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RHEOTAXIS IN CAPTURE OF HERRING

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Rheotaxis in Capture of Herring

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A large proportion of the several hundred weirs in the Passamaquoddy region of southern New Brunswick that take small herring or "sardines" are on the shores of the islands that form an archipelago across the mouth of Passamaquoddy Bay (fig. 1). These weirs are of most varied character through being constructed to suit the particular local situation according to the experience and ideas of the fishermen, which change not infrequently. The general type known as bar weirs illustrates the way in which the herring are captured through swimming rheotactically, that is, against the current.

The Black Prince weir illustrates this particularly well. It is situated (fig. 1:1) on the outer side of Deer Island near its southwestern point. It was reputedly the first sardine weir on this shore and was taken over by the father of the present owner (Arthur Haney) in the 1860s, when these small fish came into demand for conversion into oil and fertilizer. This weir is in the course of the strong flood tide that enters from the northeast and that has to turn through a right angle around Deer Island Point to flow northwestward into the Bay. This means that the strong flow of the ebbing tide southeastward past the point creates an eddy where the weir is, so that there is a current flowing past and through it toward the southwest three-quarters of the time (fig. 2).

Figure 1. Archipelago across mouth of Passamaquoddy Bay (A) between mainlands of New Brunswick (N) and Maine (M) the largest islands are Deer (B) and Campobello (C). Arrows indicate courses of main flood tide from the Bay of Fundy (D). Locations of Black Prince weir (1) and Harwood Island weirs (2) are in these courses, but in eddies of the ebb tide. Scale: $\frac{1}{8,130}$

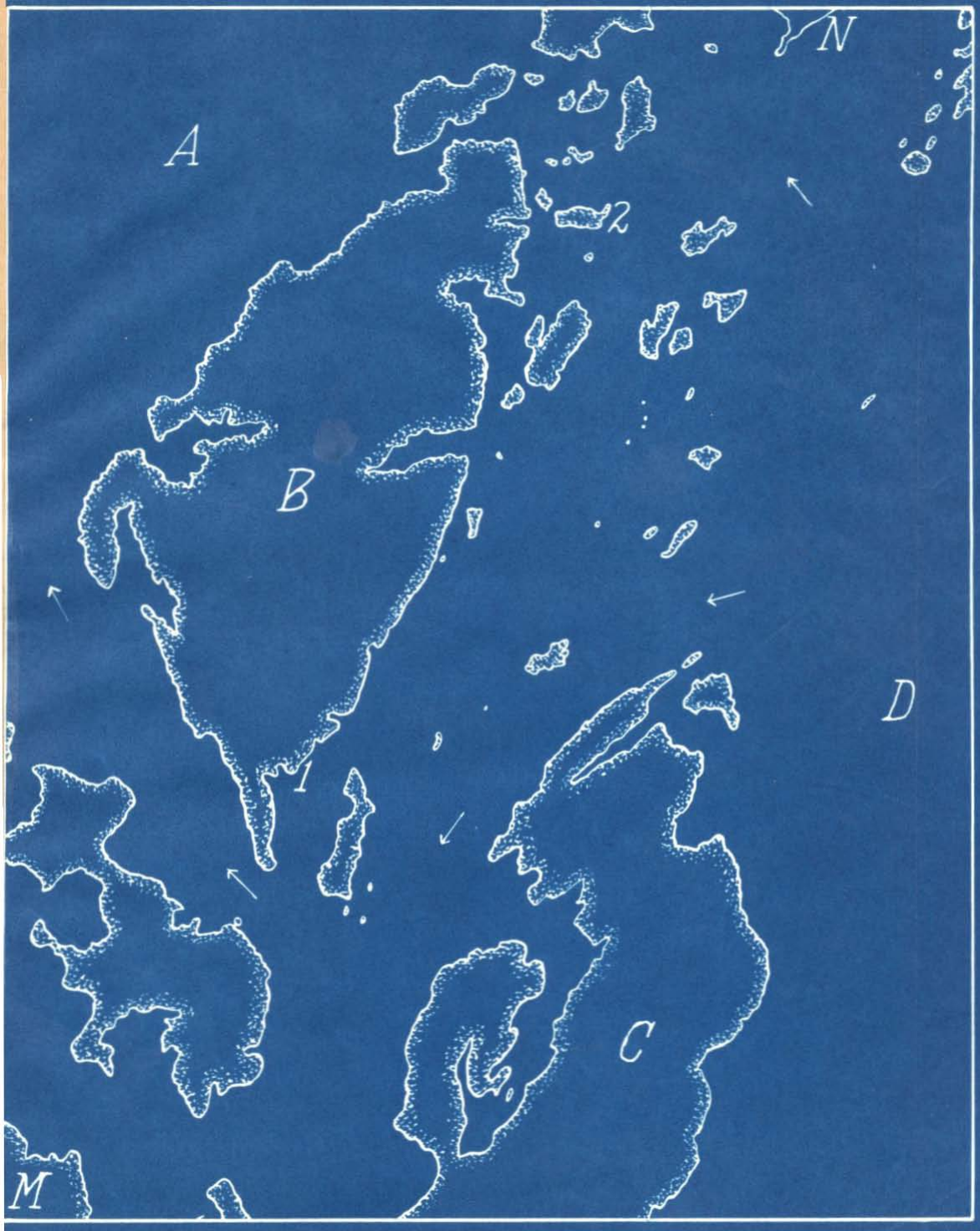
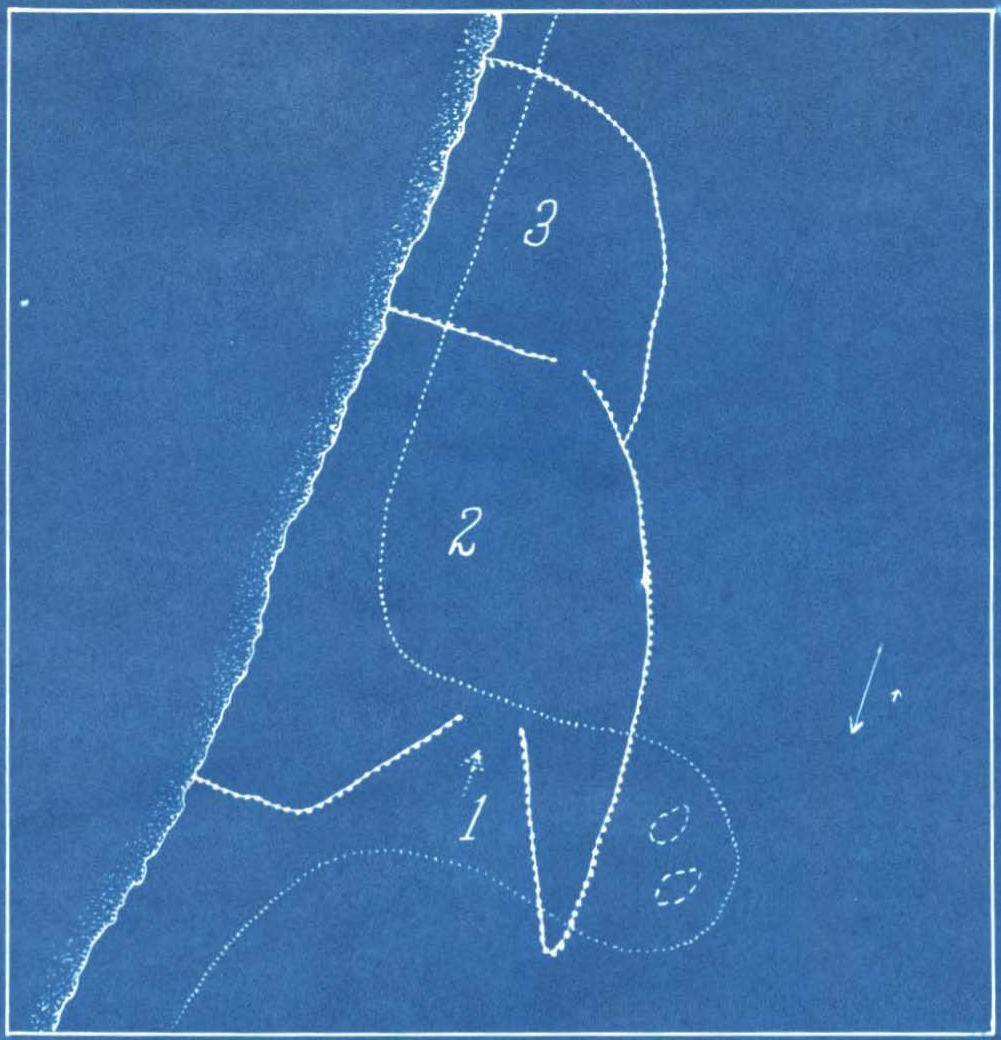

N
A
2
B
D
1
C
M

Figure 2. Black Prince, a bar weir, situated along the shore of Deer Island and consisting of entrance funnel across the bar (1), heart (2) and pound (3) as constructed in 1952. Dotted line indicates low tide level. Solid arrows indicate directions and prevalence of current, the one lasting six times as long as the other. Dotted arrow indicates swimming direction into the weir of herring against slight current. Scale: $\frac{1}{915}$


3
2
1

The way in which the Black Prince weir takes the herring is as follows: With the current to the southwest running strongly, any fish brought by it along the shore collect in the eddy on the southern side of the bar, that is, at the mouth of the weir. As the current slackens toward high tide, the fish leave the eddy and rheotaxis directs them through the funnel over the bar and so into the weir (fig. 2).

Harwood Island is situated (fig. 1:2) on the outer side of Deer Island, and near its northeast end. In somewhat similar fashion to the Black Prince weir, it is in the course of the flood tide, and more or less in an eddy of the ebb tide, so that the water flows around it predominantly in one direction (fig. 3). The four weirs which have been operating steadily (fig. 3: 1, 2, 3, 4) are variously built, but are all in relation to jutting bars and with their entrances downstream with the prevailing current so that they may take fish in the way that has been described for the Black Prince weir. They cluster around the eastern half of the island, which receives the main force of the current. The western half was without weirs for ten years or more, but one (fig. 2:5) was erected tentatively in 1952. It is not in relation to a bar. In the past, various weirs have been built on this site, as reported by Mr. Everett Stewart, who operated some of them. The second one built had a centre fence to shore, so that the fish could enter it either from the east or from the west. They were found to enter it only from the west, and, therefore, the third weir was built with only a

Figure 3. Weirs around Harwood Island (B) in 1952: Golden Press (1), Pinafore (2), Dream (3), Centennial (4) and Golden Rod (5), Deer Island (A) to left. Arrows indicate prevailing current (flood tide). Single dotted lines indicate low tide level, double dotted 5 metres (3 fathoms) deep, and triple dotted 9 metres (5 fathoms deep).


1
2
B
5
4
3

western entrance. The fourth weir was again built with both eastern and western entrances, but at a point nearer the Irish Channel at the west end of the island, which is narrow and shallow. Fish entered it again only from the channel side, and were observed to swim into it against the current, after having been carried by the prevailing current past the weir toward the Channel. It has been stated that, when carried through the Channel, they collected in the eddy on the north side of the island, and then as the current slackened, they would swim back through the Channel "just as if they were being led" and proceed along shore into the weir. This is a somewhat extreme case of rheotactic direction of the herring from a distant place into a weir.

The explanation for the concentration of weirs and of the sardine fishery in the archipelago across the entrance to Passamaquoddy Bay is seen as being the way in which the sardines are carried from their wintering grounds outside into the archipelago, which provides many and varied locations for their capture in weirs.