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THE HIGHER AQUATIC PLANTS OF SHAKESPEARE ISLAND LAKE, ONTARIO

By
ANDREW L. PRITCHARD
(From the Department of Biology
University of Toronto)

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Abstract

A qualitative study of the higher aquatic plants of Shakespeare Island lake demonstrates that they form an unbroken ring of vegetation around the lake. The numbers of individuals and species are variable in different habitats. Shores exposed to wind and wave action have scant vegetation, consisting of *Potamogeton pusillus* and *Equisetum fluviatile*. In protected bays the higher aquatic plants reach the peak of development, and show a positive zonation with *Nymphaea* and *Vallisneria spiralis*, growing in the deeper water, to *Calla palustris and Caltha palustris* at the water's edge.

During the summer of 1926, a field party from the University of Toronto undertook the investigation of a small unexploited lake on Shakespeare island in lake Nipigon, with a view to obtaining information as to the total population of whitefish, *Coregonus clupeaformis* (Mitchill), contained therein. Hart (1932) has reported on the results obtained in this connection. Concurrent with the main programme, however, numerous phases of limnobiology, which were deemed to have some relation to the general subject of productivity, were studied to a greater or lesser degree. Cronk (1932) has presented the data concerning the bottom fauna. The present paper includes a brief discussion of the larger aquatic vegetation.

Shakespeare Island lake situated on the south-eastern portion of the island of the same name, covers an area of approximately eighty-one acres, and has a shore-line of about two and one-half miles. Soundings indicate that there is a gradual slope from the sides to the central basin where the greatest depth obtained was forty-four feet, and that approximately one-half of the total area is included within the thirty-foot depth contour. Figure 1, taken from Cronk (1932), shows the essential features of the body of water under discussion. It will be noticed that four bays open into the central portion of the lake as follows: Agnes bay from the north-west, Exit bay from the north-east, Sunnyside and Gut Dump bays, really one inlet, from the south-east, and White-

fish bay from the south-west. These, with the exception of the second, possess sandy beaches at the heads and slope gradually into the deeper water. Exit bay, on the other hand, is very shallow throughout its entire extent, no depths of more than four feet being discovered.

Because this body of water is relatively deep for its size, and because over two-thirds of the shore-line is bordered by steep banks, no great areas of shallow water occur. Most of

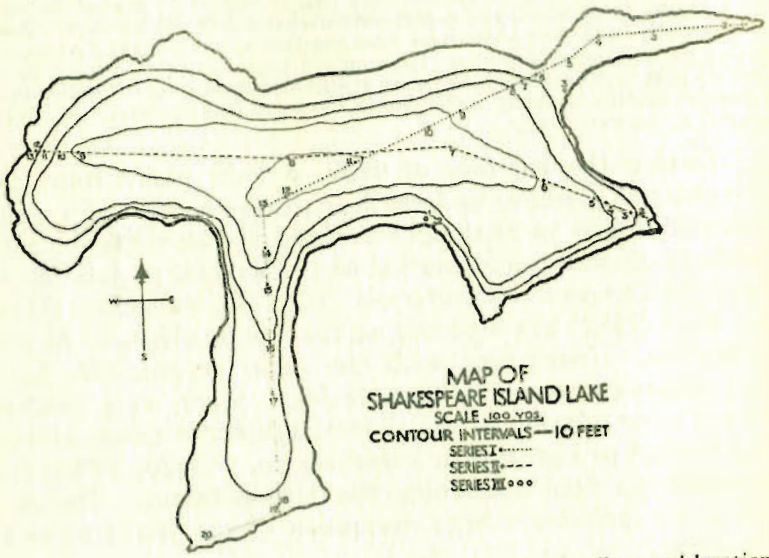

FIGURE 1.—Map of Shakespeare Island lake, with contour lines and location of dredging series.

those which are present lie in the bays and along the northern shore.

The lake is supplied with water mainly by springs and surface drainage. It empties through Exit bay by means of seepage and an underground channel into lake Nipigon which is approximately ten feet lower in altitude. With the exception of the sand noted above in the heads of the bays, the bottom is mud. In Exit bay organic debris is also present in large quantities.

Only a very cursory examination was made of the physical and chemical conditions existing in the waters of the lake. Those data which are at hand indicate that the water is basic

in reaction, the surface reading for the hydrogen-ion concentration being 8.2. At greater depths determinations gave lower figures, but at no place were they below 7.0. In the middle of the summer, thermal stratification was very noticeable, the temperature ranging from 23.7°C. at the surface to 5.2°C. at the bottom. The transparency as determined by the use of a Secchi's disk was 4.0 yards.

The examination of the flora was carried out in a purely qualitative manner. The investigator proceeded along the shore in a canoe or rowboat, anchored at intervals of approximately ten feet, and observed the vegetation. The distribution was plotted roughly in a field note-book. The data for the bottom below the point of visibility of approximately eight feet were obtained from the dredgings which were taken in connection with the investigation of the bottom organisms. Samples of each species were collected, pressed, and mounted for future reference.

The following species were taken and identified:

Chara sp.
Isoetes sp.
Potamogeton Richardsonii (Benn.) Rydb.
Potamogeton gramineus L.
Potamogeton amplifolius Tuckerm.
Potamogeton pusillus L.
Carex filiformis L.
Carex vesicaria L.
Vallisneria spiralis L.
Sparganium angustifolium Michx.
Eleocharis palustris (L.) R. & S.
Equisetum fluviatile L.
Nymphaea advena Ait.
Calla palustris L.
Caltha palustris L.
Iris versicolor L.
Menyanthes trifoliata L.
Sagittaria latifolia Willd.
Potentilla palustris (L.) Scop.
Hippuris vulgaris L.
Myriophyllum verticillatum L.

The relative distribution of the more common forms are shown in figures 2 and 3.

The study of these maps, together with the data on other species which occur less frequently, demonstrates that there is an unbroken ring of vegetation around the lake. The same species may not extend throughout the whole distance but may be replaced by another which is better suited in some ways to cope with the conditions existing in particular locations.

The conclusion that the distribution of the aquatic plants in the lake is governed by conditions existing at different places seems inevitable. Undoubtedly in any location a number of factors interact to affect the life of the plants. One or more of these may be sufficiently unfavourable to limit the abundance of the vegetation, or to cause the complete disappearance of certain species. Some of these modifying influences are discussed below.

The prevailing winds in this area blow from the north and west. As a result, some species of plants which are not suited anatomically to resist wave action and wind do not occur on the exposed southern shore but others which are better constituted to exist under the prevailing conditions take their place. In this locality, for example, *Potamogeton pusillus* with its fine leaves, and *Equisetum fluviatile*, with its tough unbranched pliable stock, occur. Apparently, however, such exposure is not conducive to the production of large numbers of any plant. On the other hand, in protected bays such as Exit, vegetation grows in great abundance.

Depth of water is evidently a factor in the limitation of the distribution of the larger aquatics. On the southern shore which, as we have noted heretofore, has high banks and a steeper slope into deeper water, the ring of plants is much narrower. Maximum abundance is attained in the shallow waters of the various bays. In Exit where no soundings greater than four feet were found, the flora becomes so thick in midsummer as to be a hindrance to the progress of boats.

In most studies of this kind, it has been found that the character of the bottom is a determinant of the type and quantity of rooted aquatic vegetation. Since, however, in Shakespeare Island lake almost all the bottom is composed of

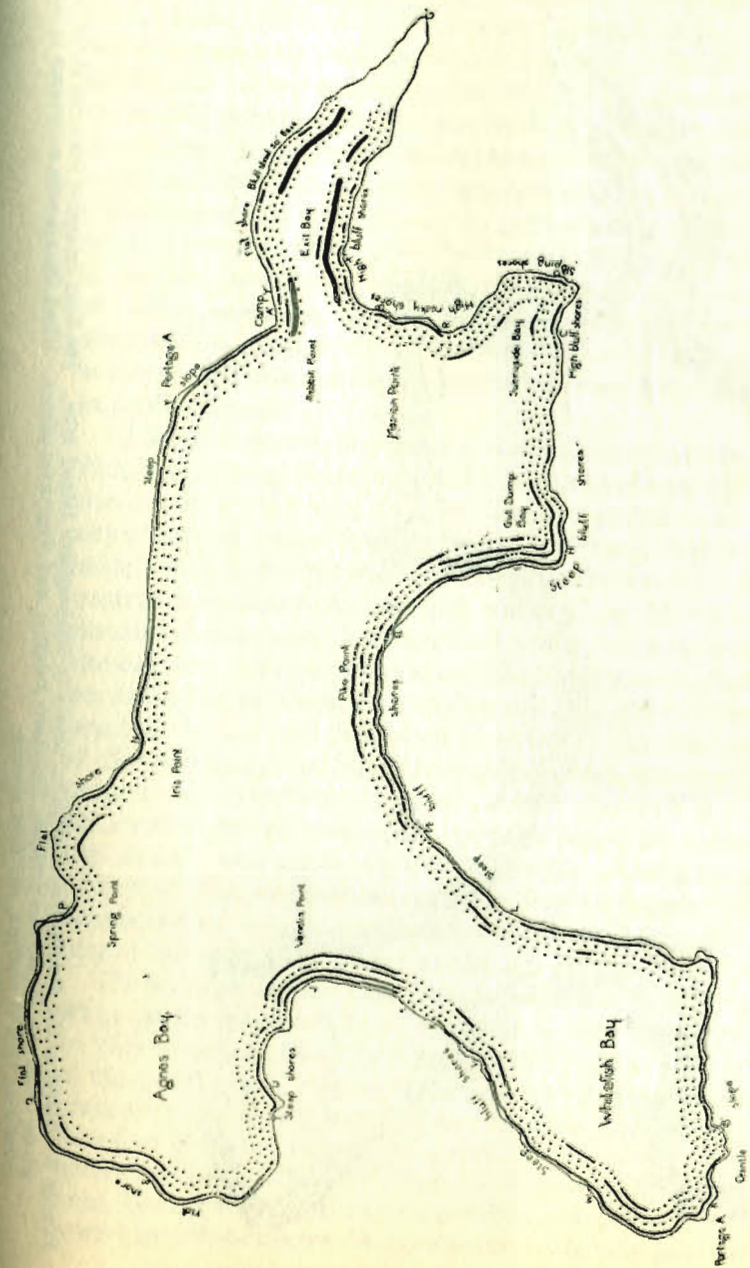

FIGURE 2.—Showing the distribution of aquatic plants in Shakespeare Island lake. The four lines represent from the shore outwards, *Potamogeton Richardsonii* and *gramineus*, *Potamogeton pusillus* and *amplifolius*, *Vallisneria spiralis*, and *Myriophyllum verticillatum*. Thick lines denote occurrence in large quantities, thin in medium, and dots absence.

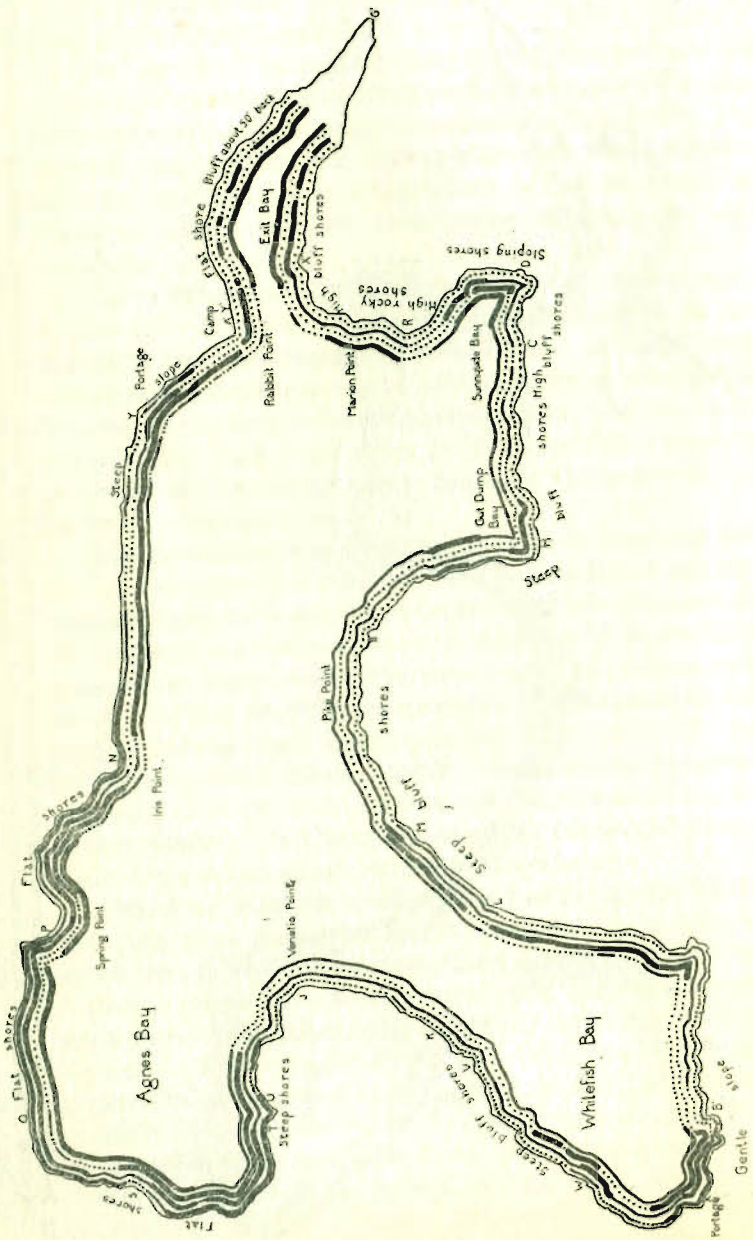

FIGURE 3.—Showing the distribution of aquatic plants in Shakespeare Island lake. The lines represent from the shore outwards, *Carex* spp., *Equisetum fluviatile*, *Eleocharis palustris*, and *Nymphaea advena*. Thick lines denote occurrence in large quantities, thin in medium, and dots absence.

mud with only a small amount of sand appearing at the heads of the bays, it is difficult to draw accurate conclusions regarding the choice of soils by different plants. Denniston (1922) found that *Chara* in lake Mendota grew best on sand. Pieters (1894) maintained that in lake St. Clair it had a preference for clay. In Shakespeare Island lake the genus appears on both sand and mud but is more prevalent on the latter. The genera *Potamogeton* and *Eleocharis* grow equally well in sand and mud. *Myriophyllum* and *Vallisneria* are practically limited to muddy bottoms. *Equisetum*, although general in its distribution, seems to prefer sand, while *Nymphaea* in its general distribution chooses mud for the most part. The genus *Carex* is apparently not limited in its choice of soils but is found only in shallow water.

The area in which plants are most abundant is Exit bay. This body of water is protected by high banks on all sides from the sweep of the wind. The bottom, which is not covered anywhere by more than four feet of water, consists of mud mixed with large quantities of organic debris. In the deeper central portions of the bay, the water lilies, *Nymphaea*, flourish and *Isoetes* and *Vallisneria spiralis* form heavy mats on the bottom. Toward the shore the pond weeds, *Potamogeton*, are mixed at random with the horse-tails, *Equisetum*. At the head of the bay which is also the outlet of the lake, large plots of the semi-aquatic buckbean, *Menyanthes trifoliata*, and the mare's tail, *Hippuris vulgaris*, occur. Around the shore are the typical marsh forms, the water arum, *Calla palustris*, and the marsh marigold, *Caltha palustris*. The general distribution of the vegetation and the large quantity of organic debris indicate that a succession is taking place and that the plants are gradually filling in the bay.

Zonation is most evident in Sunnyside bay which is somewhat protected from the prevailing winds by Marion point. In this area for thirty feet from shore only a few individuals of the pond weed, *Potamogeton gramineus*, appear in the shallows over the sandy beach. For another sixty feet, in two to four feet of water, extends a zone of *Equisetum fluviatile* mixed with *Eleocharis palustris*. Beyond this in a depth of approximately eight feet are the water lilies, *Nymphaea advena*, followed by *Potamogeton Richardsonii*. These zones correspond

closely with those found by Denniston (1922) in lake Mendota except for the presence of *Potamogeton gramineus* inside.

Zonation as it is found at the head of Whitefish bay is similar to that described above. In most places, however, *Carex* takes the place of *Potamogeton gramineus* in the shallow water. Outside of this lies an area in which *Eleocharis palustris* and *Equisetum fluviatile* are thoroughly mixed. These may extend as far out as the water lily, *Nymphaea advena*. Nearest the deep water are scattered pond weeds, *Potamogeton Richardsonii*.

LITERATURE CITED

Cronk, Myra W. 1932. The bottom fauna of Shakespeare Island lake, Ontario. Univ. Toronto Studies, Biol. 36. Pub. Ont. Fish. Res. Lab., 43.

Denniston, R. H. 1922. A survey of the larger aquatic plants of lake Mendota. Trans. Wisc. Acad. Sci. Arts, Lett., 20: 496-500.

Hart, J. L. 1932. Statistics of the whitefish (*Coregonus clupeaformis*) population of Shakespeare Island lake, Ontario. Univ. Toronto Studies, Biol. 36. Pub. Ont. Fish. Res. Lab., 42.

Pieters, A. J. 1894. The plants of lake St. Clair. Bull. Mich. Fish. Comm., 2.

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A NEW PARASITIC UNIONICOLA

By
RUTH MARSHALL
(FROM THE DEPARTMENT OF BIOLOGY
UNIVERSITY OF TORONTO)

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