

prolonged periods of quiet. Residents say, however, that herrings are thrown ashore at times by the waves. Water movements in all probability disturb the sand down to a depth of twenty-six feet as they do in Lake Michigan (Shelford 1913, page 74).

Bottom material. No definite relations of bottom soil to fish could be made out, yet certain types of bottom were preferred to others by certain fish. In Lake Superior the submerged pebble zone was avoided by the schools of free swimming young herring, perch, and suckers, as well as by sticklebacks and some others, while sculpins and burbotts evidently preferred the stony area. In the marsh lakes, there was noted a marked preference for the muck bottoms on the part of all species. The loose, black soil undoubtedly harbored much food and furnished hiding places for the small fish, although none were seen retreating into it.

Plants. The larger aquatic plants are used by the fish for protection and seclusion. Growths of stonewort, water weeds, tape grass, and pondweeds were found utilized in this way. Partly submerged sweet gale, sedges, and many other plants of similar habits also furnished concealment for fish; pike lie in ambush about their submerged bases. Filamentous algae was eaten by common suckers, young whitefish, brook sticklebacks, and sculpins, according to the writer's observations, and diatoms were found in many digestive canals, especially those of common suckers, Cayuga minnows, silvery minnows, and black-head minnows. The food value of these little plants is questionable.

Invertebrates. The invertebrates are an important part of the fish environment when they serve as food or become parasites. The principal forms eaten by fish in the region are entomostracans, chironomid larvae, black-fly larvae, May-fly larvae, caddice-worms, amphipods, and leeches. Entomostracans constituted the chief food of young herring, young whitefish, and nine-spined sticklebacks on the Lake Superior shoal. All were feeding on the same forms, which belonged chiefly to the Crustacean genera, *Diaptomus*, *Bosmina*, and *Cyclops*. Small suckers, and perch, on this shoal, were also eating these forms to a considerable extent. Chironomid larvae are extensively taken by the fish of the Whitefish Point region; they seemed especially important to bottom feeders, suckers, sculpins and burbotts. Black-fly larvae appeared to be the sole food for the colony of long-nosed dace living near the mouth of Vermilion Creek. Sculpins were also eating them in Shelldrake River. Amphipods made up most of the stomach contents of the few whitefish caught in the deeper part of the shoal. Leeches were eaten by large perch in the marsh lakes.

Vertebrates. The vertebrates are especially marked factors in the fish environment when they prey upon fish. Brook trout, rainbow

trout, common pike, and sculpins were found eating other fish. Of these the most important destroyers seem to be the common pikes, for they are numerous and often of a large size. Sculpins appear to eat other fish extensively in the region, including members of their own species. Some fish-eating birds are common. These are loons, blue-herons, night herons, bitterns, kingfishers, mergansers, and grebes. Kingfishers frequently attack schools of small fish. Minks are considered common in the region. If they are, many fish are probably eaten by them. Fish probably to some extent destroy other vertebrates for large pikes are said to catch young muskrats and young ducks in the marsh lakes.

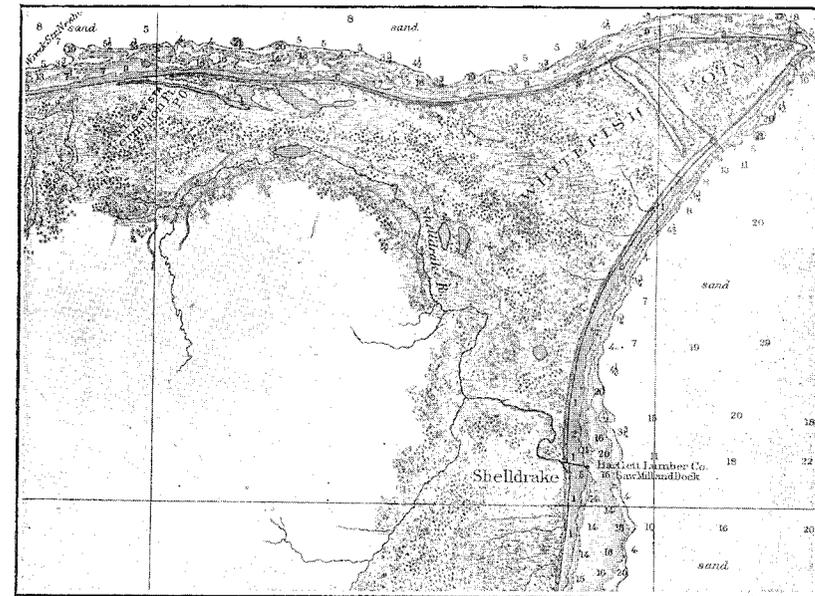
Fish affect each other through competition for food. A conspicuous instance of this in the Whitefish Point region is in the case of the hosts of nine-spine sticklebacks eating the same food as the much-less numerous little whitefish and herring and other species of the shallow water.

Most of the species of fish in the Whitefish Point region influence man in unimportant ways. Whitefish, herring, and brook trout, furnish food for residents and the first two are of much commercial value at Whitefish Point, where many tons of them are taken each year and are the cause of a very important fishery there. Man and the beaver have varied the character of the fish habitats through dams, channels, and other structures that they have built about the marsh lakes.

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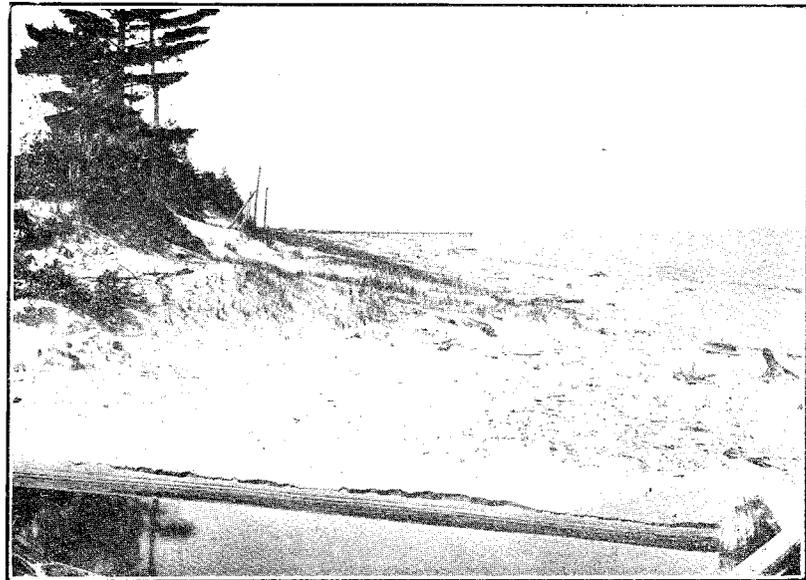
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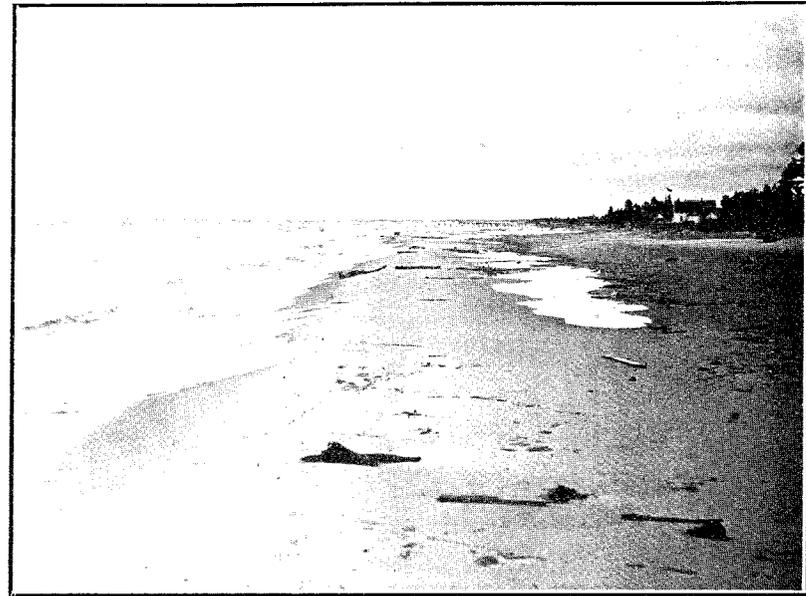
MAP OF THE WHITEFISH POINT REGION, CHIPPEWA COUNTY, MICHIGAN.



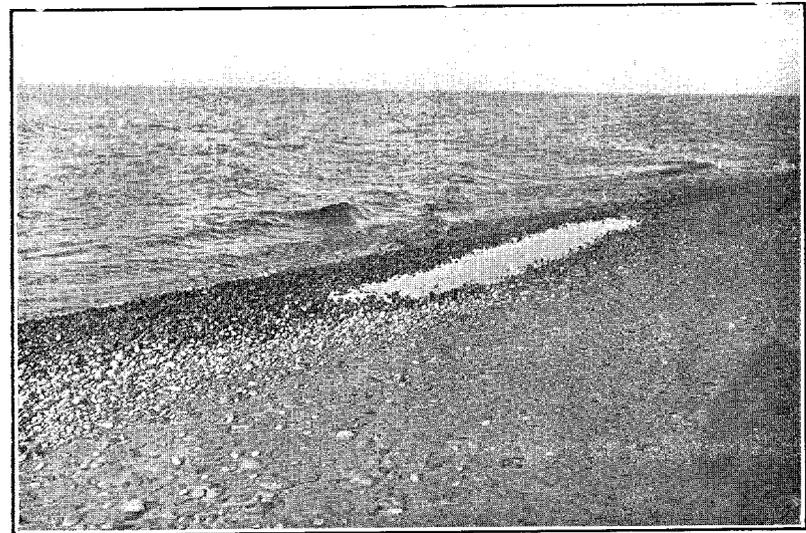
A. LAKE SUPERIOR BEACH AT VERMILION. UPPER AND LOWER BEACH SHOWN; THE LATTER WITH *AMMOPHILA ARENARIA* ZONE, SHOWN CHIEFLY IN THE FOREGROUND.



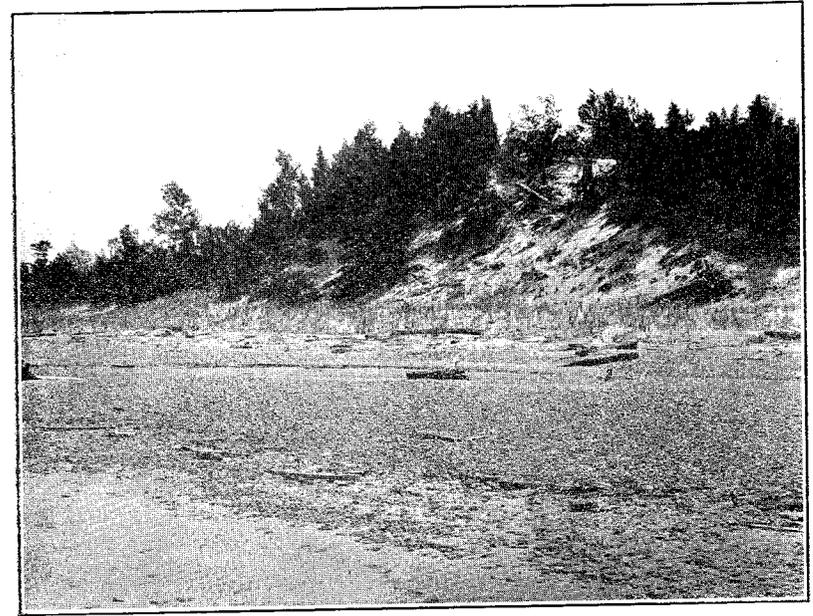
B. LAKE SUPERIOR BEACH WITH SAND RIDGE CROSSED BY CRANBERRY CREEK, JUST EAST OF VERMILION.



A. LAKE SUPERIOR BEACH, LOOKING EAST TOWARD VERMILION, DURING A STORM. SHOWING FORMATION OF TEMPORARY POOLS BY WAVES.



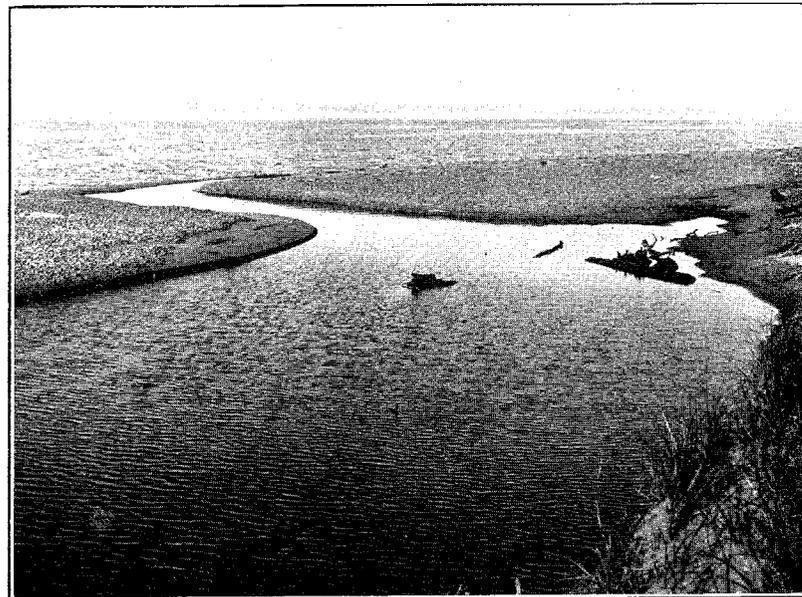
B. SMALL PORTION OF LAKE SUPERIOR BEACH SHOWING PEBBLE ZONE AND SMALL TEMPORARY POND.



A. LAKE SUPERIOR BEACH WITH DUNES OF THE FIRST SAND RIDGE.



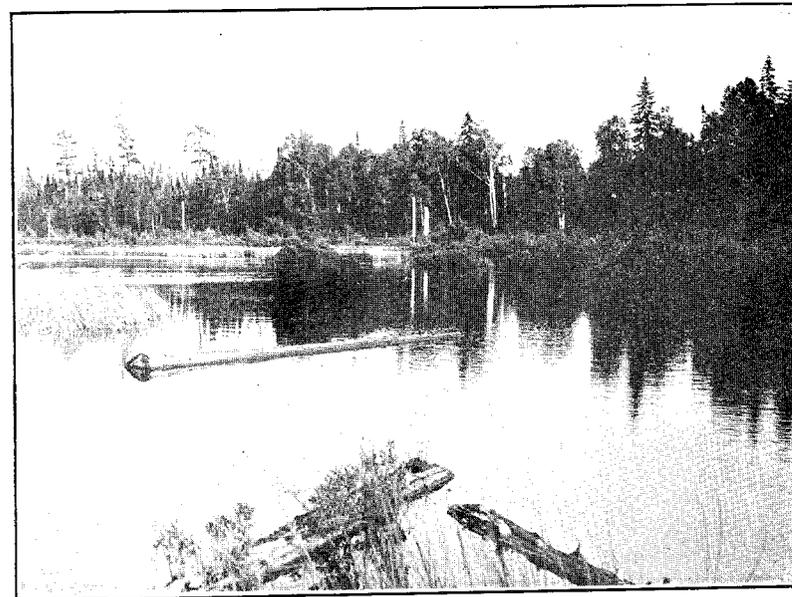
B. CRANBERRY CREEK (STATION 30), LOOKING NORTH AND DOWN STREAM,
SHOWING A PART OF THE BEACH POOL FORMED BY IT (STATION 31).



A. POND ON LAKE SUPERIOR BEACH (STATION 31) FORMED BY CRANBERRY CREEK.



B. BEAVER DAM AND POND ON MASON'S CREEK (STATION 171).



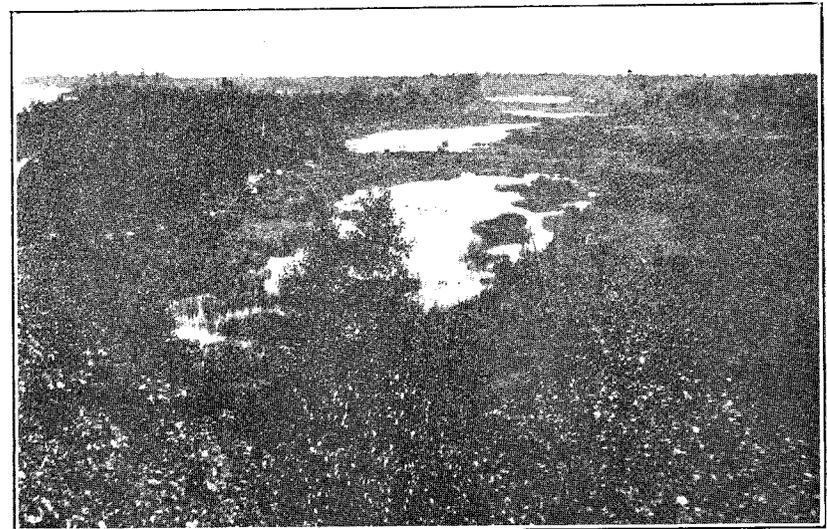
A. BEACH POND IN THE COURSE OF MASON'S CREEK



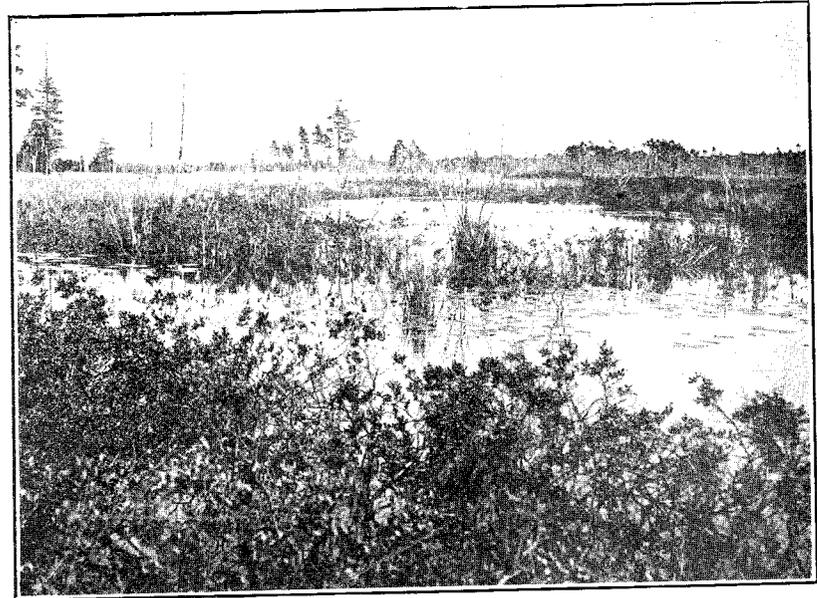
B. MARSH BORDERING MASON'S CREEK (STATION 172) ON LAKE SUPERIOR
BEACH.



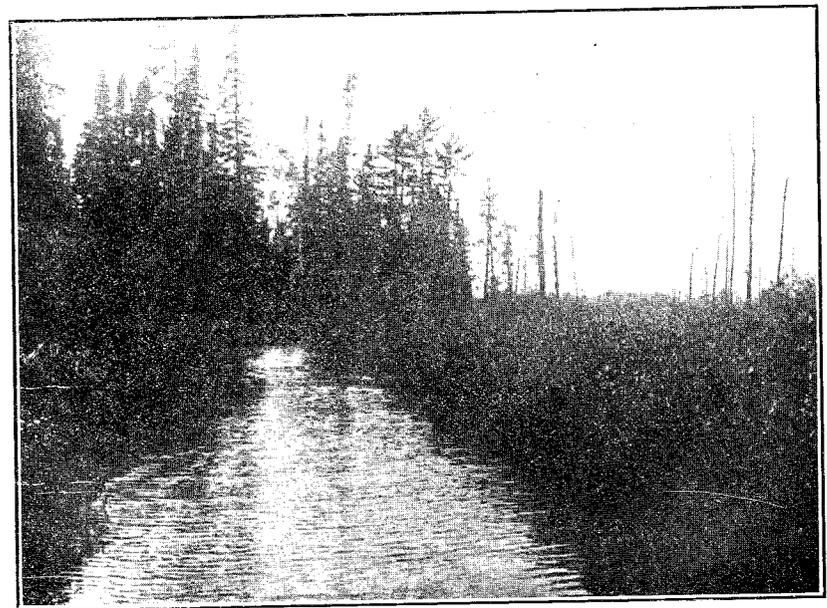
A. LOOKING SOUTHWEST FROM HIGH SAND DUNE NEAR STATION 101, SHOWING MARSH AND SAND RIDGES WITH UPLAND IN DISTANT BACKGROUND.



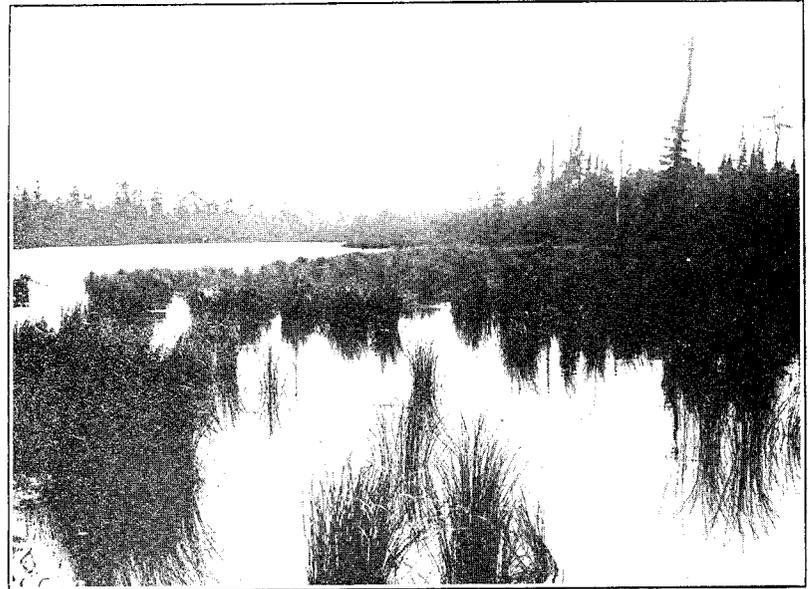
B. MARSH LAKES, LOOKING SOUTHEAST FROM THE HIGH DUNE NEAR STATION 101.



A. CHANNEL EAST FROM BEAVER LAKE (STATION 90).



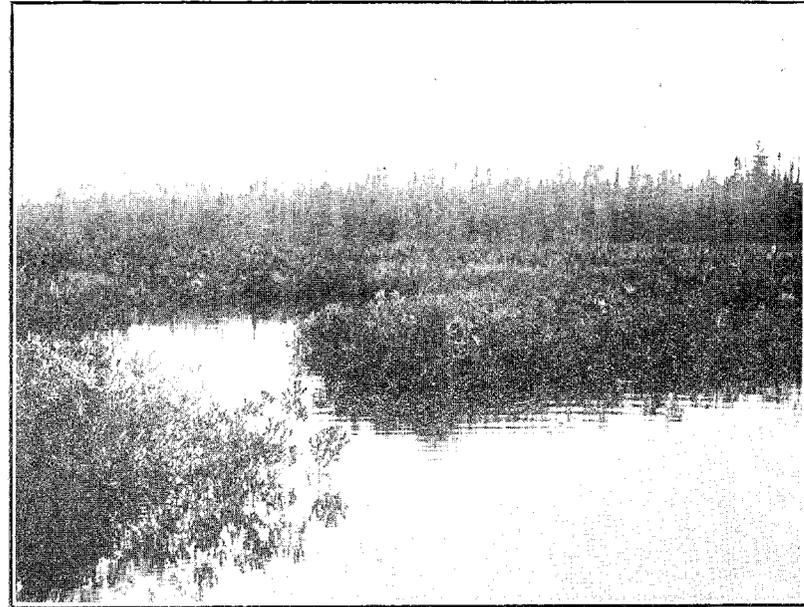
B. CHANNEL OF VERMILION LAKE (STATION 25).



A. MARSH BAY OF BEAVER LAKE (STATION 55), LOOKING SOUTHWEST (LAKE-
WARD).



B. THE SAME, LOOKING SOUTH.



A. MARSH BAY OF BEAVER LAKE (STATION 52), LOOKING NORTHEAST.



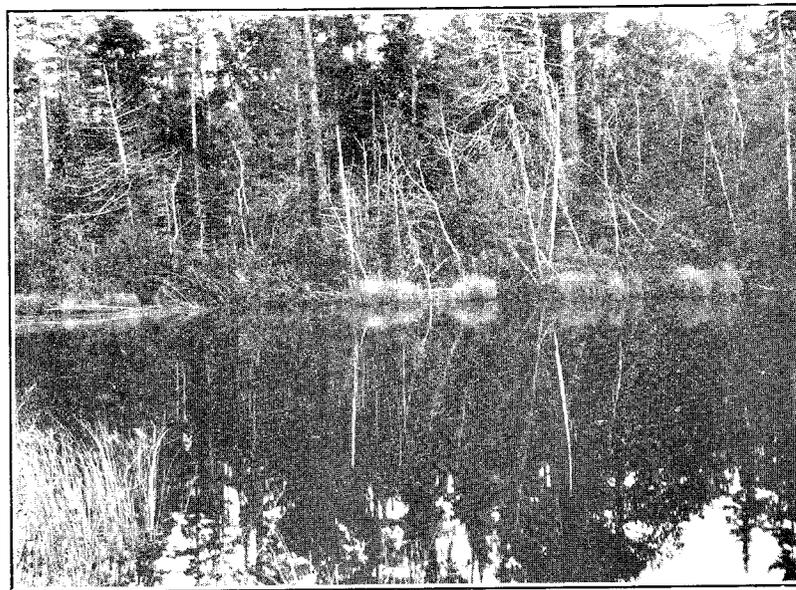
B. NORTHWEST SHORE OF BEAVER LAKE (STATION 59), LOOKING
NORTHEAST.



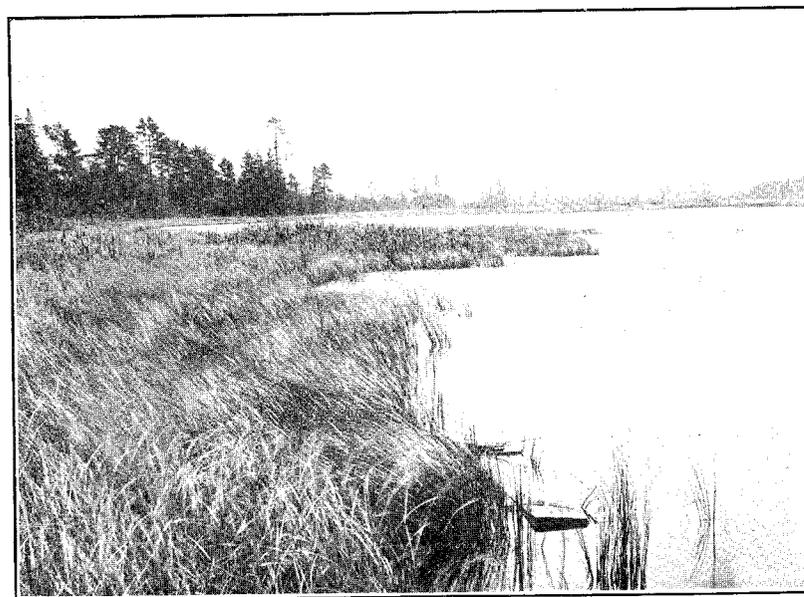
A. SPRUCE LAKE, LOOKING NORTHWEST (STATION 74).



B. STATION 84, SPRUCE LAKE, LOOKING EAST. FLOATING MATS OF STONE-
WORT ON THE SURFACE.



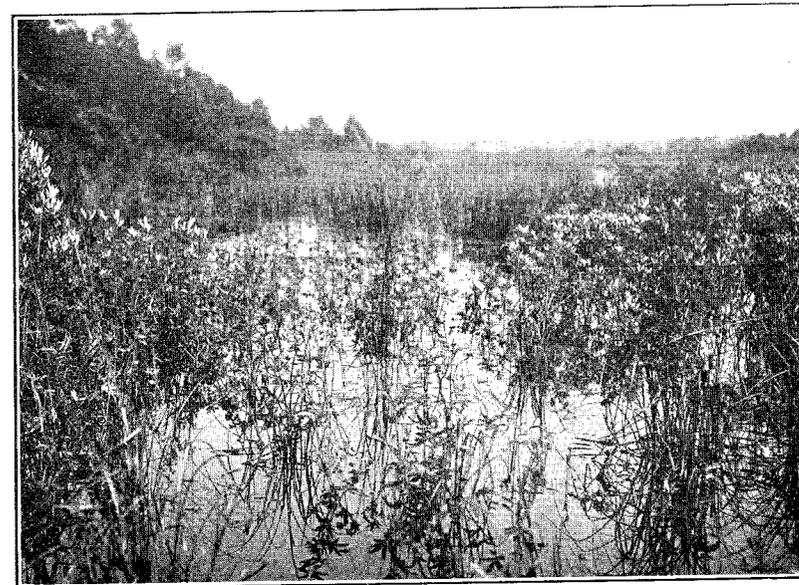
A. STATION 85, SPRUCE LAKE, LOOKING SOUTH ACROSS THE EAST END OF THE LAKE.



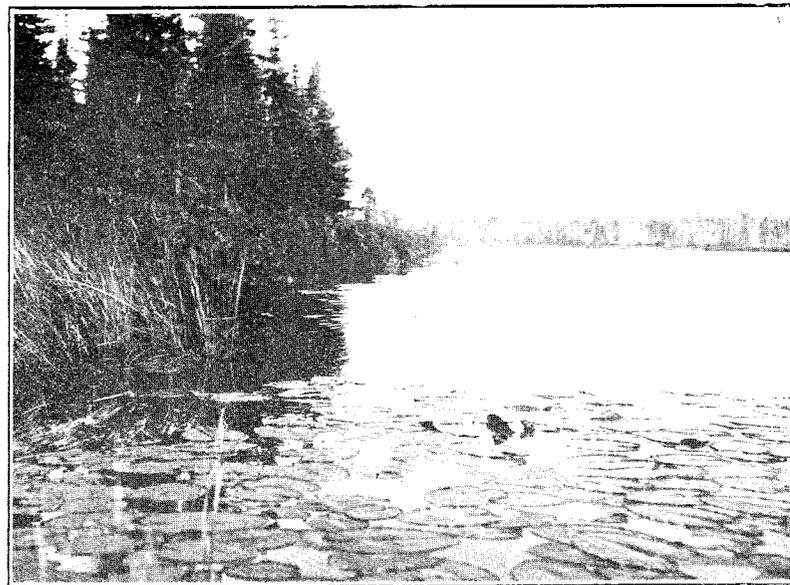
B. MARSHY NORTH SHORE OF VERMILION LAKE.



A. SMALL LAKE AND WOODED SAND RIDGE ABOUT A HALF MILE EAST OF
VERMILION (STATION 106), LOOKING NORTHEAST.



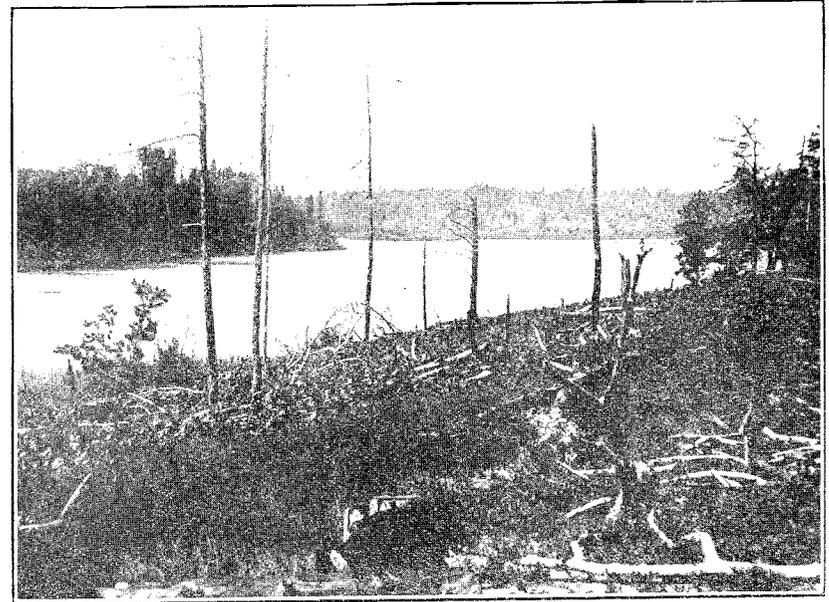
B. WEST END OF THE SMALL LAKE SHOWN IN A. STATION 101, LOOKING
EAST.



A. MITTEN LAKE, STATION 116, LOOKING EAST.



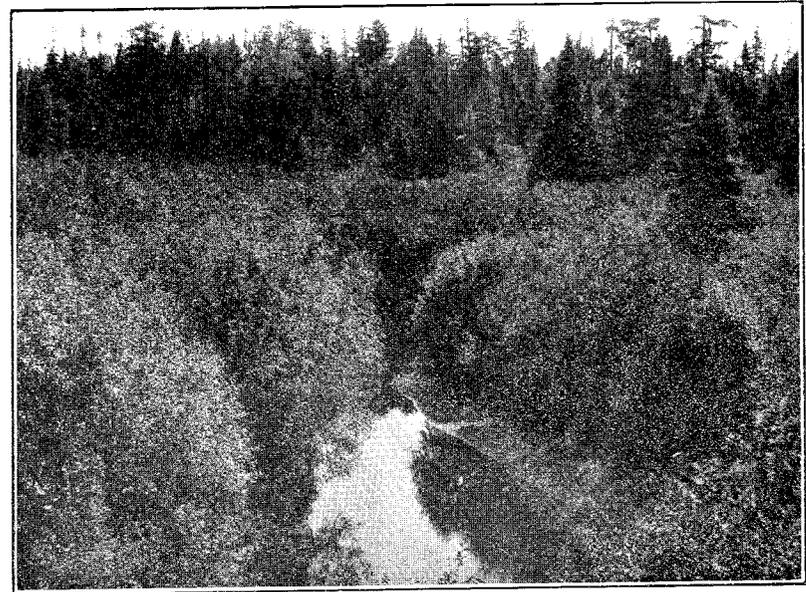
B. VERMILION CREEK AT VERMILION. GREAT BLUE HERON FEEDING.



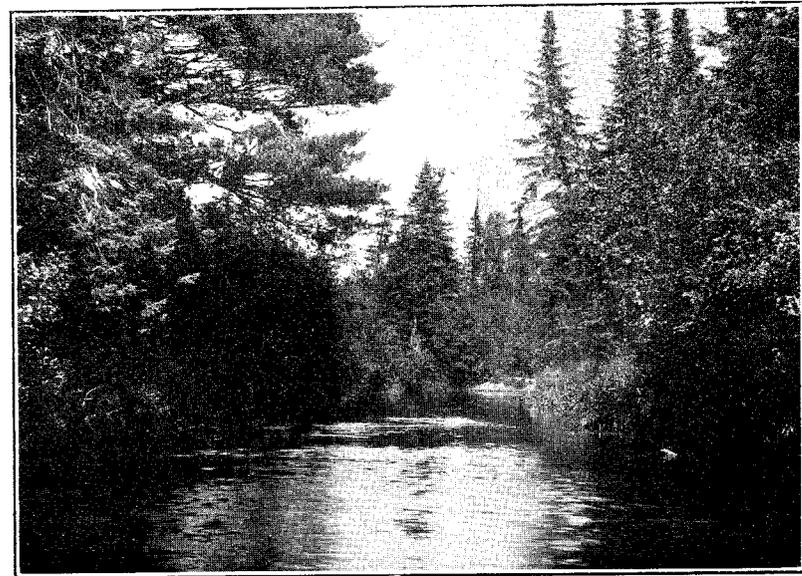
A. SHELDRAKE LAKE. LOOKING SOUTHWEST.



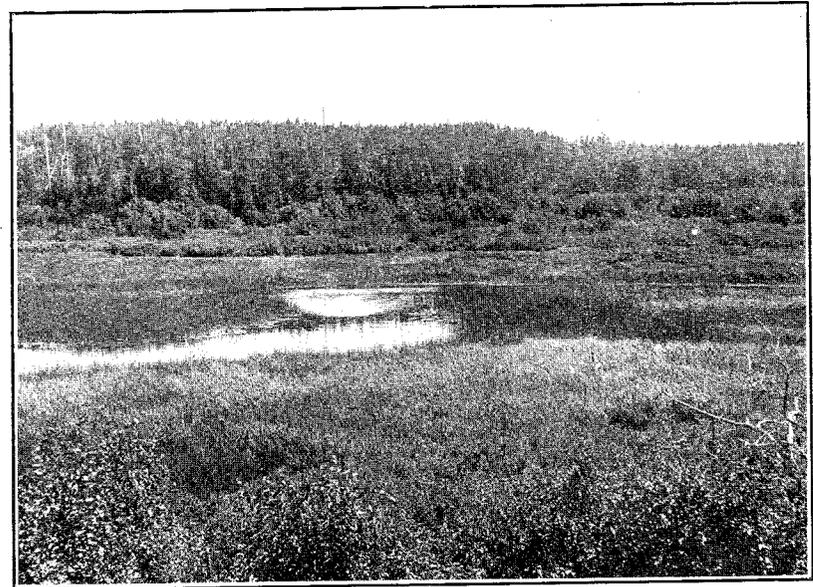
B. NORTHWEST SHORE OF SHELDRAKE LAKE, LOOKING NORTHEAST
(STATION 142).



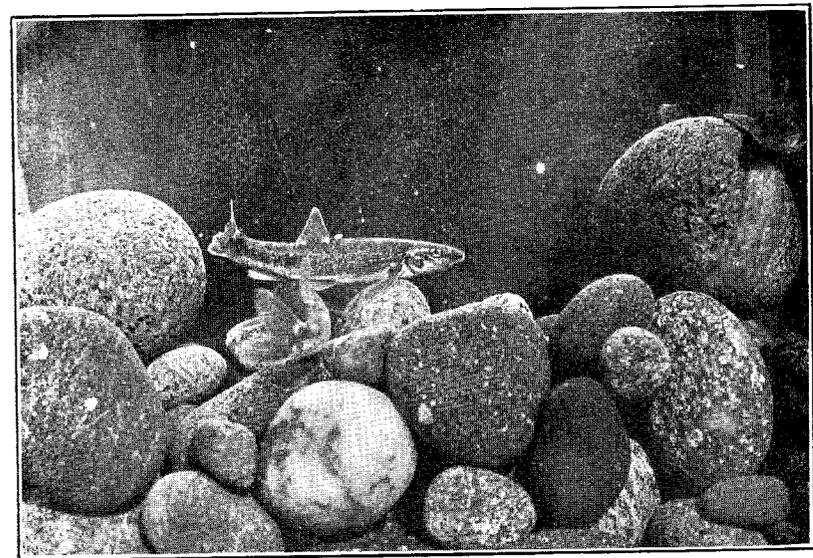
A. SHELLDRAKE RIVER AND PORTION OF WOODED SWAMP, LOOKING DOWN
STREAM FROM A HIGH, NORTH STREAM BANK.



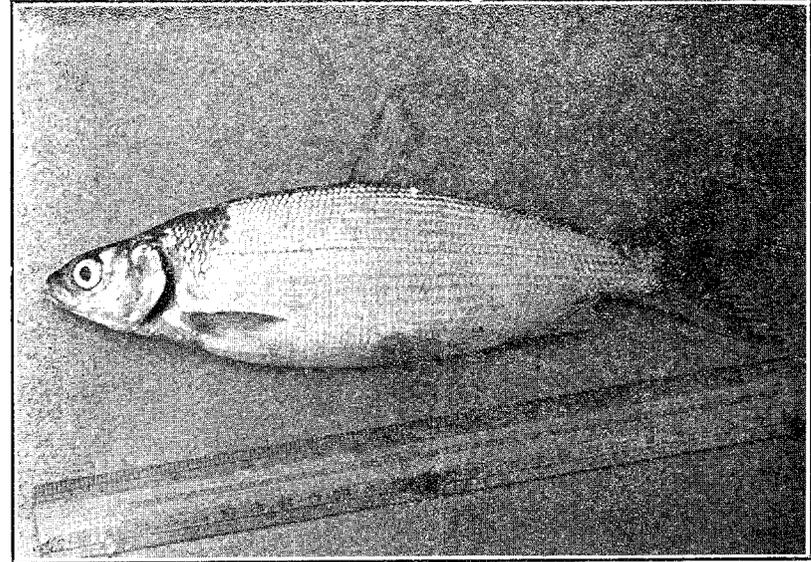
B. PORTION OF SHELLDRAKE RIVER JUST SOUTH OF VERMILION.



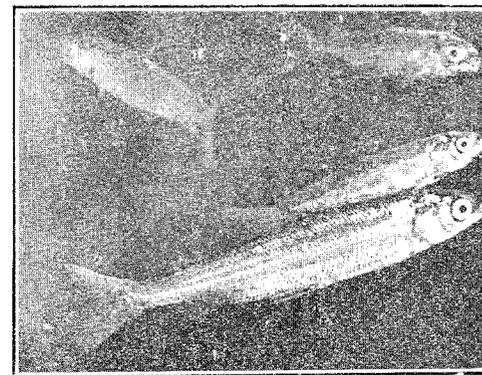
A. SHELLDRAKE RIVER JUST SOUTH OF SHELLDRAKE LAKE, LOOKING SOUTH.



B. LONG-NOSED DACE, *RHINICHTHYS CATARACTAE*.



A. TULLIBEE, *LEUCICHTHYS TULLIBEE* (?) CAUGHT AT STATION 2, LAKE SUPERIOR.



B. YOUNG WHITEFISH, *COREGONUS CLUPEAFORMIS* (POSSIBLY *ALBUS*)
LENGTH OF LARGEST ABOUT THREE INCHES, CAUGHT AT STATION 1,
ON LAKE SUPERIOR SHOAL.

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