Aquatic Vegetation of

QUAMBA LAKE

Kanabec County, MN
DOW 33001500
June 2004

Surveyed: June 4, 2003
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Ecological Services Division

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Introduction

Quamba Lake (Mud Lake) is located within the Snake River Watershed in Kanabec County, Minnesota, about five miles northeast of the town of Mora (Figure 1). The lake is approximately 214 acres with a maximum depth of 11 feet. Mud Creek enters the north end of the lake through a wetland and flows out at the eastern end of the lake (Figure 2). About one-fourth of the shoreline is developed with single family homes and a state-owned public access is located on the south shore. Quamba Lake is described as hypereutrophic with a mean summer Secchi Disk reading of two feet (MPCA 2003).

Vegetation Survey Objectives

The goals of the 2003 vegetation survey of Quamba Lake include:

1) Estimate the maximum depth of rooted vegetation
2) Estimate the percent of the littoral zone occupied by rooted vegetation
3) Record the aquatic plant species that occur in the lake
4) Collect quantitative estimates of species abundance
5) Develop distribution maps for the common species

Data from the 2003 survey can be used to monitor annual changes in the native and exotic plant species composition.

Methods

A Point-Intercept vegetation survey of Quamba Lake was conducted on June 4, 2003 following the methodology described by Madsen (1999). Sample points were established within the lake using a 100 meter by 100 meter grid. This resulted in a total of 91 sample points (Figure 3) (*note that "site 11" fell on land and was not sampled*).

A Trimble GeoExplorer 3 GPS unit was used to navigate the boat to each sample point. One side of the boat was designated as the sampling area. At each site, water depth was recorded using a measured stick in water depths less than eight feet and an electronic depth finder in water depths of eight feet or more. The surveyor recorded any plant taxa within a one meter squared sample site at the pre-designated side of the boat. A double-headed, weighted garden rake, attached to a rope was used to survey vegetation not visible from the surface. When possible, taxa were recorded to the species level. Nomenclature followed Crow and Hellquist (2000). Voucher specimens were collected for selected taxa.

Data were entered into an Excel database spreadsheet and frequency of occurrence was calculated for each species as the number of sites in which a species occurred divided by the total number of sample sites. Sampling points were grouped by water depth and separated into two depth zones for analysis: 0 to 5 feet, and 5.5 to 10 feet (*note: although a maximum depth of 11 feet has been recorded in Quamba Lake, 10 feet was the maximum depth sampled during the 2003 survey)*.

Results

Maximum rooting depth and percent of lake with vegetation

A secchi disk reading for Quamba Lake was recorded as five feet on June 4, 2003. Rooted vegetation was found to a maximum depth of 10 feet but vegetation was most often found in water depths of five feet and less. Within the zone from shore to the five foot water depth, vegetation occurred in 77% of the sample sites but in water depths greater than five feet, vegetation only occurred in 15% of the sample sites.

Species composition and distribution

A total of 18 native aquatic plant species were recorded in Quamba Lake during the 2003 survey (Table 1). This survey focused on in-lake vegetation and the majority of the plants recorded were submerged species. The non-native species, curly-leaf pondweed (*Potamogeton crispus*), was also documented in the lake.

Curly-leaf pondweed was the most frequently occurring submerged species, occurring in 30 percent of the sample sites (Table 1). It was most abundant in the shore to five foot depth zone where it was found in 58 percent of the sample sites (Figure 4). Within this shallow zone, curly-leaf formed dense mats that reached the water surface and covered approximately 33 acres (Figure 5). Curly-leaf rarely occurred beyond the five foot depth.

Coontail (*Ceratophyllum demersum*) and stonewort (*Nitella* sp.) were also common and occurred at 19 percent and 14 percent of the sample sites, respectively (Table 1). Like curly-leaf pondweed, these species were most common in depths of five feet and less (Figure 4). Curly-leaf pondweed, coontail and stonewort were the only species found in water depths greater then five feet.

Other submerged species located in Quamba Lake included flatstem pondweed (*Potamogeton zosteriformis*), Canada waterweed (*Elodea canadensis*), clasping leaf pondweed (*Potamogeton richardsoni*i), narrow leaf pondweed (*Potamogeton* sp.), sago pondweed (*Stuckenia pectinata*), wild celery (*Vallisneria americana*) and river pondweed (*Potamogeton nodosus*). Two species of duckweed (*Lemna minor* and *Spirodela polyrhiza*) were recorded. White waterlily (*Nymphaea odorata*) and yellow waterlily (*Nuphar variegata*) made up the floating leaf community. Emergent species included bulrush (*Scirpus* sp.), burreed (*Sparganium* sp.), spikerush (*Eleocharis* sp.), cattail (*Typha latifolia*) and wild rice (*Zizania palustris*). Other emergents were present in the adjacent wetlands but were not recorded during this survey.

Species richness, or the number of taxa, was greatest from shore to the five foot depth, where the mean number of taxa recorded per site was two (Figure 6).

Discussion

Curly-leaf pondweed is an exotic plant with a unique life history which provides a competitive advantage over native plant species. Unlike native aquatic plants which begin growth in late spring and reach maximum growth in mid-summer, curly-leaf pondweed starts new growth in

late summer and continues into winter. At ice-off, curly-leaf stems begin to elongate more rapidly and reach the water's surface well before native species (Madsen and Crowell 2002).

Good spring water clarity and shallow depths in Quamba Lake provide suitable conditions for spring growth of curly-leaf, at least within the shore to five foot depth. By late spring, the dense mats of curly-leaf may restrict the growth of native species which are just beginning growth (Madsen and Crowell 2002). By mid-summer, curly-leaf naturally dies back in Minnesota lakes but the water clarity decreases in Quamba Lake, further restricting native plant growth.

It is not known when curly-leaf pondweed invaded Quamba Lake. Curly-leaf has been present in Minnesota since at least 1910 (Moyle and Hotchkiss 1945) but was not officially recorded in Quamba Lake until 1995 (MNDNR Fisheries Lake Files). DNR Fisheries staff typically conduct vegetation surveys in mid-summer, after curly-leaf has died back and it is probable that it was present before 1995 but simply not detected.

It is also difficult to comment on whether the native plant community of Quamba Lake has changed since the first vegetation survey in 1959 because previous surveys were qualitative in nature. Species lists can be compared for possible changes but caution must be used in interpreting differences. Some differences in species lists between years may be due to mis-identification of species or the fact that some species were not present at the time of year the survey was conducted. For example, bushy pondweed (*Najas flexilis*) was only recorded in 1959 and this particular species is an annual plant that reaches it's maximum growth in late summer and therefore not detected during spring or early summer surveys. Other species that were detected in some years but not in other years, may occur at low abundance and may have simply been missed during a particular survey.

Monitoring changes in aquatic plant communities can help reflect changes in the overall water quality of the lake and watershed. Data collected during the 2003 survey can be compared to future quantitative surveys of Quamba Lake to better estimate how the plant community may be changing.

Literature Cited

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Madsen, J. D. (1999). "Point intercept and line intercept methods for aquatic plant management." *APCRP Technical Notes Collection* (TN APCRP-M1-02). U.S. Army Engineer Research and Development Center, Vicksburg, MS. www.wes.army.mil/el/aqua.

Madsen, J.D. and W. Crowell. Curlyleaf pondweed (Potamogeton crispus L.). Lakeline. Spring 2002. pp 31-32.

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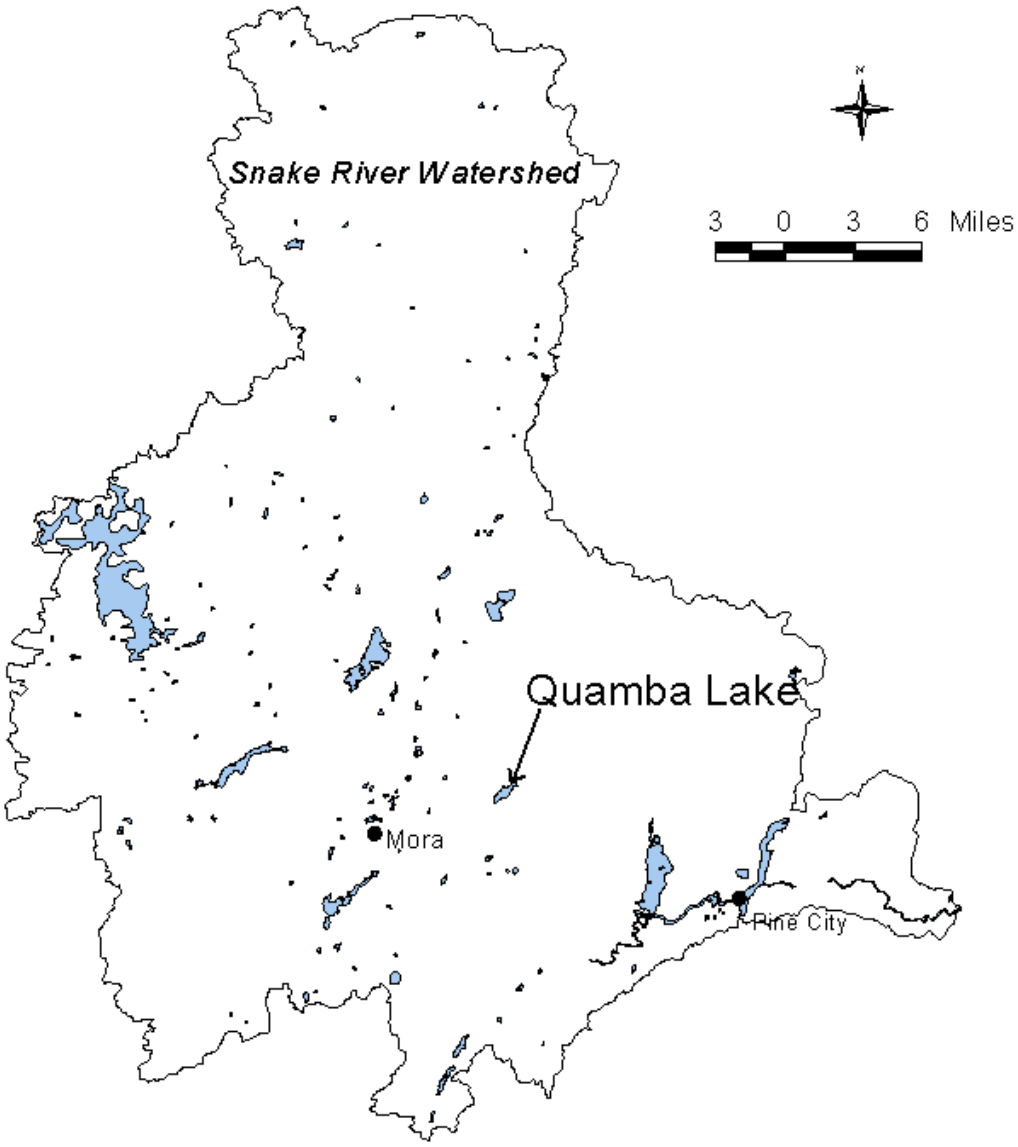
Moyle, J.B. and N. Hotchkiss. 1945. The aquatic and marsh vegetation of Minnesota and its value to waterfowl. Minnesota Dept. of Conservation. Tech. Bulletin 3. 122 pp.

MPCA. 2003. Minnesota Pollution Control Agency website. Lake Water Quality Assessment Program. http://data.pca.state.mn.us/cgi-bin/lkwq95ReadFull.pl?lakeid=18-0374

Table 1. Aquatic plants of Quamba Lake, Kanabec County, MN 1959-2003.
(X = present; value in 2003 = frequency of occurrence; * = voucher specimen collected)

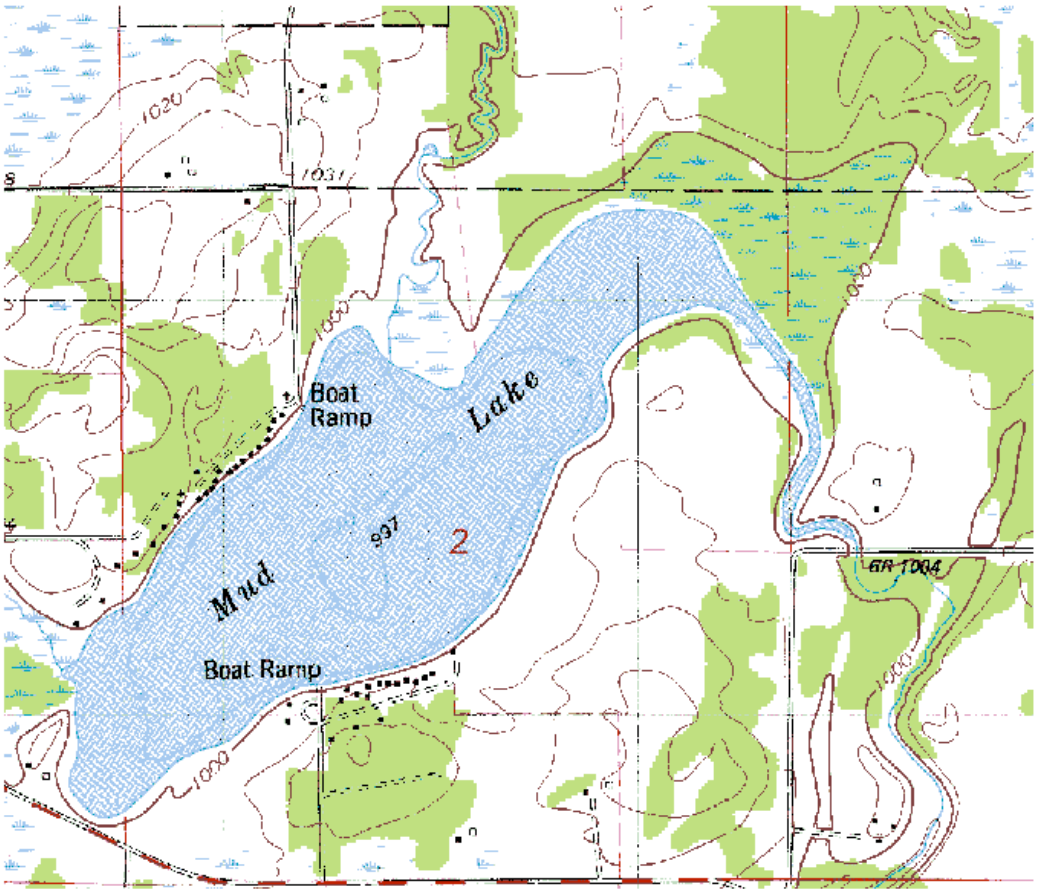
Common Name	Scientific Name	1959	1973	1985	1995	2003
SUBMERGED						frequency
Coontail	Ceratophyllum demersum	X	X	X	X	.19*
Canada waterweed	Elodea canadensis	X	X	X	X	.04*
Bushy pondweed	Najas flexilis	**X**				
Stonewort	Nitella sp.					.14*
Curly-leaf pondweed	Potamogeton crispus				X	.30*
Variable pondweed	Potamogeton illinoensis	X				
River pondweed	Potamogeton nodosus					X*
Whitestem pondweed	Potamogeton praelongus	X				
Small pondweed	Potamogeton pusillus	X				
Clasping leaf pondweed	Potamogeton richardsonii	X	X	X	X	.02*
Flatstem pondweed	Potamogeton zosteriformis	X	X	X	X	.09*
Narrowleaf pondweed	Potamogeton sp.				X	.02*
Sago pondweed	Stuckenia pectinata					.01
Wild celery	Vallisneria americana	X	X	X	X	.01*
FLOATING						
Yellow waterlily	Nuphar variegata	X	X	X	X	.01
White waterlily	Nymphaea odorata	X	X	X	X	.01
Floating leaf pondweed	Potamogeton natans		X	X		
FREE-FLOATING						
Lesser duckweed	Lemna minor		X	X	X	.02*
Star duckweed	Lemna trisulca	X				
Greater duckweed	Spirodela polyrhiza	X				.01*
IN-LAKE EMERGENTS						
Spikerush	Eleocharis smallii or sp.		X	X	X	X*
Broad-leaf arrowhead	Sagittaria latifolia		X			
Narrow-leaf arrowhead	Sagittaria rigida		X	X	X	
Arrowhead	Sagittaria spp.	X				
Hardstem bulrush	Scirpus acutus		X	X	X	
River bulrush	Scirpus fluviatilis				X	
Bulrush	Scirpus sp.	X				X
Softstem bulrush	Scirpus validus		X	X	X	
Burreed	Sparganium eurycarpum or sp.	X		X	X	X
Wild Rice	Zizania palustris	X				X
WETLAND EMERGENTS						
Sweet flag	Acorus calamus				X	
Water arum	Calla palustris		X	X		
Sedge	Carex aquatilis			X		
Sedge	Carex sp.				X	
Blue flag iris	Iris versicolor			X	X	
Reed canary grass	Phalaris arundinaceae			X	X	
Water dock	Rumex orbiculatus				X	
Broad-leaf cattail	Typha latifolia		X	X	X	X

Figure 1. Location of Quamba Lake in the Snake River Watershed.



D. Perleberg, DNR Ecological Services Sept., 2003

Figure 2. Shoreline of Quamba Lake, Kanabec Co.



D. Perleberg, MN DNR Ecological Services Sept 2003

Figure 3. Vegetation sample sites in Quamba Lake, 2003

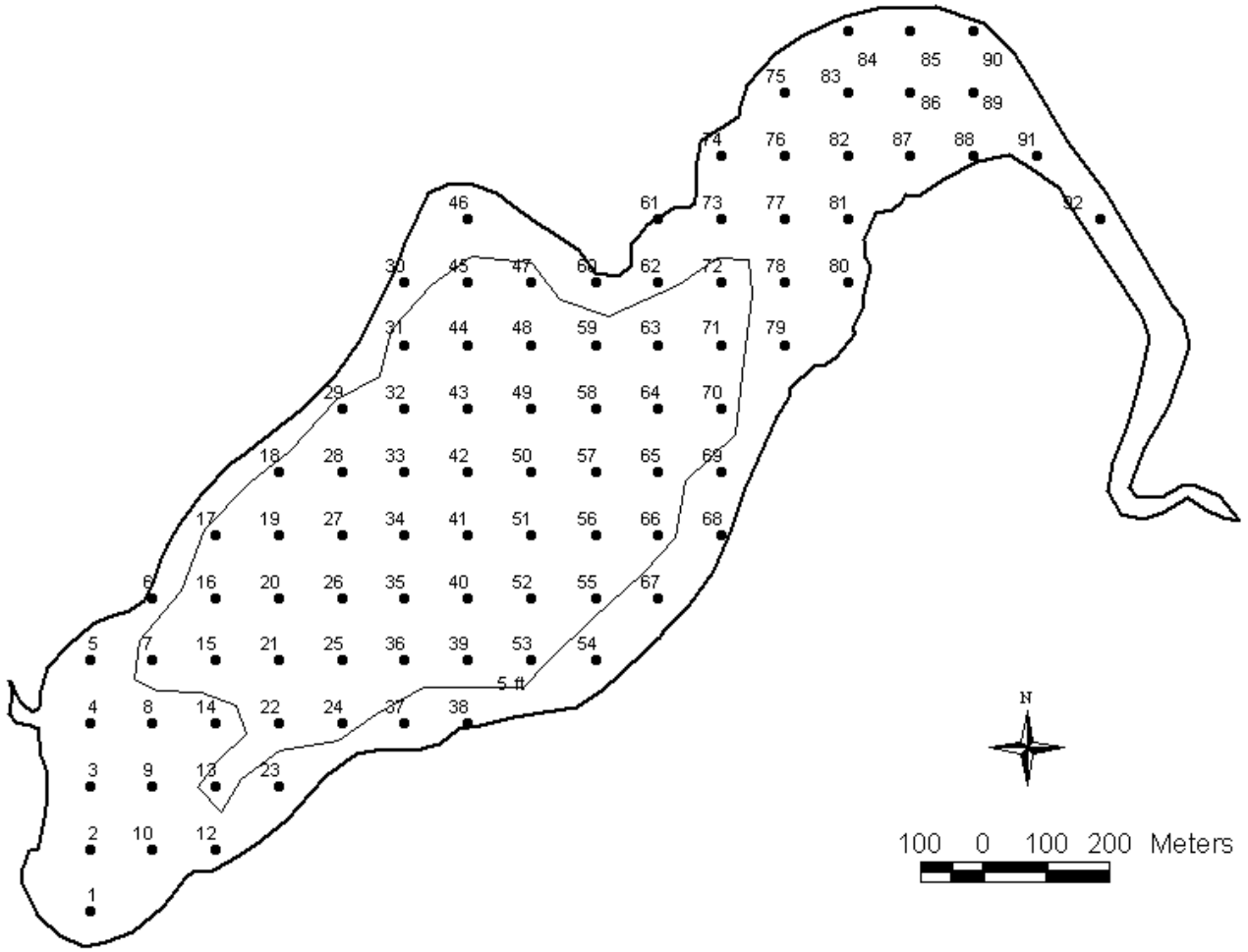


Fig 4. Distribution of Aquatic Plants by water depth.
Quamba Lake 2003

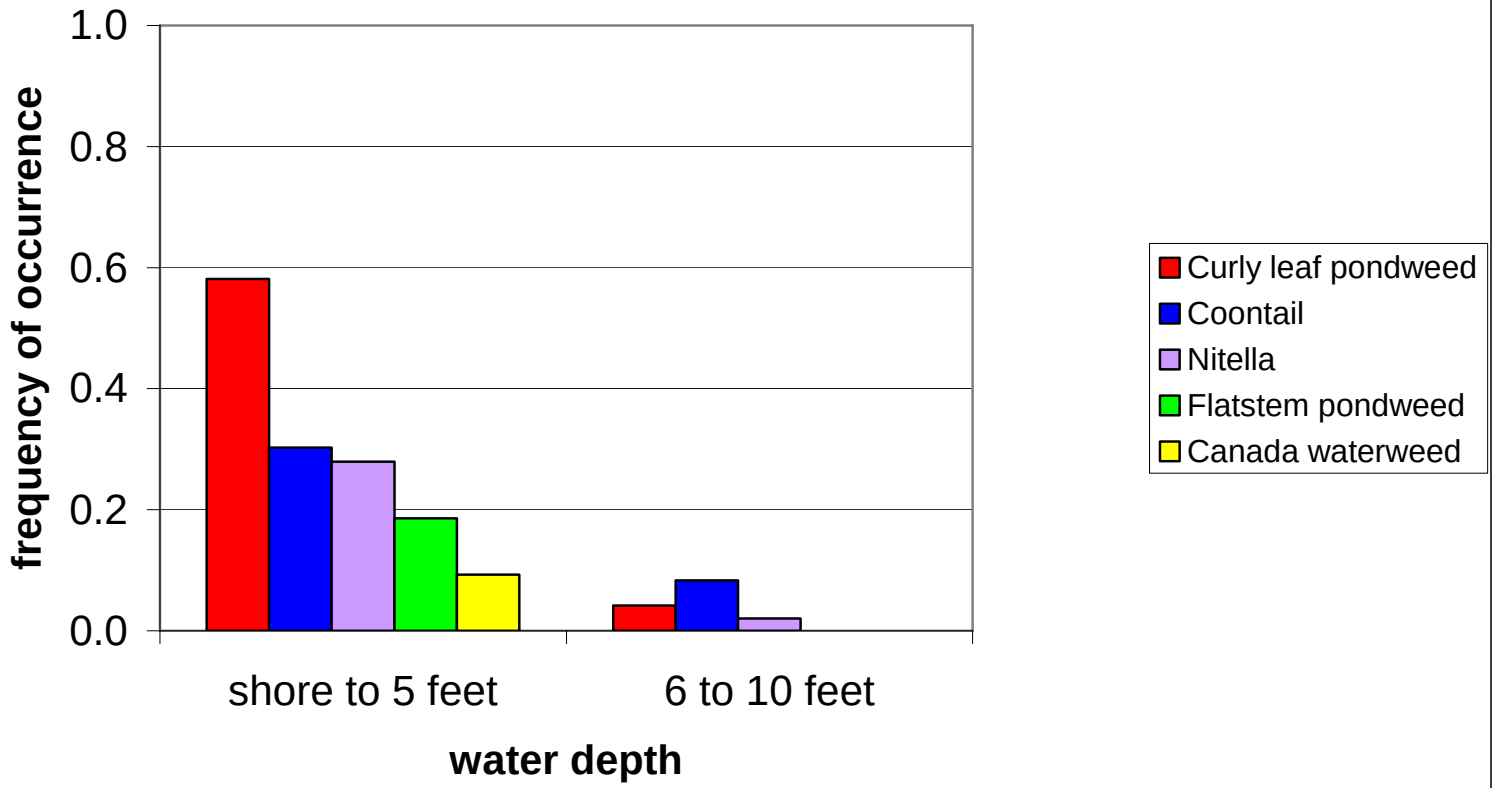


Figure 5. 2003 Curly leaf pondweed distribution on Quamba Lake, Kanabec Co.

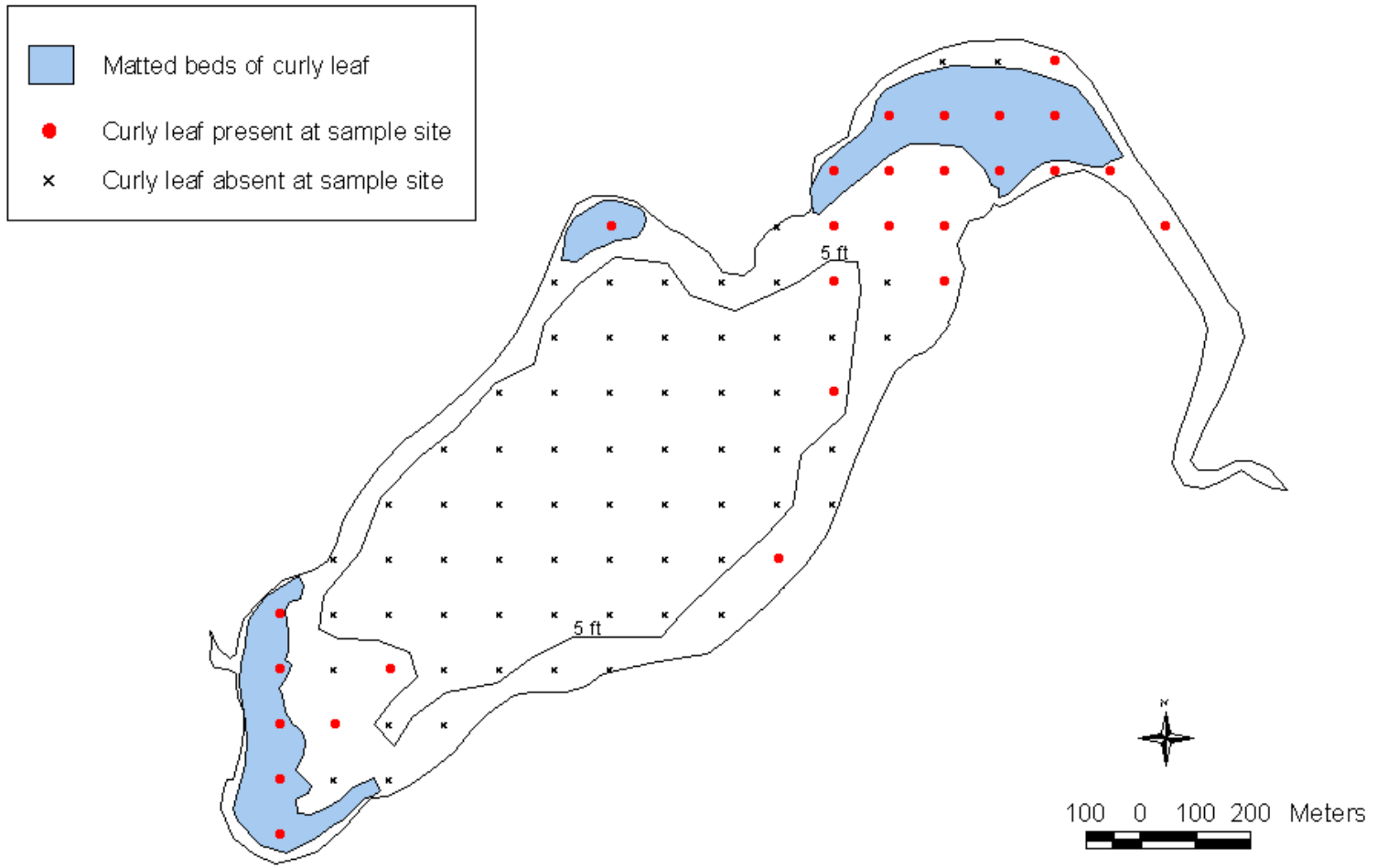


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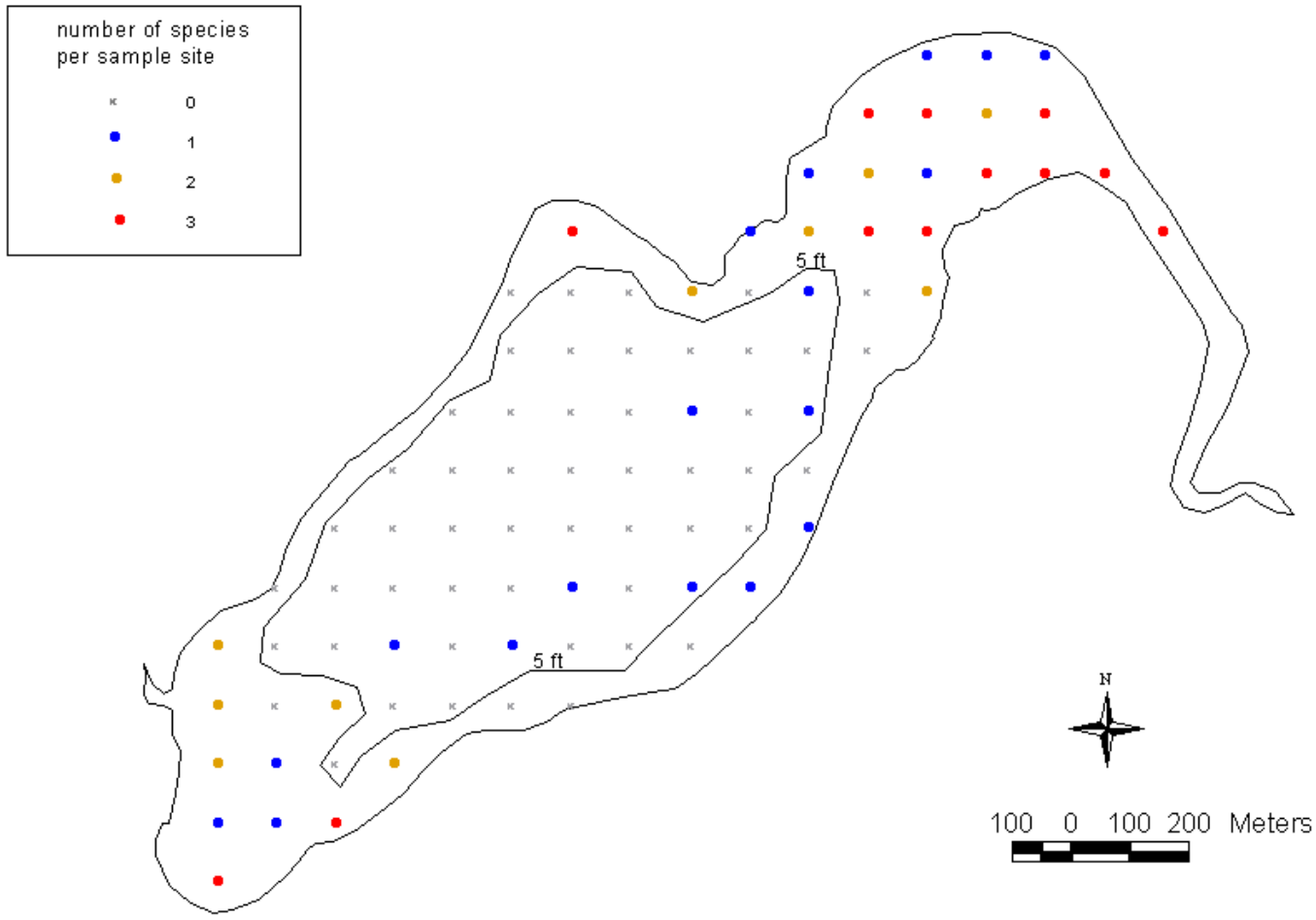
Figure 6. Plant Diversity at sample sites in Quamba Lake, 2003



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