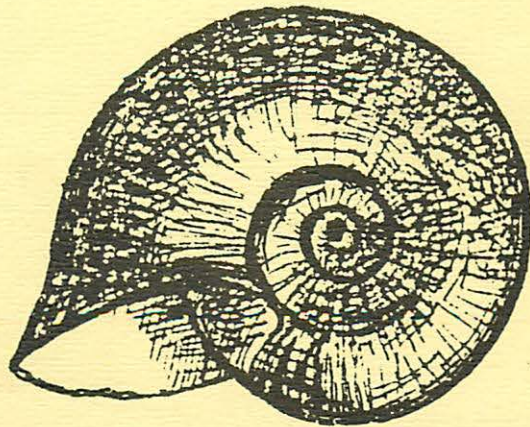


Curatorial Report Number 37

Nova Scotia Museum
1747 Summer St.
Halifax, Nova Scotia, Canada

Notes on the flora and fauna of six lakes in Cape Breton Highlands National Park

By D.S.Davis and A.Wilson
March/79

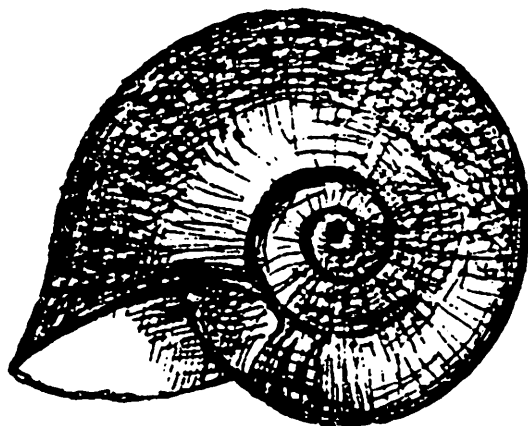


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NOVA SCOTIA MUSEUM

Curatorial Reports

The *Curatorial Reports* of the Nova Scotia Museum contain information on the collections and the preliminary results of research projects carried out under the program of the museum. The reports may be cited in publications but their manuscript status should be clearly indicated.

Abstract

In August 1976 a visit was made to Cape Breton Highlands National Park at the invitation of the Canadian Wildlife Service, to make floral and faunal inventories of some lakes being subjected to detailed limnological studies. Six lakes were visited and inventories made of the conspicuous aquatic plants and animals. Several interesting records for the Province of Nova Scotia were made. Species diversity in the lakes reflects the various levels of productivity indicated by the limnological studies, and past relationships of each lake with major drainage systems.

INTRODUCTION

Studies by the Canadian Wildlife Service on lakes in the Cape Breton Highlands National Park began in 1965. These studies were directed towards understanding the relationships between the chemical composition and productivity of lake waters, as a basis for fisheries management (Kerekes, 1968). Studies continued through 1976, when the Nova Scotia Museum was invited to carry out a small investigation of the plants and animals in selected lakes. The objective was to make inventories of the conspicuous plants and animals that could be related to information gathered on nutrient levels, productivity and fish stocks. The investigation was also intended to be of benefit to the collections and information resources of the Nova Scotia Museum as the specimens collected would be supported by good ecological information. It was also hoped that the information gathered would be of value to future interpretive programs in the Cape Breton Highlands National Park.

The lakes selected for study were French Lake, Presqu'ile Lake, Jigging Cove Lake, Warren Lake and Freshwater Lake. Two Island Lake was added during the course of the study.

The Nova Scotia Museum had made no previous studies of freshwaters in the Cape Breton Highlands Region. There are some records of plants and animals. Livingstone (1949) collected four species of fish from Warren Lake: Banded Killifish, White Perch, Gaspereau and Brook Trout. These specimens were in the Nova Scotia Museum collection but have been transferred to the National Museum of Natural Sciences. French Lake is of interest to the Museum as it forms part of the proposed Ecological site No. 17 (Taschereau, 1974).

METHODS

The investigation was carried out in August 1976. Because of limited time available a standard procedure was adopted for the examination of each of the lakes selected. Half of one day was given to the field sampling, so that two lakes could be examined on any one day. Thus French Lake and Presqu'ile Lake were visited on August 10, Jigging Cove Lake in the afternoon of August 11, and Warren Lake and Freshwater Lake on August 12. This time allocation was sufficient to carry out a reasonable qualitative study of each lake but was not fully adequate due to variations in lake size and accessibility. Thus it was felt that the smallest lake, Presqu'ile Lake, had been more thoroughly examined than the largest, Warren Lake. In addition to the five lakes mentioned a visit was made to Two Island Lake in the plateau interior of the Park. This visit was made by helicopter, chartered by the Canadian Wildlife Service, in the evening of August 12 and provided about 30 minutes to make notes and collections. The locations of the lakes visited are shown on the map, Fig. 1. Station information for each lake is given in Table 1 and in Figs. 2 to 7. A photograph of each lake is reproduced in Figs. 8 to 13.

In most cases the lake shores and littoral zone were examined from the shore by wading in the water. However, at French Lake, Presqu'ile Lake and Warren Lake, a small boat was also used. Study sites were selected to cover the visible variations in physical and vegetation features. Notes were made

on the species occurring and their distribution within the lake. Samples were taken by hand or by net as necessary for detailed examination and confirmation of field identifications. Samples of mud, stones and plant material were preserved for later examination for small animals in the laboratory. No attempts were made to obtain bottom samples from the deeper regions of the lakes, nor were plankton and fish intentionally sampled as these have been covered by the Canadian Wildlife Service investigations.

Most of the plant specimens were determined initially by the collector with reference to works listed in the bibliography. Confirmations and revisions of the vascular material were made by Dr. J.H. Soper at the National Museum of Natural Sciences in Ottawa, the Bryophytes were identified by Dr. Robert Ireland, also of the National Museum, and the algae were determined by Ms. Carolyn Bird of the National Research Council, Atlantic Regional Laboratory, Halifax. (n.b. Although the inventory of no group may be considered to be complete, the algae were probably the most poorly treated with only the larger taxa being collected.)

Zoological specimens were fixed in 5% formaldehyde solution and later transferred to 70% isopropanol preservative. Identification of animals other than insects were made by the collector using works listed in the bibliography. The insects were identified by Barry Wright. The specimens obtained from the study have been incorporated into the Nova Scotia Museum collections. Accession numbers for zoological material are listed in Table 1.

FRENCH LAKE

The lake is located in an area of bog and spruce-barren on the highland plateau, at an altitude of 430 m. It is 0.6 km long and 0.2 km wide at its maximum. The shores and middle of the lake were examined at the north end only (see Fig. 2). In this area there is a marked difference between the eastern side and western side due to the effect of exposure to the dominant southwesterly wind in summer. The west shore is in the lee and thus sheltered. Here the substrate is of sand and there is a wide bed of rushes, reeds and other emergent plants. On the exposed windward shore there is noticeable wave action resulting in a stony substrate with relatively few aquatic plants. The middle region was about two metres deep with a bottom of organic mud. Stones in shallow water on the eastern side were coated with manganese deposits. Background water chemistry data reported for 1966 include: alkalinity 0.8 ppm, hardness 4.3 ppm and pH 5.5 (Kerekes, 1968).

Even in the bed of rushes on the leeward shore, the aquatic vegetation was not very well developed. Most species were emergent, including *Eleocharis* and *Sparganium* but submerged algae, bryophytes and pondweeds were also found. *Nymphoides* and *Eriocaulon* extended into the middle of the lake with stems or shoots from one to two metres in length.

The plants recorded were:

Algae

Oedogonium sp.

Bryophyta

Fontinalis novae-angliae Sull.

Pteridophyta

Equisetum fluviatile L.

Spermatophyta

<i>Sparganium angustifolium</i> Michx.	Bur-reed
<i>Potamogeton epihydrus</i> Raf.	Pondweed
<i>Potamogeton natans</i> L.	Pondweed
<i>Eleocharis acicularis</i> R. & S. forma <i>inundata</i> Svenson	Spike-Rush
<i>Eleocharis palustris</i> (L.) R. & S.	Spike-Rush
<i>Eriocaulon septangulare</i> With.	Pipewort
<i>Juncus</i> sp.	Rush
<i>Nymphaea odorata</i> Ait.	Water-Lily
<i>Nymphoides cordata</i> (Ell.) Fern.	Floating Heart
<i>Utricularia intermedia</i> Hayne	Bladderwort
<i>Lobelia Dortmanna</i> L.	Water Lobelia

Animals were collected from the stands of aquatic plants, the bottom mud and the surfaces of stones and sticks. Some cast skins of insect nymphs were obtained along the shore line. The vegetation on the leeward shore provided the greatest diversity and numbers of specimens.

Animals recorded were:

Nematoda

Unidentified forms in bottom mud

Hirudinea

Helobdella stagnalis (Linne), in vegetation and on bottom
Species 2 in vegetation
Species 3 in vegetation and on bottom
Egg capsules on sticks near the shore

Crustacea

Hyalella azteca Saussure. Common amongst vegetation and on muddy bottom, includes the spineless form *inermis*.

Insecta

Ephemeroptera (Mayflies) Nymphs in vegetation on sheltered side
Aeschnidae (Odonata) nymphs
Cordulia shurtleffi Scudder (Odonata), cast skins of nymphs found on shore

Tanypteryx hageni (Selys) (Odonata), cast skins of nymphs found on shore
Sympetrum costiferum Hagen (Odonata), nymphs in vegetation and on bottom mud
Coenagriidae (Odonata), nymphs in vegetation
Gerris sp. (Hemiptera), on surface near windward shore
Trichoptera (Caddis flies), nymphs in bottom mud
Phryganea sp. (Trichoptera), in vegetation
Pseudostenophylax sp. (Trichoptera), in vegetation
Chironomidae (Diptera), larvae common in bottom mud
Donacia sp. (Coleoptera), in vegetation

Mollusca

Pisidium sp. 1 in vegetation and bottom mud
Pisidium sp. 2 in bottom mud

Vertebrata

Juvenile fish, undetermined
Rana sp. adults and tadpoles

PRESQU'ILE LAKE

This is a small lake, 0.8 km long and 0.08 km wide, located between the highlands of Cap Rouge and Presqu'ile (see Fig. 3). It lies 2 m above sea level and is only separated from the influence of seawater by a barrier beach and road embankment. Part of the lake at the south end is separated off as a pond, Little Presqu'ile Lake, which was included in the study. The shore on the eastern side of the lake is a steep, wooded slope, while on the western side it is a road embankment. The road now covers most of the western side of the lake so that the bottom profile is asymmetrical. The shore examined at the north end was mostly of mud and stones. Data available on the chemical composition of the water (1966) include: alkalinity 64.3 ppm, hardness 86.7 ppm, and pH 7.5 (Kerekes, 1968).

The lake contained abundant growth of aquatic plants, particularly *Myriophyllum exalbescens* and species of *Potamogeton*. These plants were most conspicuous at the shallow ends of the lake. Stands of reeds and rushes occurred in several places. The occurrence of the calcareous alga, *Chara globularis*, is of interest as this plant is characteristic of hard waters.

The plants recorded were:

Algae

Chara globularis Thuill. Stonewort
Batrachospermum sp.

Bryophyta

Sphagnum torreyanum Sull. Sphagnum

Pteridophyta

Isoetes muricata Dur. Quillwort

Spermatophyta

Sparganium angustifolium Michx. Bur-reed
Potamogeton gramineus L. Pondweed

<i>Potamogeton pectinatus</i> L.	Pondweed
<i>Scirpus validus</i> Vahl.	Bulrush
<i>Polygonum natans</i> Eat.	Smartweed
<i>Nuphar variegatum</i> Engelm.	Yellow Water Lily
<i>Myriophyllum exalbescens</i> Fern.	Water Milfoil
<i>Utricularia geminiscapa</i> Benj.	Bladderwort

Animals were obtained from the masses of *Myriophyllum* and bottom mud in the shallow areas of the lake and pond. The terrestrial gastropods, *Succinea* sp. and *Succinea ovalis* Say, were found under plant debris at the edge of the water. The occurrence of the amphipod, *Gammarus* sp., is of interest as this form is typical of estuarine conditions. The species *Hyalella azteca* Saussure, normally associated with freshwater in Nova Scotia, was not found. This situation indicates recent or continuing marine influence in the lake.

Animals recorded were:

Oligochaeta

Unidentified species in bottom mud

Crustacea

Cladocera

Gammarus sp., very common

Hydracarina

Two species found amongst *Myriophyllum*

Insecta

Zygoptera (Odonata) nymphs (two species)

Trichocorixa verticalis Fieb (Hemiptera)

Limnephilidae (Trichoptera), nymphs

Chironomidae (Diptera), larvae and pupae of several species common in bottom mud

Simuliidae (Diptera)

Cercyon sp. (Coleoptera)

Gyrinus lugens LeC. (Coleoptera)

Elmidae (Coleoptera), larvae and adults

Mollusca

Gyraulus circumstriatus (Tryon), common on vegetation

Succinea sp., under debris on lake shore

Succinea ovalis Say, with eggs, under debris on lake shore

Vertebrata

Gasterosteus aculeatus Linnaeus (Threespine stickleback) common in lake and pond

Fundulus diaphanus Leseur (Banded killifish) common in lake

JIGGING COVE LAKE

This is an artificial lake, formed by the damming of a brook. The wooden dam is no longer fully functional and the water level is lower than it had been originally. Many stumps of trees that had been cut down at the time of construction of the dam, were exposed along the shores. The lake is 0.7 km long and 0.15 km wide and lies at 45 m above sea level. Sampling was carried out at the west end of the lake (see Fig. 4). In this area the shore varied; with quaking bog, swamp with very soft organic mud, and stones, depending upon the degree of exposure. Water quality data for 1960 includes: alkalinity 0.6 ppm, hardness 14.7 ppm and pH 5.6 (Kerekes, 1968).

The aquatic vegetation was both diverse and abundant, and especially well developed at the west end of the lake, where shallow water overlies a soft mud bottom. The surface was covered with *Nuphar* and *Nymphoides*. Further eastwards, where the shores were more exposed to wind and waves, rushes, reeds and *Utricularia* were found growing among the stones.

The plants recorded were:

Bryophyta

Fontinalis sp.

Spermatophyta

(<i>Sparganium</i> sp.?)	(possibly <i>Saggitaria</i> sp.)
<i>Potamogeton epihydrus</i> Raf.	Pondweed
<i>Dulichium arundinaceum</i> (L.) Britt.	
<i>Eleocharis palustris</i> (L.) R. & S.	Spike-Rush
<i>Eriocaulon septangulare</i> With.	Pipewort
<i>Juncus militaris</i> Bigel.	Rush
<i>Nuphar variegatum</i> Engelm.	Yellow-Water Lily
<i>Nymphoides cordata</i> (Ell.) Fern.	Floating Heart
<i>Lobelia dortmanna</i> L.	Water Lobelia
<i>Utricularia</i> sp. (not collected)	Bladderwort

Animals were found to be most common in the areas of greatest vegetation growth. Insect larvae and nymphs were certainly the most important forms present. The exposed stony shore only supported growths of *Spongilla* and attached cases of Trichoptera larvae.

Animals recorded were:

Porifera

Spongilla sp. on stones and sticks, some specimens showing gemmule formation

Hirudinea

One species was found among plants. Egg capsules were seen attached to stones

Crustacea

Cladocera, taken among plants

Hyalella azteca Saussure. Very common among plants and on the bottom

Insecta

Libellula sp. (Odonata), nymph
Libellulidae (Odonata), nymph
Sympetrum sp. (Odonata), nymph
Aeschna sp. (Odonata), nymph
Sigara decoratella (Hfd.) (Hemiptera), nymphs, common
Sigara solensis Hfd. (Hemiptera) adult
Buena macrotibialis Hfd. (Hemiptera) adults and nymphs
Trichoptera. About five species, common
Chironomidae (Diptera) common in bottom mud
Gyrinus lugens LeC. (Coleoptera) adults, common
Hydroporus undulatus Say (Coleoptera) adults, common
Hydroporus clypealis Sharp (Coleoptera) adults

Mollusca

Pisidium sp. among plants
Musculium sp. among plants, common
Physa sp. among plants, on wood and stones

Vertebrata

Amphibia- unidentified frogs and tadpoles

WARREN LAKE

This was the largest of the lakes examined, being 1.9 km long and 0.65 km wide. The lake is formed behind a moraine and is fed by Warren Brook which has its source in the highland plateau. The surface is 15 m above sea level and maximum depth is 31 m. The open lake is subjected to strong winds and the shores at the eastern end are of wave-washed stones and sand. More sheltered conditions are found at the west end of the lake. Representative water quality data (1966) are: alkalinity 1.0 ppm. hardness 5.4 ppm and pH 6.0 (Kerekes, 1968). Because of the size of the lake only the shores at the eastern end which show the more exposed conditions were visited (Fig. 5). Sampling was restricted to shallow margins of the lake down to about one metre in depth.

The vegetation was sparse on the exposed shores, due to the hard, stony substratum and wave action. Beds of rushes, *Eriocaulon* and *Lobelia* occur at some places but most of the species are dispersed along the shallow lake margins.

Plants recorded were:

Algae

Nitella (*flexites* ?)
Capsosira brebissonii Keutz.

Bryophyta

Dicranella palustris (Dicks.) Crundw. ex Warb.
Fontinalis novae-angliae Sull.
Pallavicinia lyellii (Hook.) S.F.Gray

Pteridophyta

Isoetes macrospora Dur.

Quillwort

Spermatophyta

Potamogeton oakesianus Robbins

Pondweed

(*Vallisneria* sp. or *Sparganium* sp.? sterile material)

Eleocharis acicularis R. & S.

Spike-Rush

Eleocharis palustris (L.) R. & S.

Spike-Rush

Eriocaulon septangulare With.

Pipewort

Glyceria borealis (Nash) Batch

Northern Manna-Grass

Juncus militaris Bigel.

Rush

Nasturtium officinale R.Br.

Watercress

Nymphoides cordata (Ell.) Fern.

Floating Heart

Utricularia intermedia Hayne

Bladderwort

Lobelia dortmanna L.

Samples of animals were mostly obtained in association with the beds of rushes, but also from the bottom sand and in the submerged growths of the moss, *Fontinalis*. A wide variety of species was found, with insect larvae being the most conspicuous group. The freshwater mussel, *Elliptio complanatus*, was common along the south side of the lake. The finding of a pearl mussel, *Margaritifera*, shell is a first record for this species in the Cape Breton Highlands National Park.

Animals recorded were:

Porifera

Spongilla sp. common on stones, some showing gemmule formation

Nematoda

Unidentified individuals from bottom material

Oligochaeta

Unidentified

Hirudinea

One species

Crustacea

Cladocera

Hyalella azteca Saussure. common

Insecta

Unidentified (Odonata) nymphs

Coenagriidae (Odonata) nymphs

Sigara sp. (Hemiptera)

Ephemeroptera, nymphs

Leptoceridae (Trichoptera) larvae

Limnephilidae (Trichoptera) larvae

Helicopsyche sp. (Trichoptera) larvae

Chironomidae (Diptera) larvae
Dytiscus dauricus Gebl, (Coleoptera) adult
Elmidae (Coleoptera) adults and larvae

Mollusca

Margaritifera margaritifera (L.) shell only
Elliptio complanatus (Solander) common
Pisidium sp.
Musculium sp.
Amnicola limosa Say
Physa sp.

FRESHWATER LAKE

Freshwater Lake is situated 3 m above sea level behind a barrier beach of stones at South Bay, Ingonish. It is 0.85 km long and 0.7 km wide. At the eastern (seaward) end, the lake bottom is sandy and exposure to wind and waves prevents much growth of vegetation. At the western end there are small, sheltered embayments with mud bottoms and dense growths of aquatic vegetation. Sampling localities are shown in Fig. 6. Water quality data for 1966 included: alkalinity 12.6 ppm, hardness 36.5 ppm and pH 6.5 (Kerekes, 1968).

The greatest abundance and variety of plants was found in the littoral zone of sheltered bays. The most conspicuous species were various pondweeds and yellow water lilies. In the exposed sandy areas the vegetation was more sparse and included various reeds, rushes and *Isobetes* sp.

Plants recorded were:

Algae

Scytonema hofmannii Agardh (= *Tolypothrix distorta* Kutz.)
Schizothrix calciocola (C.Ag.) Gom. ex Gom. (= *Lyngba epiphytica* Hieron. ex Kirchn.)
Chara globularis Thuill. Stonewort

Bryophyta

Drepanocladus exannulatus (B.S.G.) Warnst.
Fontinalis novae-angliae Sull.
Sphagnum torreyanum Sull. Sphagnum

Pteridophyta

Isoetes (macrospora Dur?) Quillwort

Spermatophyta

Sparganium americanum Nutt. Bur-reed
Sparganium angustifolium Michx. Bur-reed
Potamogeton amplifolius Tuckerm. Pondweed
Potamogeton gramineus L. Pondweed
Potamogeton pusillus L. Pondweed

<i>Potamogeton richardsonii</i> (Ar. Benn.) Rydb.	Pondweed
<i>Najas flexilis</i> (Willd.) Rostk. & Schmidt	Bushy Pondweed
<i>Dulichium arundinaceum</i> (L.) Britt.	
<i>Eleocharis acicularis</i> R. & S.	Spike-Rush
<i>Eleocharis palustris</i> (L.) R. & S.	Spike-Rush
<i>Scirpus americanus</i> Pers.	Bulrush
<i>Juncus militaris</i> Bigel.	Rush
<i>Nuphar variegatum</i> Engelm.	Yellow Water Lily
<i>Myriophyllum alterniflorum</i> D.C.	Water Milfoil
<i>Myriophyllum tenellum</i> Bigel.	Water Milfoil

The areas where aquatic vegetation was most dense also supported the greatest variety and number of animals. Insects were important but in addition, a variety of mollusc species were present, including three bivalve and seven gastropod species. Among the gastropods, *Valvata sincera* is a noteworthy record for the province of Nova Scotia.

Animals recorded were:

Oligochaeta

Various unidentified species in bottom mud

Hirudinea

sp. 1

sp. 2

Crustacea

Cladocera

Hyalella azteca Saussure, very common

Arachnida

Hydracarina

Insecta

Plecoptera nymph

Coenagriidae (Odonata) nymphs, more than one species

Gerridae (Hemiptera)

Corixidae (Hemiptera)

Sigara sp. (Hemiptera) adults and nymphs

Notonectidae (Hemiptera)

Sialidae (Megaloptera)

Ephemeroptera nymphs

Trichoptera larvae

Limnephilidae (Trichoptera) larvae

Chironomidae (Diptera) larvae

Gyrinus sp. (Coleoptera) larvae

Haliphus sp. (Coleoptera)

Laccophilus sp. (Coleoptera)

Mollusca

Anodonta cataracta Say on muddy bottom
Pisidium sp.
Musculium sp.
Valvata sincera Say
Helisoma anceps (Menke)
Gyraulus circumstriatus (Tryon)
Lymnaea columella Say
Physa sp.
Ferrissia sp.

Vertebrata

Apeltes quadracus (Mitchell) Fourspine stickleback
Pungitius pungitius (Linnaeus) Ninespine stickleback

TWO ISLAND LAKE

Because of the short time available, the lake was only investigated at one place, near the centre of the lake in a shallow stony area. The lake is 0.75 km long and 0.65 km wide and lies at an altitude of 470 m. The surrounding shore is low-lying with a vegetation of bog and spruce-barren, rendering the lake exposed and wind-swept. Water quality data collected in 1976 included: alkalinity 1.9 ppm, hardness 3.1 ppm and pH 5.8 (Kerekes, pers. comm.).

The only area investigated had a vegetation of rushes and aquatic mosses growing among stones in shallow water.

Plants recorded were:

Bryophyta

Calliergon stramineum (Brid.) Kindb.
Cladopodiella fluitans (Nees) Joerg.
Drepanocladus exannulatus (B.S.G.) Warnst
Scapania nemorosa Dumort.
S. subalpina Dumort.
Sphagnum fallax Klinggr.
Sphagnum palustre L.
Sphagnum sp.

Pteridophyta

Isoetes (muricata Dur.?) -sterile

Quillwort

Spermatophyta

Eleocharis palustris (L.) R. & S.
Lobelia dortmanna L.

Spike-Rush
Water Lobelia

Despite the short collecting time, a variety of animals was found.

Animals recorded were:

Porifera

Spongilla sp. on shores, showing gemmule formation

Oligochaeta

unidentified sp.

Hirudinea

unidentified sp. adult

unidentified sp. egg cases on stone

Crustacea

Cladocera, very common among rushes

Hyalella azteca Saussure common

Arachnida

Hydracarina

Insecta

Odonata nymphs, two species

Trichocorixa verticalis Fieb. (Hemiptera)

Phryganea (Trichoptera) larvae

Limnephilus sp. (Trichoptera) larvae

Chironomidae (Diptera) larvae

Gyrinus sp. (Coleoptera)

Hydroporus undulatus Say

Mollusca

Pisidium sp.

DISCUSSION

Taking into consideration the time limitations and single visit during the season, the study was successful in producing lists of the common species of aquatic plants and animals at each lake. It is certain that further studies will build upon these lists, but as they stand at present they do reflect the biological characters of the lakes. It is possible to compare the lakes on the basis of their macroscopic flora and fauna and relate this to their physical and chemical conditions.

The plants recorded during the investigation are summarized in Table 2. The genus *Potamogeton* (Pondweed) is one of the most significant in this study, with eight species represented in five of the six lakes. Many of the individual taxa can be associated with specific physical and chemical parameters

of the habitat in which they grow. *Potamogeton pectinatus*, characteristic of brackish or alkaline waters, was found only at Presqu'ile Lake which has the highest salinity (210.0 ppm) and also the highest alkalinity (64.3 ppm) of all the lakes surveyed (Kerekes, 1968). Freshwater Lake also has high salinity (88.3 ppm) and moderate alkalinity (12.6 ppm). It contains *Potamogeton pusillus* which is associated with brackish water and *Potamogeton richardsonii*, a "less acid" species (Webster, 1956). As these two lakes are somewhat similar in their water chemistry, it is not surprising that *Potamogeton gramineus* would be found in both but not in the other four lakes. *Potamogeton amplifolius*, a common pondweed of "less acid" situations, is also found in Freshwater Lake, making a total of four separate species in this rather complex (with respect to substrate types and degrees of exposure) body of water which is part of a large drainage system. Presqu'ile Lake, in contrast, appears to have originated in the relatively recent past and is not connected to a large drainage system. Only the two species of *Potamogeton* were found here.

Potamogeton epihydrus, the most common pondweed in the province (Roland & Smith, 1969) was found in both French Lake and Jigging Cove Lake. These two lakes are remarkably similar in chemical composition (pH 5.6 & 5.5; alkalinity 0.8 & 0.6 ppm respectively). *Potamogeton natans* was found only in French Lake and *Potamogeton oakesianus* was found only in Warren Lake. Both of these species are rather common and scattered throughout the province (Roland & Smith, 1969).

Eleocharis palustris and *Lobelia dortmanna* are the most frequently encountered taxa. The former is absent only from Presqu'ile Lake and the latter is absent from both Presqu'ile and Freshwater Lakes. This suggests that both plants are intolerant of saline or alkaline conditions. *Eriocaulon septangulare* was reported from French, Jigging Cove and Warren Lakes. It may well be found at Two Island Lake (collecting time for this survey was very short) thus confirming it as a common plant of acid lakes in the area.

The alga, *Chara globularis*, and the moss, *Sphagnum torreyanum*, were found in both Freshwater Lake and Presqu'ile Lakes and not in the other four lakes. *Chara* is well known to be associated with the alkaline or "hard waters" (Fassett, 1940) reported from both of these lakes.

The greatest number of plant taxa (22) was reported from Freshwater Lake. This is likely to be explained by the diversity of habitat types within this lake and also the substantial drainage basin that supplies it. Warren Lake, with 18 reported taxa, is the largest lake in the study. It too has a substantial drainage system.

Table 3 gives a comparison of pairs of the six lakes surveyed. The number of times the same species was found in both lakes gives a measure of similarity or divergence between the two lakes in any given pair. The results are largely in agreement with what might be expected from a similar comparison of pH values, with the exception of Two Island Lake. However, additional collections at this lake would probably yield more common pairs with the acid lakes.

The records of animals made during the survey are summarized in Table 4. In several cases specific identifications have not been possible and in due course, when these are completed some additional interpretation may be made. The insects (42 taxa), which constitute most of the aquatic fauna, do not reveal any major differences between the lakes. The species involved all have flying adult stages and thus a wide geographic distribution is to be expected. The amphipod crustacean, *Hyalella azteca*, is ubiquitous in freshwaters in Nova Scotia and is only absent from Presqu'ile Lake. This absence is probably due to the recent influence of the sea on this lake and the related occurrence of *Gammarus* sp., an amphipod commonly associated with marine or estuarine conditions.

Thirteen taxa of freshwater mollusca as well as two members of the land snail family Succineidae were recorded. The freshwater molluscs are not uniformly distributed and do show the influence of water quality and the past affinities of each lake to larger drainage systems. The Pearl Mussel, *Margaritifera margaritifera* and unionids, *Elliptio complanatus* and *Anodonta cataracta* are all recorded from the Cape Breton Highlands for the first time, although they do occur in the Margaree River system. The sphaeriids, *Musculium* and *Pisidium*, have not been fully identified. The diverse species involved in these genera have a wide range of tolerances for water conditions. The snail *Amnicola limosa* is widespread in Nova Scotia in all but the most acidic waters. Its absence from French Lake and Two Island Lake is therefore to be expected. However, this species should have been found in Freshwater Lake and may in fact have been overlooked. *Valvata sincera* is an important record as it represents a link with the St. Lawrence Drainage system. In Nova Scotia, the species is only known at present from Freshwater Lake, but does occur in New Brunswick, Quebec and at Bonne Bay in Newfoundland. Freshwater Lake has the most diverse molluscan fauna because of its higher alkalinity, sheltered habitat and past association with an extensive drainage system. French Lake and Two Island Lake are too acidic and isolated for any species other than *Pisidium*. Jigging Cove Lake, with only *Pisidium*, *Musculium* and *Physa*, is relatively poor because of its recent modification to a lake from a stream, by damming. The poor molluscan fauna of Presqu'ile Lake with only *Gyraulus circumstriatus* again supports the view that this lake has been strongly influenced by sea water. The vertebrate records have been included in the results but sampling was not intended to give any meaningful information on these animals.

Future work in the Cape Breton Highlands National Park will certainly add many species of plants and animals to the lists provided here, but they are considered to be a useful basis for comparison of the six lakes studied. Any further studies should take into consideration the seasonality of some species, and also investigate those habitats more commonly associated with streams and rivers.

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Table 1. Zoology accession numbers for samples taken in six lakes, in the Cape Breton Highlands National Park, Aug. 1976. The number of lots in each case is shown in parentheses.

Locality		Date	Zool. Acc. No.
French Lake.	north end (sheltered shore)	10 Aug.	1976.Z.310(11)
	exposed shore	10 Aug.	1976.Z.311(4)
	bottom mud	10 Aug.	1976.Z.312(9)
	shore collection	10 Aug.	1976.Z.313(2)
	shore, etc.	10 Aug.	1976.Z.314(1)
Presqu'ile Lake.	north end (plants)	10 Aug.	1976.Z.315(12)
	north end (mud and plants)	10 Aug.	1976.Z.316(11)
	north end (shore)	10 Aug.	1976.Z.317(2)
	pond at south end	10 Aug.	1976.Z.318(7)
Jigging Cove Lake.	west end st. 1	11 Aug.	1976.Z.319(16)
	west end (mud)	11 Aug.	1976.Z.320(3)
	south side st. 2	11 Aug.	1976.Z.321(5)
Warren Lake.	st. 1 north side	12 Aug.	1976.Z.322
	st. 2 south side	12 Aug.	1976.Z.323
	st. 3 south side	12 Aug.	1976.Z.324
	st. 4 south side	12 Aug.	1976.Z.325
	st. 5 north side	12 Aug.	1976.Z.326
Freshwater Lake.	st. 1 east side	12 Aug.	1976.Z.327
	st. 2 west side	12 Aug.	1976.Z.328
Two Island Lake.	seive sample	12 Aug.	1976.Z.329
	stone with sponges	12 Aug.	1976.Z.330

Table 2. Plants recorded during the investigation of six lakes in Cape Breton Highlands National Park, N.S. Aug. 1976.

	French Lake	Presqu'ile Lake	Jigging Cove Lake	Warren Lake	Freshwater Lake	Two Island Lake
<u>Algae</u>						
<i>Capsosira brebissonii</i>				x		
<i>Schizothrix calcicola</i>					x	
<i>Scytonema hoffmannii</i>					x	
<i>Batrachospermum</i> sp.		x				
<i>Oedogonium</i> sp.	x					
<i>Chara globularis</i>		x			x	
<i>Nitella</i> sp.				x		
<u>Bryophyta</u>						
<i>Scapania nemorosa</i>						x
<i>Scapania subalpina</i>						x
<i>Pallavicinia lyellii</i>				x		
<i>Calliergon stramineum</i>						x
<i>Cladopodiella fluitans</i>						x
<i>Dicranella palustris</i>				x		
<i>Drepanocladus exannulatus</i>					x	x
<i>Fontinalis novae-angliae</i>	x			x	x	
<i>Fontinalis</i> sp.			x			
<i>Sphagnum fallax</i>						x
<i>Sphagnum palustre</i>						x
<i>Sphagnum torreyanum</i>		x			x	
<i>Sphagnum</i> sp.						x
<u>Pteridophyta</u>						
<i>Equisetum fluviatile</i>	x					
<i>Isoetes macrospora</i>				x	x	
<i>Isoetes muricata</i>		x				?

Table 2. (continued)

	French Lake	Presqu'ile Lake	Jigging Cove Lake	Warren Lake	Freshwater Lake	Two Island Lake
<u>Spermatophyta</u>						
<i>Sparganium americanum</i>					x	
<i>Sparganium angustifolium</i>	x	x			x	
<i>Sparganium</i> sp.			x	?		
<i>Potamogeton amplifolius</i>					x	
<i>Potamogeton epihydrus</i>	x		x			
<i>Potamogeton gramineus</i>		x			x	
<i>Potamogeton natans</i>	x					
<i>Potamogeton oakesianus</i>				x		
<i>Potamogeton pectinatus</i>		x				
<i>Potamogeton pusillus</i>					x	
<i>Potamogeton richardsonii</i>					x	
<i>Najas flexilis</i>					x	
<i>Vallisneria</i> sp.				?		
<i>Glyceria borealis</i>				x		
<i>Dulichium arundinaceum</i>			x		x	
<i>Eleocharis acicularis</i>	x			x	x	
<i>Eleocharis palustris</i>	x		x	x	x	x
<i>Scirpus americanus</i>					x	
<i>Scirpus validus</i>		x				
<i>Eriocaulon septangulare</i>	x		x	x		
<i>Juncus militaris</i>			x	x	x	
<i>Juncus</i> sp.	x					
<i>Polygonium natans</i>		x				
<i>Nuphar variegatum</i>		x	x		x	
<i>Nymphaea odorata</i>	x					
<i>Nasturtium officinale</i>				x		
<i>Myriophyllum alternifolium</i>					x	
<i>Myriophyllum exalbescens</i>		x				
<i>Myriophyllum tenellum</i>					x	
<i>Nymphoides cordata</i>	x		x	x		
<i>Utricularia geminiscapa</i>		x				
<i>Utricularia intermedia</i>	x			x		
<i>Utricularia</i> sp.			x			
<i>Lobelia dortmanna</i>	x		x	x		x

Table 3. Flora and pH comparisons between all possible combinations (15) of six lakes surveyed in the current study.

Lake Pairs	No. of times both lakes contain same taxa	Difference in pH
French Lake - Warren Lake	7	5.5 - 6.0 = 0.5
French Lake - Jigging Cove Lake	5	5.5 - 5.6 = 0.1
Presqu'ile Lake - Freshwater Lake	5	7.5 - 6.5 = 1.0
Jigging Cove Lake - Warren Lake	5	5.6 - 6.0 = 0.4
Warren Lake - Freshwater Lake	5	6.0 - 6.5 = 0.5
French Lake - Freshwater Lake	4	5.5 - 6.5 = 1.0
Jigging Cove Lake - Freshwater Lake	4	5.6 - 6.5 = 0.9
French Lake - Two Island Lake	2	5.5 - 5.8 = 0.3
Freshwater Lake - Two Island Lake	2	6.5 - 5.8 = 0.7
Jigging Cove Lake - Two Island Lake	2	5.6 - 5.8 = 0.2
Warren Lake - Two Island Lake	2	5.5 - 5.8 = 0.3
French Lake - Presqu'ile Lake	1	6.0 - 7.5 = 1.5
Presqu'ile Lake - Jigging Cove Lake	1	7.5 - 5.6 = 1.9
Presqu'ile Lake - Warren Lake	0	7.5 - 6.0 = 1.5
Presqu'ile Lake - Two Island Lake	0	7.5 - 5.8 = 1.7

Table 4. Animals recorded during the investigation of six lakes in Cape Breton Highlands National Park, N.S. Aug. 1976.
* indicates inclusion of more than one species

	French Lake	Presqu'ile Lake	Jigging Cove Lake	Warren Lake	Freshwater Lake	Two Island Lake
<u>Porifera</u>						
<i>Spongilla</i> sp. *			x	x		x
<u>Nematoda</u>						
unidentified	x					
<u>Annelida</u>						
<i>Helobdella stagnalis</i>	x					
Hirudinea, unidentified *	x		x	x	x	x
Oligochaeta, unidentified *		x		x	x	x
<u>Crustacea</u>						
Cladocera, unidentified *		x		x	x	x
<i>Gammarus</i> sp.		x				
<i>Hyalella azteca</i>	x		x	x	x	x
<u>Insecta</u>						
Ephemeroptera:						
unidentified *	x			x	x	
Odonata:						
unidentified *				x	x	x
Libellulidae, unidentified *	x		x			
<i>Libellula</i> sp.			x			
<i>Cordulia shurtleffi</i>	x					
<i>Sympetrum</i> sp.			x			
<i>Sympetrum costiferum</i>	x					
<i>Enallagma</i> sp.		x				
Aeschidae, unidentified	x					
<i>Aeschna</i> sp.			x			
<i>Tanypteryx hageni</i>	x					
Coenagriidae, unidentified	x	x		x	x	
Hemiptera:						
Corixidae, unidentified *		x			x	
<i>Trichocorixa verticalis</i>		x				x
<i>Sigara</i> sp.				x	x	
<i>Sigara solensis</i>			x			
<i>Sigara decoratella</i>			x			
<i>Buena macrotibialis</i>			x			
Notonectidae, unidentified					x	
Gerridae, unidentified	x				x	

Table 4. (continued)

	French L.	Presqu'ile L.	Jigging Cove L.	Warren L.	Freshwater L.	Two Island L.
Plecoptera:						
unidentified					x	
Coleoptera:						
<i>Gyrinus</i> sp.					x	x
<i>Gyrinus lugens</i>		x	x			
<i>Dytiscus dauricus</i>				x		
<i>Laccophilus</i> sp.					x	
<i>Hydroporus clypealis</i>			x			
<i>Hydroporus undulatus</i>			x			x
<i>Halipilus</i> sp.					x	
<i>Cercyon</i> sp.		x				
<i>Donacia</i> sp.	x					
Elmidae, unidentified *		x		x		
Megaloptera:						
unidentified					x	
Trichoptera:						
unidentified *	x	x	x	x	x	
Limnephilidae, unidentified †		x		x	x	
<i>Limnephilus</i>						x
<i>Pseudostenophylax</i> sp.	x					
<i>Platycentropus</i> sp.	x					x
<i>Phryganea</i> sp.	x					x
<i>Molanna</i> sp.				x		
<i>Helicopsyche</i> sp.				x		
Leptoceridae, unidentified				x		
Diptera:						
Chironomidae, unidentified	x	x		x	x	x
Arachnida						
Hydracarina, unidentified *		x			x	x
Mollusca						
<i>Margaritifera margaritifera</i>				x		
<i>Anodonta cataracta</i>					x	
<i>Elliptio complanatus</i>				x		
<i>Musculium</i> sp.			x	x	x	
<i>Pisidium</i> sp.	x		x	x	x	x
<i>Annicola limosa</i>				x		
<i>Valvata sincera</i>					x	
<i>Lymnaea columella</i>					x	
<i>Helisoma campanulatum</i>					x	
<i>Helisoma anceps</i>					x	
<i>Gyraulus circumstriatus</i>		x			x	
<i>Physa</i> sp.			x	x	x	
<i>Ferrissia</i> sp.					x	

Table 4. (continued)

	French Lake	Presqu'ile Lake	Jigging Cove Lake	Warren Lake	Two Island Lake
<u>Vertebrata</u>					
<i>Fundulus diaphanus</i>		x			
<i>Apeltes quadracus</i>				x	
<i>Gasterosteus aculeatus</i>		x			
Salmonidae, unidentified	x				
<i>Pungitius pungitius</i>					x
Anura, unidentified *	x		x		

MAPS AND PHOTOGRAPHS

FIGURES 1 - 13

Figure 1: Map of Cape Breton Highlands National Park showing the locations of six lakes examined during the 1976 field program. Redrawn from a C.W.S. map.

**Cape Breton Highlands
National Park**

Study Lakes

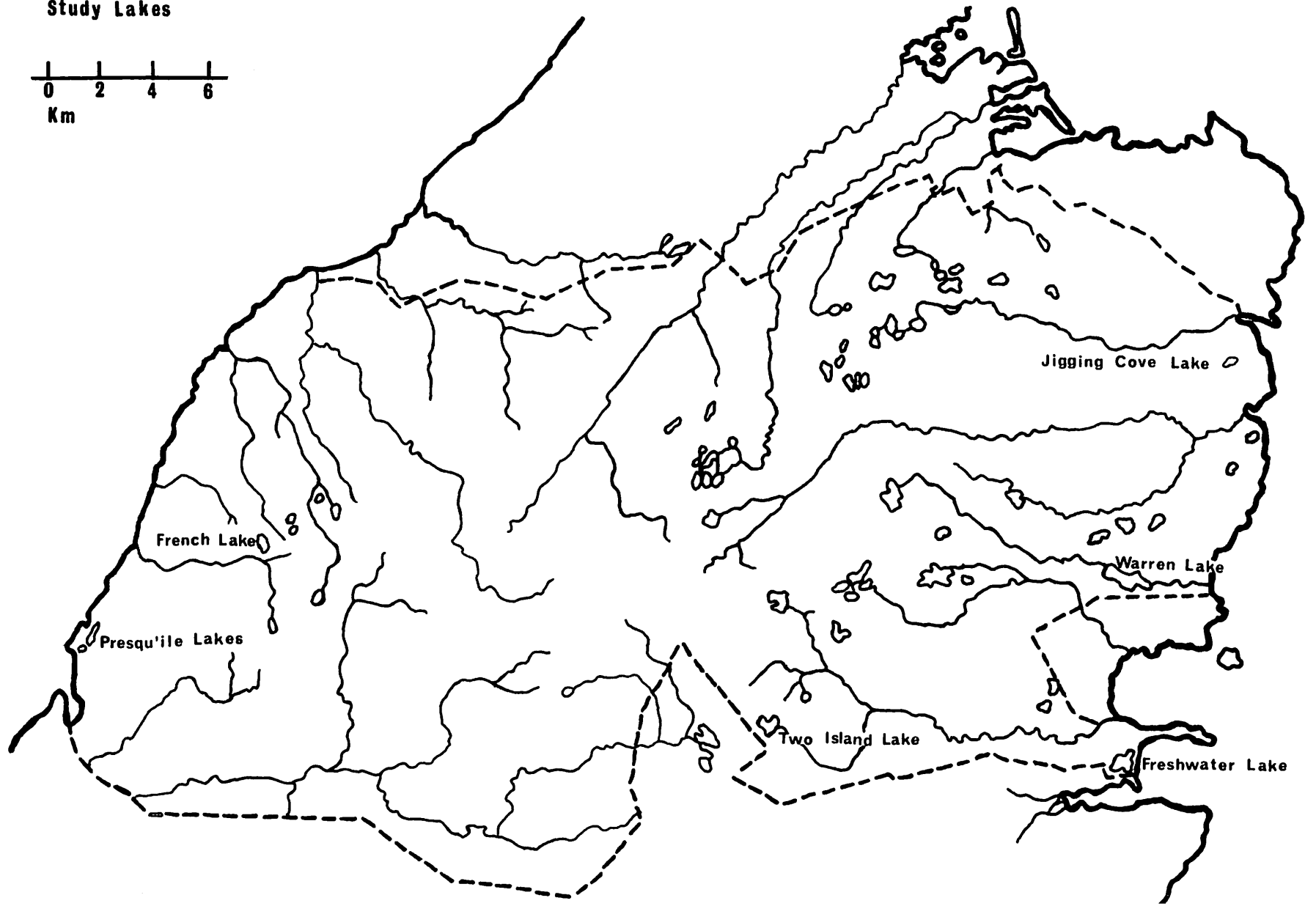
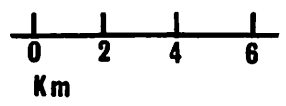
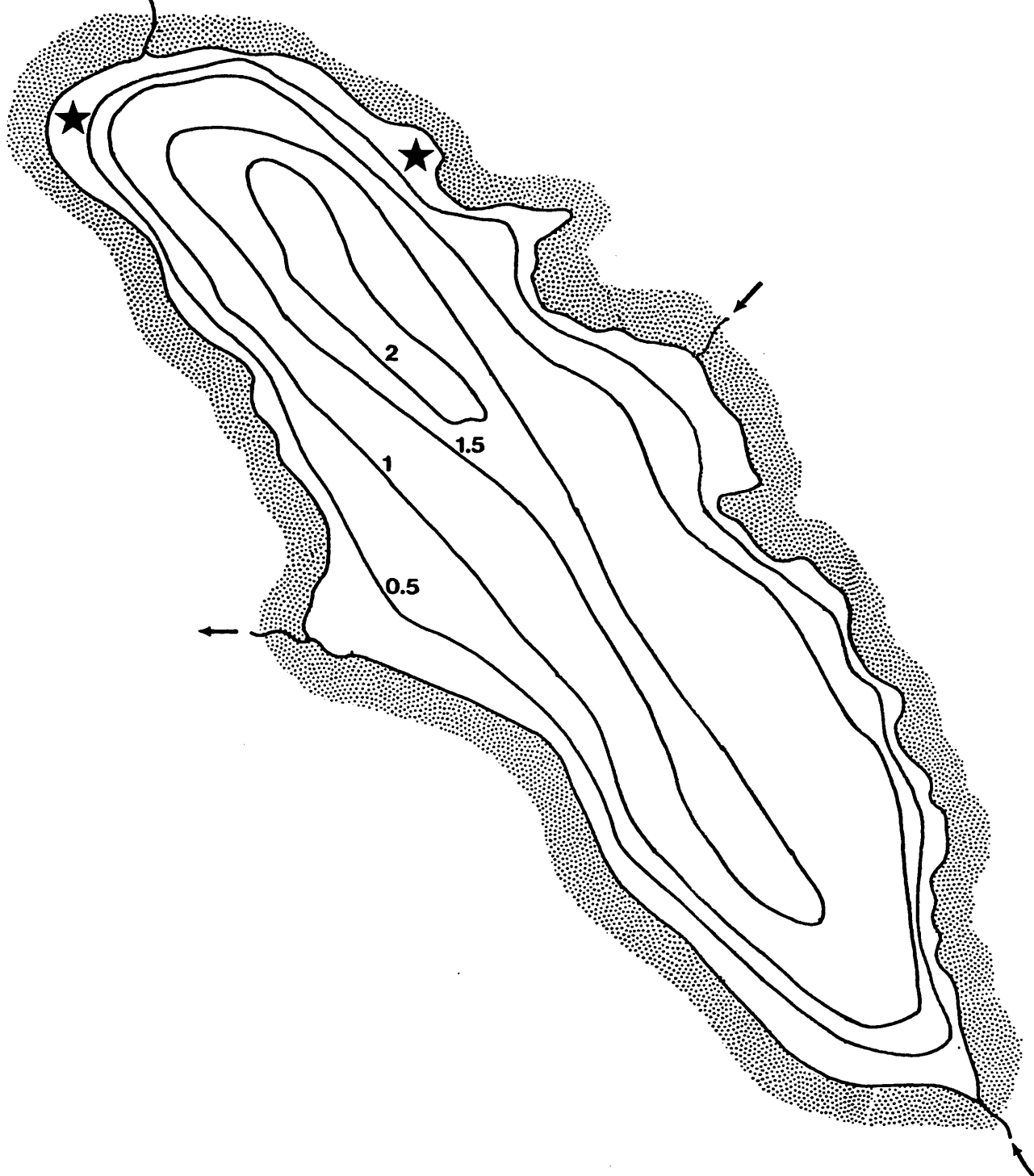


Figure 2: Bathymetric chart of French Lake, showing areas where collections were made. Courtesy of C.W.S.

Cabot Trail



French Lake

Contours in meters
↑ Direction of Flow



Meters

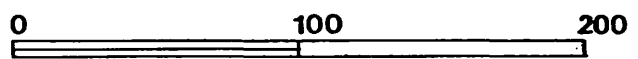
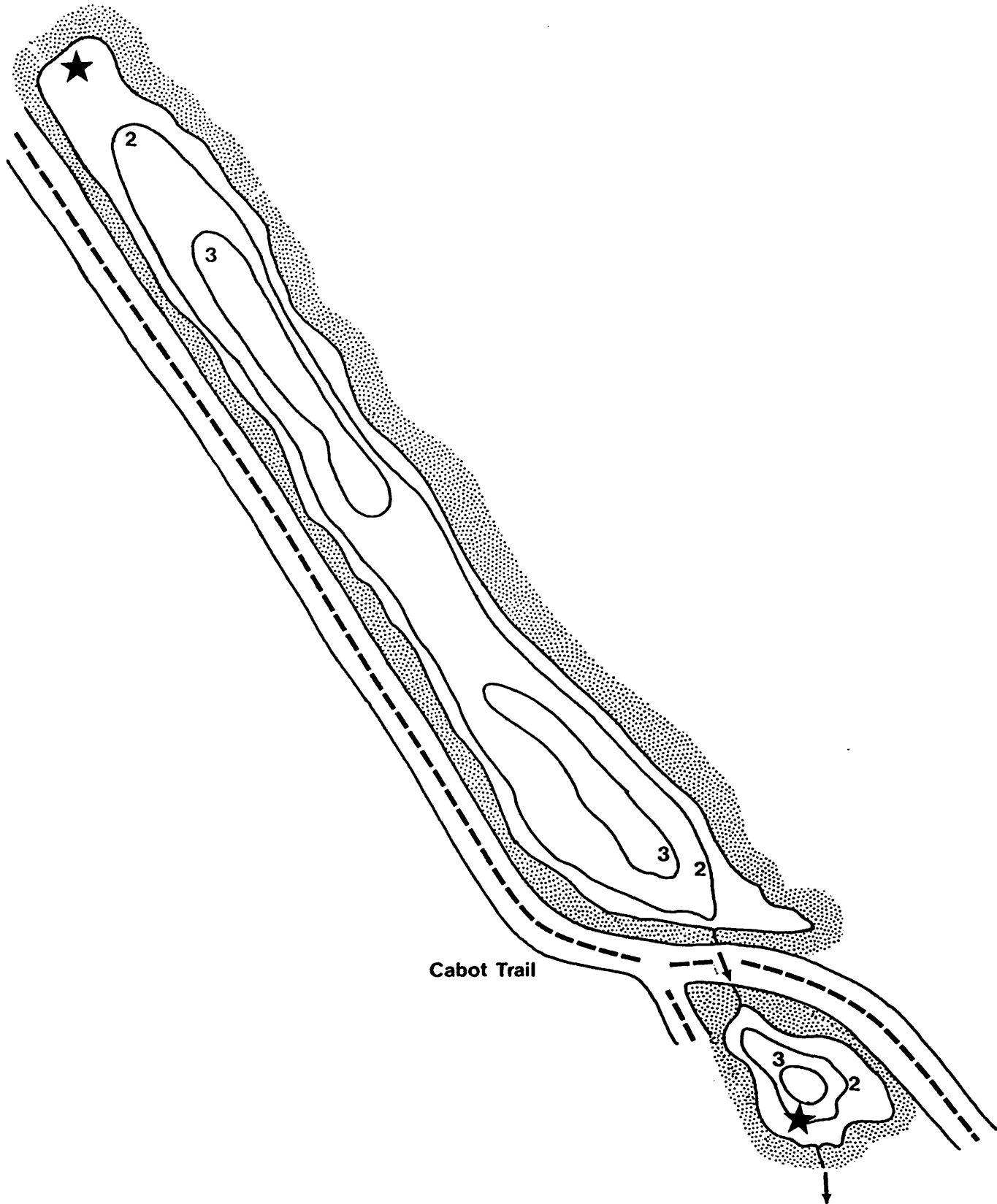


Figure 3: Bathymetric chart of Presqu'ile Lake and Little Presqu'ile Lake, showing areas where collections were made. Courtesy C.W.S.



Little Presqu'île Lake
Presqu'île Lake

Contours in meters
 † Direction of Flow



Meters

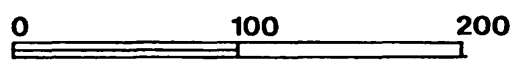
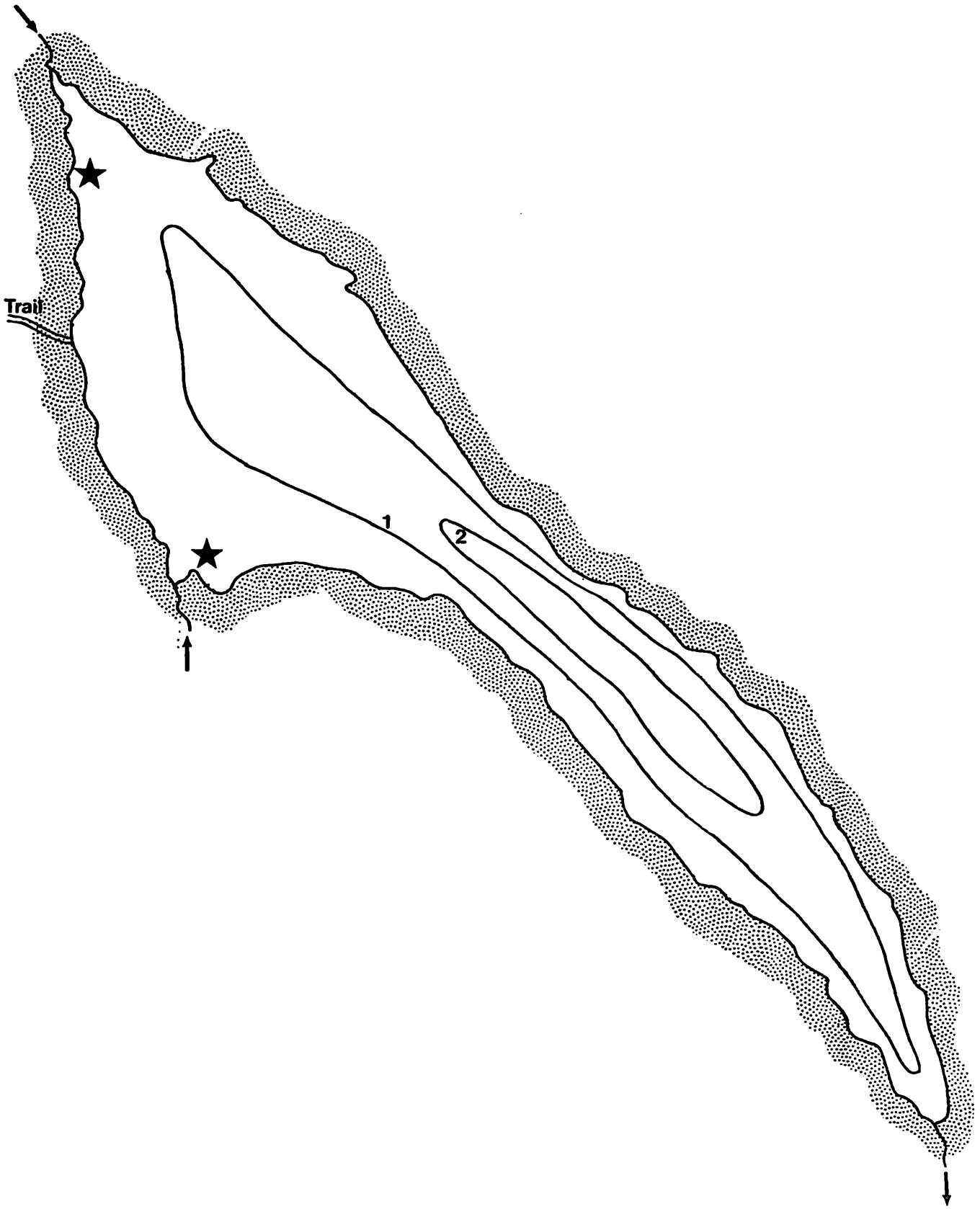


Figure 4: Bathymetric chart of Jigging Cove Lake, showing areas where collections were made. Courtesy of C.W.S.



Jigging Cove Lake

Contours in meters
↑ Direction of Flow



Meters

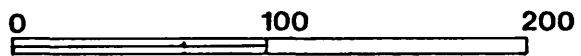
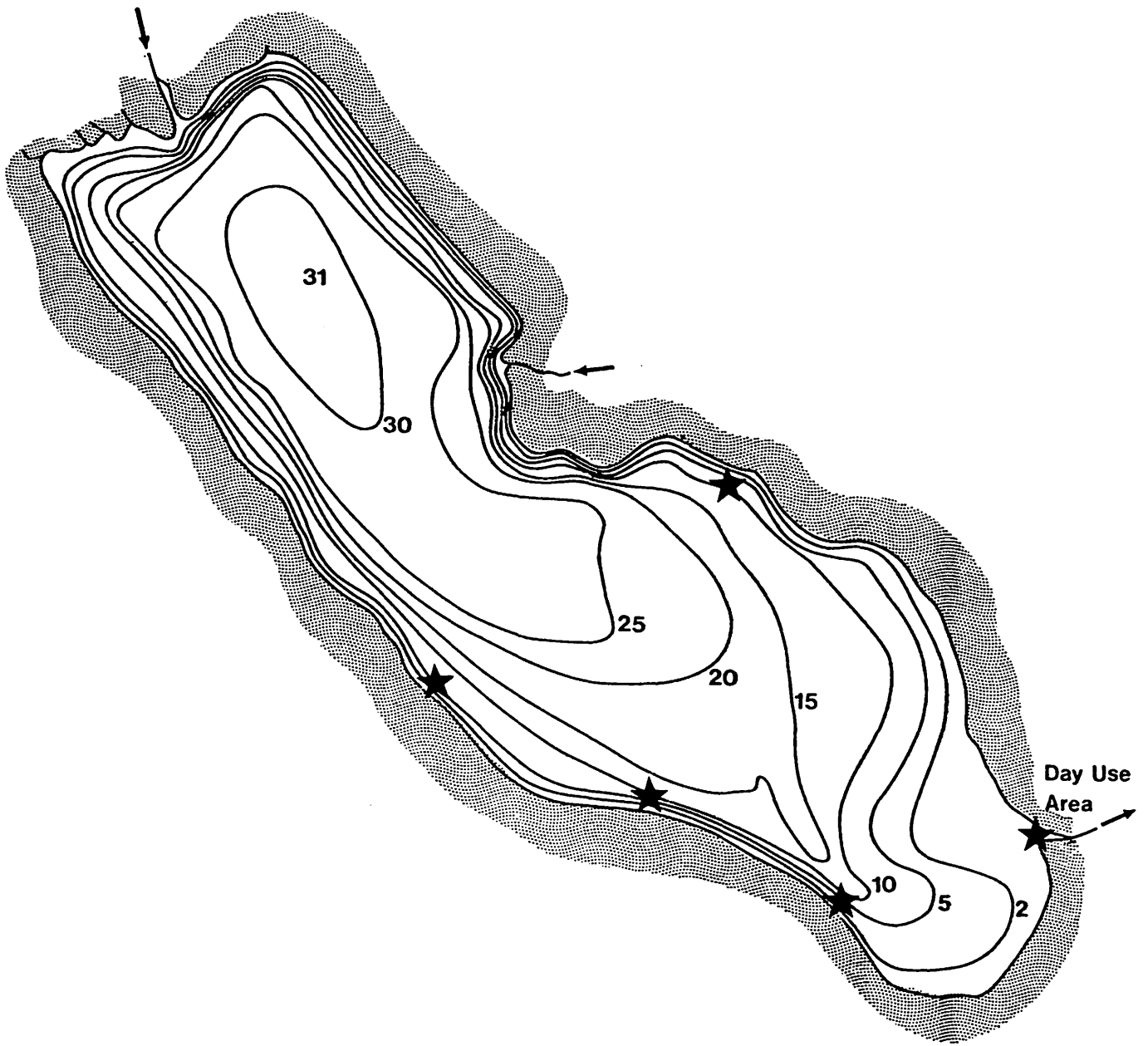


Figure 5: Bathymetric chart of Warren Lake, showing areas where collections were made. Courtesy of C.W.S.



Warren Lake

Contours in meters
 ↑ Direction of Flow



Meters

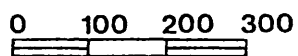
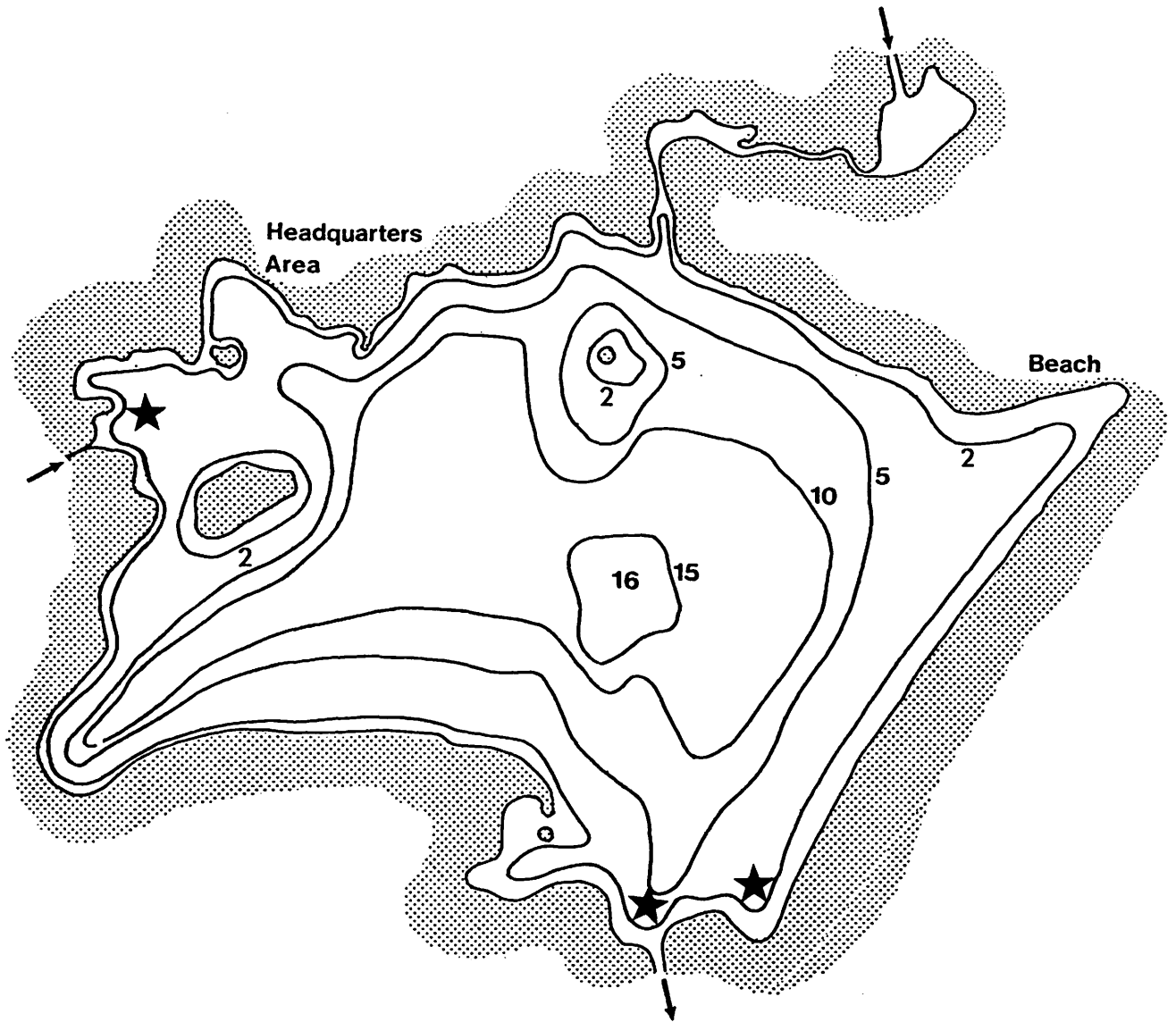


Figure 6: Bathymetric chart of Freshwater Lake, showing areas where collections were made. Courtesy of C.W.S.



Freshwater Lake

Contours in meters
↑ Direction of Flow

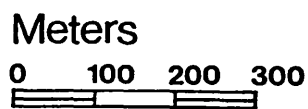


Figure 7: Bathymetric chart of Two Island Lake, showing areas where collections were made. Courtesy of C.W.S.

Two Island Lake

Contours in meters
↓ Direction of Flow

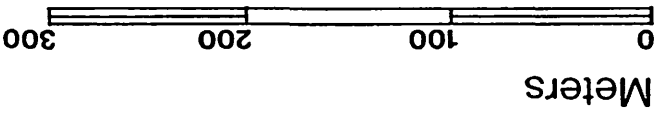
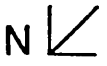


Figure 8: French Lake, viewed from the Cabot Trail, looking south. Aug. 10, 1976.

Figure 9: Presqu'ile Lake, looking north. Aug. 10, 1976.

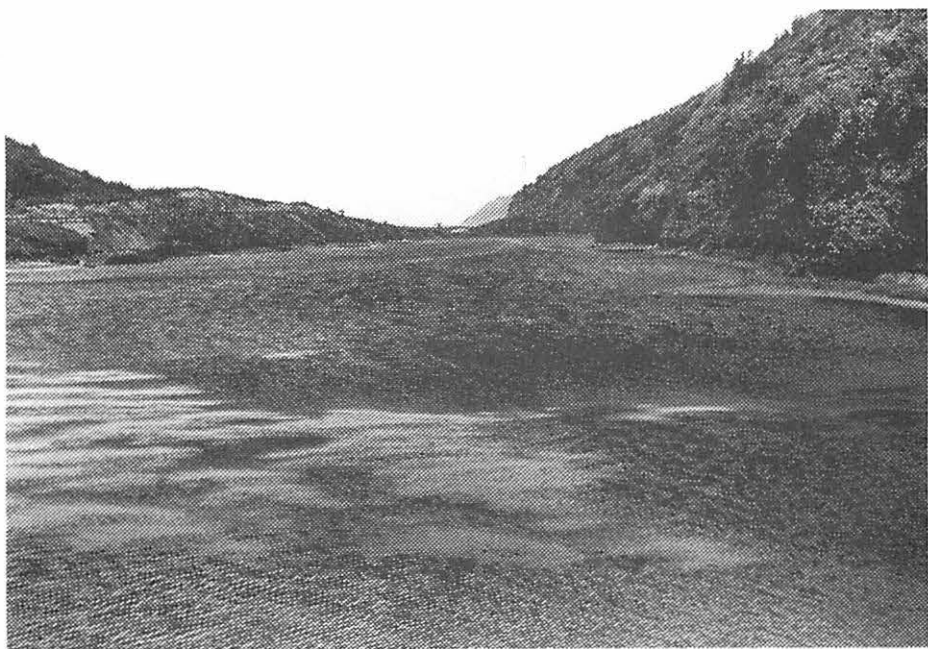


Figure 10: Jigging Cove Lake, looking east. Aug. 11, 1976.

Figure 11: Warren Lake, looking west. Aug. 12, 1976.

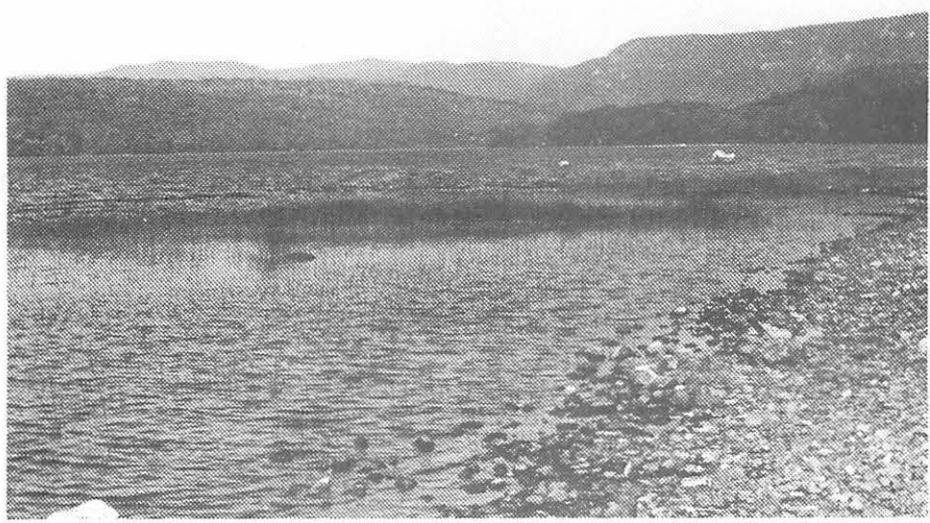


Figure 12: Freshwater Lake, the southern side looking westwards.
Aug. 12, 1976.

Figure 13: Two Island Lake. Shallow region on the west side where
collections were made. Aug. 12, 1976.

