



Sea Lake, Woodbury, Minnesota, June 20, 2015

Aquatic Plant Point-Intercept Surveys for Sea Lake, Scandia, Minnesota, 20165

[Plant Surveys Conducted: June 2 and August 23, 2016]

Prepared for:
Comfort Lake - Forest Lake
Watershed District



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January 2017

Aquatic Plant Point-Intercept Surveys for Sea Lake, Woodbury, Minnesota, 2016

Summary

Sea Lake (MnDNR ID #82-005300) is a 51-acre lake located in the City of Scandia in Washington County, Minnesota. Aquatic plant point-intercept surveys were conducted on June 2 and August 23, 2016 by Blue Water Science to characterize early and late summer conditions of native plants and to look for non-native species.

Sea Lake has a moderate early season diversity of aquatic plants, with 7 submerged species, including 1 non-native species, 3 floatingleaf species, and 2 emergent plant species in 2016. Eurasian watermilfoil was not observed in this survey but curlyleaf pondweed was fairly abundant (Figure S1). A summary of plant occurrences and relative densities are listed in Table S1. The most common plant in the lake in June was coontail followed by curlyleaf pondweed. Curlyleaf pondweed is a non-native species and had a total coverage of 21 acres with heavy growth covering about 7 acres.

Later in the summer, Sea Lake had a lower diversity of submerged aquatic plants, with 4 species observed. Submerged plants covered 100% of the lake (Figure S1). Eurasian watermilfoil and curlyleaf pondweed were not observed in the August survey. A summary of plant occurrences and relative densities are listed in Table S1. The most common plant in the lake in August was coontail followed by elodea.

In both surveys, plant coverage was 100%.

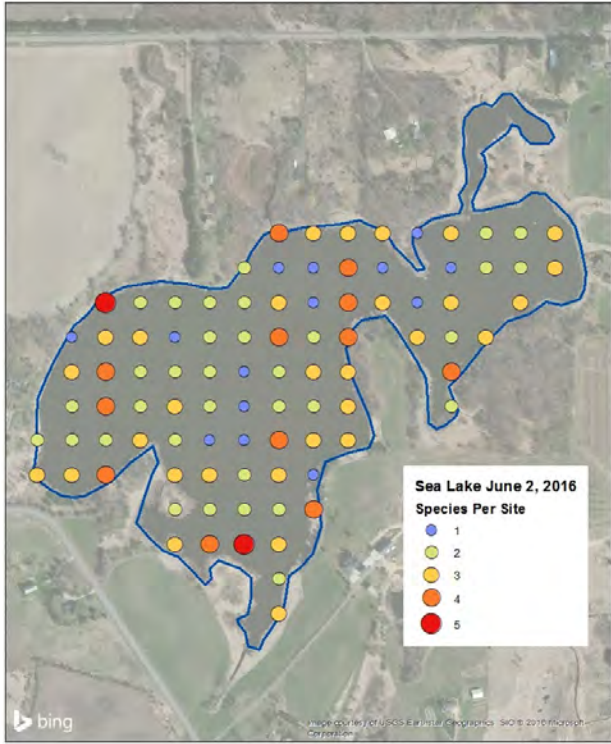
Table S1. The percent occurrence of aquatic plants for Sea Lake. Percent occurrence is calculated based on the number of times a plant species occurs at a sampling station divided into the total number of stations for the survey. For example, if coontail was found in 25 out of 50 stations, its percent occurrence would be 50%.

	June 2, 2016 % Occur (93 sites)	August 23, 2016 % Occur (93 sites)
Bulrush (<i>Scirpus sp</i>)	1%	--
Cattails (<i>Typha sp</i>)	3%	--
Duckweed (<i>Lemna sp</i>)	2%	11%
Spatterdock (<i>Nuphar variegatum</i>)	13%	10%
White Water lilies (<i>Nymphaea tuberosa</i>)	32%	30%
Coontail (<i>Ceratophyllum demersum</i>)	88%	63%
Chara (<i>Chara sp</i>)	4%	--
Elodea (<i>Elodea canadensis</i>)	24%	42%
Star duckweed (<i>Lemna trisulca</i>)	24%	4%
Curlyleaf pondweed (<i>Potamogeton crispus</i>)	42%	--
Stringy pondweed (<i>P. sp</i>)	4%	--
Flatstem pondweed (<i>P. zosteriformis</i>)	16%	27%
Aquatic Plant Coverage (acres)	94	33



Underwater view of coontail.

Sea Lake Species Richness
June 2, 2016



Sea Lake Species Richness
August 23, 2016

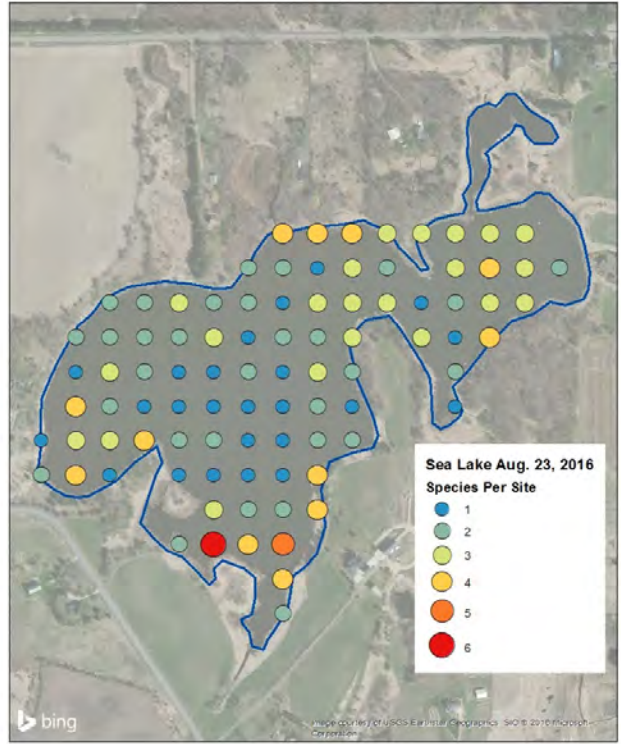


Figure S1. Species richness for Sea Lake on June 2, 2016 (left) and on August 23, 2016 (right).



Aquatic Plant Point-Intercept Surveys for Sea Lake, Scandia, Minnesota, 2016

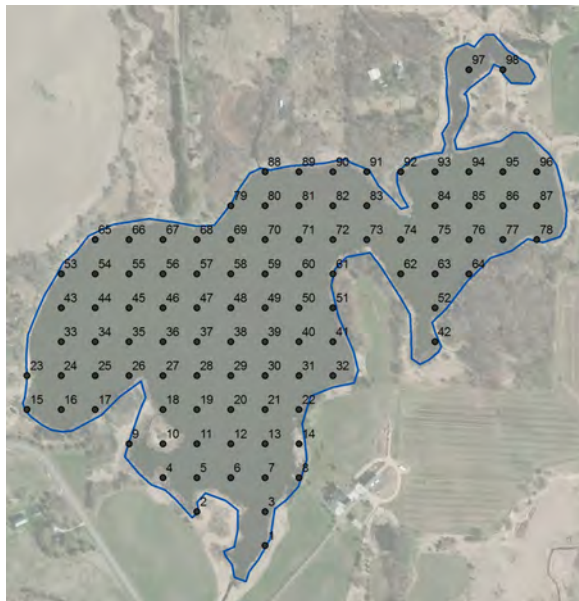
Sea Lake, Scandia, Washington County (ID: 82-005300)
Size: 51 acres (MnDNR)

Introduction

Aquatic plant point-intercept surveys were conducted on 51 acre Sea Lake, located in Scandia in Washington County, on June 2 and August 23, 2016. The objectives of the surveys were to characterize early and late season conditions of native plants and to look for non-native species.

Methods

A point-intercept survey with ninety-five locations were sampled on Sea Lake with 50 meter spacing between points (Figure 1). The amount of plants on the rake determined the density of each species at that location. The plant species were recorded and the density of each species



was assigned. Densities were based on the coverage on the teeth of the rake. Density ratings were from 1 to 5 with 1 being sparse and 5 being matted growth (Figure 2). Based on these sample sites, plant distribution maps were constructed.

Figure 1. Points used for the aquatic plant survey conducted on Sea Lake. Points were placed 50 meters apart.

Chart of Aquatic Plant Density Ratings

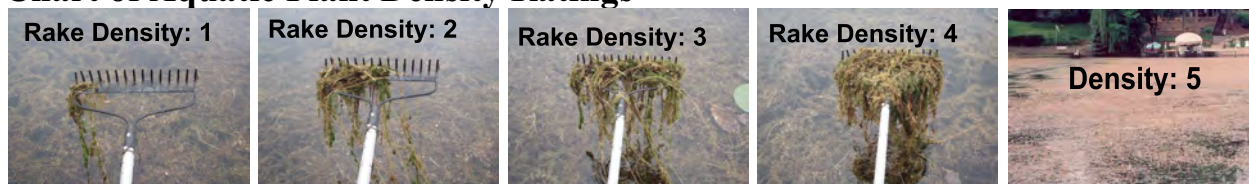


Figure 2. Aquatic plant density ratings from 1 to 5. A density rating of 4.5 or 5 is used for plants topping out at the surface.

Results - June 2, 2016

Results of the early summer aquatic plant point intercept survey conducted on June 2, 2016 found there were 7 submerged plants and coontail was the dominant plant in the lake with curlyleaf pondweed second (Table 1). There was 100% coverage of aquatic plants.

Results from the aquatic plant survey found that plants grew out to depth of 8 feet (Table 2) which was the deepest depth of the lake. Plants covered 100% of the lake bottom.

Eurasian watermilfoil was not observed in this survey.

Table 1. Sea Lake aquatic plant occurrences and densities for the June 2, 2016 survey based on 93 sites. Density ratings are 1-5 with 1 being low and 5 being most dense.

	All Stations (n=93)		
	Occur	% Occur	Density
Bulrush (<i>Scirpus sp</i>)	1	1	1.0
Cattails (<i>Typha sp</i>)	3	3	3.3
Duckweed (<i>Lemna sp</i>)	2	2	1.0
Spatterdock (<i>Nuphar variegatum</i>)	12	13	2.3
White Water lilies (<i>Nymphaea tuberosa</i>)	30	32	2.5
Coontail (<i>Ceratophyllum demersum</i>)	82	88	2.1
Chara (<i>Chara sp</i>)	4	4	1.5
Elodea (<i>Elodea canadensis</i>)	22	24	1.9
Star duckweed (<i>Lemna trisulca</i>)	22	24	1.5
Curlyleaf pondweed (<i>Potamogeton crispus</i>)	39	42	2.5
Stringy pondweed (<i>P. sp</i>)	4	4	1.0
Flatstem pondweed (<i>P. zosteriformis</i>)	15	16	1.0

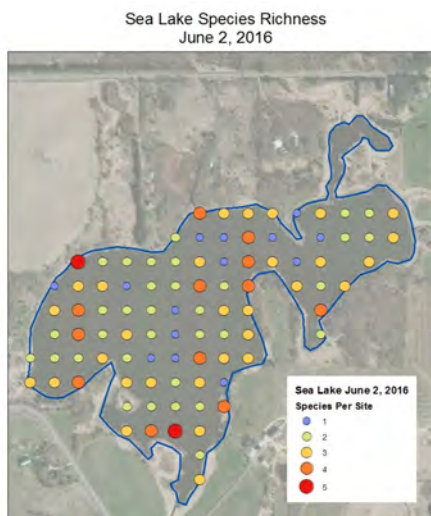


Figure 3. Species richness for Sea Lake on June 2, 2016.

Table 2. Individual site data for June 2, 2016. Numbers indicate plant density.

Site	Depth (ft)	Bul-rush	Cattails	Duck-weed	Spatter dock	White lilies	Chara	Coon-tail	CLP	Elodea	Flat-stem	Star duck-weed	Stringy	No plants
1	2			1				1	5		1			
2	1		4											
3	3							1	1					
4	3					4		2			1			
5	4							1	4	1		2		
6	5				3			3	3		1	1		
7	5							1	4			1		
8	land													1
9	land													1
10	1		3			1						1		
11	5							2	3					
12	6							1	4					
13	6							2	4					
14	1				2	1			1			1		
15	2					3		2				3		
16	5					2		3				2		
17	3				2	2		1				2		
18	3					3		2		1				
19	7							2		2		1		
20	7							3				1		
21	7							1	1	2				
22	5					1								
23	1					1		1						
24	6							4				1		
25	6							3				2		
26	6							3	1			2		
27	7							2		3				
28	7							2						
29	8							3						
30	8							2	2			1	1	
31	6							1	5	1				
32	4				1	1			4					
33	6							3				2		
34	7						1	2	4			2		
35	7							2	4					
36	7							2	2	3				
37	7							3	1					
38	7							2						
39	8							2	1					
40	7							2	3					
41	3				1	1		1						
42	1					4		1						
43	6							3		3		1		
44	7						1	1	4	3				
45	7								4	4				
46	8							2	3					
47	7							3	3					
48	8							3						
49	7							1					1	
50	7							2	3				1	

Table 2. Individual site data for June 2, 2016. Numbers indicate plant density.

Site	Depth (ft)	Bul-rush	Cattails	Duck-weed	Spatter dock	White lilies	Chara	Coon-tail	CLP	Elodea	Flat-stem	Star duck-weed	Stringy	No plants
51	2				2			2		2				
52	4					3		2	1		1			
53	1			1					2					
54	6							2		1		1		
55	7							3	3		1			
56	8							2						
57	8							2		3				
58	7							2				1		
59	8							1	1	1			1	
60	7							3		1				
61	1				2	2		2	1					
62	4					2		2			1			
63	6							3			1			
64	2					2	3				1			
65	2				3	2		2	1			1		
66	5							1	1					
67	5							2		2				
68	5							3		1				
69	8							2		1				
70	6							3	4	1				
71	7							3						
72	6					1		1	2	3				
73	2					3		2		1				
74	6							4						
75	6					2		3			1			
76	6					3		2						
77	4					4		1			1			
78	land													1
79	3				3					1				
80	6							3						
81	7							3						
82	7					1		2	1		1			
83	5							4						
84	6							3						
85	6						1	2						
86	5					4		3						
87	4					4		2			1			
88	2				4			1	2			1		
89	2	1			3			2	1					
90	3				2			2	2					
91	2					2			3			2		
92	1		3			3								
93	4					4		2			1			
94	6							3			1			
95	4					4		2						
96	3					4		3			1			
97	land													1
98	land													1

Aquatic plants are distributed throughout Sea Lake on June 2, 2016 (Figure 4).

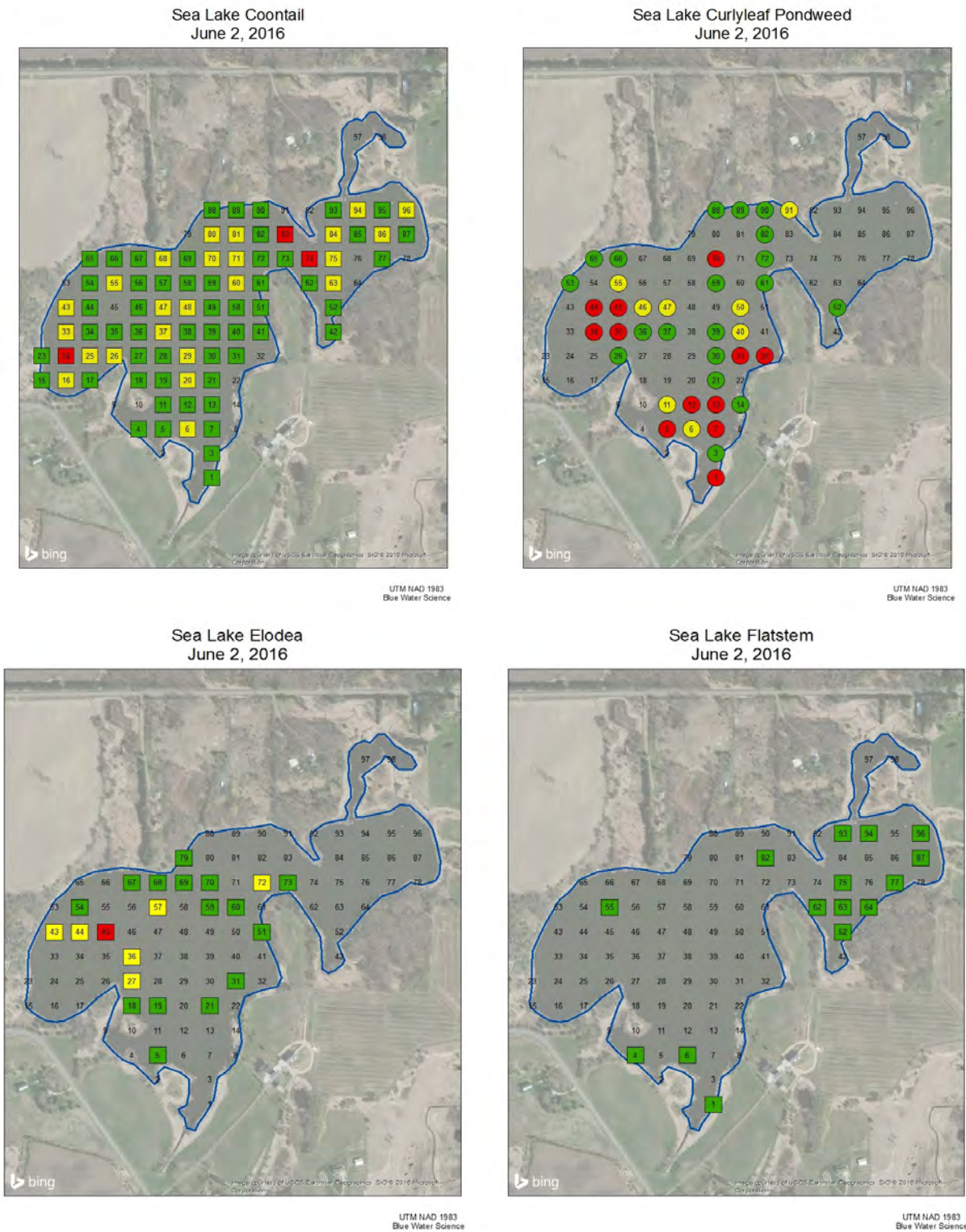


Figure 4. Aquatic plants were found throughout Sea Lake, coontail (top-left), curlyleaf pondweed (top-right), elodea (bottom-left), and flatstem pondweed (bottom-right).

Key: green = light growth, yellow = moderate growth, and red = heavy growth.

Results - August 23, 2016

Results of the late summer aquatic plant point intercept survey conducted on August 23, 2016 found several plant species had disappeared and there were 4 submerged plant species present. Coontail was the dominant plant in the lake with elodea second (Table 3). There was 100% coverage of aquatic plants.

Results from the aquatic plant survey found that plants grew out to depth of 8 feet (Table 4) which was the deepest depth of the lake.

Eurasian watermilfoil was not observed in this survey.

Table 3. Sea Lake aquatic plant occurrences and densities for the August 23, 2016 survey based on 93 sites. Density ratings are 1-5 with 1 being low and 5 being most dense.

	All Stations (n=93)		
	Occur	% Occur	Density
Duckweed (<i>Lemna sp</i>)	10	11	1.3
Spatterdock (<i>Nuphar variegatum</i>)	9	10	1.6
White Water lilies (<i>Nymphaea tuberosa</i>)	36	39	2.3
Coontail (<i>Ceratophyllum demersum</i>)	89	96	2.5
Elodea (<i>Elodea canadensis</i>)	46	49	4.8
Star duckweed (<i>Lemna trisulca</i>)	4	4	1.8
Flatstem pondweed (<i>Potamogeton zosteriformis</i>)	25	27	1.2

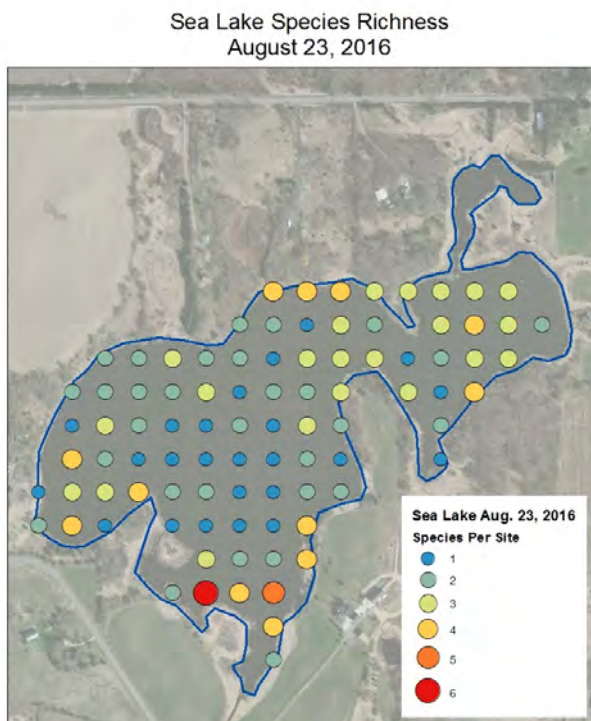


Figure 5. Species richness for Sea Lake on August 23, 2016.

Table 4. Individual site data for August 23, 2016. Numbers indicate plant density.

Site	Depth	Duckweed	Spatterdock	White lilies	Coontail	Elodea	Flatstem	Star duckweed	No plants
1	2				1	1			
2	0								
3	3	3	2	1	3		2		
4	3			2	2				
5	5		1	2	2	1	1	1	
6	5		1	3	3			3	
7	4		2	3	2	1		2	
8	0								
9	0								
10	1								
11	4				2	3		1	
12	5				3	1			
13	6				3		1		
14	4	1	1	2	2	2			
15	2			2	2				
16	4			3	2	2	1		
17	3				2				
18	3				3				
19	7				2				
20	7				3				
21	7				1				
22	4	2		1	3	3	1		
23	1			1					
24	5				3	4	1		
25	5			1	3	4			
26	5		2	1	2	4			
27	5				2	3			
28	6				3	1			
29	8				2				
30	8				2				
31	6	1			3		1		
32	4			1	1				
33	5			1	3	1	1		
34	6				3		1		
35	7				1				
36	6				2				
37	7				2				
38	7				1				
39	7				1				
40	5				2	4			
41	3				1				
42	1				1				
43	6				1				
44	5				3	2	1		
45	7				2		1		
46	8				2				
47	7				3				
48	7	1			3	1			
49	6				2				
50	5				3	1	1		
51	2				2	1			
52	4				2	1			
53	1				1	1			
54	7				4	2			
55	6				2	2			
56	6				3	2			

Table 4. Individual site data for August 23, 2016. Numbers indicate plant density.

Site	Depth	Duckweed	Spatterdock	White lilies	Coontail	Elodea	Flatstem	Star duckweed	No plants
57	6				3	1	1		
58	6				2				
59	6				2	1			
60	6				3	2			
61	1			2	2	1			
62	4	1		2	3	1			
63	5				4				
64	4			3	3	1	1		
65	4				3	2			
66	5				4	2			
67	6				3	2	1		
68	5				2	4			
69	7				2	2			
70	6				1				
71	7	1		2	3		1		
72	6			1	2	4			
73	4			3	3	1			
74	6				2				
75	5				3		1		
76	6	1		3	3		1		
77	5			3	3		1		
78	0								
79	5				3	1			
80	5			2	3				
81	5				3				
82	5			2	3	1			
83	4				3		1		
84	5			2	4		1		
85	5	1		3	4	1	2		
86	5			3	3		2		
87	4			3	3				
88	3		1	2	3	1			
89	2		2	3	2	2			
90	3		2	3	3	1			
91	2			1	1	1			
92	2			4	4	1			
93	4			3	3	1			
94	5			3	3		1		
95	4	1		4	4		2		
96									
97									
98									

Native aquatic plants are distributed throughout Sea Lake (Figure 6).

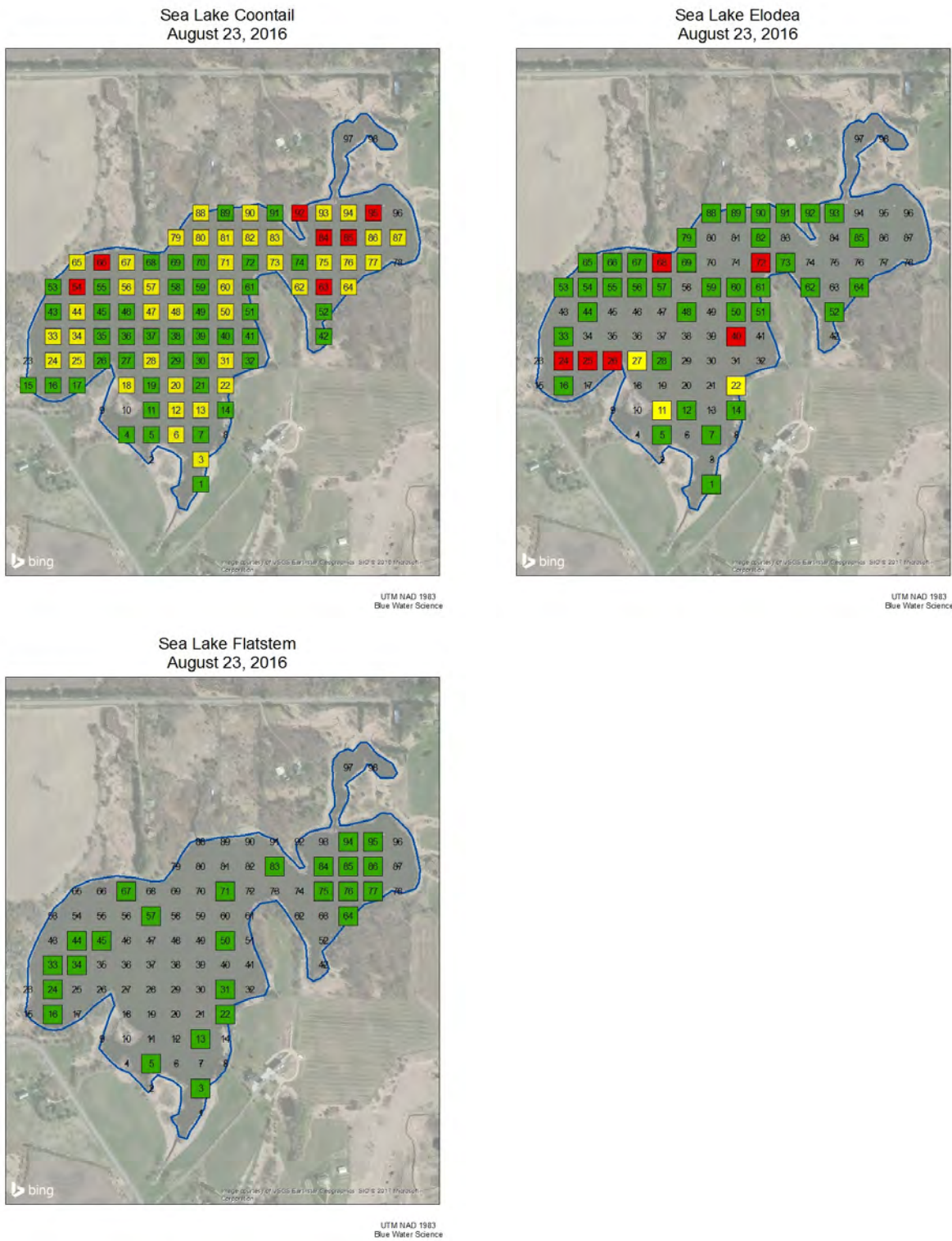


Figure 6. Aquatic plants were found throughout Sea Lake, coontail (top-left), curlyleaf pondweed (top-right), elodea (bottom-left), and flatstem pondweed (bottom-right).

Key: green = light growth, yellow = moderate growth, and red = heavy growth.

Summary

Sea Lake (MnDNR ID #82-0053) is a 51-acre lake located in the City of Scandia in Washington County, Minnesota. An aquatic plant survey was conducted on June 2 and August 23, 2016 by Blue Water Science to characterize early season conditions of native plants and to look for non-native species.

Sea Lake has a moderate early season diversity of submerged aquatic plants, with 7 species in June and a poor diversity of plants in August with only 4 submerged species. Eurasian watermilfoil was not observed in either survey but curlyleaf pondweed was fairly abundant in the early season. A summary of plant occurrences and relative densities are listed in Table 5. The most common plant in the lake in June was coontail followed by curlyleaf pondweed. Curlyleaf pondweed is a non-native species and had a total coverage of 21 acres with heavy growth covering 7 acres. In August the most common plant was again coontail.

Table 5. The percent occurrence of aquatic plants for Sea Lake. Percent occurrence is calculated based on the number of times a plant species occurs at a sampling station divided into the total number of stations for the survey. For example, if coontail was found in 25 out of 50 stations, its percent occurrence would be 50%.

	June 2, 2016 % Occur (93 sites)	August 23, 2016 % Occur (93 sites)
Bulrush (<i>Scirpus sp</i>)	1%	--
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Coontail (<i>Ceratophyllum demersum</i>)	88%	63%
Chara (<i>Chara sp</i>)	4%	--
Elodea (<i>Elodea canadensis</i>)	24%	42%
Star duckweed (<i>Lemna trisulca</i>)	24%	4%
Curlyleaf pondweed (<i>Potamogeton crispus</i>)	42%	--
Stringy pondweed (<i>P. sp</i>)	4%	--
Flatstem pondweed (<i>P. zosteriformis</i>)	16%	27%
Aquatic Plant Coverage (acres)	94	33

APPENDIX - Soil Data

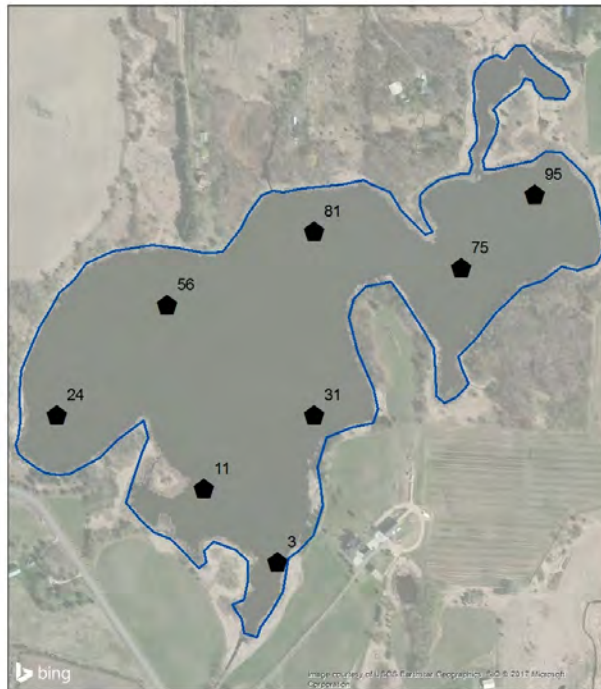
Lab Data

Sample Name	Bray P (ppm)	Olsen P (ppm)	NH4OAc-K (ppm)	LOI OM (%)	Water pH	Hot Water Boron (ppm)	DTPA-Fe (ppm)	DTPA-Mn (ppm)	DTPA-Zn (ppm)	DTPA-Cu (ppm)	NH4OAc-Ca (ppm)	NH4OAc-Mg (ppm)	SO4-S (ppm)	NH4-N (ppm)	10 gm Scoop Wt	10 gm Scoop Wt	10 gm Scoop Wt
Sea 3	12	8	140	11.05	5.85	0.472	356.41	40.793	6.700	2.348	1560.0	245.11	13	15.30	6.37	6.40	6.40
Sea 11	14	6	112	2.9	6.5	0.209	94.242	25.861	1.210	2.050	1286.3	231.19	15	12.93	9.97	9.96	9.93
Sea 24	7	4	213	25.6	5.8	0.709	451.78	38.333	8.593	3.172	1944.8	332.94	51	38.57	4.97	5.19	5.06
Sea 31	10	5	166	29.2	6.1	0.730	325.28	33.857	6.428	4.359	2327.2	393.59	67	14.51	4.86	4.95	4.94
Sea 56	12	6	173	33.6	5.9	0.917	306.34	35.801	9.017	3.365	2286.2	411.26	96	12.27	4.92	4.83	4.86
Sea 95	5	3	125	35.5	5.8	0.666	448.06	22.643	4.115	3.628	1794.0	305.48	24	20.40	4.01	3.99	4.11
Sea 75	32	23	152	24.7	5.9	0.902	412.23	70.521	5.820	3.182	1761.2	254.79	38	104.28	4.60	4.65	4.65
Sea 81	9	5	196	33.1	5.8	0.923	369.71	52.410	8.201	3.276	2333.0	402.59	40	28.92	5.55	5.53	5.48

Adjusted Data

Sample Name	Bulk Density (wt/8.51)	Bray P (ppm) adjusted	Olsen P (ppm) adjusted	NH4OAc-K (ppm) adjusted	LOI OM (%)	Water pH	Hot Water Boron (ppm) adjusted	DTPA-Fe (ppm) adjusted	DTPA-Mn (ppm) adjusted	DTPA-Zn (ppm) adjusted	DTPA-Cu (ppm) adjusted	NH4OAc-Ca (ppm) adjusted	NH4OAc-Mg (ppm) adjusted	SO4-S (ppm) adjusted	NH4-N (ppm) adjusted	Average Scoop	Correct factor	Fe/Mn
Sea 3	0.75	7.7	5.1	89	11.05	5.85	0.302	228	26.1	4.3	1.5	997	157	8.3	9.8	6.39	0.64	8.7
Sea 11	1.17	14	6.0	111	2.9	6.5	0.208	93.8	25.7	1.2	2.0	1280	230	14.9	12.9	9.95	1.00	3.6
Sea 24	0.60	3.6	2.0	108	25.6	5.8	0.360	229	19.4	4.4	1.6	987	169	25.9	19.6	5.07	0.51	11.8
Sea 31	0.58	4.9	2.5	82	29.2	6.1	0.359	160	16.6	3.2	2.1	1144	194	32.9	7.1	4.92	0.49	9.6
Sea 56	0.57	5.8	2.9	84	33.6	5.9	0.447	149	17.4	4.4	1.6	1113	200	46.8	6.0	4.87	0.49	8.6
Sea 95	0.47	2.0	1.2	50	35.5	5.8	0.269	181	9.1	1.7	1.5	724	123	9.7	8.2	4.04	0.40	19.8
Sea 75	0.54	15	11	70	24.7	5.9	0.418	191	32.7	2.7	1.5	816	118	17.6	48.3	4.63	0.46	5.8
Sea 81	0.65	5.0	2.8	108	33.1	5.8	0.509	204	28.9	4.5	1.8	1288	222	22.1	16.0	5.52	0.55	7.1

Sea Lake Sediment Site Map



LTM NAD 1983
Blue Water Science

Curlyleaf Pondweed (non-native aquatic plant)

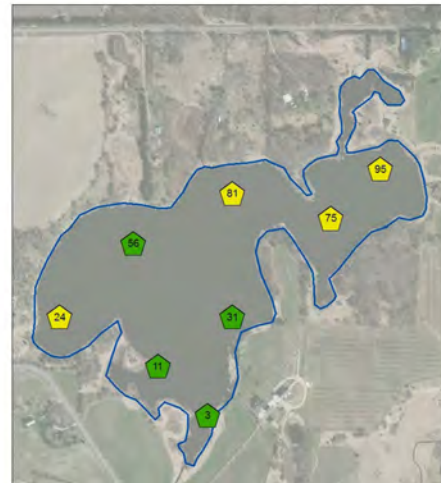
Sea Lake Status: Present in Sea Lake.

Curlyleaf Pondweed Growth Potential Based on Lake Sediments: Curlyleaf pondweed is present in Sea Lake. Research has found curlyleaf is limited or enhanced based on lake sediment characteristics. Based on lake sediment characteristics, curlyleaf has the potential to produce mostly moderate growth on an annual basis.

Sea Lake sediment data and ratings for potential growth of curlyleaf pondweed growth.

Site	Depth (ft)	pH (su)	Bulk Density (g/cm ³ dry)	Organic Matter (%)	Fe:Mn Ratio	Potential for Curlyleaf Pondweed Growth
		<7.4	>1.04	0.1-5	>4.5	Light (green)
		7.4 - 7.7	0.52 - 1.03	6-20	1.6 - 4.5	Moderate (yellow)
		>7.7	<0.51	>20	<1.6	Heavy (red)
3	3	5.85	0.75	11.05	8.7	Light
11	4	6.5	1.17	2.9	3.6	Light
24	5	5.8	0.60	25.6	11.8	Moderate
31	6	6.1	0.58	29.2	9.6	Light
56	6	5.9	0.57	33.6	8.6	Light
75	5	5.9	0.54	24.7	5.8	Moderate
81	5	5.8	0.65	33.1	7.1	Moderate
95	4	5.8	0.47	35.5	19.8	Moderate

2016 Sea Lake Curlyleaf Pondweed Potential Growth



The color indicates the potential growth of curlyleaf pondweed. Key: green = light growth and yellow = moderate growth.

Examples of Curlyleaf Pondweed Growth Characteristics



Light growth (left) refers to non- nuisance growth that is mostly below the surface and is not a recreational or ecological problem. Moderate growth (middle) refers to growth that is just below the water surface. Heavy growth (right) refers to nuisance matting curlyleaf pondweed. This is the kind of nuisance growth predicted by high sediment pH and a sediment bulk density less than 0.51.

Eurasian Watermilfoil (non-native aquatic plant)

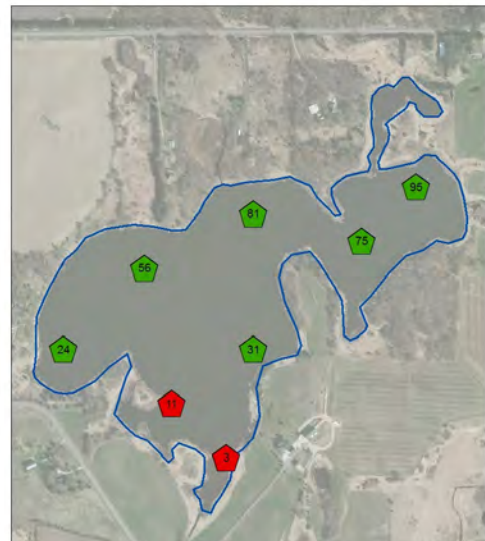
Sea Lake Status: Not present in Sea Lake.

Eurasian Watermilfoil (EWM) Growth Potential Based on Lake Sediments: Lake sediment sampling results from 2016 have been used to predict lake bottom areas that have the potential to support heavy EWM growth. Eurasian watermilfoil has not been observed in Sea Lake as of August 2016. The potential for milfoil growth, based on lake sediment sampling, would be mostly light growth. Heavy milfoil growth has been correlated with high sediment nitrogen condition and Sea Lake had high sediment nitrogen values at some sites sampled.

Sea Lake sediment data and ratings for potential growth of Eurasian watermilfoil.

Site	Depth (ft)	NH ₄ Conc (ppm)	Organic Matter (%)	Potential for EWM Growth
		<4	<0.5 and >20	Light (green)
		4 - 10	0.6 - 2 and 18 - 20	Moderate (yellow)
		>10	3 - 17	Heavy (red)
3	3	9.8	11.05	Heavy
11	4	12.9	2.9	Heavy
24	5	19.6	25.6	Light
31	6	7.1	29.2	Light
56	6	6.0	33.6	Light
75	5	48.3	24.7	Light
81	5	16.0	33.1	Light
95	4	8.2	35.5	Light

2016 Sea Lake Eurasian Watermilfoil Potential Growth



The color indicates the potential growth of EWM. Key: green = light growth and red= heavy growth.

Examples of Eurasian Watermilfoil Growth Characteristics



Light growth (left) refers to non-nuisance growth that is mostly below the surface and is not a recreational or ecological problem. Heavy growth (right) refers to nuisance matting Eurasian watermilfoil. This is the kind of nuisance growth predicted by high sediment nitrogen values and a sediment organic matter content less than 20%.