LAKE VERMILION (69 - 0378 - 00)



Aquatic Vegetation Survey



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Lake: Lake Vermilion	DOW Number : 69-0378-00	Date of inspection: 6/ 5-9 & 11-15/17 and 8/14-18/17		
County: St. Louis	Observers: Emelia Hauck, Katherine Millette, Laura Geyen			
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Executive Summary

Lake Vermilion was surveyed by RMB Environmental Laboratories in both 2016 and 2017. The main goals of these plant surveys were to 1) document all areas of curly-leaf pondweed, 2) document native plants, and 3) identify any starry stonewort. The curly-leaf pondweed was easy to spot since we waited until later in the curly-leaf pondweed growing season to complete the survey (mid-June). Curly-leaf pondweed was only found in Stuntz Bay (Figure 19 and 26), Everetts Bay (Figure 33 and 40), Wolf Bay (Figure 59), and a small area in Wakemup Narrows (Figure 82). The curly-leaf pondweed found in Everett's Bay was dense and in previously identified areas. There were a few plants outside the known area, but nothing significant. The curly-leaf pondweed plants outside the known area. New curly leaf pondweed infestations were found in Wolf Bay and Wakemup Narrows in 2017. The curly leaf pondweed in Wakemup Narrows was very sparse and in a different area in 2017 than in 2016. Wolf bay had a larger population of curly leaf pondweed, but it did not inhibit travel and native plant populations in both bays were healthy and abundant (Figures 58 and 59).

No starry stonewort was found in Lake Vermilion although many native stonewort (*Nitella*) were identified (Figures 96 and 102). Unlike starry stonewort, native stonewort have round bulbils while starry stonewort have star shaped bulbils.

Many of the bays in the southeast portion of Lake Vermilion, with the exception of Stuntz, Pike, Everetts, and Armstrong Bays, are very rocky and have few plants. These rocky bottoms are very poor substrate for vegetation in general and are unlikely to contain curly-leaf pondweed.

Armstrong Bay was very tea-stained, which decreases the area at which plants can grow. No plants were found in the central portion of the bay although the bay is fairly shallow.

Introduction

Lake Vermilion (DOW 69-0378-00) is a large 28,181 acre lake located one mile northwest of Tower MN, in St. Louis County. Lake Vermilion has a maximum depth of 70 feet and contains a littoral area of about 33 percent which permits light penetration and allows plant growth.

Lake Vermilion is classified as a mesotrophic lake with good water clarity as measured sporadically over the past 18 years by mean secchi depth of approximately 8.5 feet. Continual annual monitoring can help track trends in water quality in the lake. There is not enough consecutive data to determine a trend. Total phosphorus and chlorophyll-a (values that provide a measure of the amount of algae in the water) are considered moderate with mean values 25.9 and 7.3 ug/L.

Bay	MPCA	Years with	Trophic	Mean Secchi	Phosphorus	Chlorophyll a
	established site	data	State	depth (ft)	(ug/L)	(ug/L)
Armstrong Bay	69-0378-01-134	2008	Mesotrophic	6.9	26.4	7.6
			/Eutrophic			
Black Duck	No site available	NA	NA	NA	NA	NA
Bay						
Cable Bay	No site available	NA	NA	NA	NA	NA
Everetts Bay	69-0378-01-118	1993	Mesotrophic	5.9	28.8	7.3
			/Eutrophic			
Greenwood Bay	69-0378-01-111	NA	NA	NA	NA	NA
Mattson Bay	No site available	NA	NA	NA	NA	NA
Pike Bay	69-0378-03-201	NA	NA	NA	NA	NA
Stuntz Bay	69-0378-01-123	NA	NA	NA	NA	NA
Swedetown Bay	69-0378-01-122	NA	NA	NA	NA	NA
Wakemup	69-0378-02-212	1995-2003	Mesotrophic	9.7	NA	NA
Narrows	69-0378-02-131	2000,2008,	Mesotrophic	9.8	22.9	7.0
		2015	-			

Table 1. Water quality means over the last 10 years for Lake Vermilion.

Objectives of Survey

This survey describes the aquatic plant community of Lake Vermilion including:

- 1) Vegetation data to include; 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) Frequency of all aquatic plants found.
- 5) Estimation of abundance of species sampled using MN DNR ranking system.
- 6) Distribution map for common species.
- 7) 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 littoral zone surface in a 120 meter by 120 meter grid in all littoral areas of Lake Vermilion. Points were added in areas with curly leaf for better delineation. In the field, all points except those in the southwest corner of Pike Bay (as discussed at a meeting upon arrival) were sampled and vegetation was not found beyond 11 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.

A double-headed, weighted garden rake, attached to a rope (Figure 1 and 2) was used to survey vegetation. 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 ($\leq 1/3$ of the rake head covered), 2 being scattered ($\geq 1/3$ but $\leq 2/3$ of the rake head covered), 3 being common ($\geq 2/3$ 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. The average number of 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 5 depth zones for analysis. Depth zones included less than 3 feet, 4 to 7 feet, 8 to 11 feet, 12 to 16 feet, and over 17 feet.



Figure 3. Northwest Lake Vermilion Point-Intercept Survey, June and August, 2017.



Figure 4. Southeast Lake Vermilion Point-Intercept Survey, June and August, 2017.

Armstrong Bay

On June 7, 2017, 54 locations were observed and sampled for aquatic vegetation (Figure 5). The weather was good for the survey with clear skies, temperatures reaching 80 degrees and little wind.



Figure 5. Armstrong Bay, Lake Vermilion Point-Intercept Survey with the number of species present per site, June 7, 2017.

The average number of plants per rake sample in Armstrong Bay was 0.4. Six was the maximum number of species sampled at one location in Armstrong Bay while one, two, and five species were sampled occasionally (Figure 5).



Figure 6. Bulrush areas in Armstrong Bay, Lake Vermilion Point-Intercept Survey, June 9, 2017.



Figure 7. Illinois Pondweed areas in Armstrong Bay, Lake Vermilion Point-Intercept Survey, June 9, 2017.



Figure 8. Northern Milfoil areas in Armstrong Bay, Lake Vermilion Point-Intercept Survey, June 9, 2017.

Armstrong Bay, Lake Vermilion					All sampled sites (spring 2016)
Life Form	Common Name	Scientific Name	Count	Frequency (%)	Frequency (%)
SUMBMERGED -	Coontail	Ceratophyllum demersum	4	4.8%	2.9%
ANCHORED - These plants grow primarily under the water	Greater Bladderwart	Utricularia vulgaris	1	1.2%	0%
surface. Upper leaves may float	Illinois Pondweed	Potamogeton illinoensis	5	6.0%	0%
near the surface and flowers	Northern Milfoil	Myrophyllum sibiricum	4	4.8%	1.5%
Plants are often rooted or	Robbin's Pondweed	Potamogeton robbinsii	2	2.4%	0%
anchored to the lake bottom.					
FLOATING - LEAF -These plant leaves float on water and are anchored to the bottom of the lake.	NA				
EMERGENT - These plants	Dulmah	Solution a sector	10	22.00/	17.60/
extend well above the water surface and are usually found in shallow water, near shore.	Yellow Waterlily	Nuphar variegata	15	1.2%	4.4%
	White Waterlily	Nymphaea odorata	1	1.2%	1.5%
Total number of plants (species d	iversity for the bay)		8		
Total number of plant occurrence	S		37		
Total number of sites			83		

 Table 2. Aquatic plants surveyed in Armstrong Bay, Lake Vermilion, St. Louis County, MN: June 9, 2017.

Sampling occurred to a maximum depth of 20 feet; however, no plants were found to be growing beyond 4 feet of water. Plant abundance was greatest between 4-7 feet of water. As depths increased beyond that range, the presences of vegetation decreased and became less dense (Figure 9).



Of the 83 sampled locations in Armstrong Bay, 64 sites had no vegetation present.

Figure 9. Frequency of vegetation vs. water depth, Armstrong Bay, Lake Vermilion, St. Louis County, MN: June 9, 2017.



Figure 10. Frequency of occurrence for aquatic plant species in Armstrong Bay, Lake Vermilion, June 9, 2017.

Cable Bay Access

On June 7, 2017, 12 locations were observed and sampled for aquatic vegetation in Cable Bay (Figure 11). The weather was good for the survey with clear skies, temperatures reaching 80 degrees and little wind.



Figure 11. Cable Bay access, Lake Vermilion; number of species present per site, June 7, 2017.

No plants were found at the Cable bay access. The access was found to be very rocky and not suitable for plant growth.

Pike's Bay Accesses

On June 7, 2017, 78 locations were observed and sampled for aquatic vegetation (Figure 12 & 13). The weather was good for the survey with clear skies, temperatures reaching 80 degrees and little wind.



Figure 12. Northeast Pike's Bay Accesses, Lake Vermilion Point-Intercept Survey with the number of species present per site, June 7, 2017.



Figure 13. Southwest Pike's Bay Accesses, Lake Vermilion Point-Intercept Survey with the number of species present per site, June 7, 2017.

The average number of plants per rake sample in front of the Pike's Bay accesses was 1.5. Eight was the maximum number of species sampled at one location in Stuntz Bay while One and two species were sampled regularly (Figure 12 & 13).



Figure 14. Areas with Yellow Waterlily, the most abundant species by the Northeast Pike's Bay Accesses, Lake Vermilion Point-Intercept Survey, June 7, 2017.



Figure 15. Areas with Arrowhead, the most abundant species by the Southwest Pike's Bay Accesses, Lake Vermilion Point-Intercept Survey, June 7, 2017.

Pike's Bay, Lake Vermilion	All sampled sites			
Life Form	Common Name	Scientific Name	Count	Frequency (%)
SUMBMERGED -	Greater Bladderwart	Uricularia vulgaris	11	15.7%
grow primarily under the water	Bushy Pondweed	Najas flexilis	1	1.4%
surface. Upper leaves may float	Celery	Vallisneria americana	7	10.0%
near the surface and flowers	Chara	Chara sp.	2	2.9%
Plants are often rooted or	Claspingleaf	Potamogeton richardsonii	6	8.6%
anchored to the lake bottom.	Coontail	Ceratophyllum demersum	9	12.9%
	Flat-stem Pondweed	Potamogeton zoseriformis	1	1.4%
	Star Grass	Zosterella dubia	1	1.4%
	Variable Pondweed	Potamogeton gramineus	1	1.4%
	Watermoss	Drepanocladus sp.	9	12.9%
	1			
FLOATING - LEAF - These plant leaves float on water and	Floatingleaf Pondweed	Potamogeton natans	1	1.4%
are anchored to the bottom of	White Waterlily	Nymphaea odorata	7	10.0%
the lake.	Yellow Waterlily	Nuphar varieggata	14	20.0%
	Watershield	Brasenia schreberi	4	5.7%
	Arrowhead	Sagitaria sp.	13	18.6%
EMERGENT - These plants	Bulrush	Scirpus acutus	5	7.1%
surface and are usually found in shallow water, near shore.	Wild Rice	Zizania aquatica	6	8.6%
	Burreed	Sparganium sp.	8	11.4%
	Horsetail	Equisetum fluviatile	1	1.4%
Tetel work on a Calenda (an action d				
I otal number of plants (species diversity for the bay)			20	
I otal number of plant occurrence	S		107	
Total number of sites			70	

Table 3. Aquatic plants surveyed by Pike's Bay accesses, Lake Vermilion, St. Louis County, MN: June 7, 2017.

Sampling occurred to a maximum depth of 11 feet; however, no plants were found to be growing beyond 7 feet of water (Figure 16).

Of the 70 sampled locations in Pike's Bay, 29 sites had no vegetation present.



Figure 16. Frequency of vegetation vs. water depth, Pike's Bay, Lake Vermilion, St. Louis County, MN: June 7, 2017.



Figure 17. Frequency of occurrence for aquatic plant species in Pike's Bay, Lake Vermilion, St. Louis County, MN: June 7, 2017.

Stuntz Bay (spring survey)

On June 5 and 7, 2017, 97 locations, plus 11 additional points around curly leaf areas and accesses were observed and sampled for aquatic vegetation (Figure 18). The weather was good for the survey with partially cloudy skies, temperatures reaching 80 degrees and some wind.



Figure 18. Stuntz Bay, Lake Vermilion Point-Intercept Survey with the number of species present per site, June 5 and 7, 2017.

The average number of plants per rake sample on Stuntz Bay was 2.6. Six was the maximum number of species sampled at one location in Stuntz Bay while two and three species were sampled regularly (Figure 18).

The invasive Curly-leaf Pondweed was found in the northwest portion of Stuntz Bay at low densities (Figure 19).



Figure 19. Curly-leaf areas in Stuntz Bay, Lake Vermilion Point-Intercept Survey, June 5 and 7, 2017.



Figure 20. Northern Milfoil areas in Stuntz Bay, Lake Vermilion Point-Intercept Survey, June 5 and 7, 2017.



Figure 21. Canada Waterweed in Stuntz Bay, Lake Vermilion Point-Intercept Survey, June 5 and 7, 2017.



Figure 22. Northern Milfoil in Stuntz Bay, Lake Vermilion Point-Intercept Survey, June 5 and 7, 2017.

Stuntz Bay, Lake Vermilion	All sampled sites (spring 2017)	All sampled sites (spring 2016)				
Life Form	Common Name	Scientific Name	Count	Frequency (%)	Frequency (%)	
SUMBMERGED -	Buttercup	Ranunculus sp.	3	3.4%	0.7%	
ANCHORED - These plants grow primarily under the water	Chara	Chara sp.	40	44.9%	6.5%	
surface. Upper leaves may float	Canada Waterweed	Elodea canadensis	19	21.3%	30.1%	
near the surface and flowers	Celery	Vallisneria americana	10	11.2%	0%	
Plants are often rooted or	Chara	Chara sp.	8	9.0%	0%	
anchored to the lake bottom.	Curly Leaf Pondweed	Potamogeton crispus	1	0.4%	20.9%	
	Claspingleaf	Potamogeton richardsonii	28	31.5%	0.7%	
	Coontail	Ceratophyllum demersum	35	39.3%	11.8%	
	Flat-stem Pondweed	Potamogeton zoseriformis	2	2.2%	12.4%	
	Large-leaf Pondweed	Potamogeton amplifolius	12	13.5%	0%	
	Marigold	Bidens beckii	41	46.1%	0.7%	
	Northern Milfoil	Myrophyllum sibiricum	11	12.4%	22.9%	
	Robbin's Pondweed	Potamogeton robinsii	3	3.4%	0.7%	
	Stargrass	Zosterella dubia	0	0%	3.3%	
	Watermoss	Fontinalis antipyretica	10	11.2%	0%	
	Whitestem Pondweed	Potamogeton praelongus	0	0%	6.5%	
FLOATING - LEAF - These	Star Duckweed	Lemna triscula	7	7.9%	0%	
are anchored to the bottom of the lake.						
EMERGENT - These plants	Cane	Phragmites australis	1	1.1%	0%	
extend well above the water surface and are usually found in shallow water, near shore.	Burreed	Sparganium sp.	1	1.1%	0.7%	
Total number of plants (species diversity for the hay)						
Total number of plant occurrences 228			228			
Total number of sites						
1 out number of sites	Total number of sites			89		

Table 4. Aquatic plants surveyed in Stuntz Bay, Lake Vermilion, St. Louis County, MN: June 5 and 7, 2017.

Sampling occurred to a maximum depth of 17 feet; however, no plants were found to be growing beyond 11 feet of water. Plant abundance was greatest between one and seven feet of water. As depths increased beyond that range, the presences of vegetation decreased and became less dense (Figure 23).



Of the 108 sampled locations in Stuntz Bay, 14 sites had no vegetation present.

Figure 23. Frequency of vegetation vs. water depth, Stuntz Bay, Lake Vermilion, St. Louis County, MN: June 5 and 7, 2017.



Figure 24. Frequency of occurrence for aquatic plant species in Stuntz Bay, Lake Vermilion, June 5 and 7, 2017.

Stuntz Bay (summer survey)

On August 15, 2017, 292 locations were observed and sampled for aquatic vegetation (Figure 25). The weather was good for the survey with partially cloudy skies, temperatures reaching 63 degrees and little wind.



Figure 25. Stuntz Bay, Lake Vermilion Point-Intercept Survey with the number of species present per site, August 15, 2017.

The average number of plants per rake sample on Stuntz Bay was 2.7. Nine was the maximum number of species sampled at one location in Stuntz Bay while Three to five species were sampled regularly (Figure 25).

The invasive Curly-leaf Pondweed was found at two sites in the northwest and one point in the southeast portion of Stuntz Bay at low densities (Figure 26).



Figure 26. Curly-leaf areas in Stuntz Bay, Lake Vermilion Point-Intercept Survey, August 15, 2017.



Figure 27. Areas with celery in Stuntz Bay, Lake Vermilion Point-Intercept Survey, August 15, 2017.



Figure 28. Coontail in Stuntz Bay, Lake Vermilion Point-Intercept Survey, August 15, 2017.



Figure 29. Northern Milfoil in Stuntz Bay, Lake Vermilion Point-Intercept Survey, August 15, 2017.

Stuntz Bay, Lake Vermilion	All sampled sites					
Life Form	Common Name	Scientific Name	Count	Frequency (%)		
SUMBMERGED - ANCHORED	Greater Bladderwort	Utricularia vulgaris	1	0.3%		
- These plants grow primarily under the water surface. Upper	Buttercup	Ranunculus sp.	2	0.7%		
leaves may float near the surface	Canada Waterweed	Elodea canadensis	96	32.9%		
and flowers may extend above the	Celery	Vallisneria americana	161	55.1%		
surface. Plants are often rooted or anchored to the lake bottom	Chara	Chara sp.	1	0.3%		
unchored to the face bottom.	Claspingleaf	Potamogeton richardsonii	42	14.4%		
	Coontail	Ceratophyllum demersum	116	39.7%		
	Curlyleaf Pondweed	Potamogeton crispus	3	1.0%		
	Flat-stem Pondweed	Potamogeton zoseriformis	77	26.4%		
	Illinois Pondweed	Potamogeton illinoensis	3	1.0%		
	Large-leaf Pondweed	Potamogeton amplifolius	1	0.3%		
	Marigold	Bidens beckii	29	9.9%		
	Narrowleaf Pondweed	Potamogeton sp.	3	1.0%		
	Northern Milfoil	Myrophyllum sibiricum	101	34.6%		
	Robbin's Pondweed	Potamogeton robinsii	19	6.5%		
	Star grass	Zosterella dubia	29	9.9%		
	Variable Pondweed	Potamogeton gramineus	24	8.2%		
	Whitestem Pondweed	Potamogeton praelongus	19	6.5%		
	Nitella	Nitella sp.	13	4.5%		
	Hornwort	Ceratophyllum echinatum	6	2.1%		
FLOATING - LEAF - These	White Waterlily	Nymphaea odorata	14	4.8%		
plant leaves float on water and are	Star Duckweed	Lemna triscula	16	5.5%		
anchored to the bottom of the take.	Minor Duckweed	Lemna minor	2	0.7%		
EMERGENT - These plants	Arrowhead	Sagittaria sp.	3	1.0%		
and are usually found in shallow	Bulrush	Scirpus acutus	1	0.3%		
water, near shore.						
Total number of plants (species d	iversity for the bay)		25			
Total number of plant occurrences			782	782		
Total number of sites			292			

Table 5. Aquatic plants surveyed in Stuntz Bay, Lake Vermilion, St. Louis County, MN: August 15, 2017.
Sampling occurred to a maximum depth of 17 feet; however, no plants were found to be growing beyond 11 feet of water. Plant abundance was greatest below three feet of water. As depths increased beyond that range, the presences of vegetation decreased and became less dense (Figure 30).



Of the 292 sampled locations in Stuntz Bay, 70 sites had no vegetation present.

Figure 30. Frequency of vegetation vs. water depth, Stuntz Bay, Lake Vermilion, St. Louis County, MN: August 15, 2017.



Figure 31. Frequency of occurrence for aquatic plant species in Stuntz Bay, Lake Vermilion, August 15, 2017.

Everetts Bay (spring survey)

On June 6, 2017, 192 locations were observed and sampled for aquatic vegetation (Figure 32). The weather was good for the survey with clear skies, temperatures reaching 78 degrees and little wind.



Figure 32. Everetts Bay, Lake Vermilion Point-Intercept Survey with the number of species present per site, June 6, 2017.

The average number of plants per rake sample in Everetts Bay was 2.3. Eight was the maximum number of species sampled at one location in Everetts Bay (Figure 32).



Figure 33. Curly Leaf areas in Everetts Bay, Lake Vermilion Point-Intercept Survey, June 6, 2017.



Figure 34. Flatstem Pondweed areas in Everetts Bay, Lake Vermilion Point-Intercept Survey, June 6, 2017.



Figure 35. Robbin's Pondweed areas in Everetts Bay, Lake Vermilion Point-Intercept Survey, June 6, 2017.



Figure 36. Canada Waterweed areas in Everetts Bay, Lake Vermilion Point-Intercept Survey, June 6, 2017.

Everetts Bay, Lake Vermilion	All sampled sites			
Life Form	Common Name	Frequency (%)	Count	Frequency (%)
SUMBMERGED - ANCHORED - These plants grow primorily under the water	Greater Bladderwart	Utricularia vulgaris	11	5.7%
	Buttercup	Ranunculus sp.	5	2.6%
surface. Upper leaves may float	Canada Waterweed	Elodea canadensis	46	24.0%
near the surface and flowers	Celery	Vallisneria americana	16	8.3%
may extend above the surface.	Chara	Chara sp.	2	1.0%
anchored to the lake bottom.	Clasping-leaf Pondweed	Potamogeton richardsonii	24	12.5%
	Coontail	Ceraophyllum demersum	29	15.1%
	Curly-leaf Pondweed	Potamogeton crispus	6	3.1%
	Flat-stem Pondweed	Potamogeton zoseriformis	98	51.0%
	Marigold	Bidens beckii	18	9.4%
	Nitella	Nitella sp.	24	12.5%
	Northern Milfoil	Myriophyllum sibiricum	26	13.5%
	Robbin's Pondweed	Potamogeton robbinsii	96	50.0%
	Variable Pondweed	Potamogeton ggramineus	8	4.2%
	White-stem Pondweed	Potamogeton praelongus	19	9.9%
FLOATING - LEAF -These plant leaves float on water and are anchored to the bottom of the lake.	Floating-leaf Pondweed	Potamogeton natans	1	0.5%
	White waterlily	Nymphaea odorata	4	2.1%
	Star Duckweed	Lemna triscula	2	1.0%
EMERGENT - These plants	Arrowhead	Sagitaria sp.	1	0.5%
extend well above the water surface and are usually found in shallow water, near shore.	Bulrush	Scirpus acutus	3	1.6%
	Cattail	Typha sp.	1	0.5%
	Wild Rice	Zizania aquatica	4	2.1%
Total number of plants (species d	iversity for the bay)		22	
Total number of plant occurrences			445	
Total number of sites			192	

Table 6. Aquatic plants surveyed in Everetts Bay, Lake Vermilion, St. Louis County, MN; June 6, 2017.

Sampling occurred to a maximum depth of 20 feet; however, no plants were found to be growing beyond 8 feet of water. Plant abundance was greatest between four and seven feet of water. As depths increased beyond that range, the presences of vegetation decreased and became less dense (Figure 37).



Of the 192 sampled locations in Everetts Bay, 15 sites had no vegetation present.

Figure 37. Frequency of vegetation vs. water depth, in Everetts Bay, Lake Vermilion, St. Louis County, MN: June 6, 2017.



Figure 38. Frequency of occurrence for aquatic plant species in Everetts Bay, Lake Vermilion, June 6, 2017.

Everetts Bay (summer survey)

On August 16, 2017, 580 locations were observed and sampled for aquatic vegetation (Figure 39). The weather was good for the survey with clear skies, temperatures reaching 64 degrees and little wind.



Figure 39. Everetts Bay, Lake Vermilion Point-Intercept Survey with the number of species present per site, August 16, 2017.

The average number of plants per rake sample in Everetts Bay was 1.8. Ten was the maximum number of species sampled at one location in Everetts Bay (Figure 39).



Figure 40. Curly leaf pondweed areas in Everetts Bay, Lake Vermilion Point-Intercept Survey, August 16, 2017.



Figure 41. Robbin's Pondweed areas in Everetts Bay, Lake Vermilion Point-Intercept Survey, August 16, 2017.



Figure 42. Celery areas in Everetts Bay, Lake Vermilion Point-Intercept Survey, August 16, 2017.



Figure 43. Canada Waterweed areas in Everetts Bay, Lake Vermilion Point-Intercept Survey, August 16, 2017.

Everetts Bay, Lake Vermilion			All sampled sites	
Life Form	Common Name	Scientific Name	Count	Frequency (%)
SUMBMERGED - ANCHORED - These plants grow primarily under the water	Greater Bladderwart	Utricularia vulgaris	52	9.0%
	Bushy Pondweed	Najas flexilis	2	0.3%
surface. Upper leaves may float	Buttercup	Ranunculus sp.	8	1.4%
near the surface and flowers	Canada Waterweed	Elodea canadensis	147	25.3%
may extend above the surface. Plants are often rooted or	Celery	Vallisneria americana	155	26.7%
anchored to the lake bottom.	Clasping-leaf Pondweed	Potamogeton richardsonii	72	12.4%
	Coontail	Ceraophyllum demersum	59	10.2%
	Curly-leaf Pondweed	Potamogeton crispus	3	0.5%
	Flat-stem Pondweed	Potamogeton zoseriformis	137	23.6%
	Marigold	Bidens beckii	49	8.4%
	Narrowleaf Pondweed	Potamogeton sp.	16	2.8%
	Nitella	Nitella sp.	33	5.7%
	Northern Milfoil	Myriophyllum sibiricum	63	10.9%
	Robbin's Pondweed	Potamogeton robbinsii	165	28.4%
	Star grass	Zosterella dubia	11	1.9%
	Variable Pondweed	Potamogeton ggramineus	19	3.3%
	White-stem Pondweed	Potamogeton praelongus	26	4.5%
	Watermoss	Drepanocladus sp.	3	0.5%
FLOATING - LEAF - These	White waterlily	Nymphaea odorata	34	5.9%
plant leaves float on water and	Star Duckweed	Lemna triscula	6	1.0%
the lake.				I
EMERGENT - These plants	Pickerelweed	Pontederia cordata	2	0.3%
extend well above the water surface and are usually found in shallow water, near shore.	Burreed	Sparganium sp.	9	1.6%
Total number of plants (species d	iversity for the bay)		23	
Total number of plant occurrences			1071	
Total number of sites			580	

Table 7. Aquatic plants surveyed in Everetts Bay, Lake Vermilion, St. Louis County, MN; August 16, 2017.

Sampling occurred to a maximum depth of 20 feet; however, no plants were found to be growing beyond 7 feet of water. Plant abundance was greatest up to three feet of water. As depths increased beyond that range, the presences of vegetation decreased and became less dense (Figure 44).



Of the 580 sampled locations in Everetts Bay, 15 sites had no vegetation present.

Figure 44. Frequency of vegetation vs. water depth, in Everetts Bay, Lake Vermilion, St. Louis County, MN: August 16, 2017.



Figure 45. Frequency of occurrence for aquatic plant species in Everetts Bay, Lake Vermilion, August 16, 2017.

Greenwood Bay

On June 8 & 9, 2017, 114 locations were observed and sampled for aquatic vegetation (Figure 46). The weather was good for the survey with partially cloudy skies, temperatures reaching 78 degrees and little wind.



Figure 46. Greenwood Bay, Lake Vermilion Point-Intercept Survey with the number of species present per site, June 8 & 9, 2017.

The average number of plants per rake sample in Greenwood Bay was 2.1. Nine was the maximum number of species sampled at one location in Greenwood Bay (Figure 46).



Figure 47. Robbin's Pondweed areas in Greenwood Bay, Lake Vermilion Point-Intercept Survey, June 8 & 9, 2017.



Figure 48. Canada Waterweed areas in Greenwood Bay, Lake Vermilion Point-Intercept Survey, June 8 & 9, 2017.



Figure 49. Claspingleaf Pondweed areas in Greenwood Bay, Lake Vermilion Point-Intercept Survey, June 8 & 9, 2017.

Greenwood Bay, Lake Vermilion			All sampled sites	All sampled sites	
Life Form	Common Name	Scientific Name	Count	Frequency (%)	Frequency (%)
SUMBMERGED - ANCHORED - These plants grow primarily under the water surface. Upper leaves may float	Greater Bladderwart	Utricularia vulgaris	8	7.0%	0%
	Buttercup	Ranunculus sp.	3	2.6%	1.8%
	Canada Waterweed	Elodea canadensis	27	23.7%	20.0%
near the surface and flowers	Celery	Vallisneria americana	11	9.6%	0%
may extend above the surface.	Chara	Chara sp.	4	3.5%	2.7%
anchored to the lake bottom.	Clasping-leaf Pondweed	Potamogeton richardsonii	25	21.9%	16.4%
	Coontail	Ceraophyllum demersum	20	17.5%	9.1%
	Flat-stem Pondweed	Potamogeton zoseriformis	23	20.2%	8.2%
	Large-leaf Pondweed	Potamogeton amplifolius	1	0.9%	1.8%
	Marigold	Bidens beckii	18	15.8%	2.7%
	Narrowleaf Pondweed	Potamogeton sp.	1	0.9%	0%
	Northern Milfoil	Myriophyllum sibiricum	18	15.8%	18.2%
	Robbin's Pondweed	Potamogeton robbinsii	61	53.5%	48.2%
	Star grass	Zosterella dubia	1	0.9%	0%
	White-stem Pondweed	Potamogeton praelongus	1	0.9%	8.2%
	Watermoss	Fontinalis antipyretica	2	1.8%	0.9%
	Variable Pondweed	Potamogeton gramineus	0	0%	1.8%
FLOATING - LEAF - These	Floating-leaf Pondweed	Potamogeton natans	1	0.9%	0%
plant leaves float on water and are anchored to the bottom of the lake.	White waterlily	Nymphaea odorata	7	6.1%	4.5%
	Yellow Waterlily	Nuphar variegata	3	2.6%	2.7%
	Star Duckweed	Lemna triscula	2	1.8%	0%
EMERGENT - These plants	Arrowhead	Sagitaria sp.	2	1.8%	0%
extend well above the water surface and are usually found in shallow water, near shore.	Bulrush	Scirpus acutus	3	2.6%	5.5%
Total number of plants (species d	iversity for the bay)		22		
Total number of plant occurrences			243		
Total number of sites			114		

Table 8. Aquatic plants surveyed in Greenwood Bay, Lake Vermilion, St. Louis County, MN; June 8 & 9, 2017.

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Sampling occurred to a maximum depth of 20 feet; however, no plants were found to be growing beyond 13 feet of water. Plant abundance was greatest between four and seven feet of water (Figure 50).



Of the 114 sampled locations in Greenwood Bay, 15 sites had no vegetation present.

Figure 50. Frequency of vegetation vs. water depth, in Greenwood Bay, Lake Vermilion, St. Louis County, MN: June 8 & 9, 2017.



Figure 51. Frequency of occurrence for aquatic plant species in Greenwood Bay, Lake Vermilion, June 8 & 9, 2017.

Bystrom Bay and Narrows

On June 8, 2017, 247 locations were observed and sampled for aquatic vegetation (Figure 52). The weather was good for the survey with partially cloudy skies, temperatures reaching 78 degrees and little wind.



Figure 52. Bystrom Bay, Lake Vermilion Point-Intercept Survey with the number of species present per site, June 8, 2017.

The average number of plants per rake sample in Bystrom Bay was 0.3. Four was the maximum number of species sampled at one location in Bystrom Bay (Figure 52).



Figure 53. Bulrush areas in Bystrom Bay, Lake Vermilion Point-Intercept Survey, June 8, 2017.



Figure 54. Largeleaf Pondweed areas in Bystrom Bay, Lake Vermilion Point-Intercept Survey, June 8, 2017.



Figure 55. Yellow Waterlily areas in Bystrom Bay, Lake Vermilion Point-Intercept Survey, June 8, 2017.

Bystrom Bay, Lake Vermilion	All sampled sites			
Life Form	Common Name	Scientific Name	Count	Frequency (%)
SUMBMERGED - ANCHORED - These plants grow primarily under the water surface. Upper leaves may float	Greater Bladderwart	Utricularia vulgaris	4	1.6%
	Canada Waterweed	Elodea canadensis	2	0.8%
	Celery	Vallisneria americana	1	0.4%
near the surface and flowers	Chara	Chara sp.	1	0.4%
may extend above the surface.	Coontail	Ceraophyllum demersum	2	0.8%
anchored to the lake bottom.	Flat-stem Pondweed	Potamogeton zoseriformis	1	0.4%
	Illinois Pondweed	Potamogeton illinoensis	1	0.4%
	Largeleaf Pondweed	Potamogeton amplifolius	11	4.5%
	Marigold	Bidens beckii	1	0.4%
	Northern Milfoil	Myriophyllum sibiricum	5	2.0%
	Robbin's Pondweed	Potamogeton robbinsii	3	1.2%
	Watermoss	Drepanocladus sp.	1	0.4%
		1		
FLOATING - LEAF - These plant leaves float on water and are anchored to the bottom of the lake.	Floating-leaf Pondweed	Potamogeton natans	1	0.4%
	White waterlily	Nymphaea odorata	5	2.0%
	Yellow Waterlily	Nuphar variegata	10	4.0%
	1	1		
EMERGENT - These plants	Arrowhead	Sagitaria sp.	4	1.6%
surface and are usually found in shallow water, near shore.	Bulrush	Scirpus acutus	26	10.5%
	Cattail	Typha sp.	2	0.8%
	Burreed	Sparganium sp.	2	0.8%
	• • • • • • • •			
I otal number of plants (species diversity for the bay)			19	
Total number of plant occurrences			83	
Total number of sites			247	

Table 9. Aquatic plants surveyed in Bystrom Bay, Lake Vermilion, St. Louis County, MN; June 8, 2017.

Sampling occurred to a maximum depth of 20 feet; however, no plants were found to be growing beyond 7 feet of water. Plant abundance was greatest between four and seven feet of water (Figure 56).



Of the 247 sampled locations in Bystrom Bay, 193 sites had no vegetation present.

Figure 56. Frequency of vegetation vs. water depth, in Bystrom Bay, Lake Vermilion, St. Louis County, MN: June 8, 2017.



Figure 57. Frequency of occurrence for aquatic plant species in Bystrom Bay, Lake Vermilion, June 8, 2017.

Wolf Bay

On June 9 & 12, 2017, 180 locations were observed and sampled for aquatic vegetation (Figure 58). The weather was good for the survey with partially cloudy skies, temperatures reaching 77 degrees and little wind.



Figure 58. Wolf Bay, Lake Vermilion Point-Intercept Survey with the number of species present per site, June 9 & 12, 2017.

The average number of plants per rake sample in Wolf Bay was 2.5. Eight was the maximum number of species sampled at one location in Wolf Bay (Figure 58).



Figure 59. Curly Leaf Pondweed areas in Wolf Bay, Lake Vermilion Point-Intercept Survey, June 9 & 12, 2017.



Figure 60. Bushy Pondweed areas in Wolf Bay, Lake Vermilion Point-Intercept Survey, June 9 & 12, 2017.



Figure 61. Flatstem Pondweed areas in Wolf Bay, Lake Vermilion Point-Intercept Survey, June 9 & 12, 2017.


Figure 62. Robbin's Pondweed areas in Wolf Bay, Lake Vermilion Point-Intercept Survey, June 9 & 12, 2017.

Wolf Bay, Lake Vermilion				All sampled sites
Life Form	Common Name	Scientific Name	Count	Frequency (%)
SUMBMERGED -	Greater Bladderwart	Utricularia vulgaris	3	1.7%
ANCHORED - These plants	Bushy Pondweed	Najas flexilis	55	30.6%
surface. Upper leaves may float	Canada Waterweed	Elodea canadensis	22	12.2%
near the surface and flowers	Celery	Vallisneria americana	2	1.1%
may extend above the surface.	Chara	Chara sp.	5	2.8%
anchored to the lake bottom.	Clasping-leaf Pondweed	Potamogeton richardsonii	9	5.0%
	Coontail	Ceraophyllum demersum	25	13.9%
	Flat-stem Pondweed	Potamogeton zoseriformis	6	3.3%
	Curly Leaf Pondweed	Potamogeton crispus	46	25.6%
	Illinois Pondweed	Potamogeton illinoensis	1	0.6%
	Largeleaf Pondweed	Potamogeton amplifolius	5	2.8%
	Marigold	Bidens beckii	1	0.6%
	Narrowleaf Pondweed	Potamogeton sp.	12	6.7%
	Northern Milfoil	Myriophyllum sibiricum	28	15.6%
	Robbin's Pondweed	Potamogeton robbinsii	35	19.4%
	Variable Pondweed	Potamogeton gramineus	11	6.1%
	White-stem Pondweed	Potamogeton praelongus	1	0.6%
	Nitella	Nitella sp.	1	0.6%
FLOATING - LEAF - These	Floating-leaf Pondweed	Potamogeton natans	1	0.6%
plant leaves float on water and are anchored to the bottom of	White waterlily	Nymphaea odorata	5	2.8%
the lake.	Yellow Waterlily	Nuphar variegata	1	0.6%
	Watershield	Brasenia schreberi	7	3.9%
	Star Duckweed	Lemna triscula	3	1.7%
EMERGENT - These plants extend well above the water surface and are usually found in shallow water, near shore.	Bulrush	Scirpus acutus	5	2.8%
	Wild Rice	Zizania aquatica	2	1.1%
Total number of plants (species diversity for the bay)			24	
Total number of plant occurrences			292	
Total number of sites			180	

Table 10. Aquatic plants surveyed in Wolf Bay, Lake Vermilion, St. Louis County, MN; June 9 & 12, 2017.

Sampling occurred to a maximum depth of 20 feet; however, no plants were found to be growing beyond 12 feet of water. Plant abundance was greatest below three feet of water (Figure 63).



Of the 180 sampled locations in Wolf Bay, 90 sites had no vegetation present.

Figure 63. Frequency of vegetation vs. water depth, in Wolf Bay, Lake Vermilion, St. Louis County, MN: June 9 & 12, 2017.



Figure 64. Frequency of occurrence for aquatic plant species in Wolf Bay, Lake Vermilion, June 9 & 12, 2017.

Norwegian Bay

On June 14, 2017, 156 locations were observed and sampled for aquatic vegetation (Figure 65). The weather was good for the survey with partially cloudy skies, temperatures reaching 78 degrees and some wind.



Figure 65. Norwegian Bay, Lake Vermilion Point-Intercept Survey with the number of species present per site, June 14, 2017.

The average number of plants per rake sample in Norwegian Bay was 1.5. Eight was the maximum number of species sampled at one location in Norwegian Bay (Figure 65).



Figure 66. Robbin's Pondweed areas in Norwegian Bay, Lake Vermilion Point-Intercept Survey, June 14, 2017.



Figure 67. Coontail areas in Norwegian Bay, Lake Vermilion Point-Intercept Survey, June 14, 2017.



Figure 68. Canada Waterweed areas in Norwegian Bay, Lake Vermilion Point-Intercept Survey, June 14, 2017.

Norwegian Bay, Lake Vermilion				All sampled sites
Life Form	Common Name	Scientific Name	Count	Frequency (%)
SUMBMERGED -	Greater Bladderwart	Utricularia vulgaris	4	2.5%
ANCHORED - These plants	Bushy Pondweed	Najas flexilis	1	0.6%
surface. Upper leaves may float near the surface and flowers may extend above the surface.	Buttercup	Ranunculus sp.	2	1.3%
	Canada Waterweed	Elodea canadensis	27	17.2%
	Celery	Vallisneria americana	4	2.5%
anchored to the lake bottom.	Clasping-leaf Pondweed	Potamogeton richardsonii	9	5.7%
	Coontail	Ceraophyllum demersum	38	24.2%
	Flat-stem Pondweed	Potamogeton zoseriformis	17	10.8%
	Hornwort	Ceraophyllum echinatum	3	1.9%
	Largeleaf Pondweed	Potamogeton amplifolius	2	1.3%
	Marigold	Bidens beckii	3	1.9%
	Narrowleaf Pondweed	Potamogeton sp.	16	10.2%
	Northern Milfoil	Myriophyllum sibiricum	20	12.7%
	Robbin's Pondweed	Potamogeton robbinsii	45	28.7%
	Variable Pondweed	Potamogeton gramineus	2	1.3%
	White-stem Pondweed	Potamogeton praelongus	6	3.8%
	Nitella	Nitella sp.	6	3.8%
	Watermoss	Drepanocladus sp.	5	3.2%
FLOATING - LEAF - These	Floating-leaf Pondweed	Potamogeton natans	3	1.9%
plant leaves float on water and are anchored to the bottom of	White waterlily	Nymphaea odorata	6	3.8%
the lake.	Watershield	Brasenia schreberi	5	3.2%
	Star Duckweed	Lemna triscula	7	4.5%
EMERGENT - These plants	Bulrush	Scirpus acutus	2	1.3%
extend well above the water surface and are usually found in shallow water, near shore.	Wild Rice	Zizania aquatica	1	0.6%
Total number of plants (species diversity for the bay)			24	
Total number of plant occurrences			234	
Total number of sites			157	

Table 11. Aquatic plants surveyed in Norwegian Bay, Lake Vermilion, St. Louis County, MN; June 14, 2017.

Sampling occurred to a maximum depth of 20 feet; however, no plants were found to be growing beyond 13 feet of water. Plant abundance was greatest between 4 and 7 feet of water (Figure 69).



Of the 157 sampled locations in Norwegian Bay, 89 sites had no vegetation present.

Figure 69. Frequency of vegetation vs. water depth, in Norwegian Bay, Lake Vermilion, St. Louis County, MN: June 14, 2017.



Figure 70. Frequency of occurrence for aquatic plant species in Norwegian Bay, Lake Vermilion, June 14, 2017.

Black Bay

On August 17, 2017, 173 locations were observed and sampled for aquatic vegetation (Figure 71). The weather was good for the survey with partially cloudy skies, temperatures reaching 58 degrees and some wind.



Figure 71. Black Bay, Lake Vermilion Point-Intercept Survey with the number of species present per site, August 17, 2017.

The average number of plants per rake sample in Black Bay was 1.8. Eight was the maximum number of species sampled at one location in Black Bay (Figure 71).



Figure 72. Bushy Pondweed areas in Black Bay, Lake Vermilion Point-Intercept Survey, August 17, 2017.



Figure 73. Watershield areas in Black Bay, Lake Vermilion Point-Intercept Survey, August 17, 2017.



Figure 74. Canada Waterweed areas in Black Bay, Lake Vermilion Point-Intercept Survey, August 17, 2017.

Black Bay, Lake Vermilion				All sampled sites
Life Form	Common Name	Scientific Name	Count	Frequency (%)
SUMBMERGED -	Greater Bladderwart	Utricularia vulgaris	22	12.7%
ANCHORED - These plants	Bushy Pondweed	Najas flexilis	44	25.4%
surface. Upper leaves may float near the surface and flowers may extend above the surface.	Buttercup	Ranunculus sp.	1	0.6%
	Canada Waterweed	Elodea canadensis	35	20.2%
	Celery	Vallisneria americana	37	21.4%
anchored to the lake bottom.	Chara	Chara sp.	2	1.2%
	Clasping-leaf Pondweed	Potamogeton richardsonii	6	3.5%
	Coontail	Ceraophyllum demersum	24	13.9%
	Flat-stem Pondweed	Potamogeton zoseriformis	4	2.3%
	Hornwort	Ceraophyllum echinatum	2	3.5%
	Largeleaf Pondweed	Potamogeton amplifolius	6	0.6%
	Marigold	Bidens beckii	1	1.7%
	Narrowleaf Pondweed	Potamogeton sp.	3	2.9%
	Northern Milfoil	Myriophyllum sibiricum	5	10.4%
	Robbin's Pondweed	Potamogeton robbinsii	18	0.6%
	Variable Pondweed	Potamogeton gramineus	1	0.6%
	Nitella	Nitella sp.	21	7.5%
	Watermoss	Drepanocladus sp.	1	4.6%
FLOATING - LEAF - These	Floating-leaf Pondweed	Potamogeton natans	1	22.0%
plant leaves float on water and are anchored to the bottom of	White waterlily	Nymphaea odorata	13	8.7%
the lake.	Yellow waterlily	Nuphar variegata	8	4.0%
	Watershield	Brasenia schreberi	38	0.6%
EMERGENT - These plants	Arroowhead	Sagittaria sp.	15	12.1%
extend well above the water surface and are usually found in shallow water, near shore.	Wild Rice	Zizania aquatica	7	1.2%
Total number of plants (species diversity for the bay)			24	
Total number of plant occurrences			315	
Total number of sites			173	

Table 12. Aquatic plants surveyed in Black Bay, Lake Vermilion, St. Louis County, MN; August 17, 2017.

Sampling occurred to a maximum depth of 20 feet; however, no plants were found to be growing beyond 12 feet of water. Plant abundance was greatest up to three feet of water (Figure 75).



Of the 173 sampled locations in Black Bay, 65 sites had no vegetation present.

Figure 75. Frequency of vegetation vs. water depth, in Black Bay, Lake Vermilion, St. Louis County, MN: August 17, 2017.



Figure 76. Frequency of occurrence for aquatic plant species in Black Bay, Lake Vermilion, August 17, 2017.

South Frazier Bay Access

On June 11, 2017, 42 locations were observed and sampled for aquatic vegetation in South Frazier Bay (Figure 77). The weather was good for the survey with clear skies, temperatures reaching 73 degrees and little wind.



Figure 77. South Frazier Bay access, Lake Vermilion; number of species present per site, June 11, 2017.

Bulrush and Largeleaf Pondweed were found at one location each near the South Frazier Bay access.

West Daisy Bay & East Big Bay

On June 11, 2017, 71 locations were observed and sampled for aquatic vegetation in West Daisy Bay & East Big Bay (Figure 78). The weather was good for the survey with clear skies, temperatures reaching 73 degrees and little wind.



Figure 78. West Daisy Bay & East Big Bay, Lake Vermilion; number of species present per site, June 11, 2017.

Only two sites were found with vegetation in West Daisy Bay & East Big Bay.

West Head O'Lakes Access

On June 15, 2017, 12 locations were observed and sampled for aquatic vegetation in West Head O'Lakes Access (Figure 79). The weather was good for the survey with clear skies, temperatures reaching 73 degrees and some wind.



Figure 79. West Head O' Lakes Bay access, Lake Vermilion; number of species present per site, June 15, 2017.

The average number of plants per rake sample near west Head O' Lakes Access was 1.6. Four was the maximum number of species sampled at one location (Figure 79).



Figure 80. Bulrush, the most abundant species near West Head O' Lakes Bay access, Lake Vermilion, June 15, 2017.

West Head O' Lakes Bay access, Lake Vermilion				All sampled sites
Life Form	Common Name	Scientific Name	Count	Frequency (%)
SUMBMERGED -	Coontail	Ceraophyllum demersum	1	8.3%
ANCHORED - These plants	Marigold	Bidens beckii	3	25.0%
surface. Upper leaves may float	Northern Milfoil	Myriophyllum sibiricum	4	33.3%
near the surface and flowers	Robbin's Pondweed	Potamogeton robbinsii	3	25.0%
may extend above the surface. Plants are often rooted or	Watermoss	Fontinalis antipyretica	1	8.3
anchored to the lake bottom.				
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FLOATING - LEAF - These	Yellow Waterlily	Nuphar variegata	2	16.7%
are anchored to the bottom of				
the lake.				
EMERGENT - These plants	Arrowhead	Sagitaria sp.	1	8.3%
extend well above the water surface and are usually found in	Bulrush	Scirpus acutus	4	33.3%
shallow water, near shore.				
			Γ	
Total number of plants (species diversity for the bay)			8	
Total number of plant occurrences			19	
Total number of sites			12	

Table 13. Aquatic plants surveyed by West Head O' Lakes Bay access, Lake Vermilion, St. Louis County, MN; June 15, 2017.

Wakemup Narrows: Indian Bay

On June 12, 2017, 29 locations were observed and sampled for aquatic vegetation in Indian Bay (Figure 81). The weather was good for the survey with clear skies, temperatures reaching 75 degrees and some wind.



Figure 81. West Head O' Lakes Bay access, Lake Vermilion; number of species present per site, June 15, 2017.



Figure 82. Curly Leaf in Indian Bay, Lake Vermilion, June 15, 2017.



Figure 83. Canada Waterweed, the most abundant species in Indian Bay, Lake Vermilion, June 15, 2017.

Wakemup Narrows: West end

On June 12, 2017, 16 locations were observed and sampled for aquatic vegetation in a western bay in Wakemup Narrows (Figure 84). The weather was good for the survey with clear skies, temperatures reaching 75 degrees and some wind.



Figure 84. West Head O' Lakes Bay access, Lake Vermilion; number of species present per site, June 15, 2017.



Figure 85. Canada Waterweed in a western bay in Wakemup Narrows, Lake Vermilion, June 15, 2017.



Figure 86. Narrowleaf Pondweed in a western bay in Wakemup Narrows Lake Vermilion, June 15, 2017.

Norwegian Bay,, Lake Vermilion				All sampled sites
Life Form	Common Name	Scientific Name	Count	Frequency (%)
SUMBMERGED -	Canada Waterweed	Elodea canadensis	18	40.0%
ANCHORED - These plants grow primarily under the water surface. Upper leaves may float	Chara	Chara sp.	2	4.4%
	Clasping-leaf Pondweed	Potamogeton richardsonii	1	2.2%
near the surface and flowers	Coontail	Ceraophyllum demersum	14	31.1%
may extend above the surface.	Curly Leaf Pondweed	Potamogeton crispus	3	6.7%
anchored to the lake bottom.	Flat-stem Pondweed	Potamogeton zoseriformis	6	13.3%
	Largeleaf Pondweed	Potamogeton amplifolius	2	4.4%
	Narrowleaf Pondweed	Potamogeton sp.	8	17.8%
	Northern Milfoil	Myriophyllum sibiricum	5	11.1%
	Robbin's Pondweed	Potamogeton robbinsii	10	22.2%
	Variable Pondweed	Potamogeton gramineus	1	2.2%
	Watermoss	Drepanocladus sp.	1	2.2%
FLOATING - LEAF - These	White waterlily	Nymphaea odorata	1	2.2%
are anchored to the bottom of				
the lake.				
EMERGENT - These plants				
extend well above the water				
surface and are usually found in				
shallow water, hear shore.				
Total number of plants (species diversity for the bay) 2			24	
Total number of plant occurrences			234	
Total number of sites			157	

Table 14. Aquatic plants surveyed in Wakemup Narrows, Lake Vermilion, St. Louis County, MN; June 15, 2017.



Figure 87. Frequency of occurrence for aquatic plant species in Wakemup Narrows, Lake Vermilion, June 15, 2017.

Canfield Portage Bay and Northern Narrows

On August 14, 2017, 121 locations were observed and sampled for aquatic vegetation in Canfield Portage Bay and the narrows just north of Canfield Portage (Figure 88). The weather was good for the survey with clear skies, temperatures reaching 65 degrees and some wind.



Figure 88. Canfield Portage Bay and northern narrows, Lake Vermilion; number of species present per site, August 14, 2017.



Figure 89. Robbin's Pondweed in Canfield Portage Bay and northern narrows, Lake Vermilion, August 14, 2017.



Figure 90. Coontail in Canfield Portage Bay and northern narrows Lake Vermilion, August 14, 2017.



Figure 91. Largeleaf Pondweed in Canfield Portage Bay and northern narrows, Lake Vermilion, August 14, 2017.

Canfield Portage Bay and northern narrows, Lake Vermilion				All sampled sites
Life Form	Common Name	Scientific Name	Count	Frequency (%)
SUMBMERGED - ANCHORED - These plants grow primarily under the water surface. Upper leaves may float	Greater Bladderwort	Utricularia vulgaris	2	1.7%
	Bushy Pondweed	Najas flexilis	1	0.8%
	Canada Waterweed	Elodea canadensis	3	2.5%
near the surface and flowers	Celery	Valisneria americana	3	2.5%
may extend above the surface.	Coontail	Ceraophyllum demersum	6	5.0%
anchored to the lake bottom.	Flat-stem Pondweed	Potamogeton zoseriformis	2	1.7%
	Largeleaf Pondweed	Potamogeton amplifolius	4	3.3%
	Marigold	Bidens beckii	3	2.5%
	Robbin's Pondweed	Potamogeton robbinsii	8	6.6%
	Nitella	nitella sp.	1	0.8%
	1	- 1	ſ	
FLOATING - LEAF - These	Floatingleaf Pondweed	Potamogeton natans	3	2.5%
are anchored to the bottom of	Yellow Waterlily	Nuphar variegata	2	1.7%
the lake.				
	1			
EMERGENT - These plants				
surface and are usually found in				
shallow water, near shore.				
	·		I	
Total number of plants (species diversity for the bay)			12	
Total number of plant occurrences			38	
Total number of sites			121	

Table 15. Aquatic plants surveyed in Canfield Portage Bay and northern narrows, Lake Vermilion, St. Louis County, MN; August 14, 2017.


Figure 92. Frequency of occurrence for aquatic plant species in Canfield Portage Bay and northern narrows, Lake Vermilion, August 14, 2017.

Birch and Oak Narrows

On June 8, 2017, 57 locations were observed and sampled for aquatic vegetation (Figure 93). The weather was good for the survey with partially cloudy skies, temperatures reaching 78 degrees and some wind.



Figure 93. Birch and Oak Narrows, Lake Vermilion Point-Intercept Survey with the number of species present per site, June 8, 2017.

The average number of plants per rake sample in Norwegian Bay was 1.5. Eight was the maximum number of species sampled at one location in Norwegian Bay (Figure 93).



Figure 94. Northern Milfoil, the most abundant species in Birch and Oak Narrows, Lake Vermilion Point-Intercept Survey, June 8, 2017.

Discussion

Lake Vermilion is a moderately deep lake for northern 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. Lake Vermilion has an average clarity of 7-10 feet depending upon the bay, and greatest numbers of plants were found between 1-8 feet of water.

The main goal of this plant survey was to document all areas of curly-leaf pondweed, document native plants, and identify any starry stonewort. The curly-leaf pondweed was easy to spot since we waited until later in the curly-leaf growing season to complete the survey (mid-June). It reached the surface of the water in some places in Everetts Bay (Figure 33 and 40), which made it easy to identify between sample points. Curly-leaf pondweed was only found in Stuntz Bay (Figure 19 and 26), Everetts Bay (Figure 33 and 40), Wolf Bay (Figure 59), and a small area in Wakemup Narrows (Figure 82). The curly-leaf pondweed found in Everett's Bay was dense and in previously identified areas. There were a few plants outside the known area, but nothing significant. The curly-leaf in Stuntz bay was diminished from last year's survey and also had a couple of curly leaf plants outside the known area. New curly leaf infestations were found in Wolf Bay and Wakemup Narrows. The curly leaf in Wakemup Narrows was very sparse and in a different area than in 2016. Last year's curly leaf areas were checked and no curly leaf was found. Wolf bay had a larger population of curly leaf, but it did not inhibit travel and native plant populations in both bays were healthy and abundant (Figures 58 and 59).

No starry stonewort was found in Lake Vermilion although many native stonewort (*Nitella*) were identified (Figures 96 and 102). Unlike starry stonewort, native stonewort have round bulbils while starry stonewort have star shaped bulbils.

Many of the bays in the southeast portion of Lake Vermilion, with the exception of Stuntz, Pike, Everetts, and Armstrong Bays, are very rocky and have few plants. These rocky bottoms are very poor substrate for vegetation in general and are unlikely to contain curly-leaf pondweed.

Armstrong bay was very tea-stained, which decreases the area at which plants can grow. No plants were found in the central portion of the bay although the bay is fairly shallow.

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. Aquatic plants should be protected to maintain water quality and habitat.

Some plants are found more often in lakes with good water clarity, such as Muskgrass (*Chara*). Muskgrass was found in most of the bays sampled. Though it gives off a 'musky' odor when brought to the surface, it is a great bottom stabilizer and slows the suspension of sediments; therefore, large communities of it can greatly benefit water quality and clarity. This plant is also wonderful habitat for fish and is a favorite food for waterfowl.

Coontail is also a great native plant and is common in Lake Vermilion. It has a unique ability to draw a great abundance of nutrients from the water, which increases water clarity. It also has a tolerance for cold weather and low oxygen levels, which allows it to remain alive longer into the winter and provides great habitat for many critters.

Bulrush, an emergent plant, is very common in Lake Vermilion. It is very important to a lake for many reasons. It provides spawning habitat for crappies, filters the water, and helps to prevent shoreline erosion by acting as a wave break. It is imperative to protect bulrush beds in lakes for these reasons. Larger leave plants, such as the pondweeds, are important spawning and hiding areas for panfish.

What Local Residents Can Do

- Leave large plant beds alone. Only clear a small area by your dock from swimming. Removal of large areas of plants destabilizes the sediment and causes phosphorus to come up to the surface of the lake and cause algae blooms. It also leaves that area open for invasive species to establish.
- Protect the lake from additional phosphorus by installing vegetative buffers along the lakeshore to slow and filter runoff.
- Protect the lake from additional phosphorus and harmful bacteria by properly maintaining your septic system and picking up pet waste.
- Learn what aquatic invasive plants look like, and check around your dock periodically throughout the summer.
- Have a couple people designated to check around the public accesses for any new invasive plants periodically throughout the summer.

Plant Identification

Plants in Lake Vermilion that look similar to curly-leaf pondweed:

- Claspingleaf pondweed
- Illinois pondweed
- Variable pondweed

The way to tell difference between these look-alikes and curly-leaf pondweed: serrated edges (Figure 95). Curlyleaf pondweed leaves have serrated edges like a butter knife. Also, curly-leaf does not wrap around stem (Claspingleaf does), is not pointed at the end (Illinois is), and branches out of a single central stem (unlike

variable)



Figure 96. Claspingleaf Pondweed



Figure 97. Variable Pondweed



Figure 95. Curly-leaf pondweed serrated edges.



Figure 98. Illinois Pondweed

Plants in Lake Vermilion that look similar to starry stonewort:

- Chara
- Nitella

The way to tell the difference between these look-alikes and starry stonewort: star-shaped bulbils (Figure 16). Starry stonewort has star-shaped bulbils and *Chara* and Native *Nitella* do not.



Figure 16. Starry stonewort with white star-shaped bulbils.

RMB Lake Vermilion 2017 Survey Photos:



Figure 95. Sampling rake with many native aquatic plants in Lake Vermilion on June 5, 2017.



Figure 96. Native Stonewort (Nitella), Lake Vermilion on June 5, 2017.



Figure 97. Curly-leaf Pondweed in Stuntz Bay, Lake Vermilion on June 6, 2017.



Figure 98. Rake with Curly-leaf Pondweed in Stuntz Bay, Lake Vermilion on June 6, 2017.



Figure 99. Rake with Rusty Crayfish, Lake Vermilion on June 7, 2017.



Figure 100. Curly Leaf Pondweed in Wolf Bay, Lake Vermilion on June 9, 2017.





Figure 102. Native Nitella in Everetts Bay, Lake Vermilion on June 6, 2017.



Figure 103. Large Leaf Pondweed, Lake Vermilion, June 6, 2017.



Figure 104. Watermoss on Lake Vermilion, June 12, 2017.



Figure 105. Bladderwort on Lake Vermilion, June 14, 2017.



Figure 106. Yellow Waterlily and Arrowhead on Lake Vermilion, June 15, 2017.

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