

MACROPHYTE SURVEY
PINE LAKE, FOREST COUNTY
AUGUST 2004

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INTRODUCTION

On August 7 and 8, 2004, Northern Lake Service, Inc. personnel performed a general macrophyte survey of Pine Lake (Forest County, Wisconsin). This survey was performed to measure current distribution and density of aquatic plants. It followed the same methodology employed during a survey performed by Northern Lake Service in 1992. That methodology is described in the next section of this report. The survey was performed at the request of the Pine Lake Protection and Rehabilitation District for the purpose of assessing and rewriting their plant management plan.

SURVEY METHODOLOGY

A grid is drawn on a map of the lake so that intersection points give a good representation of the littoral zone – (the area in which the bottom receives enough sunlight to support plant growth). Since Pine Lake is relatively shallow, the grid extends over the entire lake surface. The sample points are approximately 400 yards apart. The grid consisted of 55 sample stations, but an additional 6 were added to include several areas that did not fall properly within the grid. This is essentially the same sample grid used for the survey performed in 1992.

Once on the lake, a map, compass and visual estimations are used to locate the sampling stations. (GPS was not used.) At each station an 8 to 10-foot circle is visualized and divided into 4 quadrants. Macrophytes are then collected, identified, and ranked as follows: 1 if present in 1 quadrant, 2 if present in 2 quadrants, etc...

If a species is observed growing outside the circle, it is given a "p" for present. Species receiving only this designation are not considered when relative frequency, average density, and depth of growth are calculated, but are included on the species list. If a specimen cannot be identified to species it is referred to by the generic name followed by "sp" ("spp" indicates the presence of more than one unidentified species of the given genus.)

Water depth, depth to vegetation, percent open water, and bottom type (if depth permits) is also recorded at each station.

This report was prepared from the field sheets. Along with a written section on the status of the aquatic plant population of the lake, it contains all field sheets, a site map, a community map, a species list with percent frequency, average density and depth of growth for each species, a species glossary and species sketches. An abbreviated version of the 1992 survey report is included as Appendix A.

SURVEY FINDINGS

The plant community in Pine Lake remains extensive, but was slightly different from that of 12 year ago. Of 61 stations sampled 60 supported at least some plant growth. The vast majority of locations supported extensive growth, with at least one species receiving a density ranking of 3 or 4. Nearly 60% of the sample stations supported growth of 5 or more different species.

Sample site number 2, near the inlet exhibited the most diversity with 11 species. This was also the most diverse site in 1992, with 15 species present. Only one station, which was over 10 feet deep, supported no plant growth. Several sample locations on the east shore supported sparse vegetation. The sparse low-growing plant community encountered here is consistent with the sandier, unsedimented substrate found in this area.

The average depth to growth during this survey was only 2.5 feet, significantly less than in 1992 (5.9 ft.). This value is biased significantly however by the present of a large bed of pondweed located in the southern half of the lake. This dense, surfacing bed exists in an area that during previous studies supported only sparse growth, which remained near the bottom. This area will be discussed more specifically later.

The most commonly encountered plant was *Elodea Canadensis*, which was present at 87% of the sample stations. This plant can be a nuisance in some lakes, but it is not in Pine Lake. Its density was not particularly high and it did not surface.

The second most common plant was *Potamogeton zosterformis* or flat-stemmed pondweed. This plant is closely related to the beneficial broad-leaved pondweeds and, while very common, tends to grow in lower density. Additional information on this species and other pondweeds is provided later in this section.

Three additional plants were collected at over half of the sample sites. They are *Ceratophyllum demersum* (coontail), *Najas flexilis* (slender najas), and *Myriophyllum exalbescens* *hyb.* (milfoil). These species were also among the most commonly collected during the 1992 survey, though the frequency of collection was somewhat different. (See species list for relative frequency data.)

The first species, coontail was the most commonly collected plant during the last survey with a frequency of 76%, but fell to 59% during this survey. As with the previous two species discussed, it occurred at relatively low densities during this survey but can grow to nuisance levels under the right circumstances.

Najas flexilis exists in greater density but its growth form keeps it near the bottom so it also is not a nuisance plant. The growth form of these two species make them beneficial in that they retain a great deal of nutrients near the lake bottom thus, not impeding lake use.

Myriophyllum exalbescens *hyb.* is the form of milfoil that was collected during the 1992 study. This plant was later determined to be a hybrid between the native species *Myriophyllum exalbescens* and the invasive nuisance species *Myriophyllum spicatum* (Eurasian water milfoil). When it was discovered during the 1992, the implications of its presence were not known. Superficially, this plant looks very much like the native Northern Water milfoil but tends to have more leaflet pairs than the native species.

The hybrid also exhibits some of the characteristics that give Eurasian water milfoil a competitive advantage, including advantageous roots on plant stems. The distribution of this plant has increased over the past decade, but not to the extent that Eurasian Water Milfoil would have been expected to spread in this type of environment. In 1992, it was collected at 20% of the sample locations with an average density of 1.8. In 2004 it was collected at 59% of the sample sites, but the average density remained the same.

Generally, Eurasian Water milfoil will completely dominate specific areas of a lake where water depth, substrate and light penetration allow it to use its biological advantages to out-compete native species. This is not the case on Pine Lake. The milfoil hybrid was the dominant species at only two sample sites and even at these sites, no fewer than 5 other plant species were present. While the overall plant biomass in Pine Lake remains at nuisance levels in some areas of the lake, it does not appear that the native community is threatened by the hybrid milfoil at this point.

During the initial survey in the 1970s and again in 1992, Pine Lake had a relatively large area in the south-central part of the lake that supported very sparse plant growth. Scattered pondweed beds, sparse coontail growth and low beds of a small-leafed pondweed were encountered in these areas but the amount of plant biomass was significantly less in this area than in most of the rest of the lake. During this survey, much of that area was dominated by a small-leafed pondweed identified as *Potamogeton pusillus*. This plant is likely the same pondweed collected in this area in 1992, although

there are many native species in this genus and identification of the small-leafed varieties is very difficult. The plant was only collected at 16 sampling locations but at 11 of those it received a density rating of 3 or 4. In these locations the excessive growth made boat travel extremely difficult and severely inhibits recreational use. The excessive growth this year may be an indication of a long-term change in the plant community in this area or may simply be a short-term "fluke". The District may want to survey lake users to try to determine the nature of this plant bed.

As in 1992, other members of the *Potamogeton* genus made up the majority of the remaining plant biomass in Pine Lake. This is varied genus, which includes many species considered to be quite beneficial to the aquatic community. The most commonly collected species was *P. zosterformis* or flat-stem pondweed. This plant was also the most common pondweed in 1992. *Potamogeton robbinsii* or fern-leaf pondweed, which creates much of the understory of the large-leaf pondweed beds, was the second-most commonly encountered species. Richardson's, White-stem, and Large-leaf (often collectively referred to as "cabbage) were also quite common.

An exotic (non-native) pondweed, *Potamogeton crispus*, was collected at two sample sites in the southern half of the lake (see community map). Lake users should familiarize themselves with this species and its spread should be carefully monitored. Only scattered individual plants were collected during this survey, but if more dense beds are observed, their specific removal should be considered in subsequent monitoring plans.

This species was not collected in 1992.

Emergent and floating-leaf plant communities appear similar or slightly diminished from those noted in 1992. The same species of emergent and floating-leaf vegetation were collected in 2004 as had been collected in 1992. The floating leaf beds consisted of *Nymphaea odorata* (white water lily), *Nuphar variegatum* (yellow pond lily) and *Brasenia schreberi* (water shield). The emergent vegetation observed was *Scirpus heterochaetus* (bulrushes) and *Pontederia cordata* (pickerel weed). Since these communities are relatively limited on Pine Lake and provide specific ecological benefits they should be protected from harvesting activities. Also, for the same reasons, lake users should be encouraged to avoid damaging these areas.

Twenty-four different species were collected during this survey. No protected or endangered species were collected during this survey.

SUMMARY and RECOMMENDATIONS

At the time of this survey, Pine Lake supported extensive macrophyte growth nearly throughout. While the exact distribution of species has changed to some extent over the past decade, the basic community type remains – a thick understory of plants, consisting mainly of *Ceratophyllum demersum*, *Elodea Canadensis*, *Najas flexilis* and *Potamogeton robbinsii*, often with moderate growth of broad-leaf pondweeds extending to near surface.

The plant community remains very diverse despite the presence of a potentially-aggressive water milfoil hybrid for more than a decade. Another non-native species, *Potamogeton crispus*, is present and may pose a long-term threat to the native population, but it is very uncommon within Pine Lake at this time.

A long-term plant management program of some sort is probably necessary to keep Pine Lake a viable recreational resource. Mechanical harvesting has been performed for several seasons, with varying results. The following considerations should be made in revising the plant management plan.

1. The dense, diverse growth near the inlet on the northeast corner of the lake should be protected from harvesting. This area provides several benefits to the lake. It acts as a nutrient sink, slowing water flow and allowing particulate matter to settle out and nutrients to be absorbed by the plant growth. It also provides valuable wildlife habitat. Since it is an area of heavy sedimentation, disruption through harvesting, potentially releases a significant amount of nutrients to the rest of the lake that would otherwise remain in the sediment. Since most of this area is undeveloped, leaving it unharvested should not inconvenience any residents.

2. Areas with emergent or floating-leaf vegetation should also be avoided, since they are relatively scarce on Pine Lake and provide unique natural habitats for wildlife and valuable shoreline protection. In areas where lake access is severely inhibited by such growth, only access paths should be maintained.

3. Block-type harvesting should be avoided in favor of strip harvesting. Strip harvesting, if done properly, provides a number of benefits. First, it maximizes effort versus resident satisfaction. This practice maintains access strips for lake users while still removing essentially the same plant biomass in the process. Strip harvesting also creates more "edge" which is beneficial to the fishery by allowing larger game fish more opportunity to feed and potentially control the population of smaller "feeder" fish. In some cases, strip harvesting has been found to increase the tendency for nuisance plant growth to control itself to some extent.

4. Some residents have expressed an interest in localized chemical treatment. This would likely be difficult to build into a management plan since the majority of the plant communities are diverse native stands.

5. The district should consider writing a plan that can be *and is* easily and regularly updated to address a dynamic system. Situations like the dense pondweed outbreak in the southern portion of the lake and the potential spread of curly-leaf pondweed may require specific short-term approaches.

While the development or updating of a plant management program is the primary purpose of a survey of this sort, it is important also, to remember that plant management is only a treatment of a symptom. Residents must be reminded that their actions can also dramatically impact the system. While the natural conditions of Pine Lake will probably always support potentially nuisance plant growth, residents should make every effort to reduce the adverse effects their activities may have on a lake. This is accomplished through nutrient runoff reduction, shoreline protection, wise land development practices and reasonable lake use. Awareness and education are keys to understanding and protecting the delicate balance of our water resources.

PINE MACROPHYTE SPECIES LIST 2004

<u>Species (common name)</u>	<u>Relative Frequency(%)</u>	<u>Average Density</u>	<u>Depth of Growth(ft.)</u>
Brasenia schreberi (water shield)	p (1.8)		
Ceratophyllum demersum (coontail)	59.0 (76)	1.8	2.5 - 10.5
Chara (chara)	3.3 (3.6)	2.0	2.5 - 3.0
Eleocharis acicularis (water needles)	1.6 (1.8)	1.0	4.5
Elodea canadensis (American elodea)	86.9 (44)	2.1	2.0 - 10.5
Isoetes sp. (quillwort)	4.9 (1.8)	2.0	2.5 - 4.5
Lemna trisulca (star duckweed)	8.2 (5.5)	1.8	3.0 - 4.0
Megalodonta beckii (water marigold)	4.9 (1.8)	1.0	3.0 - 4.0
Myriophyllum exalbescens (Northern water milfoil)	59.0 (20)	1.8	2.5 - 10.5
Najas flexilis (slender najas)	59.0 (33)	2.4	3.0 - 10.5
Nitella (nitella)	1.6 (1.8)	2.0	7.0
Nuphar variagatum (yellow pond lily)	p (5.5)		
Nymphaea odorata (white water lily)	1.6 (3.6)	3.0	3.0
Pontederia cordata (Pickerel weed)	p (p)		
Potamogeton amplifolius (large-leaf pondweed)	21.3 (13)	1.2	2.0 - 7.0

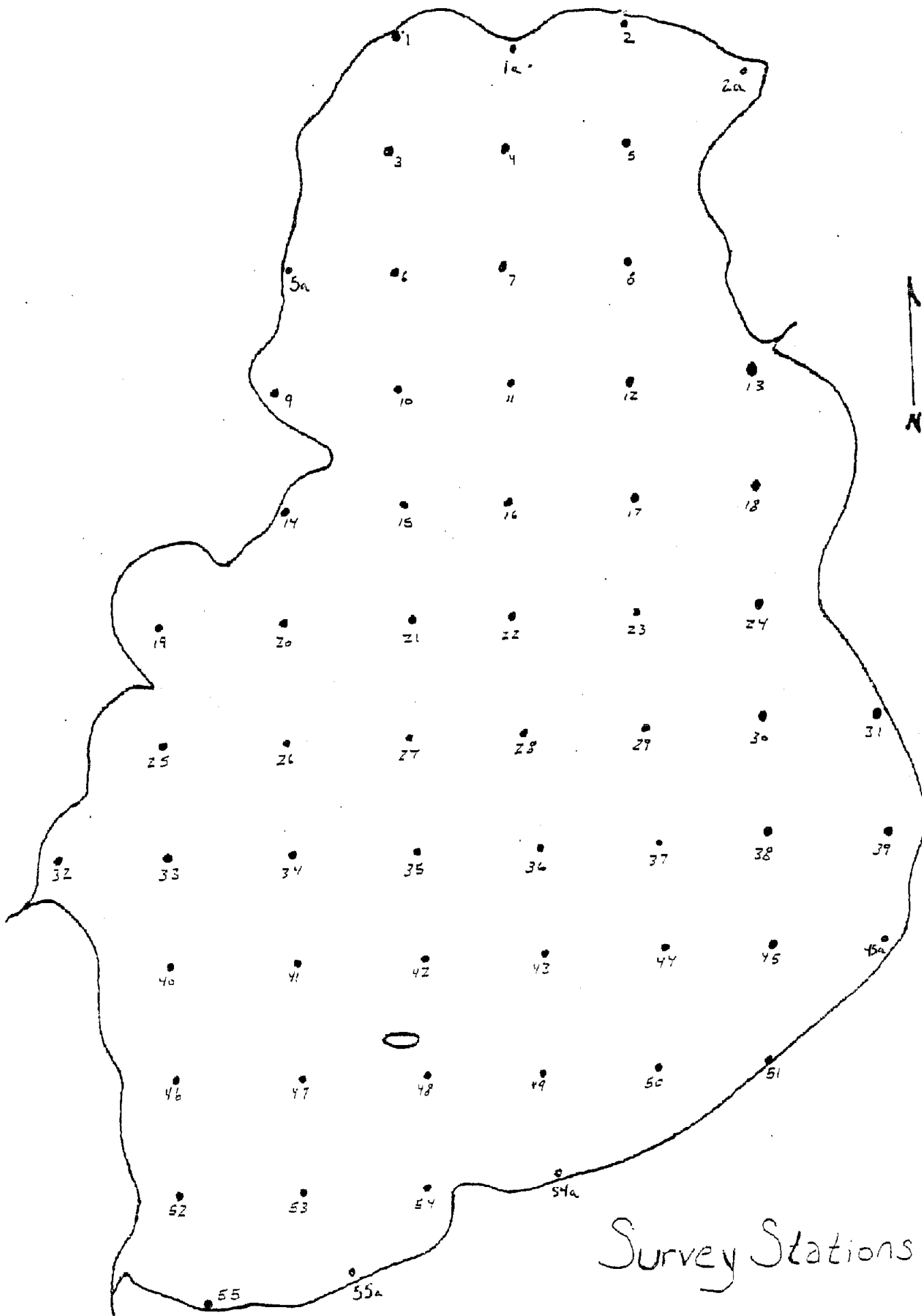
PINE MACROPHYTE SPECIES LIST 2004 (cont.)

<u>Species (common name)</u>	<u>Relative Frequency(%)</u>	<u>Average Density</u>	<u>Depth of Growth(ft.)</u>
P. crispus (curly pondweed)	3.3	1.0	6.5 - 10.5
P. praelongus (white stem pondweed)	27.9 (40)	1.5	3.0 - 10.5
P. richardsonii (Richardson's pondweed)	27.9 (25)	1.6	2.0 - 9.0
P. robbinsii (fern leaf pondweed)	41.0 (29)	2.8	3.0 - 9.0
P. zosteriformes (flat stem pondweed)	67.2 (40)	1.3	2.5 - 10.5
P. pusillus (small pondweed)	26.2 (14)	2.9	8.5 - 10.5
Scirpus heterochaetus (bulrush)	p (3.6)		
Utricularia vulgaris (bladderwort)	3.3 (1.8)	1.0	3.0
Vallisneria americana (eelgrass, wild celery)	32.8 (p)	2.4	2.0 - 7.0

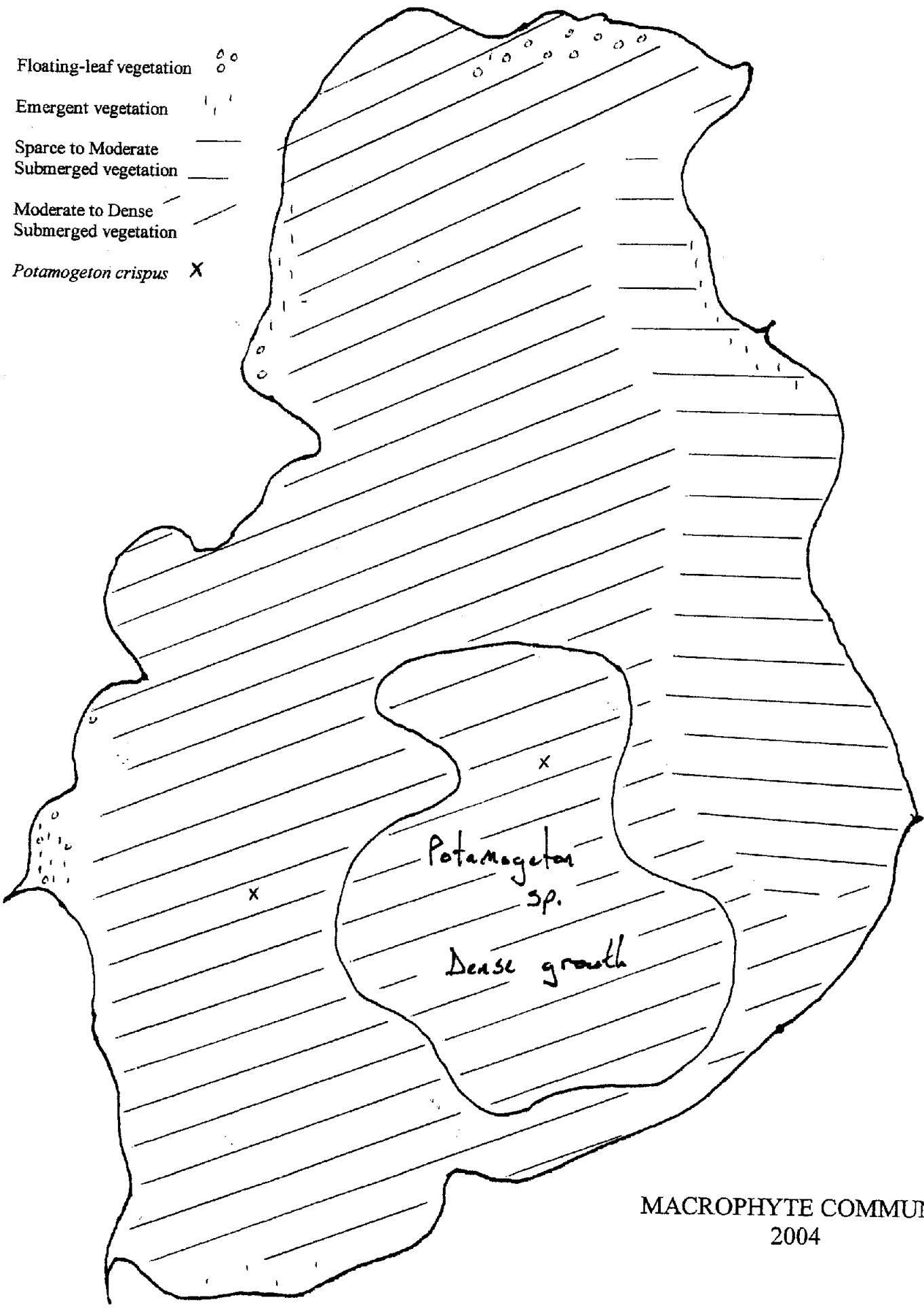
NOTE: P = present, this species was present but did not occur within the circle at any given station

Numbers in parenthesis are frequency values from 1992 survey.

Potamogeton gramineus and p. illinoensis were collected in 1992 but were not recollected in 2004.



- Floating-leaf vegetation ○○
- Emergent vegetation | |
- Sparse to Moderate Submerged vegetation —
- Moderate to Dense Submerged vegetation //
- Potamogeton crispus* X



MACROPHYTE COMMUNITIES
2004

Abundant Submergent

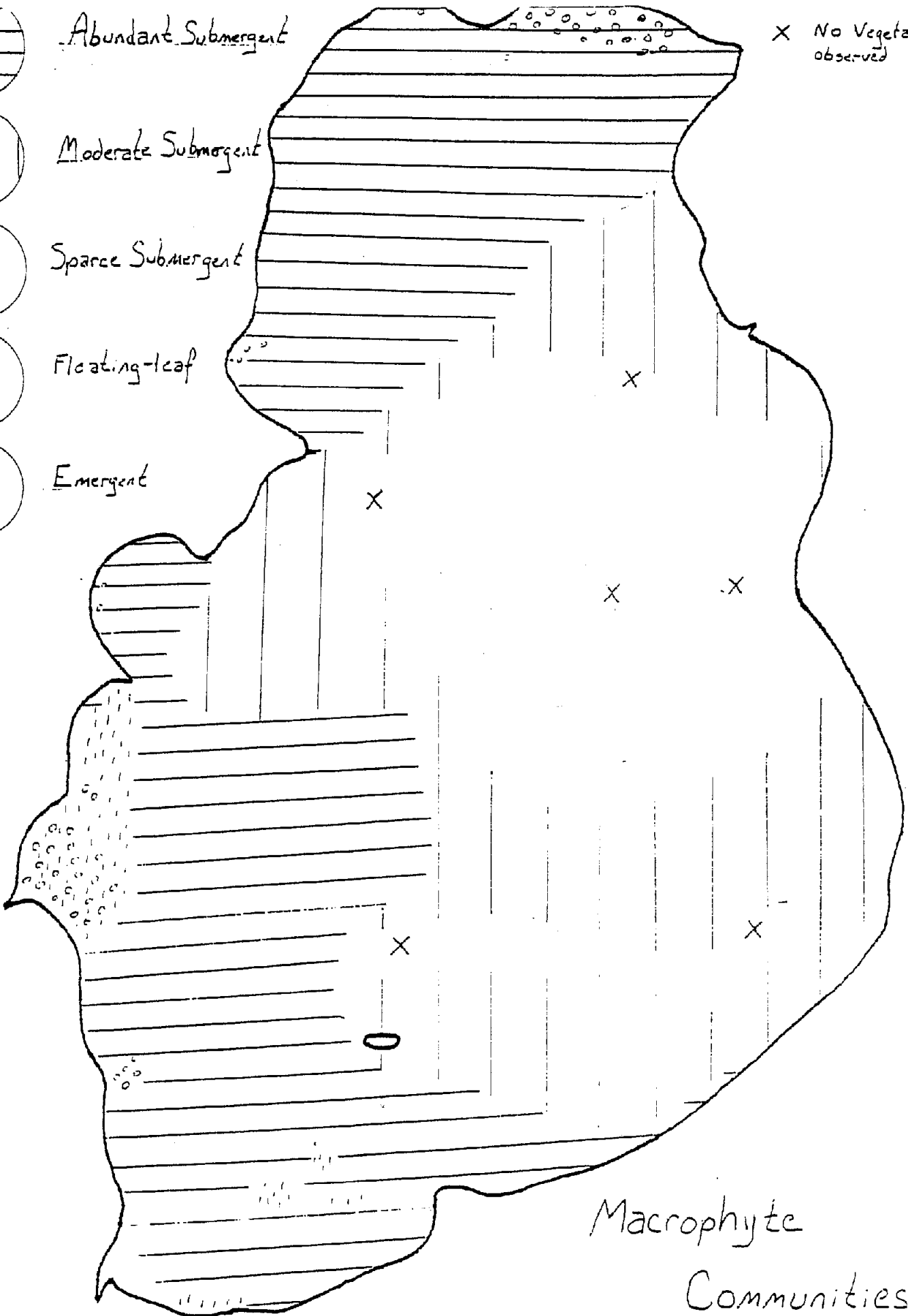
Moderate Submergent

Sparse Submergent

Floating-leaf

Emergent

X No Vegetation observed



Macrophyte

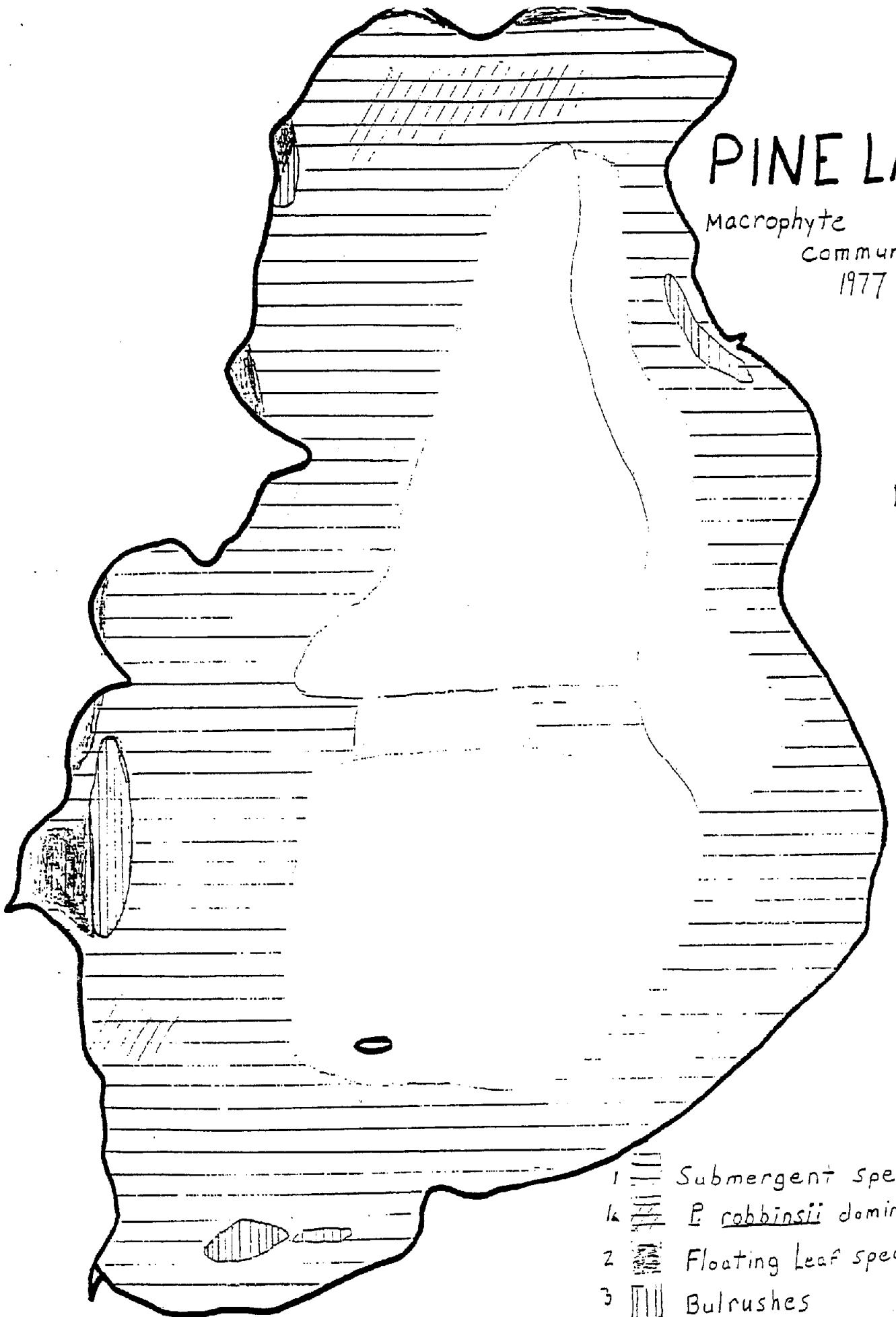
Communities

1992

RTK/NLS 15

PINE LAKE

Macrophyte
Communities
1977



- 1 Submergent species
- 1k *P. robbinsii* dominant
- 2 Floating leaf species
- 3 Bulrushes

MACROPHYTE SURVEY OF: Pine

BY: RTK FGAK

ON: 7-30-92

TAXA	STATION	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
<i>Brasenia Shreberi</i>										2						
<i>Ceratophyllum demersum</i>		2	4	1	1	3	2	4	3	2		1		3	3	
<i>Chara</i>																
<i>Eleocharis acicularis</i>																
<i>Flodea canadensis</i>		1	2													
<i>Heteranthera dubia</i>																
<i>Juncus belocarpus</i>																
<i>Lemna minor</i>																
<i>Lemna trisulca</i>		3	1													
<i>Megalodonta Beckii</i>				1												
<i>Myriophyllum exalbescens</i>																
H.			2													
H.																
Musci																
<i>Najas flexilis</i>																
N.																
<i>Nitella</i>																
<i>Nuphar variegatum</i>			4													
<i>Nymphaea</i>			2													
<i>Pontederia cordata</i>			P													
<i>Polygonum perfoliatum</i>																
<i>Potamogeton amplifolius</i>			P													
<i>P. gramineus</i>																
<i>P. oregonus</i>			1													
<i>P. zosteriformes</i>			2		1											
<i>P. robbinsii</i>		2	3	4	4											
<i>P. richardsoni</i>		1	1	2												
<i>P. illinoensis</i>			P													
<i>P. Sp. III</i>																
<i>Scirpus</i>																
<i>Sagittaria eurycardum</i>																
<i>Spirodella polycarpum</i>																
<i>Typha latifolia</i>																
<i>Utricularia</i>			1													
<i>Vallisneria spiralis</i>		4														
<i>Wolffia columbiana</i>																
Depth to vegetation		2.5	-	3.5	3.5											
% Open water @ 0.5' depth			40													
Water depth (ft)		4	3	5	4											
Bottom type		M	M	M	M	ic										

Numbers correspond to station map on the following page.

Numbers as explained on page 1

Each of these species belongs to the genus *Potamogeton*

This is the depth (in feet) from the surface to which vegetation extends - if this space is blank either vegetation was surfacing or it was absent

If this space is blank then no vegetation was surfacing - % open water is 100

Bottom type

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MACROPHYTE SURVEY OF: <i>Pine</i>		BY: <i>Rth</i>										ON: <i>8/8-9/04</i>					
TAXA	STATION	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
<i>Brasenia Shreberi</i>										P							
<i>Ceratophyllum demersum</i>		1	2	1	1			2				1			1	2	2
<i>Chara</i>																	
<i>Eleocharis acicularis</i>														1			
<i>Elodea canadensis</i>		1	3	1	1		4			1	1	2	1	1	2	1	2
<i>Heteranthera dubia</i>																	
<i>Juncus pelocarpus</i>																	
<i>Lemna minor</i>																	
<i>Lemna trisulca</i>		2	2														1
<i>Megalodonta Beckii</i>				1	1												
<i>Myriophyllum exalbescens</i>		2	2	2	1		1	3		1	2				1		2
M.																	
M.																	
Musci																	
<i>Najas flexilis</i>		1				1			2		2	4				3	
N.								2									
<i>Nitella</i>																	
<i>Nuphar variegatum</i>										P							
<i>Nymphaea</i>			3														P
<i>Pontederia cordata</i>																	
<i>Polygonum natans</i>																	
<i>Potamogeton amplifolius</i>		1		1	1			1		1							
<i>P. gramineus</i>								1									
<i>P. praelongus</i>				1	1			3									1
<i>P. zosteriformes</i>		1	1	1	1		1	2			2		1	1	1	1	1
<i>P. rich</i>		1	1	2				3	2	1						1	1
<i>P. sub</i>			4	2	4		4								1		4
P.																	
<i>P. sp</i>																	1
<i>Scirpus</i>										P							
<i>Sparganium eurycarpum</i>																	
<i>Spirodella polycarpum</i>																	
<i>Typha latifolia</i>																	
<i>Utricularia</i>				1													1
<i>Vallisneria americana</i>		4	2	4					3	3				1	4		1
<i>Wolffia columbiana</i>																	
<i>Isotria</i>														1			
Depth to vegetation		.5		.5	1.5		2	.5	5	2	5	8	8	4	1	2	
% Open water @ 0.5' depth			10														5
Water depth (ft)		3	3	4	6	10	5	7	5.5	3	8	10.5	10.5	4.5	5	5.5	3
Bottom type		S	M	M	M	S	M	M		S	S	S	S	S	S	S	M

MACROPHYTE SURVEY OF: Pine

BY: RJA

ON: 6/7-8/04

TAXA	STATION	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
<i>Brasenia Shreberi</i>																
<i>Caracophyllum demersum</i>		2	1		1	1	2	1	2			1	2		3	
Chara																
<i>Eleocharis acicularis</i>																
<i>Flodea canadensis</i>		3	2	1	2	3	3	2	3		2	2	3	2	3	
<i>Heteranthera dubia</i>																
<i>Juncus belocarpus</i>																
<i>Lemna minor</i>																
<i>Lemna trisulca</i>																
<i>Megalodonta Beckii</i>																
<i>Myriophyllum exalbescens</i>						3	2	2	1							
M.																
M.																
Musci																
<i>Najas flexilis</i>		3	3		3	3	2	1	4					4	4	3
N.											2					
<i>Nitella</i>																
<i>Nuphar variegatum</i>																
<i>Nymphaea</i>																
<i>Pontederia cordata</i>																
<i>Polygonum natans</i>																
<i>Pocamogeton amplifolius</i>																
<i>P. gramineus</i>																
<i>P. graeloncus</i>		1						1	2	1					1	2
<i>P. rostriformes</i>		1		1												
<i>P. sp.</i>						3	1									
<i>P. sp.</i>					1	3	1				4					
<i>P. sp.</i>																
<i>P. sp.</i>		3	3						4	4						2
<i>Scirpus</i>																
<i>Sagittaria eurycarpa</i>																
<i>Spirodella polycarpa</i>																
<i>Syngonium laxifolia</i>																
<i>Utricularia</i>																
<i>Vallisneria americana</i>																
<i>Wolffia columbiana</i>																
Depth to vegetation		1	8	4	.5	4				9	6	.5	4	3	1	8
* Open water @ 0.5' depth																
Water depth (ft)		9	10	5	4	9	2.5	9	10.5	7	3	8	9	8.5	10	11
		M	M	S	S	MS	M	M	M	S	SM	MS	M	M	M	S

NORTHERN LAKE SERVICE, INC.

MACROPHYTE SURVEY OF: <i>PWC</i>		BY: <i>RTA</i>														
		DN: <i>8/7-8/04</i>														
TAXA	STATION	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45
<i>Brasenia Shreberi</i>																
<i>Ceratophyllum demersum</i>			1	2	3	2	3	3	3		1	1	1			1
<i>Chara</i>			1													
<i>Eleocharis acicularis</i>																
<i>Elodea canadensis</i>		1	2	3	3	2	3	3		2	3	3	2	2	2	2
<i>Heteranthera dubia</i>																
<i>Juncus pelocarpus</i>																
<i>Lemna minor</i>																
<i>Lemna trisulca</i>																
<i>Megalodonta Beckii</i>										1						
<i>Myriophyllum exalbescens</i>			1	1	2	2	3	1			2	2	1	2	2	
M.																
M.																
Musci																
<i>Najas flexilis</i>				4	3	3	3	3	3		1	1	1	2	1	1
N.																
<i>Nitella</i>																
<i>Nuphar variegatum</i>			P													
<i>Nymphaea</i>																
<i>Pontederia cordata</i>																
<i>Polygonum natans</i>																
<i>Potamogeton amplifolius</i>					2							1				
<i>P. gramineus</i>																
<i>P. praelongus</i>				1	1		1				1	1				
<i>P. zosteriformes</i>			1	2	2	1		2	1	1	2	2				1
<i>P. r. 2h</i>					3											1
<i>P. r. 6b</i>				3	3						3	3				
<i>P. 4. curly</i>							1					1				
<i>P.</i>						3	3	2		2			4	4	4	1
<i>Scirpus</i>			P													
<i>Sparganium eurycarpum</i>																
<i>Spirodella polycarpum</i>																
<i>Typha latifolia</i>																
<i>Otricularia</i>																
<i>Vallisneria americana</i>		3	3													
<i>Wolffia columbiana</i>																
<i>P. ches</i>			2													
Depth to vegetation		3	15	2	5	15	1	15	5	3	15	1				4
% Open water @ 0.5' depth													20	80	80	
Water depth (ft)		3 1/2	2.5	7	7	9	10.5	10	10.5	8.5	6	6.5	9	9	8.5	10
Bottom type		SG	SG	M	M	M	M	M	M	S.M	M	M	M	M	M	M

NORTHERN LAKE SERVICE, INC.



MACROBENTHIC SURVEY OF: Pine		BY: RJA										ON: 2a 5a 7a 9a 5a				
TAXA	STATION	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
<i>Brasenia Shreberi</i>																
<i>Ceratophyllum demersum</i>			3	2		1	3						2	3		
<i>Chara</i>																3
<i>Eleocharis acicularis</i>																
<i>Elodea canadensis</i>		2	2	2	3	3	1	2		2	1	2	2	2	1	
<i>Heteranthera dubia</i>																
<i>Juncus pelocarpus</i>																
<i>Lemna minor</i>																
<i>Lemna trisulca</i>												3	1			
<i>Megalodonta Beckii</i>																
<i>Myriophyllum exalbescens</i>		1		4		2	3		3	4	1	1	1	1		
M.																
M.																
Musci											4	2				
<i>Najas flexilis</i>		1	1	3	3	2				2	4	2				
N.																←→
<i>Nitella</i>																
<i>Nuphar variegatum</i>														P		
<i>Nymphaea</i>														P		
<i>Pontederia cordata</i>														P		
<i>Polygonum natans</i>																
<i>Potamogeton amplifolius</i>								1		1	2	1	2			
<i>P. gramineus</i>																
<i>P. praelongus</i>			1				1		3	2					3	
<i>P. zosteriformes</i>		1	1	2		2	2			2		1	1	2	4	
<i>P. rich</i>										3	2		2		1	
<i>P. m6</i>		4	4	2			3	4	4	3	1		4	3	1	
<i>P.</i>							8									
<i>P.</i>					4	3										
<i>Scirpus</i>																
<i>Sparganium eurycarpum</i>																
<i>Spirodella polycarpum</i>																
<i>Typha latifolia</i>																
<i>Utricularia</i>																
<i>Vallisneria americana</i>										2	1	4	1		2	3
<i>Wolffia columbiana</i>																
<i>isotus</i>															←→	3
Depth to vegetation		3	3			4	4.5	3				1	2 1/2	.5		2 2 1/2
% Open water @ 0.5' depth				75	75				95	85		100				
Water depth (ft)		5	7.5	7	6.5	9	6	6.5	6	4 1/2	2	3	4	6	3	3
Bottom type		M	M	M	M	M	M	M	MS	M	M	S	M	S	S	S

SPECIES GLOSSARY

- Brasenia shreberi*: Water shield(1); football-shaped floating leaves approximately 12 cm x 7 cm; thin, red stem attached to center of leaf; red waxy flower held about 1 cm above water surface; stem and underside of leaf extremely slimy.
- Ceratophyllum demersum*: Coontail (2); leaves 1 - 3.5 cm long, whorled on stems, palmately divided and serrated on one side; leaves crowded at tips of stems giving "coontail" effect.
- Chara* sp.: Muskwort(3); rigid, often brittle algae growing to 1 ft.; "leaves" simple, whorled around stems; plants reddish brown, yellow or green; strong musty smell when crushed.
- Eleocharis acicularis*: Needle rush(4); usually inconspicuous small grass-like plant; leaves linear 1 mm diameter to 10 cm long.
- Elodea canadensis*: American elodea(5); leaves 1-2 cm long by 1.5-3 mm whorled on stems in groups of 3's or 4's; whorls about 0.5-1 cm apart; stem thin, light colored and brittle; flowers, with extremely thin white petiole, float on surface.
- Isoetes* sp.: Quillwort(6); leaves 10-30 cm, grass-like, hollow, recurved pointed; leaf bases swollen clasping.
- Lemna trisulca*: Star duckweed(7); small (7 mm) spatula-shaped segment connected to one another by "stalk" portion; each segment with one tiny root; plants often form large, tangled, sinking mats.
- Megalodonta beckii*: Water marigold(8); submerged leaves somewhat stiff finely dissected and crowded at the nodes; nodes 2-4 cm apart; stems ? 4 mm diameter; flower daisy-like, held above the water and rare.
- Myriophyllum exalbescens*: Northern water milfoil; submerged leaves to 3 cm long, in whorls of 3,4, or 5, dissected into 6-10 pairs of thin segments from a central axis; flower small on a spike held above the water; floral bracts very small.
- M. spicatum*: Eurasian milfoil; more branching than other members of this genus, leaves drooping, each with more than 11 pairs of leaflets.
- M. hybrid*: Milfoil hybrid (25); Species found in Pine Lake looks superficially like *M. exalbescens*, but tends to branch more, has occasional advantageous roots and has 11 or more leaflet pairs.

- Naja flexilis*: Slender naiad(9); leaves 1-3.5 cm long, opposite on stems, tapering to a slender pointed tip; leaf bases clasping; stems slender, flexible; plant extremely limp out of water.
- Nitella* sp.: *Nitella*(10); large limp algae; dark green, almost transparent; "leaves" whorled on stems, with forked tips.
- Nuphar variegatum*: Yellow pond lily, spatterdock(12); leaves large (to 50 cm) oval, basal lobes rounded; stem stout, attached to leaf between basal lobes; flowers large (to 10 cm), yellow spherical.
- Nymphaea odorata*: White water lily(11); leaves large (to 40 cm) nearly circular; basal lobes pointed; stem stout attached to leaf between basal lobes; flower large (to 20 cm) with 25-50 waxy white petals surrounding yellow center.
- Pontedaria cordata*: Pickerel weed(13); leaves large (to 30 cm) heart-shaped, held upright above water; flowers numerous ? 2 cm, usually purple, held above water in a spike-like arrangement (to 10 cm).
- Potamogeton amplifolius*: Large-leaf pondweed(14); leaves to 20 cm, folded along midrib and recurved (banana-shaped); plants often turning brown; flowers on dense spike (to 8 cm) held above the water; stipules rigid, persistent (to 4 cm); often with elliptical floating leaves.
- P. crispus*: Curly pondweed(23); leaves about 10 cm green to reddish, and translucent with tiny teeth along entire margin.
- P. praelongus*: White-stem pondweed(15); stems stout often whitish and zig-zag; leaves to 20 cm often with conspicuous white midvein, clasping; leaf tips rounded into boat-shape which splits when pressed; stipules paper-like persistent ? 5 cm long; spike dense to 6 cm long.
- P. pusillus*: Small pondweed (24); leaves 1-6 cm long and .5 to 2 mm wide; stems very slender and stringy; fruiting heads slender, coming from axils of upper leaves.
- P. richardsonii*: Richardson's pondweed(16); leaves to 10 cm, often with conspicuous white midvein, wavy leaf margins, clasping stems tapering to slender tip; stipules blunt, not persistent; stem usually white; floral spike to 3 cm.
- P. robbinsii*: Robbin's pondweed(17); leaves strongly two ranked(plant resembles a fern under water), stiff, ? 10 cm x 5 mm; stipules not persistent; stem slightly flattened usually un-branched.
- P. zosteriformis*: Flat-stem pondweed(18); leaves linear to 20 cm x 5 mm; stem to 5 mm wide, strongly flattened slightly winged, limp; stipules to 3 cm; peduncle to 5 cm often curved.

Scirpus sp.: Bulrush(19); stems simple, rigid, linear, erect to 2m, round, mostly hollow; flowers spraying out from side of stem near the end (actually end of stem with bract).

Typha latifolia: Cattail; leaves sword-like to 2 m, stiff; to 3 m stiff, erect; flowers tiny crowd into large (to 20 x 5 cm) cigar-like spike.

Utricularia vulgaris: Common bladderwort(20); leaves numerous, 1-3.5 cm, forked dissected into narrow segments-"net-like"; stems with many small egg-shaped bladders (? 2 mm) flowers conspicuous yellow, lipped, held above water; plant often not rooted but suspended in large masses.

Vallisneria americana: Eel grass, wild celery(21); leaves ribbon-like to 1 m x ? 1.5 cm wide; flowers, white ? 1 cm, floating on long, slender, spirally stem.

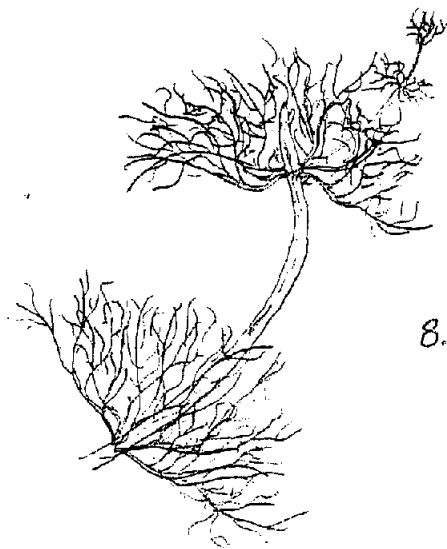
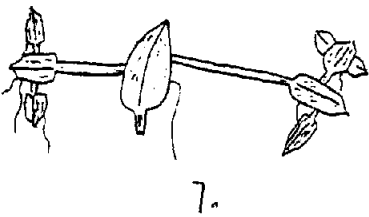
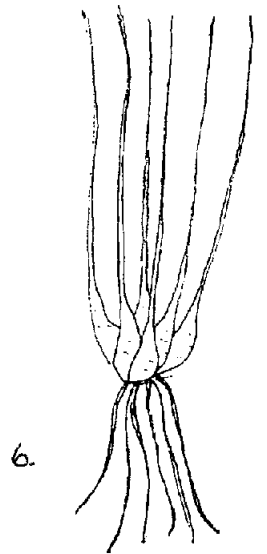
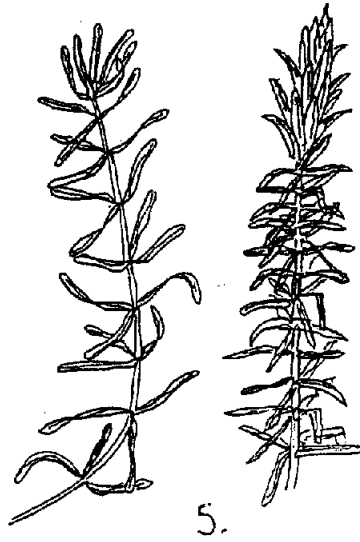
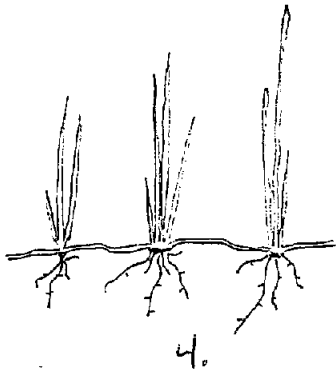
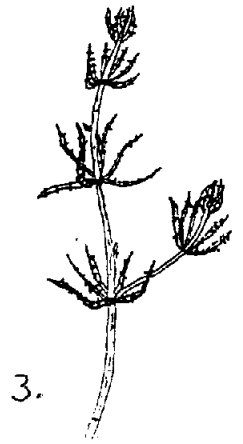
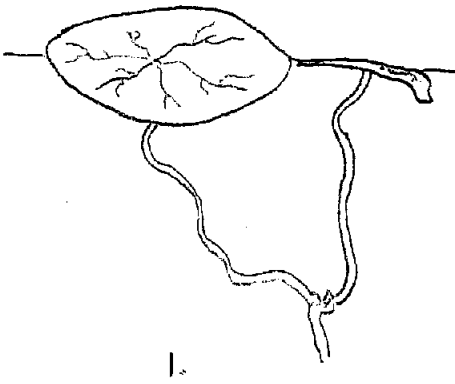
(These definitions have been written with regard to the species and variations of species found in Pine Lake, Forest County. It should not be relied upon as a key, especially in other areas.)

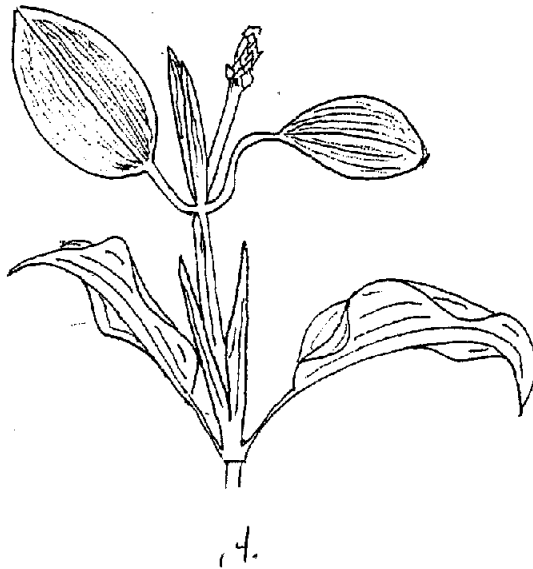
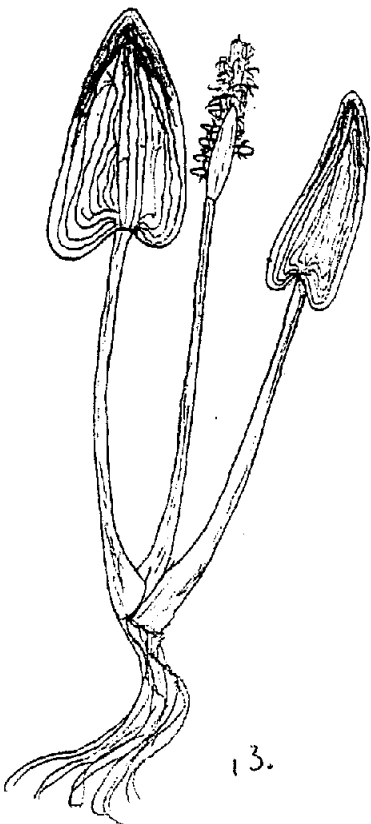
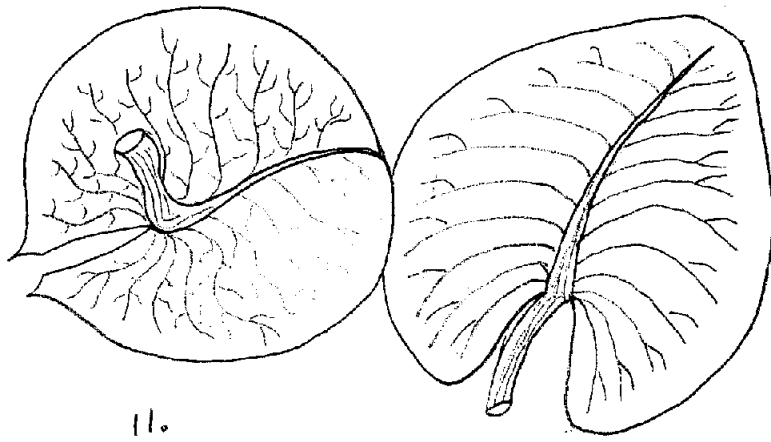
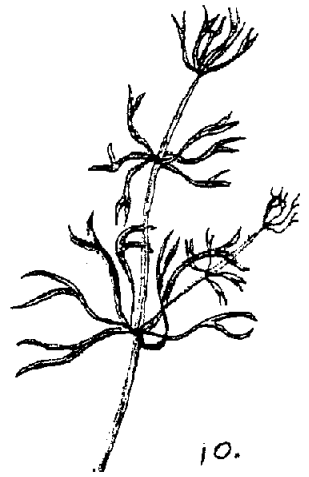
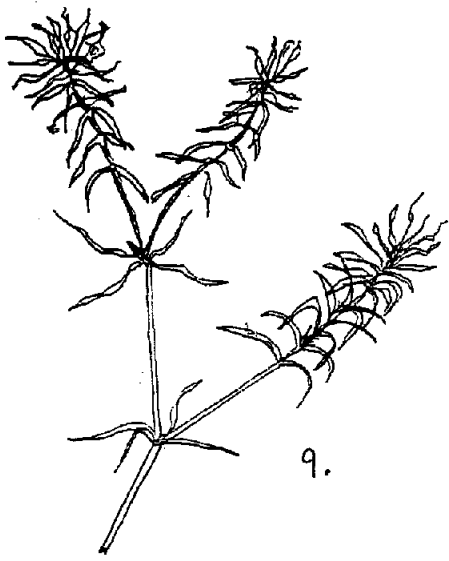
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Fassett, Norman C., A Manual of Aquatic Plants, 1957, Revision appendix by Eugene C. Ogden, pp. 405, University of Wisconsin Press, Madison.

Lopinot, Alvin C. and Glen S. Winterringer, Aquatic Plants of Illinois, 1966, pp. 140, Department of Registration and Education, Illinois State Museum Division and Department of Conservation, Division of Fisheries.

/pine glos.doc



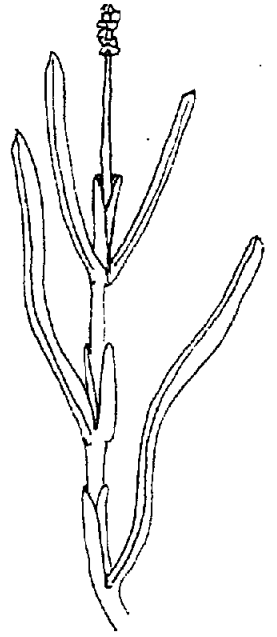




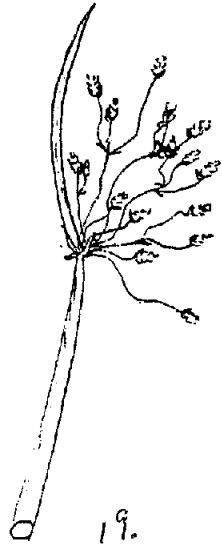
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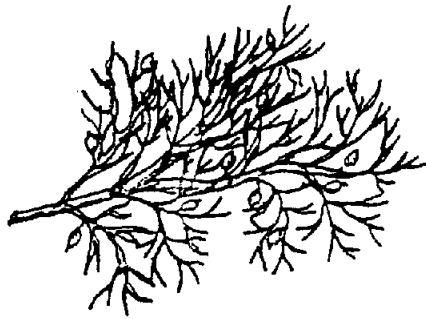
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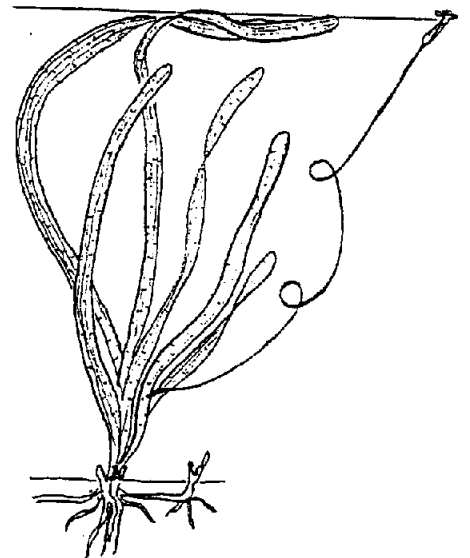
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19.



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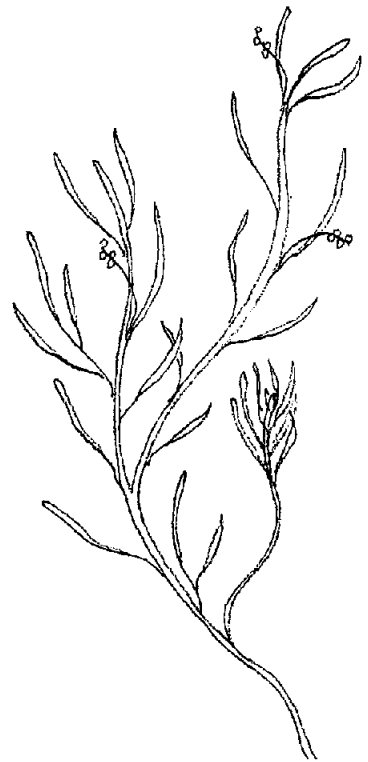


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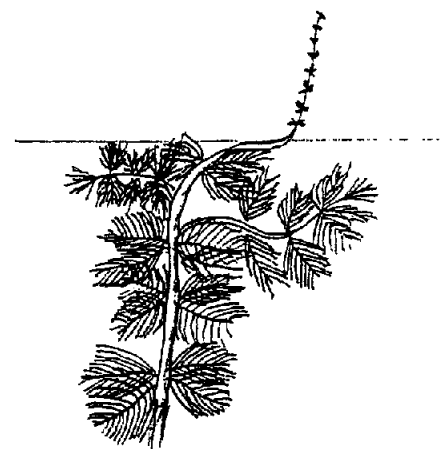
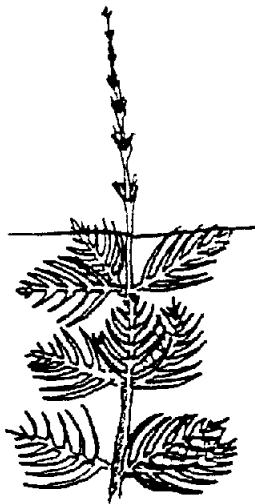
Species of concern



Potamogeton crispus (23)



Potamogeton pusillus (24)



Myriophyllum hybrid (25); this species displays characteristics of both *Myriophyllum exalbescens* (left) and *Myriophyllum spicatum* (right)

MACROPHYTE SURVEY

PINE LAKE
FOREST COUNTY, WISCONSIN

PERFORMED BY: R.T. KRUEGER & G.A. KRUEGER

NORTHERN LAKE SERVICE, INC.
400 NORTH LAKE AVENUE
CRANDON, WISCONSIN 54520
JULY 30, 1992

PREPARED:
AUGUST 14, 1992

Introduction

On July 30, 1992, a general macrophyte survey was conducted on Pine Lake, Forest County. This was done to determine density, diversity, and distribution of aquatic plants. General observations were made throughout the lake with depth and density measurements made at specific numbered stations. The 55 stations on Pine Lake represent intersection points on a grid approximately 400 yds on the side. While this grid is larger than that used in 1977, I feel, due to the structure of the lake and nature of the plant communities, this study is as representative as the earlier work. This study also included sampling points in deeper areas of the lake which were not taken into consideration in 1977.

Methodology

At each numbered station a 10 foot circle is visualized and divided into 4 quadrants. Macrophytes are then collected, identified, and ranked as follows: 1 if present in 1 quadrant, 2 if present in 2 quadrants, etc... A ranking of 5 signifies complete or near complete dominance by one species, occupying a significant portion of the water column. If a species is observed growing outside the circle it is given a "p" for present. Species receiving only this designation are not considered when relative frequency, average density, and depth to growth are calculated, but are included on the species list. If a specimen cannot be identified to species it is referred to by the generic name followed by "sp". ("spp"

indicates the presence of more than one unidentified species of the given genus). Water depth, depth to vegetation, percent open water, and bottom type (if depth permits) are also recorded at each station.

Bottom type descriptions are as follows: D=detritus, G=gravel, H=hard, clay like, M=muck, r=rocks, S=sands.

Survey Finding

Pine Lake continues to support abundant and diverse plant growth. Vegetation was collected at all but 6 stations, and even these areas probably support some macrophyte growth albeit extremely sparse.

The most diversity was exhibited at station 2 with 15 species present. Three stations along the west shore shore (9, 19, & 32), and three on the south end (53, 54, & 55) support at least 10 species. Most other stations with depths of under 10 ft supported 3 to 7 species.

The most abundant species were *Ceratophyllum demersum* or coontail which was present in about 75% of the lakes and *Elodea canadensis* which was present at about 45% of the stations. In combination these plants were present at all but one vegetated station, from depths of 2.5 ft. to 13 ft. *Ceratophyllum* and *Elodea* generally produce low but dense growth - sometimes to nuisance proportions.

At the time of this study they were not surfacing and therefore not hampering recreation. (It has been pointed out that weed growth is down significantly from previous years.) In Pine Lake these two species account for approximately 45% of the plant biomass.

The genus *Potamogeton* contributes another 45%. This is an extremely diverse taxa. *Potamogeton praelongus*, white-stem pond weed and *P. zosteriformes*, flat-stem pondweed were the most prevalent, both present at 22 of the 55 stations. *P. robbinsii* and *P. richardsoni* were both present at over 25% of the stations with *P. robbinsii* receiving the highest average density of any species present at more than 3 stations, at 3.2. Five other *Potamogetens* were present. Most of the *Potamogetens* in Pine Lake have long erect stems (to 11 ft.) and are not as dense as *Ceratophyllum* and *Elodea*.

The remaining submergent species account for little biomass. *Myriophyllum exalbescens* (milfoil) was present in most of the beds of broadleaf pond weeds. *Vallisneria americana* and *Chara* (a large rigid algae) were the most prevalent on the sandy, wind-swept east shore.

Beds of emergent vegetation were present on approximately 5% of the surface area of the lake. These beds consisted mostly of the bulrush *Scirpus heterochaetus* and were located near the south shore and at the mouth of Wildcat Creek. These areas generally had a

sandy bottom without much muck accumulation. Other emergents included *Typha latifolia* or cattail near the north and south shores and *Pontederia cordata* found at the mouth of Wildcat Creek. Emergents grew at depths of 3 to 5 ft.

Floating leaf vegetation was also present over about 5% of Pine Lake. The largest beds were near stations 2 and 32. The bed at station 2 consist of *Nuphar variegatum* and *Nymphaea odorata* while the one at 32 consisted of these two species along with *Brasenia shreberi*.

Summary

At the time of this survey, Pine Lake supported macrophyte growth nearly throughout. Plant growth extended to 13 ft deep and grew to an average of approximately 5.9 ft below the water's surface. (The average at the 13 stations 7 ft deep or less was 2.1 ft, while the remaining vegetated stations averaged 8 ft to growth.) Twenty-eight species were noted: 4 floating leaf, 3 emergents, and 21 submergents, two of which are actually large colonial algae. The vast majority of the plant biomass was accounted for by the submergent species, especially *Ceratophyllum demersum*, *Elodea canadensis*, and the *Potamogetens*.

As the macrophyte community maps indicate, distribution of community types and extent of growth have changed very little over the last 15 years. The species list and corresponding numbers are

also quite similar. Also like the original, this study found plant growth extended to depths beyond the predicted maximum. This is probably due clearer water conditions earlier in the year when growth began.

PINE LAKE MACROPHYTE SPECIES LIST

<u>Species (common name)</u>	<u>Relative Frequency(%)</u>	<u>Average Density</u>	<u>Depth of Growth(ft.)</u>
<i>Brasenia shreberi</i> (water shield)	1.8	2	3.5
<i>Ceratophyllum demersum</i> (coontail)	76.4	2.2	3 - 13
<i>Chara</i> (muskwort)	3.6	2	2.5 - 5
<i>Eleocharis acicularis</i> (spike rush)	1.8	1	11.5
<i>Elodea canadensis</i> (American elodea)	44.0	2	2.5 - 11
<i>Isoetes</i> (quillwort)	1.8	3	5
<i>Lemna minor</i> (lesser duckweed)	P	P	---
<i>Lemna trisulca</i> (star duckweed)	5.5	2.3	3 - 4
<i>Megalodonta beckii</i> (water marigold)	1.8	3	3
<i>Myriophyllum exalbescens</i> (milfoil)	20.0	1.8	3 - 8
<i>Najas flexilis</i> (slender naiad)	32.7	1.8	2.5 - 12
<i>Nitella</i> (nitella)	1.8	4	7
<i>Nuphar variegatum</i> (yellow pond lily, spatterdock)	5.5	2.7	3 - 3.5
<i>Nymphaea</i> sp. (white water lily)	3.6	3	3
<i>Pontedaria cordata</i> (pickerel weed)	P	P	---
<i>Potamogeton amplifolius</i> (large leaf pondweed)	12.7	1.7	5 - 8.5
<i>P. berchtoldi</i> (Berchtold's pondweed)	9.1	2.2	8.5 - 12
<i>P. gramineus</i> (variable pondweed)	10.9	2	3 - 6.5
<i>P. foliosus</i> (leafy pondweed)	14.5	1.3	6.5 - 12.5

PINE LAKE MACROPHYTE SPECIES LIST

<u>Species (common name)</u>	<u>Relative Frequency(%)</u>	<u>Average Density</u>	<u>Depth of Growth(ft.)</u>
<i>P. illinoensis</i> (Illinois pondweed)	5.5	2.3	7 - 8.5
<i>P. praelongus</i> (white stem pondweed)	40.0	1.8	3 - 12
<i>P. richardsoni</i> (Richardson's pondweed)	25.5	1.6	2.5 - 12
<i>P. robbinsii</i> (Robbin's pondweed)	29.1	3.2	3 - 12
<i>P. zosteriformes</i> (flat-stem pondweed)	40.0	1.7	2.5 - 10.5
<i>Scirpus heterochaetus</i> (slender bulrush)	3.6	2	2.5 - 3
<i>Typha latifolia</i>	p	P	---
<i>Utricularia vulgaris</i> (bladderwort)	1.8	1	3
<i>Vallisneria americana</i> (eelgrass, wild celery)	p	P	---

Note: p=present, but not found at any numbered station.

NORTHERN LAKE SERVICE, INC.

MACROPHYTE SURVEY OF: Pine

BY: RTK FGAK

ON: 7-30-92

TAXA	STATION	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
<i>Brasenia Shreberi</i>										2						
<i>Ceratophyllum demersum</i>		2	4	1	1	3	2	4	3	2		1		5	3	
<i>Chara</i>																
<i>Eleocharis acicularis</i>																
<i>Flodea canadensis</i>		1	2			1	2	1		2	2					2
<i>Heteranthera dubia</i>																
<i>Juncus pelocarpus</i>																
<i>Lemna minor</i>										P						
<i>Lemna trisulca</i>		3	1							3						
<i>Megalodonta Beckii</i>			1													
<i>Myriophyllum exalbescens</i>																
M.			2							1	3			1	1	
M.																
Musci																
<i>Najas flexilis</i>														2	1	
N.																
<i>Nitella</i>																
<i>Najas variegatum</i>																
<i>Nymphaea</i>																
<i>Pontederia cordata</i>																
<i>Polygonum natans</i>																
<i>Potamogeton amplifolius</i>																1
<i>P. gramineus</i>														2		
<i>P. praelongus</i>																
<i>P. rostriformis</i>																
<i>P. robbinsii</i>		2														
<i>P. richardsoni</i>		1	1	2		1	2			0	2				1	
<i>P. Illinoensis</i>			P				2				1					
<i>P. Sp. III</i>								1	1							
<i>Scirpus</i>										P						
<i>Scarcanium eurycarpum</i>																
<i>Spirodella polycarpum</i>																
<i>Typha latifolia</i>																
<i>Utricularia</i>			1													
<i>Vallisneria americana</i>		4								3	4			2	3	
<i>Wolffia columbiana</i>																
Depth to vegetation		2.5	-	3.5	3.5	2	1.5	6.5	12		0	10.5		3	5.5	
% Open water @ 0.5' depth			40							40						
Water depth (ft)		4	3	5	6	9	8.5	9	12.5	3.5	7	11	14	4.5	6	12
Bottom type		M	M	M	M	M	M	M	M	M	5	M	M	5	5	5

Don't know what "M." is.
 or Scirpus, or sp
 I used sp3 for Sp. III.
 Otherwise, all is entered

MACROPHYTE SURVEY OF: P. W.

BY: R-TK & GAK

ON: 7-30-12

TAXA	STATION	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
<i>Brasenia Shreberi</i>																
<i>Ceratophyllum demersum</i>		2	2	1		3	2	2			2	4	3	1	2	1
<i>Chara</i>																
<i>Eleocharis acicularis</i>																
<i>Flodea canadensis</i>		1						1			2					
<i>Heteranthera dubia</i>																
<i>Juncus belocarpus</i>																
<i>Lemna minor</i>																
<i>Lemna trisulca</i>																
<i>Megalodonta Beckii</i>											3					
<i>Myriophyllum exalbescens</i>																
M.																
M.																
Musci																
<i>Najas flexilis</i>			1										2			
N.																
<i>Nitella</i>																
<i>Nuphar variegatum</i>																
<i>Nymphaea</i>																
<i>Pontederia cordata</i>																
<i>Polygonum natans</i>																
<i>Potamogeton amplifolius</i>						2					2					
<i>P. gramineus</i>																
<i>P. praelongus</i>		2	1		3	3	3					P				
<i>P. zosteriformes</i>					3					1						
<i>P. robbinsii</i>					4	2						3				
<i>P. richardsonii</i>					1	1										
<i>P. illinoensis</i>																
<i>P. sp. variegatus</i>						2						1	4			
<i>Scirpus validus</i>											P					
<i>Sparganium eurycarpum</i>																
<i>Spirodella polycarpum</i>																
<i>Typha latifolia</i>																
<i>Utricularia</i>																
<i>Vallisneria americana</i>											3					
<i>Zostera columbiana</i>																
<i>Z. sp. III</i>				1												
Depth to vegetation		10.5	11	11.5	bin.	2	2	10.5			1.5	7 1/2	11	11.5	11.5	12.5
Open water @ 0.5' depth																
Water depth (ft)		11	11.5	12	6	10	12	11	11.5	12	5	9	12	12	12	13
Bottom type		m	m		m	m	m	m	m		H	m	m	m	m	m

NORTHERN LAKE SERVICE, INC.

MACROPHYTE SURVEY OF: Pine

BY: RTK & GAK

ON: 7-30-92

TAXA	STATION	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45
<i>Brasenia Shreberi</i>			P													
<i>Ceratophyllum demersum</i>		1	1		3	4	3 3	3	3	3		4		2	1	
<i>Chara</i>																
<i>Eleocharis acicularis</i>							2									
<i>Elodea canadensis</i>		2		2	2						3					
<i>Heteranthera dubia</i>																
<i>Juncus pelocarpus</i>																
<i>Lemna minor</i>																
<i>Lemna trisulca</i>																
<i>Megalodonta Beckii</i>										1	2					
<i>Myriophyllum exalbescens</i>																
M.				1							3					
M.																
Musci																
<i>Najas flexilis</i>		2						1	2	1				1	3	
N.																
<i>Nitella</i>																
<i>Nuphar variegatum</i>			2													
<i>Nymphaea</i>			2													
<i>Pontederia cordata</i>			P													
<i>Polygonum natans</i>																
<i>Potamogeton amplifolius</i>											2					
<i>P. gramineus</i>		2	P													
<i>P. praelongus</i>				2	3	1	3	1	1	1	2				1	
<i>P. zosteriformes</i>		1	2	1	1			1	1	3	1					
<i>P. robbinsii</i>		P	4	4				1								
<i>P. richardsoni</i>			2							3						
<i>P. illinoensis</i>			4													
<i>P. Sp.</i>					3										1	
<i>Scirpus validus</i>		3	P													
<i>Sagittaria arifolia</i>																
<i>Spirodella polycarpum</i>																
<i>Sagittaria latifolia</i>																
<i>Utricularia</i>																
<i>Vallisneria spiralis</i>		4	1							1						
<i>Wolffia columbiana</i>																
<i>P. Sp. III</i>						1	1	3	1							
Depth to vegetation				6in.	4	6	11	6	4"	3"	1	5		11		
% Open water @ 0.5' depth		4.5	50													
Water depth (ft)		5	3	7	9	9.5	11.5	11	12	10.5	5	9.5	11	11.5	12	13
Bottom type		GrS	S	M	M	M	M	M	M	S	M	M	M	M	M	M

NORTHERN LAKE SERVICE, INC.

MACROPHYTE SURVEY OF: PIPE

BY: RK GAK

ON: 7-30-97

TAXA	STATION	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
<i>Brasenia Shreberi</i>													1			
<i>Ceratophyllum demersum</i>			1	3	2	2	1			4	1					
<i>Chara</i>								2			2					
<i>Eleocharis acicularis</i>																
<i>Elodea canadensis</i>		3	1	3	2		3	2	3	3	2					
<i>Heteranthera dubia</i>																
<i>Juncus belocarpus</i>										1						
<i>Lemna minor</i>																
<i>Lemna trisulca</i>																
<i>Megalodonta Beckii</i>																
<i>Myriophyllum exalbescens</i>																
M.		P	2				1	P	4	1						
M.																
Musci																
<i>Najas flexilis</i>				3	2	1		2		3	3					
N.																
<i>Nitella</i>																
<i>Nuphar variegatum</i>																
<i>Nymphaea</i>																
<i>Pontederia cordata</i>																
<i>Polygonum natans</i>																
<i>Potamogeton amplifolius</i>									2	1						
<i>P. gramineus</i>							2	1	2	3						
<i>P. praelongus</i>		2	3	1					1							
<i>P. zosteriformes</i>		2	3	2			1	1	2	1	1					
<i>P. robbinsii</i>		4	4	1												
<i>P. richardsoni</i>		P	P				2		2		1					
<i>P. illinoensis</i>																
<i>P. sp. 2 W/L</i>									1							
<i>Scirpus validus</i>									P	P	1					
<i>Sparganium eurycarpum</i>																
<i>Spirodella polycarpum</i>																
<i>Typha latifolia</i>																
<i>Utricularia</i>																
<i>Vallisneria americana</i>							2	2	2	4	2					
<i>Wolffia columbiana</i>																
<i>Isotria</i>									3							
Depth to vegetation		2	1	6	10	11	1.5	3	1	3	95					
Open water @ 0.5' depth											95					
Water depth (ft)		4.5	9	9	10.5	11.5	4	5	6.5	6	25	MM				
Bottom type		m	m	m	m	m	S	S	S	SR	S	\$				