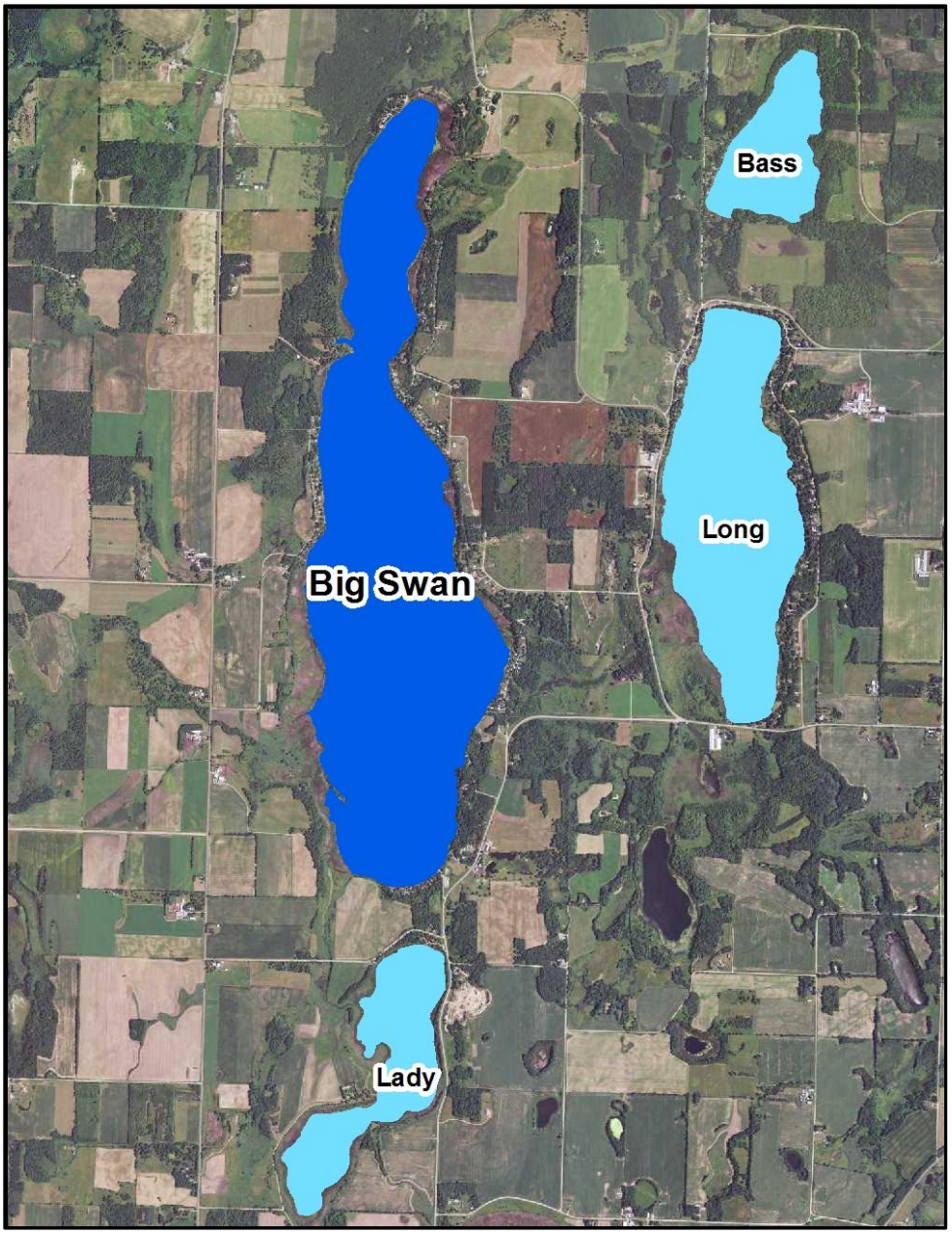
Big Swan Lake (77-0023-00)



Aquatic Vegetation Survey

RMB
Environmental Laboratories, Inc.

Lake: Big Swan Lake **DOW Number**: 77-0023-00 **Date of inspection:** May 23-24, 2013

County: Todd **Observers**: Tim Randt and Jake Anderson

Author of report: Jake Anderson **Date of report**: June 3, 2013

Introduction

Big Swan Lake (DOW 77-0023-00) is a medium sized 887 acre lake located in Todd County 13.5 miles southeast of Long Prairie, MN. Big Swan Lake consists of two main bays; the main portion of the lake is located to the south and is connected to a smaller more northern bay. Big Swan Lake has a maximum depth of 45 feet and contains a littoral area of about 45.5 percent (404 acres) which permits light penetration and allows plant growth.

Big Swan Lake is classified as a eutrophic lake with fair water clarity as measured between 2006-2008 by chemical sampling and secchi disk readings at the primary site 201. Increased phosphorus levels throughout all of Big Swan Lake contribute to algal abundance associated with a decrease in water clarity throughout the summer. Total phosphorus and chlorophyll-a (values that provide a measure of the amount of algae in the water) are considered high with mean values 58 and 34 ug/L respectively, for the main southern portion of the Big Swan Lake. Surrounding lakes were found to have similar or better water quality than Big Swan Lake, with most lakes in the area being eutrophic or mesotrophic (Table 1).

Table 1. Water quality means over the last 10 years for Big Swan, Sauk (NE), Big Birch (NE), Big Birch (S) and Long Lakes.

Lake	Trophic State	Mean Secchi depth (ft)	Phosphorus (ug/L)	Chlorophyll a (ug/L)
Big Swan	Eutrophic	6	58	34
Sauk (NE)	Eutrophic	6	54	35
Big Birch (NE)	Eutrophic	3	41	8
Big Birch (S)	Mesotrophic	3	37	7
Long	Mesotrophic	10	22	10

Objectives of Survey

This survey describes the aquatic plant community of Big Swan Lake including:

1) Vegetation data to include; sample point number, depth, plant taxa observed, and the estimated abundance of each taxon.
2) Identification of taxa to the level of species when possible.
3) Frequency of occurrence of each taxon found, stating the number of points used as the denominator for the calculations.
4) Combined frequency of all aquatic plants found
5) Estimation of maximum depth of submersed vegetation
6) Estimation of abundance of species sampled using MN DNR ranking system
7) Distribution map for common species
8) Determination of any invasive aquatic plants

Methods:

The point-intercept survey followed methodology described by Madsen (1999). Geographic Information System (GIS) software was used to generate sample points across the lake surface in 90 meter by 90 meter grid, resulting in a total of 303 potential survey points on Big Swan Lake. In the field, depths up to 25 feet were sampled but vegetation was not found beyond 19 feet in depth. A Global Positioning System (GPS) unit was used to navigate the boat to each sample point. Water depths at each site were recorded in 1-foot increments using an electronic depth finder.

All plant species found within a one square meter sample site at the pre-designated side of the boat were recorded. A double-headed, weighted garden rake, attached to a rope (Figure 1 and 2) was used to survey vegetation not visible from the surface. Aquatic vegetation that was found under the surface by use of the double-headed garden rake was assigned a number between 1 and 4, 1 being rare (≤ 1/3 of the rake head covered), 2 being scattered (>1/3 but ≤ 2/3 of the rake head covered), 3 being common (> 2/3 of the rake head covered), and 4 being abundant (plants over top of rake head). Plant identification followed Blickenderfer (2007).

Figures 1 and 2. Double-headed, weighted garden rake, attached to a rope used to survey aquatic vegetation.

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. Frequency was calculated for all sampled locations as well as locations 20 feet or less. The average number of native submersed plants per rake sample was calculated as the total number of plants sampled divided by the number of sample locations.

Sampling points were also grouped by water depth and separated into nine depth zones for analysis. Depth zones included 3 feet or less, 4-5 feet, 6-7 feet, 8-9 feet 10-11, 12-13, 14-15, 16-20, and depths greater than 20 feet (Figure 4).

Summary

On May 23-24, 2013, 303 combined locations were observed on Big Swan Lake. Of the 303 observed sites in Big Swan Lake, 248 sites were sampled for a point-intercept survey of aquatic vegetation (Figure 3). Eleven different types of native plants were found along with one non-native invasive plant, Curly-leaf pondweed (*Potamogeton crispus*) (Figure 4). The weather was fair for the survey with clear skies, calm wind, and an air temperature around 65 degrees. Water temperatures on the survey dates were between 52 and 54 degrees Fahrenheit.

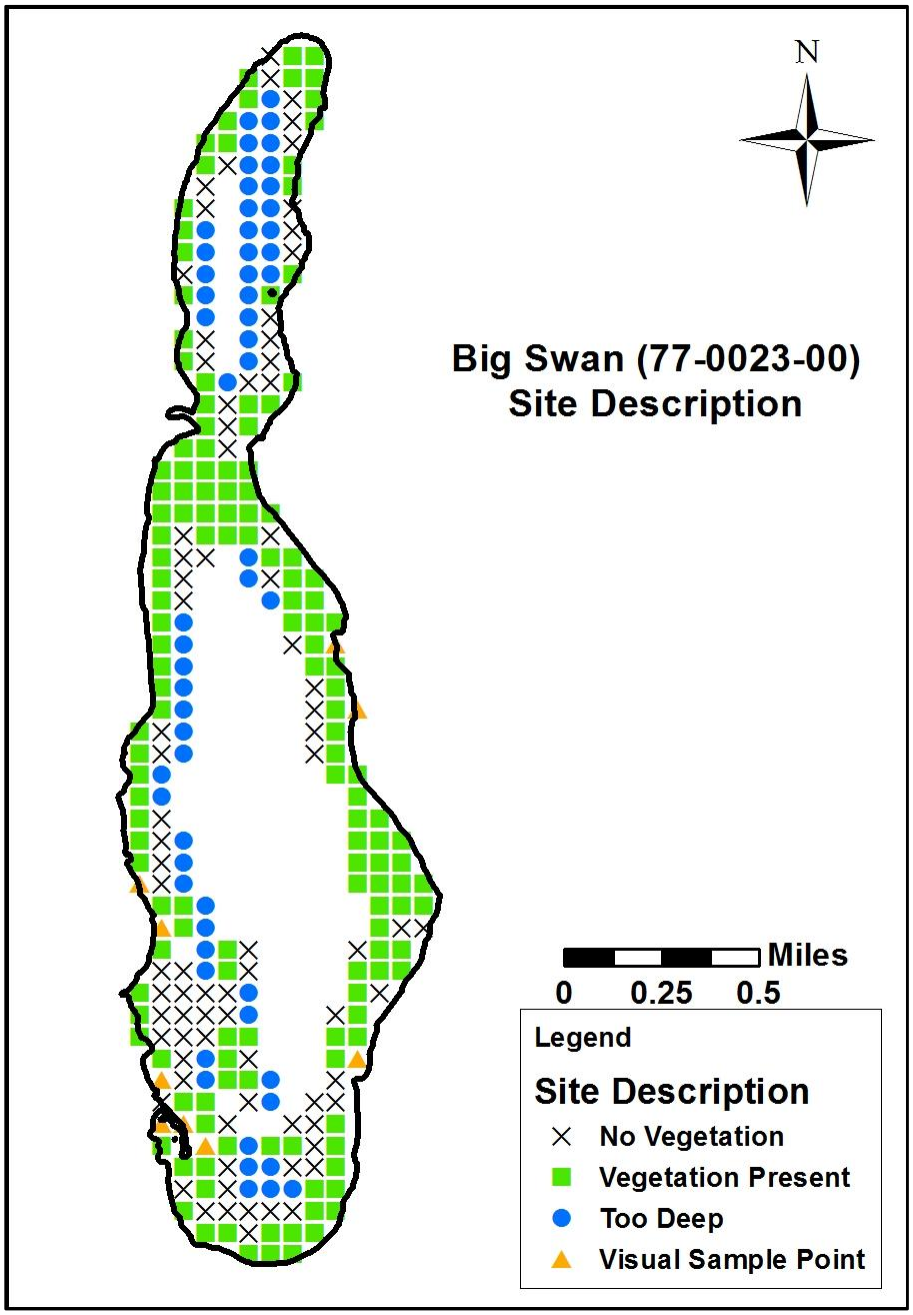


Figure 3. Site description for Big Swan Lake.

Two submersed native species and Curly-leaf pondweed make up a majority of plants sampled in Big Swan Lake. Non-native Curly-leaf pondweed *(Potamogeton crispus)* was sampled at 20.1% of all observed locations and 29.9% of locations with a depth of 20 feet or less (Figure 4). Muskgrass *(Chara vulgaris*) was sampled at a frequency of 15.5% of all sites and 23% of sites 20 feet or less. Star duckweed (Lemna trisulca) had a frequency of 26.4% of all sites and 39.2% at sites 20 feet or less (Figure 5 and Table 2).

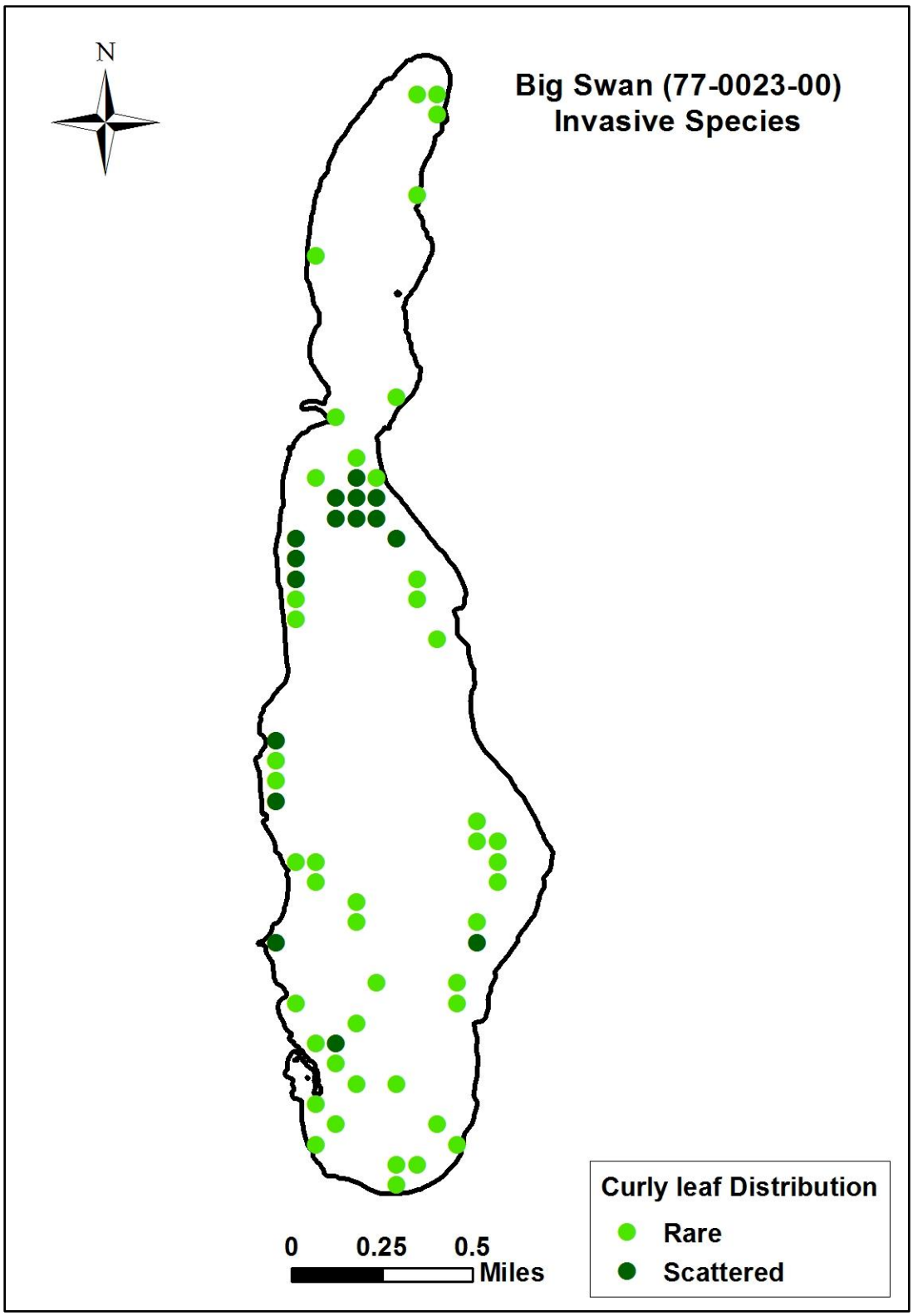


Figure 4. Sampled locations with invasive species, Curly-leaf pondweed present, Big Swan Lake, Todd County, MN May 23-24, 2013.

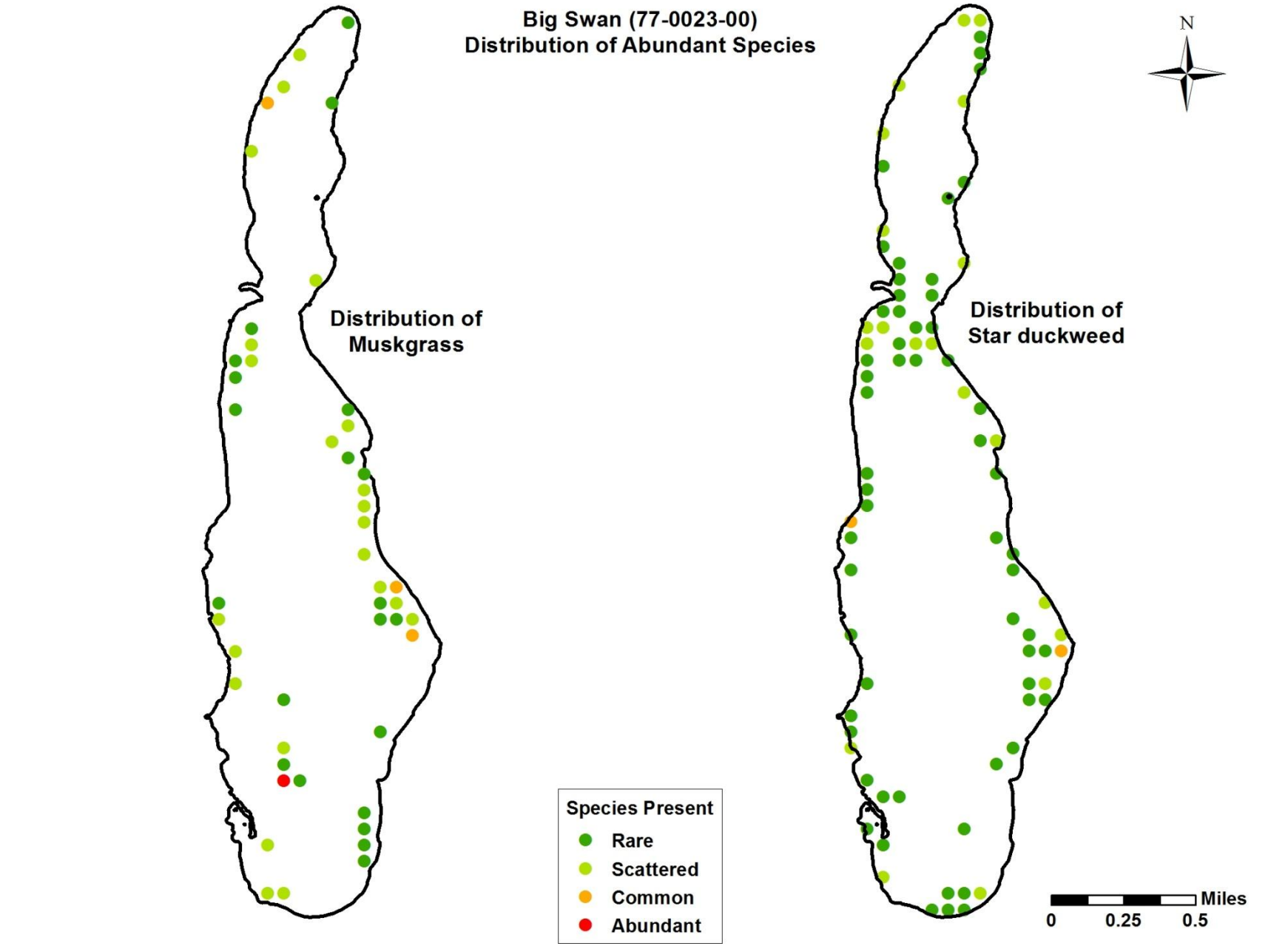


Figure 5. Distribution of common native aquatic plant species, Big Swan Lake, Todd County, MN, May 23-34, 2013.

				All Sampled Sites	Sites 20 Feet or Less
Life Form	**Common Name**	**Scientific Name**	**Count**	**Frequency (%)**	**Frequency (%)**
SUMBMERGED - ANCHORED - These plants grow primarily under the water surface. Upper leaves may float near the surface and flowers may extend above the surface. Plants are often rooted or anchored to the lake bottom.	Canada Waterweed	*Elodea canadensis*	2	0.7%	1%
	Muskgrass	*Chara vulgaris*	47	15.5%	23%
	Coontail	*Ceratophyllum demersum*	20	6.6%	9.8%
	Curly leaf pondweed*	*Potamogeton crispus*	61	20.1%	29.9%
	Flat-stem pondweed	*Potamogeton zosteriformis*	15	5%	7.4%
	White-stem pondweed	*Potamogeton praelongus*	1	0.3%	0.5%
	Buttercup	*Ranunculus sp.*	1	0.3%	0.5%
	Northern Water Milfoil	*Myriophyllum exalbescens*	3	1%	1.5%
	Star duckweed	*Lemna trisulca*	80	26.4%	39.2%
	Illinois pondweed	*Potamogeton illinoensis*	6	2%	2.9%
	Bladderwort	*Utricularia vulgaris.*	2	0.7%	1.0%
EMERGENT - These plants extend well above the water surface and are usually found in shallow water, near shore.	Cattail	*Typha sp.*	9	3%	4.4%
Average number of plants at all sites (303 Sites)		0.82			
Average number of plants at sites<21 feet		1.21			
Total number of observed sites		303			
Total number of sampled sites less than 20 feet		204			

**Invasive Species*

Table 2. Aquatic Plants surveyed from Big Swan Lake, Todd County MN

Sampling occurred to a maximum depth of 20 feet; however, no plants were found to be growing beyond 19 feet of water. Plant abundance was high in most depths up to 15 feet of water in Big Swan Lake. As depths increased beyond 15 feet the presences of vegetation decreased and became less dense (Figure 6). Of the 303 sampled locations in Big Swan Lake, 58 were deeper than 25 feet. A total of 204 sites were observed at locations with depths of 20 feet or less.

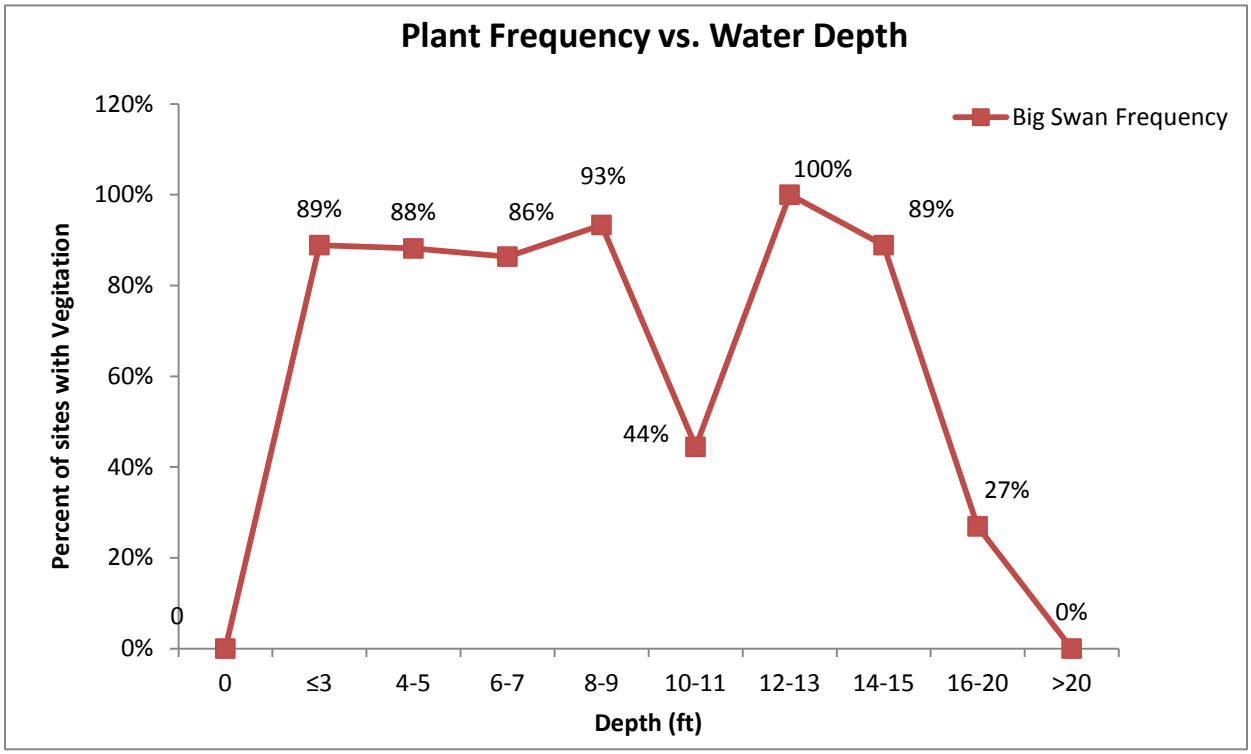


Figure 6. Frequency of vegetation vs. water depth, Big Swan Lake, Todd County, MN.

The average number of plants per rake sample on Big Swan Lake was 0.82 for all sampled depths and 1.21 for depths 20 feet or less. Four was the maximum number of species sampled at one location in Big Swan Lake but only 1 and 2 species per site were sampled regularly (Figure 7).

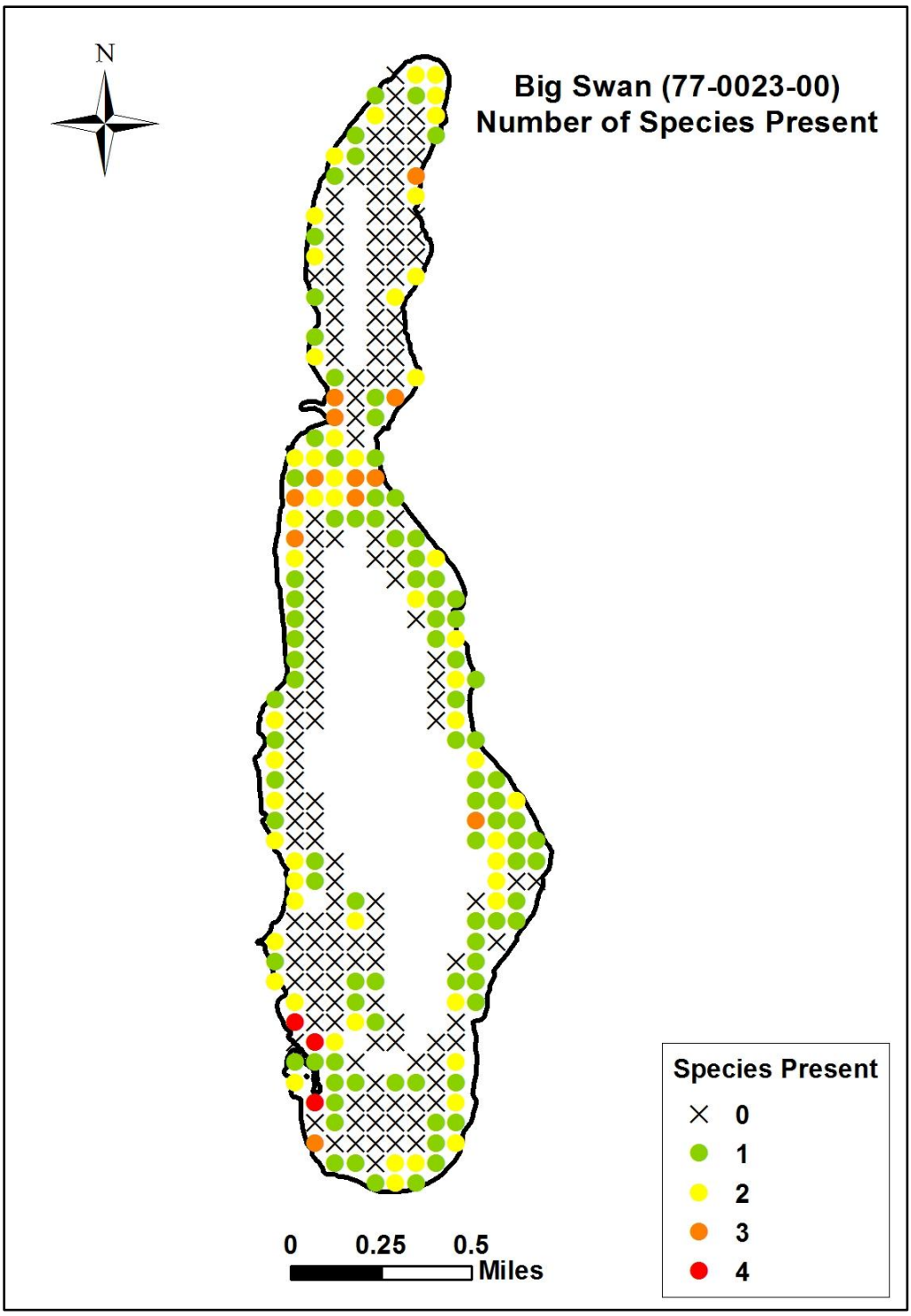


Figure 7. Number of species present per site, Big Swan Lake, Todd County, MN.

Other native plants sampled in Big Swan Lake included: Canada Waterweed (*Elodea canadensis*), Coontail (*Ceratophyllum demersum*), Northern Water Milfoil (*Myriophyllum exalbesven),* Flat-stem pondweed *(Potamogeton zosteriformis),* White-stem pondweed (*Potamogeton praelongus),* Buttercup(*Ranunculus sp),* Illinois pondweed (*Potamogeton illinoensis*), Bladderwort (*Utricularia vulgaris*) and Cattail (*Typha* sp.*)* (Figure 8).

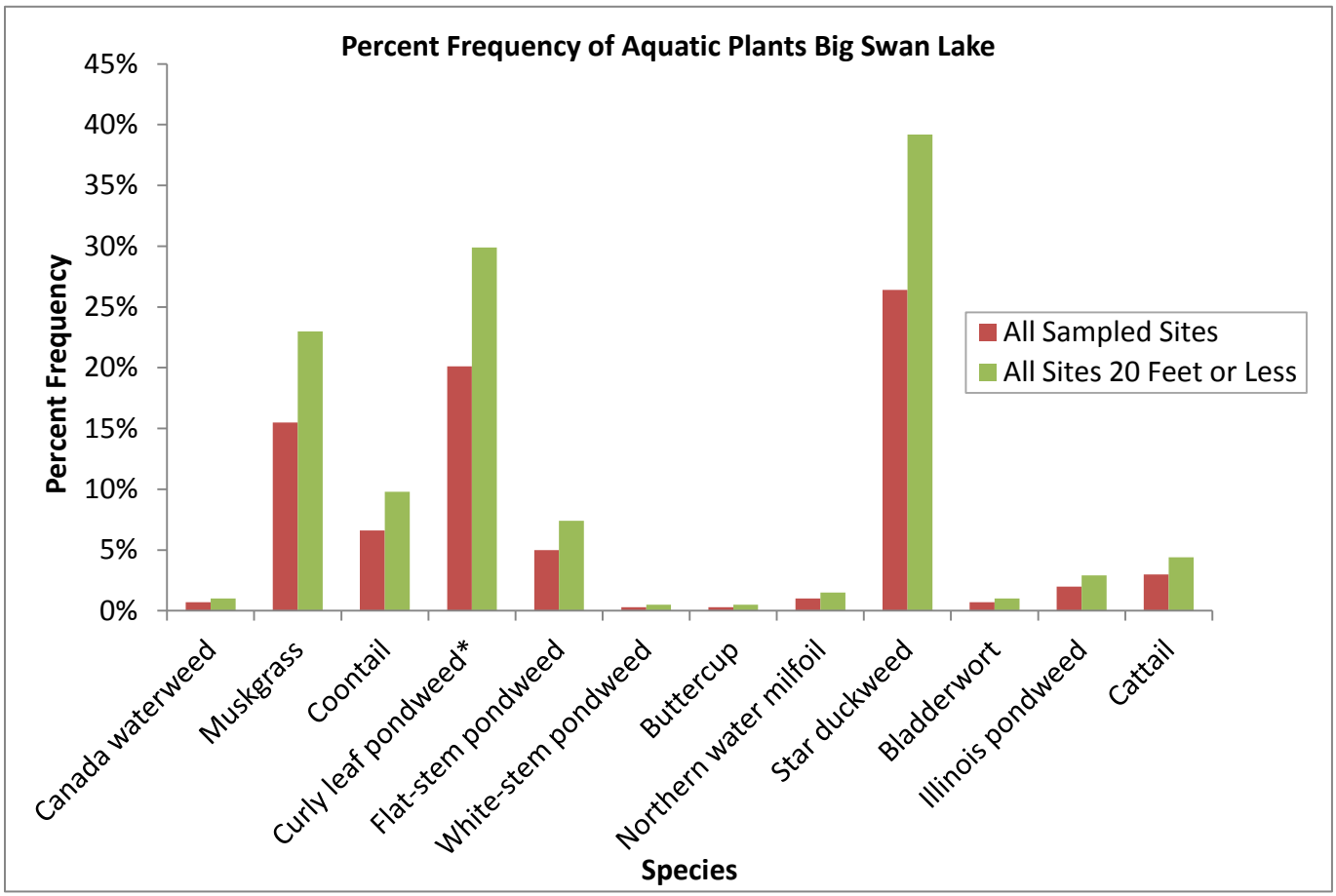


Figure 8. Frequency of occurrence for aquatic plant species in Sauk Lake, Todd County, MN (*invasive species).

Discussion

Big Swan Lake was found to be a relatively deep lake for central Minnesota. The presence of plants and the depth at which one finds them is related to the water clarity. In areas where the sunlight does not reach the lake's bottom, there won't be plants present. Big Swan Lake has an average clarity of 6 feet, and an average of 0.82 plants were found at each sample site.

The Minnesota DNR lists the littoral area of Big Swan Lake to be approximately 45.5% of the total surface area, the findings of this plant survey support these findings. In general, the littoral area of a lake is approximated as the area of the lake that is 15 feet deep or less, in this plant survey, plants were found in up to 19 feet of water.

In addition, some plants such as Muskgrass are found more often in lakes with good water clarity. Muskgrass was found at 47 sites, second most plants surveyed on Big Swan Lake.

Aquatic plant communities are important to a body of water because of their ability to maintain water clarity and good fish habitat. Plants in all lakes lock up nutrients in their tissues which limit algae growth keeping lakes clear and healthy. Aquatic plants produce oxygen throughout the water column as a byproduct of photosynthesis, which oxygenates the water column. Plants also help to keep the sediments stable at the bottom of the lake and prevent it from mixing into the water column. Tiny invertebrates called zooplankton eat algae and use plants as a hiding place from predators such as perch, sunfish and crappies.

Unfortunately, if a lake isn't taken care of, the water can become green and murky (switch to the turbid state). If large areas of native plants are removed, the sediments can get churned up and nutrients are released. If there are fewer plants to use the nutrients, the algae will use the nutrients and multiply. Once the water is "green" with dense algae, these lakes have mostly muck on the bottom instead of plants because the sunlight can't get through the dense algae to the bottom of the lake. Algae-dominated lakes are also not as high of quality habitat for fish and wildlife. If the plants are gone there is no place for aquatic animals to hide. The natural state of lakes is to have abundant aquatic vegetation in the shallows and clear water.

Literature Cited

Blickenderfer, Mary. 2007. A Field Guide to Identification of Minnesota Aquatic Plants. University of Minnesota Extension.

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

Appendix I. Sampling day photos

Site 171: Vegetation present includes Curly-leaf pondweed scattered (2) and Star duckweed rare (1).