P.M. Tide high 12:53, low 4:45 P.M.

West river, October 13th. The following series of drags were made in West river (Elliot river) in the afternoon of October 13th. Their purpose was to discover whether there were large quantities of small oysters to be found in the deep water of this inlet similar to those at the head of East (Hillsborough) river. The boat proceeded directly to the head of the easily navigable part - i.e. to a point about 7 or 8 miles from Charlottetown (farther following the course of the channel) where there are two wharves facing each other on the opposite sides of the channel.

1. Mid-channel just above wharves, going upstream, 30 feet. Rocks and some fresh eel-grass. A few crabs (Cancer). 3:02 P.M.
2. Continuing above 1. Small rocks, crabs, large clam shells, one 3" oyster. 30 feet. (Some *Littorina Litorea*, one or two *Solen?*, *Crepidula plana*, *Mya* and *Venus* shells, large Cancers).
3. Going back over same ground as 2. and 1. Muddy with fine shells and eel-grass. One 3" oyster and one large quahaug. 3. 49 P.M. (small crab - *Neopanope* - small starfish (1), worms in wood, hydroids).
4. Between wharves, 27 feet. 3.57 p.m. Small bag. Small rocks, crab, quahaug shells, very little eelgrass, dead oyster.
5. Just below bridges. 30 feet. 3.59 p.m. Muddy with small stones and clam and quahaug shells. (Red sponge).
6. First black buoy below wharves, just rounding buoy, more or less on edge of bank. 4:02 p.m. Small flounder, eel-grass and a few quahaug shells.
7. Mid-channel just above red buoy. 27 feet. 4:07 p.m. Eel-grass and mud, crabs and a few small stones.
8. Off red buoy. Mid-channel. About 20 feet. 4:11 p.m. No live bivalves. Red sponges and yellow. Small stones, shells and mud. Crabs and *Littorina* shells.
9. Off 2nd black buoy below wharves. 30 feet. 4:15 p.m. Small haul. Scallop shells, yellow sponge, one large crab, some eel-grass. (Small *Ophiopholis aculeata* ?).
10. Nearing red buoy. Big haul. Oyster shells, stones, mud, a little eel-grass, quahaug shells, dulse. (a small *Gammarus* ?).
11. Half-way to next buoy (black). 40 feet. 4:22 p.m. (Chain at 45° possibly not very efficient). Chain shorter than on September 25 or October 14). Almost nothing in drag. Eel-grass and *Solen* shell.
12. Rounding black buoy. 27 feet. 4:28 p.m. Chain at 20° or less. Rough hauling. Rocks and a little eel-grass, oyster shells, cunners, and a little mud. (Small crabs in sponge. A third kind of crab in addition to *Cancer* and *Neopanope* seen and preserved).
13. Off red buoy. 25 to 30 feet. 4:34 p.m. Small haul. Rough dragging. One or two small rocks, a few oyster shells and clam shells, a little eel-grass. (Tube worms, starfish, small brittle-star). (*Pholis gunnellus*, one).
14. Nearing blackbuoy. 4:50 p.m. Over 30 feet. Small haul. Stones and grass and a few shells, (scallop, quahaug and oyster).
15. Nearing Rocky point ferry wharf. 4:53 p.m. Over 40 feet. Chain at 45°. Rough hauling, small haul. *Solen* shells, yellow sponge, stones, a few live scallops, *Crepidula fornicata*.
16. Next to 15, nearer ferry. Stones and a few scallop and razor shells. A few live scallops, *Crepidula fornicata*. The scallops in this and the previous hauls were about five inches in diameter with the exception of one small one about 2 inches in diameter.

17. Off Rocky point ferry wharf. Depth 35 feet. 5:03 p.m. Stones only with a few starfish.

Weather was clear with light westerly wind. Tide high at 12:01 p.m.; low at 6:00 p.m.

Consideration of Results.

The exploration was made primarily to find out the extent of the deep area which supported large numbers of oysters. The bottoms too deep to be fished with tongs were the parts of chief interest as these areas were regarded as a potential source of seed without interference with the existing fishery. The findings are summarized below.

1. An area of not more than 125 acres near the head of Hillsborough or East river supports now an abundance of small and apparently stunted oysters. This estimate of the area is based on the assumption that the greater part of the channel supports the oysters. This is not certain as all of the area has not been covered and within that part on which dredging has been carried out the abundance varies greatly. It is probable that the actual area where the oysters are abundant is much less. The area of channel bottom supporting oysters lies between Scotchfort (Cranberry wharf) and McNally's and Hickey's wharves which face one another about three miles down the inlet. As the lower reaches of this stretch are approached the abundance of the oysters decreases and at the upper end there is a public fishery now of considerable importance and the growth of the oysters in the channel is somewhat better. There is, therefore, not more than two miles of channel where an abundance of oysters are available for seeding purposes.

2. The deep water in the channel of Hillsborough river below this supports no abundance of oysters where it has been examined to date. No oysters were found in mid-channel in seven drags below Munn's cove where one 4" round thick-shelled oyster was found - about three miles above the bridge at Charlottetown. No more were found in mid-channel until the mouth of Johnson's river was reached six miles above the bridge and about 2½ miles below McNally's wharf. Here a few oysters were obtained - one of marketable size. From this point up a few oysters mostly small and round, appeared in the dredgings in the channel, but it was not until McNally's wharf was reached that as many as half a peck were taken in a dredging for 125 yards or more. The dredgings in the lower part of the river indicate that the strong current keeps the bottom clean but that it does not seem to be favourable to the growth of oysters. The temperature and salinity are more favourable than in many places where oysters are found and it seems probable that the current is too strong - probably moving the rounded red stones about. Among the oysters found farthest down the inlet most individuals were very thick-shelled but with small bodies - a shape which suggests that they had been rolled about and continually had the edge of the shell broken, resulting in the prevention of growth except in the thickening of the shell, and consequently in an almost spherical shape.

3. The dredgings made in the lower part of West (Elliott) river revealed conditions similar to those in the lower parts of East (Hillsborough) river. No oysters were found in the channel below the two wharves, i.e. within seven miles of Charlottetown.

4. Thus it is seen that the deep water of the channels of East and West rivers supports an abundance of oysters only in certain places and that the abundance is far from a general thing. The only area discovered to date where oysters are to be found in worth while quantities in the deep water of the channel is the stretch of East river between Scotchfort and McNally's wharf described in 1. above.

5. The whole area has not been explored thoroughly and the ilure to find other areas where the channel supports large quantities of small oysters is not yet conclusive. There is good possibility that worth while quantities are to be found in the deep water in places which have not yet been tried. The areas where dredging has not yet been carried on and where the probability of finding beds of small oysters is greatest are as follows: (a) The upper part of West river. The part corresponding to the stretch between Scotchfort and McNally's wharf has not yet been examined. It is possible that there is a limited length of channel at the head of the deep water in East as in East river. (b) No dredgings have been made in North river (York river) and the same is true of this river. (c) It is yet possible that considerable quantities may be found in the lower parts of East and West rivers in limited areas where the conditions are suitable. This cannot be considered highly probable but it can be expected that small quantities, at least, might be found in some places. It is suggested that in the more sheltered coves or bends of the channel or in a narrow zone along the sides beds of oysters may be found in future. It is recommended that further exploration be carried out next season (1932) in these places - especially (a) and (b). These are considered the more promising places to explore. With reference to (c) it may be noted that the three series of dredgings in different positions from one side of the channel to the other in East river did not on the whole alter appreciably the picture presented by the previous mid-channel dredgings. But those dredgings in different depths and positions close to one another confirmed the writer's suspicions that the small oysters were very local in the distribution. An abundance of oysters may obtain within a few yards of their complete absence.

6. In view of the limited quantity of small oysters in deep water discovered to date, it is important to take especial care to conserve the supply and make the best possible use of it. There are still many thousands of bushels in the Scotchfort - McNally's wharf area but the area and, therefore, the supply of oysters is by no means unlimited.

7. In order to insure the continuance of a reserve for spawning purposes it is recommended that no oysters be removed from the channel in the upper part of this stretch - within half a mile of Scotchfort (Cranberry wharf). Such a reserve is of value both to the areas where the public fishery now exists and to the remainder of the area just below. It is pointed out that the rate of replacement of the small oysters in the channel is not known and it cannot be safely assumed that the natural reproduction there will still remain high, although it is obvious that an abundant natural "set" has occurred there in certain years. We must, therefore, maintain a large reserve for spawning purposes as it is probable that the abundance of oysters in the channel plays an important part in the abundance of the set and the removal of large quantities of oysters from the channel might quite possibly reduce the set. It is like killing the goose that lays the golden eggs.

8. In addition to the reserve recommended above it is desirable that steps be taken to assist the natural reproduction in the channel.

9. In view of the limited quantities of small oysters in the channel it is recommended that the Department of Fisheries exercise strict control of the removal of these oysters. Two alternatives by which control of the removal and provision for assistance of the natural reproduction could be carried out are outlined below.

(a). As the first alternative and that favoured by the writer it is suggested that the removal of the oysters be carried on by the Department alone and that the use of dredges by anyone else in Hillsborough river be prohibited. The oysters could be sold to lessees of oyster ground at a price of about \$1.50 per barrel which is well within their worth. With the proceeds from this sale the costs of the fishing would be covered and a profit of about \$1.00 per barrel result. This profit would be utilized in cultural work to maintain the supply of small oysters in the channel. This would take the form of landing all shells taken with the oysters, separating them, leaving them on the shore over winter and planting them at the proper time next year for the collection of spat. In this way the operations would be self-supporting and probably yield a slight net revenue.

(b). As the alternative to the above, dredging by private individuals might be permitted but the quantities strictly limited by the Department. A royalty could be collected for the oysters and the shells required to be landed. With the royalty the Department could plant the shells.

The relative merits of these two suggestions for the utilization of the small oysters in the channel need to be carefully considered. The second alternative has been found to work well in Delaware bay on the New Jersey side. There the good areas for natural "set" (meaning set on shells on the bottom) are thrown open to dredgers who in turn plant them on their own grounds or sell them for planting purposes. The State collects a royalty with which it plants the shells resulting from the shucking operations. The writer does not believe that a similar method would succeed here for several reasons. In the first place the area in Hillsborough river is small and that in Delaware bay large. Therefore, the amounts taken would have to be limited here whereas they are not there. It is doubtful whether private dredging could be adequately controlled to the satisfaction of both parties. It may be found in the future that the production of spat in the channel may be sufficient to allow the complete removal of the small oysters each year without harm; but that is an extremely doubtful eventuality and for the present the writer believes that strict control is necessary. A further argument in favour of the prohibition of dredging by private individuals in Hillsborough river lies in the difficulty of protecting the present public areas to prevent dredging of them, removal of small oysters, etc.

The writer would strongly recommend that at least for such a time as would suffice to indicate the rate of replacement of the small oysters, their exploitation be done solely and directly by the department. The desire which has already been shown by various parties to lease ground in the neighboring bays on the North shore and engage in oyster culture, shows that there will be a demand for the small oysters for planting purposes, and if the experimental transplantation of some of the small oysters is as successful as is expected by the writer the demand will be increased and there will be every reason for satisfying it.