Vegetation with Atlantic Coastal Plain Affinities in Axe Lake, near Georgian Bay, Ontario

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Keddy, P. A. 1981. Vegetation with Atlantic coastal plain affinities in Axe Lake, near Georgian Bay, Ontario. Canadian Field-Naturalist 95(3): 241–248.

Axe Lake is a small, sandy lake about 25 km NW of Huntsville, Muskoka District, Ontario. Many species with eastern or Atlantic coastal plain affinities occur in the lake, including *Muhlenbergia uniflora* (One-flowered Dropseed), *Juncus militaris* (Bayonet Rush), *Nymphoides cordata* (Floating-heart), *Rhexia virginica* (Meadow-beauty), *Rhynchospora capitellata* (beak-rush), *Woodwardia virginica* (Virginian Chain-fern), *Utricularia purpurea* (Purple Bladderwort), and *Xyris caroliniana* (Yellow-eyed Grass). The lake occurs on the edge of a sand plain which marks the former high waterline of postglacial Lake Algonquin. The vegetation of this lake may thus be of a relict shoreline type which was formerly much more widespread in the sandy bays of postglacial Lake Algonquin. Extensive beds of emergents and shallow water aquatics occur on the gently sloping shores. During July 1979, quantitative data on species composition were collected, using 25 transects run from 0.5 m above to 0.5 m below the waterline. These transects represented much of the variation in species composition and substrate types occurring in Axe Lake (except for floating bog mats and rock outcrops). The transects were divided into three categories based on the substrate type of the shoreline at 0.5 m above the waterline: sand (mean = 0.9% organic matter), transition (mean = 3.7% organic matter), and peat (mean = 16.4% organic matter). Species composition varied markedly among these categories. Many coastal plain species (such as *R. virginica*, *X. caroliniana*, and *M. uniflora*) reached their maximum abundance in the transition areas. Few occurred in *Sphagnum* bogs elsewhere on the lakeshore. Axe Lake appears to be a small remnant of a larger open water area, most of which is now *Sphagnum* bog. Thus, it appears that bog formation is gradually eliminating a relict type of shoreline vegetation.

Key Words: aquatic plants, coastal plain flora, Georgian Bay, Lake Algonquin, phytogeography, rare species, shoreline vegetation, substrate type.

It has long been known that areas about the Great Lakes, particularly the southern end of Lake Michigan and the sand barrens of northwestern Wisconsin, have floristic affinities with the Atlantic coastal plain of the eastern United States (Peattie 1922; McLaughlin 1932). The Atlantic coastal plain is a relatively flat marginal area of eastern North America which extends as a narrow band up the eastern coast between the Applachian Mountains and the Atlantic Ocean; it ranges in width from a few kilometres on Cape Cod to up to 250 km in Georgia. It is often poorly drained, with extensive wetlands; as well, acid soils are frequent (Fernald 1942). Fernald (1942) was critical of the use of the term "Atlantic coastal plain species" to describe many of the Great Lakes disjuncts, noting that the term was overused, and that "the true members of the Atlantic coastal plain flora are rarely found off the coastal plain." Although some of the species listed by Peattie (1922) and McLaughlin (1932) are questionable, there are still many species known to occur along the Atlantic coastal plain, with extensions northwards into eastern Canada, and inland to the Great Lakes. In spite of Fernald's admonition, the use of the term "coastal plain species" empahsizes the geographical affinities of these species, and thus seems useful to retain in its broader sense (e.g., in Roland and Smith 1969; Voss 1972).

In recent years, there has been growing evidence of another concentration of coastal plain species about the Great Lakes, around Georgian Bay in Ontario. Some of the more notable examples include *Rhexia virginica* (Meadow-beauty) (Soper 1956), *Potamogeton bicupulatus* (pond weed) (Reznicek and Bobbette 1976), *Bartonia paniculata* (Screw-stem) (Reznicek and Whiting 1976), and *Panicum spretum* (panic-grass) (Catling et al. 1977). Reznicek and Whiting (1976) note that other eastern species such as *Listera australis* (Southern Twayblade), *Juncus militaris* (Bayonet Rush), *Gratiola aurea* (Golden-pert), and *Linum striatum* (Flax) have similar disjunct distributions. R. C. Simpson and H. Simpson (1973. The biology of Balckstone Harbour-Moon Island Provincial Park Reserve, Parry Sound District, Ontario. Resource Inventory Report, Ontario Ministry of Natural Resources, Toronto, 153 pp.) found many shoreline species with eastern affinities including *R. virginica*, *P. bicupulatus*, and *Nymphoides cordata* (Floating-heart) on a portion of the Georgian Bay shoreline in Parry Sound District.

Field work on shoreline vegetation in the Muskoka and Parry Sound areas has revealed another locality for some of these species. This locality, Axe Lake, is further north than previous reports, and is also inland from Georgian Bay. The purpose of this paper is to describe and discuss the vegetation at this locality with reference to the substrate type of the shoreline and the geological history of the area.

Study Area — Axe Lake

Axe Lake occurs on the boundary between Muskoka and Parry Sound districts, about 25 km NW of Huntsville, Ontario (Figure 1). This region has a growing season of between 180 and 190 d. The frost-free period is between 100 and 120 d, with the last frost occurring around 25 May and the first occurring around 20 September. There are between 160 and 180 d per annum with precipitation, for a total of about 100 cm (Department of Energy, Mines and Resources 1974).

Figure 2 shows Axe Lake and the adjacent wetlands. The lake is about 0.5 × 3 km and has a sand bottom with occasional outcrops of Precambrian granitic rocks. The southern third of the lake is largely surrounded by floating bog mats, although in places a sand bottom is exposed during low water periods. The northern two-thirds has scattered boggy areas, and shorelines dominated by shrubs. In deeper water on the lake side of the shrubs, emergent and floating-leaved aquatics are well developed. Most of the lake is shallow enough to support floating-leaved aquatics, producing extensive beds of *Nymphaea odorata* (Fragrant Water-lily), *Brasenia schreberi* (Water-shield), and *Utricularia purpurea* (Purple Bladderwort). Only one area in the northern portion of the lake is deep enough to be free of floating-leaved aquatics. Small streams draining peat bogs enter at both the north and south end; the lake initially drains eastward into Buck Lake and then Lake Vernon, eventually emptying westward into Georgian Bay via the Moon River.

Although no long term data are available on lake

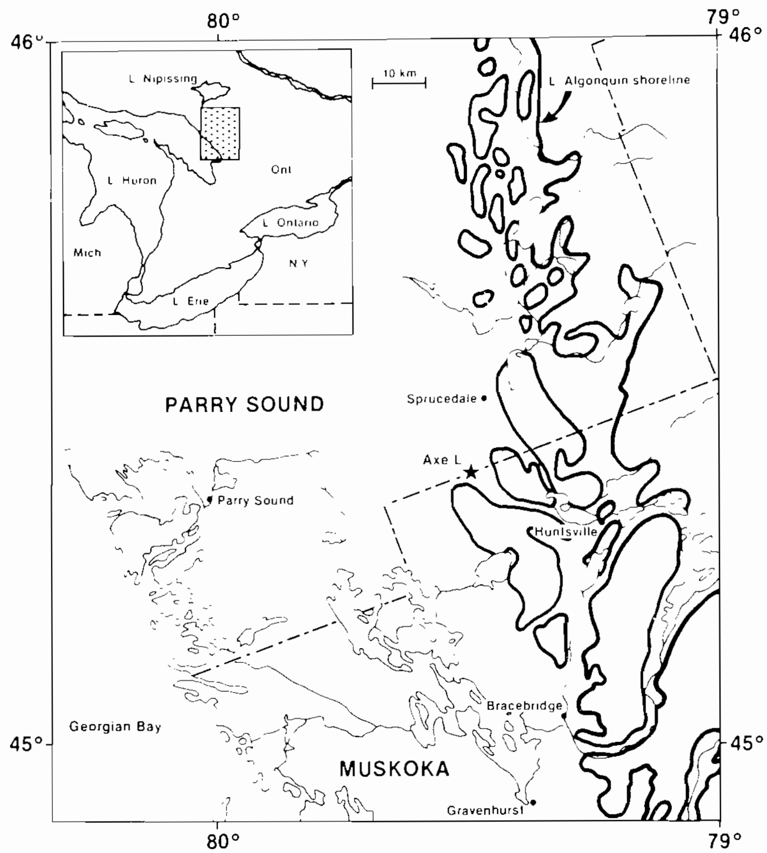

FIGURE 1. Location of Axe Lake relative to existing Georgian Bay shoreline and postglacial Lake Algonquin shoreline. Extensive sand plains parallel the old shoreline (after Chapman 1975, Figure 6).

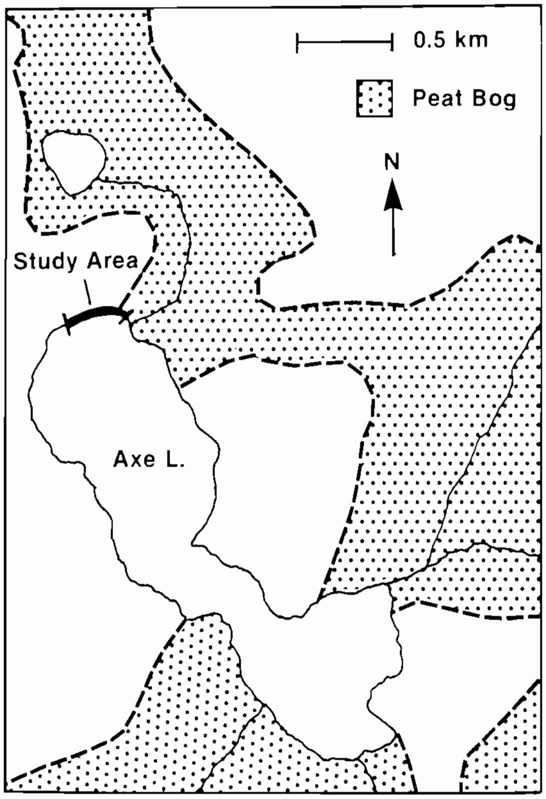

FIGURE 2. Axe Lake and immediate vicinity. Note the extensive areas of peat bog, and the location of the study area.

levels, there is considerable variation. The water level in July 1979 was about 30 cm lower than it had been the preceding autumn. The water level fell another 5 cm from 13 to 21 July. A subsequent visit in September 1979 revealed the water level 20 cm above the July level, approaching that of the previous autumn. While 20- to 30-cm fluctuations may seem minimal, the extremely gentle slopes (as little as 1:250) means that a few centimetres drop may expose more than a metre-wide strip of lake bottom.

Sampling Techniques

Floristic data were gathered over a period of three years: September 1978, July 1979, September 1979, and August 1980. Voucher specimens were taken for most taxa. The problematic taxa (*Potamogeton* and *Carex* in particular) were confirmed or determined by P. W. Ball (Herbarium, Erindale College, University of Toronto) or A. A. Reznicek (Herbarium, University of Michigan). These vouchers are on file in the author's herbarium with duplicates, where available, in TRT, CAN, and the National Water Research Institute Herbarium at the Canada Centre for Inland Waters, Burlington.

The vegetation data were gathered during 13 to 21 July 1979. A 600-m section of shoreline was surveyed along the northeastern end of the lake (Figure 2); this encompassed much of the range of variation seen in the lake as a whole, from open sand beach to mature bog shoreline (but excluding floating bog mats and rock outcrops). Along this perimeter I located 25 transects chosen by means of random numbers subject to the criterion that no two transects could be closer together than 10 m. This ensured that each transect was relatively independent. The transects were sampled in the order that the random numbers were drawn to ensure that variation resulting from changes in observer expertise, working conditions, and/or plant maturity would be randomly assigned along the shoreline.

Each transect contained a belt of vegetation 50 cm wide and was surveyed into 5-cm-height increments using an automatic level. The waterline on 13 July was used as the reference point, and for each transect increments were marked out ranging from 50 cm above to 50 cm below this water level, a total of 20 height increments (or quadrats) per transect. Because the water level fell as the study progressed, daily corrections were made for falling water levels. An observer started at the top of each transect and recorded the presence of each species in each height increment. The final set of data then consisted of lists of species occurrences in 20 height increments for 25 transects.

These randomly chosen transects were assigned to three shoreline types: sand (6 transects), transition (12 transects), and peat (7 transects). For each of these categories frequency of occurrence for each species was calculated by summing all occurrences over all transects and dividing by the total number of height increments examined. For example, 120 height increments (6 transects × 20 height increments) were examined on sand. The proportion of these which contained a given species is a measure of that species' frequency.

Soils data presented are based on samples collected to a 10-cm depth at 0.25 m above the waterline in each transect. Organic content was estimated by percentage loss on ignition at 400°C.

Nomenclature follows Fernald (1950) except for the use of *Triadenum fraseri* (Marsh St. John's Wort), instead of *Hypericum virginicum*. Most common names, where available, generally also follow Fernald (1950).

Results and Discussion

Floristics

Peattie (1922) provided a summary table of coastal plain species known to occur around the Great Lakes. One of Fernald's (1942) main criticisms was that too many botanists thought of the coastal plain flora in ecological rather than phytogeographic terms, thus lumping many species of acid sands and bogs into the coastal plain category. The following discussion of the flora of Axe Lake attempts to separate these components.

Two species from Axe Lake, *R. virignica* and *J. militaris*, are widely disjunct from the Atlantic coastal plain. Their Ontario distribution is largely restricted to the Georgian Bay region, although *J. militaris* occurs north to Temagami District (Fernald 1950) and east to the Ottawa River (M. I. Moore. 1972. Vascular Plants of the Middle Ottawa Valley and Northeastern Algonquin Park. Petawawa Forest Experiment Station Information Report PS-X-34. Environment Canada. 48 pp.). In eastern Canada *R. virginica* reaches southwestern Nova Scotia (Roland and Smith 1969) and *J. militaris* reaches Newfoundland (Fernald 1918).

Other species from Axe Lake are also prominent on the coastal plain and form a strong component of vegetation in the vicinity of coastal plain disjuncts, although there are scattered inland stations elsewhere in North America. Such species include *Eleocharis olivacea* (Olive-brown Spike-rush), *N. cordata*, *Rhynchospora capitellata* (beak-rush), *U. purpurea*, *U. resupinata* (bladderwort), *Woodwardia virginica* (Virginian Chain-Fern), and *Xyris caroliniana* (Yellow-eyed Grass) as well as *J. militaris* and *R. virginica*.

Many more widespread and northern species now occur primarily on glaciated areas off the Atlantic coastal plain, but appear to have survived on the coastal plain during the last glaciation. *Cladium mariscoides* (Twig-rush), *Drosera intermedia* (Narrow-leaved Sundew), *Juncus pelocarpus* (Brown-fruited Rush), *Myriophyllum tenellum* (Water-milfoil), *Muhlenbergia uniflora*, *Potamogeton confervoides*, *P. oakesianus*, *Utricularia cornuta* (Horned Bladderwort), *and Viola lanceolata* (Lance-leaved Violet) are frequently conspicuous in sites supporting coastal plain disjuncts.

Lastly, there are species considered by Peattie (1922) and/or McLaughlin (1932) as coastal plain species, but which are much more widespread, although ecologically they may be a prominent component of the flora on lakes such as Axe Lake. Species such as *Calamagrostis canadensis* (Blue-joint), *Dulichium arundinaceum* (Three-way Sedge), *Eriocaulon septangulare* (Pipewort), *Lycopodium inundatum* (Bog Club-moss), *Lycopus uniflorus* (Water-horehound), *Pontederia cordata* (Pickerel weed), *Rhynchospora fusca* (beak-rush), *Scirpus torreyi* (bulrush), and *Utricularia gibba* (Humped Bladderwort) are probably best classified simply as species of acid sands and bogs.

The restricted distribution of the following seven species results in their being classed as "rare" in Ontario (Argus and White 1977): *E. olivacea*, *J. militaris*, *P. oakesianus*, *R. virginica*, *R. capitellata*, *S. torreyi*, *X. caroliniana*.

Miller (1977) used floristic and water chemistry data to classify 56 lakes of southern Ontario into five "types," based on floating and submerged macrophytes. Axe Lake was included in his study and classified as type A, ". . . very soft, low conductivity lakes that are dominated by Isoetids and Utricularids . . .". These lakes generally have alkalinity values of 0–7 mg $CaCO_3 \cdot L^{-1}$ and conductivity values from 20–42 μS [μmhos]$\cdot cm^{-1}$. Miller reported that Axe Lake had an alkalinity of 3, conductivity of 29, and a pH value of 6. Miller did not provide the raw data matrix used in his floristic analysis, but based on his tables of "characteristic species," type A lakes are characterized by species such as *Lobelia dortmanna* (Water-lobelia). *E. septangulare*, *M. tenellum*, *U. purpurea*, *U. resupinata*, *J. pelocarpus*, *J. militaris*, and *Elatine minima* (Waterwort). Only the latter species has not been observed in Axe Lake. Crowder et al. (1977) studied 16 lakes in southeastern Ontario and similarly concluded that lakes with conductivities of below 60 $\mu s \cdot cm^{-1}$ contained species not found in other lakes, notably *E. septangulare*, *L. dortmanna*, and *M. tenellum*. Swindale and Curtis (1957) also found that species such as *M. tenellum*, *E. septangulare*, *J. pelocarpus*, and *E. minima* occurred together in low conductivity lakes in Wisconsin.

Vegetation

The most botanically interesting area of the lake is the extreme north end (Figure 2). The substrate ranges from the gently sloping sand shown in Figure 3 through to peat. This small area at the north end appears to encompass much of the variation in the shoreline types of Axe Lake.

Figure 4 shows shoreline profiles from the north end of Axe Lake in three different substrate types: (1) sand, (2) transition, and (3) peat. These categories are based on the organic content of the transects at 0.25 m above the waterline, as determined by weight loss on ignition to 400°C (mean values for each category are: sand = 0.9%, transition = 3.7%, peat = 16.4%). These changes in organic content are related to the physiognomy of the shoreline (Figure 4) and species composition (Table 1). These categories could be distinguished in the field. "Sand," as shown in Figure 3, referred to

FIGURE 3. The shoreline vegetation at the north end of Axe Lake in a sand shoreline type. Note the gently sloping sand exposed by falling summer water levels. The vegetation types from left to right (above to below waterline) are (1) *Betula papyrifera* (White Birch) and *Pinus strobus* (White Pine) forest, (2) a band of shrubs, principally *Myrica gale*, (3) open sand with *Rhynchospora fusca, Lobelia dortmanna, Eriocaulon septangulare, Drosera intermedia, and Utricularia cornuta* (at peak of flower — see lower left of picture), (4) emergents such as *Scirpus torreyi* mixed with *E. septangulare* and *L. dortmanna*, and (5) open water supporting *Scirpus subterminalis, Nympoides cordata, E. septangulare*, and *L. dortmanna*.

shorelines with extensive areas of open sand and only sparse plant cover. "Transition" shores were densely vegetated, but scattered openings in the vegetation revealed a sandy substrate. "Peat" shores were densely vegetated and had a peat layer covering the sand.

Sand was the least common of the three shoreline types, and occurred only on the north and east sides of the lake. (The latter has been disturbed by recent campsites, and possibly by a now-abandoned farm, so it was excluded from the study.) Peat shores were the most common of all. Transition areas intermediate in organic content were also common. These three categories are arbitrary divisions in a continuum, so a more accurate assessment of relative abundances of these shoreline types was not attempted. These categories are based only on above-water characteristics. The below-water organic content was consistently low (mean = 0.78%), yet, as Table 1 shows, the aquatic flora differed among the three shoreline types.

Species such as *N. cordata, E. septangulare*, and *M. tenellum* were abundant on areas of sand. All of the species in column 1 (except for *Juncus filiformis*) (rush) also occurred on more organic shorelines. In general, sand shorelines supported few species.

The transition shorelines supported many more species. *Rhexia virginica, X. caroliniana, M. uniflora*, and *V. lanceolata* attained their peak abundance on these shores. The dominant species included *Cladium mariscoides, E. septangulare*, and *N. cordata*.

The peat shorelines were dominated by *T. fraseri, Myrica gale* (Sweet Gale), *C. mariscoides, Scirpus subterminalis* (Swaying Rush), *E. septangulare*, and

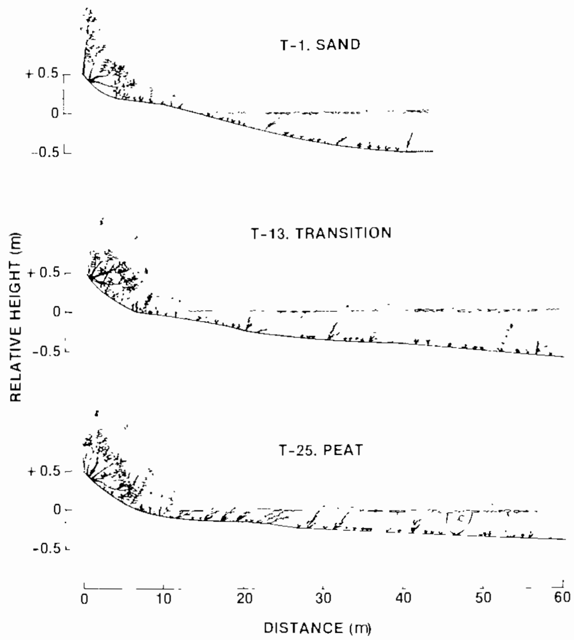

FIGURE 4. Diagrammatic profiles through transects representing the three main shoreline types studied. Note the increasing plant cover from sand through transition to peat shorelines.

N. cordata. Many floating-leaved aquatics, such as *B. schreberi*, *N. ordorata*. *Nuphar variegatum* (Yellow Pond-lily), and *Potamogeton oakesianus*, reached their peak abundance here. *Myriophyllum tenellum*, *L. dortmanna*, *U. cornuta*, and *J. pelocarpus* all decreased in frequency on peat shorelines.

Eleocharis olivacea did not occur in the study transects; this species and *X. caroliniana* reach their peak abundance on floating peat islands in the south end of the lake. *Woodwardia virginica* and *Rhynchospora capitellata* were also absent from the study area; each occurred at a single point elsewhere on the lakeshore.

Geological History

This area emerged from beneath the Wisconsin ice sheet roughly 12 000 years ago (Douglas 1970, fig. XII-15). Chapman (1975) stated that the absence of any strong moraines suggested an uneventful glacial withdrawal from the area. The glacier left behind sandy and stony till which is so thin that it generally fails to cover completely the underlying rock ridges. These ridges are composed of Precambrain granitic rocks (Hewitt 1967). A most interesting feature, however, is the postglacial Lake Algonquin shoreline which runs due north from Bracebridge to Lake Nipissing. This shoreline is now marked by extensive sand plains (Chapman 1975, map 2228). When Lake Algonquin was present, this shoreline possessed an intricate series of islands and bays (Figure 1). Axe Lake is just "off shore" from this maximum water level of Lake Algonquin. Lake Algonquin water levels then gradually dropped (because of new outlets such as the Fossmill outlet, as well as isostatic rebound) leaving behind scattered lakes with rich shoreline floras. At its peak the shoreline of Lake Algonquin may have had bays and islands with gently sloping sandy shores not unlike those on Axe Lake today.

Peattie (1922) attempted to trace the inland migration of coastal plain species in relation to the postglacial development of the Great Lakes. He concluded that the coastal plain flora entered the Great Lakes during the Lake Algonquin stage, when Lake Algonquin was drained by the Kirkfield outlet into Lake Iroquois, which in turn drained down the Hudson River to the Atlantic coastal plain. Speaking of this time, he wrote "Judging from the large number of old spits and beach ridges which have been traced out for the glacial lakes giving rise to Lake Erie and Lake Michigan, it is reasonable to imagine their shores to have been an intricate series of lagoons, ridges, strands and low dunes harbouring the newly-migrated coastal plain types." This appears to be an excellent description of the shoreline of Lake Algonquin from Bracebridge to Lake Nipissing.

McLaughlin (1932) noted that the greatest number of coastal plain plants grow on moist, sandy lakeshores, and that the development of *Sphagnum* bogs was partially responsible for the gradual elimination of these species. Figure 2 showed the extensive areas of peat bog around Axe Lake. These areas were presumably open water when Lake Algonquin was at its maximum; they have since become peat bogs, and judging from the extensive areas of boggy shores and floating peat islands in Axe Lake, this process is continuing. Many of the coastal plain species listed in Table 1 were absent from those shores of the lake with floating bog mats. On a smaller scale, comparison of column 2 (transition) with column 3 (peat) also appears to support McLaughlin's observation, as species such as *M. uniflora* and *R. virginica* are absent from peat shorelines. Aquatic coastal plain species, however, such as *P. confervoides*, *P. oakesianus*, *U. resupinata*, *U. purpurea*, and *J. militaris* reached their peak abundance in shallow water adjacent to the peat shores.

Recent History

Recent human activities, particularly cottage development, may be modifying many lakes in this area. To examine this problem, Miller and Dale (1979) studied changes in the aquatic macrophyte floras of eight small lakes in the Muskoka area. They

TABLE 1—Frequency of shoreline plants on three shoreline types in Axe Lake. Columns give percentage occurrence in "quadrats" located between 0.5 m above and 0.5 below the waterline. Species are arranged by (1) shoreline type of peak abundance (sand, transition, peat), (2) habitat specificity (number of shoreline types occupied), and (3) abundance. Shoreline types are shown in profile in Figure 4

Species	Occurrence along shoreline (%)		
	Sand (n = 120)	Transition (n = 240)	Peat (*n* = 140)
Sand			
Juncus filiformis	0.8	—	—
Viburnum cassinoides	6.7	0.8	—
Bidens sp.	1.7	0.4	—
*Nymphoides cordata**	70.8	56.7	43.6
Eriocaulon septangulare	65.0	57.1	43.6
*Myriophyllum tenellum**	41.7	26.3	12.1
Lobelia dortmanna	39.2	23.7	11.4
*Utricularia cornuta**	24.2	14.6	1.4
Hypericum boreale	10.0	9.2	2.9
Alnus rugosa	10.0	2.5	2.9
Spiraea alba	3.3	1.3	1.4
Transition			
*Rhexia virginica** +	—	14.2	—
Potamogeton natans	—	2.1	—
Lycopodium inundatum	—	1.7	—
Ilex verticillata	—	0.4	—
Carex michauxiana	—	0.4	—
Pyrus arbutifolia	—	0.4	—
Agrostis hyemalis	—	0.4	—
Panicum lanuginosum	—	0.4	—
Carex echinata	—	0.4	—
*Xyris caroliniana** +	6.7	14.2	—
Juncus brevicaudatus	1.7	4.2	—
Nemopanthus mucronata	3.3	3.3	—
Muhlenbergia uniflora	—	17.5	2.1
Utricularia gibba	—	7.5	7.1
Carex lasiocarpa	—	1.3	0.7
*Drosera intermedia**	16.7	39.2	14.3
*Cladium mariscoides**	3.3	39.2	30.0
*Juncus pelocarpus**	22.5	27.5	2.9
*Viola lanceolata**	4.2	25.8	3.6
Aster nemoralis	6.7	19.2	5.0
Scirpus torreyi†	1.7	19.2	12.1
Rhynchospora fusca	10.8	17.5	5.0
Transition (*continued*)			
Hypericum ellipticum	3.3	7.5	4.3
Juncus canadensis	1.7	2.9	0.7
Peat			
Potamogeton epihydrus	—	—	2.9
Iris versicolor	—	—	1.4
Chamaedaphne calyculata	—	—	0.7
Vaccinium oxycoccus	—	—	0.7
Dulichium arundinaceum	—	14.2	25.7
Eleocharis palustris	—	3.3	21.4
Calamagrostis canadensis	—	5.8	20.7
Brasenia schreberi	—	10.4	20.0
Nymphaea odorata	—	7.5	17.1
Rubus hispidus	—	7.9	15.7
Vaccinium macrocarpon	—	9.2	15.0
Nuphar variegatum	—	2.1	14.3
Pontederia cordata	—	3.3	13.6
Carex rostrata	—	4.2	12.1
*Potamogeton oakesianus** +	—	1.7	10.0
Glyceria canadensis	—	1.3	10.0
Carex vesicaria	—	1.7	5.7
Carex stricta	—	1.7	4.3
Utricularia intermedia	—	3.3	3.6
*Potamogeton confervoides**	—	0.4	2.9
Carex oligosperma	—	0.8	1.4
Scirpus subterminalis	15.0	40.4	50.7
Triadenum fraseri	9.2	20.8	35.7
Myrica gale	17.5	13.8	33.6
Lysimachia terrestris	20.8	20.8	31.4
Utricularia vulgaris	3.3	13.8	17.9
*Utricularia resupinata**	6.7	15.4	15.7
Lycopus uniflorus	10.8	6.7	13.6
*Utricularia purpurea**	1.7	8.8	12.1
*Juncus militaris** +	1.7	3.7	5.0

*Rare in Ontario (Argus and White 1977).
+Species with coastal plain affinities.

compared a 1953 survey of these lakes to their 1976 and 1977 surveys. Axe Lake, one of the lakes they studied, did not appear to have lost any species of aquatic macrophytes during this time period. Miller and Dale (1979) record nine additional species in Axe Lake; these were likely missed in the 1953 survey. In addition to their total of 19 species I collected *Potamogeton natans* (Floating Brown leaf), *P. confervoides*, *Glyceria borealis* (Small Floating Mannagrass), *J. militaris*, *J. pelocarpus*, *M. tenellum*, and *Zizania aquatica* (Wild Rice). Because the emphasis of this study was on shoreline and shallow water plants, additional species may yet be found. Local residents have remarked that the lake has become more weedy, but there is no convincing evidence of recent changes in the flora of Axe Lake.

In conclusion, Axe Lake appears to be a relict fragment of a once extensive sandy shoreline stretching from Bracebridge to Lake Nipissing. The flora of Axe Lake contains some coastal plain species which apparently migrated into the Great Lakes area near the end of the last ice age. The vegetation of this lake may be a relict of the shoreline vegetation that flourished in the sandy bays of postglacial Lake Algonquin. Because the coastal plain flora of the Georgian Bay area has not yet been adequately recognized in planning parks and other reserves, it is to be hoped that thought will be given to preserving some suitable shores in the near future.

Acknowledgments

The assistance with summer field work by S. M. van Walsum and K. McCulloch was much appreciated. P. W. Ball (Erindale College, University of Toronto) and A. A. Reznicek (Herbarium, University of Michigan) kindly assisted in the annotation and determination of voucher specimens. Thanks also to R. Proctor for assistance with the data manipulation, and to D. F. Brunton, C. J. Keddy, G. La Roi, and A. A. Reznicek for constructive criticism of various drafts of this paper. G. Burger kindly permitted us to work on his land and use his cabin for 1980 field work. This research was supported by University of Guelph R.A.B. grant No. 83193 and NSERC grant A6963.

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Received 3 June 1980
Accepted 12 December 1980