Spring Lake, April 2020

Curlyleaf Pondweed Surveys and Aquatic Plant Point Intercept Survey for Spring Lake, Scott County, Minnesota in 2020

Curlyleaf Pondweed Meandering Survey: April 30, 2020
CLP Treatment: May 19, 2020, 14.92 ac (diquat)
Curlyleaf Pondweed Assessment Surveys: June 11, 2020
Summer Point Intercept Plant Survey: August 14, 2020

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March 10, 2021

Curlyleaf Pondweed Surveys and Aquatic Plant Point Intercept Survey for Spring Lake, Scott County, Minnesota in 2020

Summary

Early Season CLP Delineation and Assessment: Curlyleaf pondweed (CLP) distribution and abundance were delineated in Spring Lake on April 30, 2020 to determine if curlyleaf control was needed. Curlyleaf growth was observed at 62 out of 254 sample sites (Figure S1). Growth ranged from light to heavy. Four areas totaling 14.92 acres were projected to produce abundant growth and were delineated for treatment (Figure S1).

Treatment of 14.92 acres occurred on May 19, 2020 using a diquat herbicide.

A post-treatment assessment survey included a line transect survey and a meandering survey and was conducted on June 11, 2020 to check the status of curlyleaf pondweed and native plant community in Spring Lake. CLP was observed at a number of sites with light to heavy growth. Treatment control in 3 of the 4 areas was poor and fair control was observed in the fourth area (Figure S1).

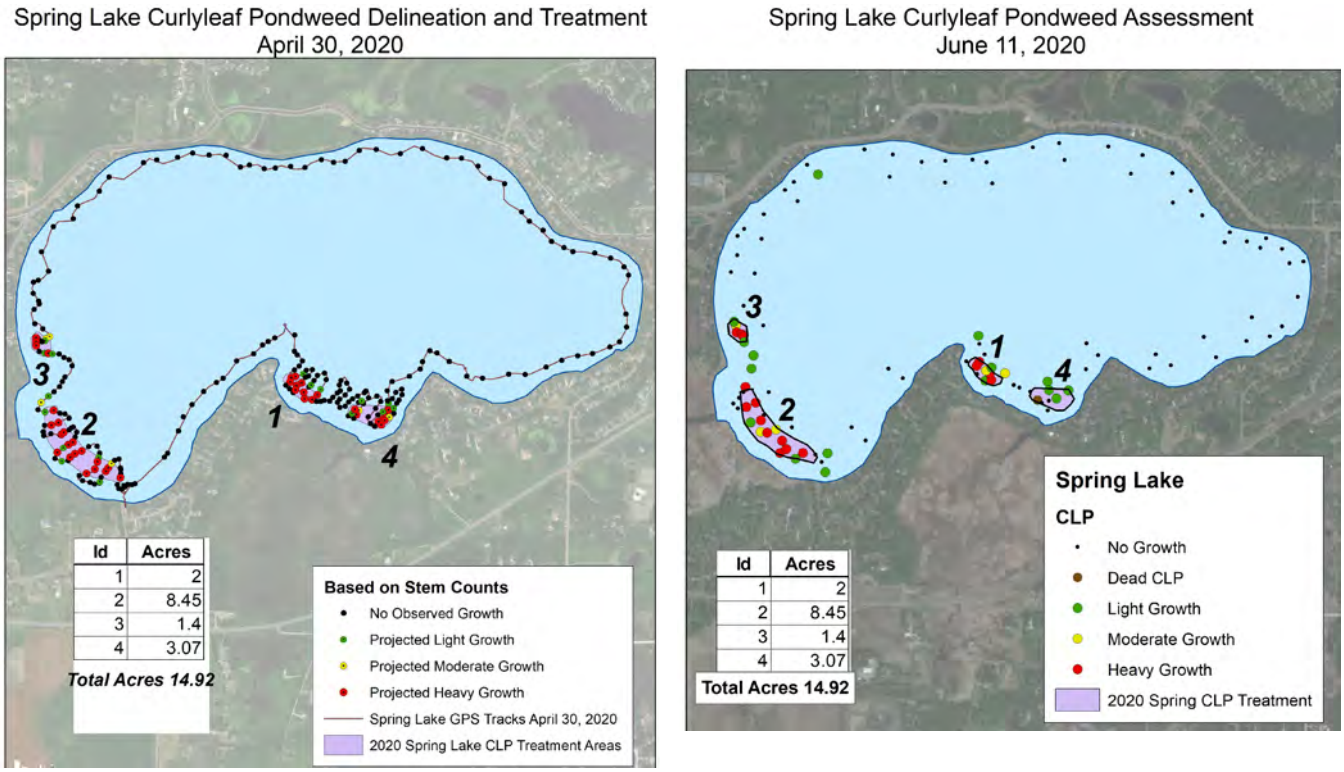


Figure S1. [left] curlyleaf pondweed delineation. [right] curlyleaf pondweed assessment (post treatment).

Point Intercept Survey: A grid with points spaced 50 meters apart was put over the entire lake and sites were sampled throughout the growing zone. A total of 352 sites were sampled, plants were observed growing to a depth of 9 feet. Results of the summer aquatic plant point intercept survey conducted on August 14, 2020 found 14 submerged aquatic plant species with including CLP. Native plants were found around the perimeter of the basin of Spring Lake (Figure S2).

Native aquatic plants were estimated to cover of the lake bottom (98 acres). Coontail was the dominant aquatic plant. The 14 aquatic plant species found in this survey represents a fair to good diversity for Spring Lake in late summer.

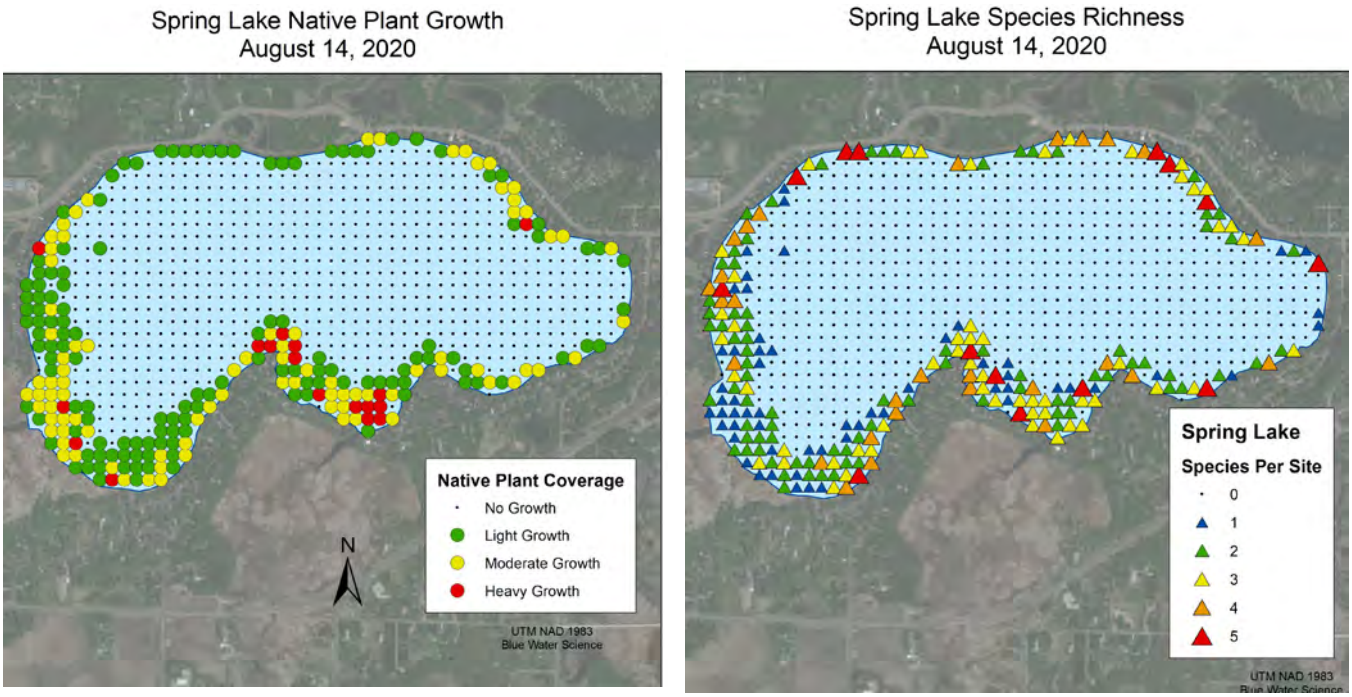


Figure S2. [left] Native plant distribution and abundance for the August 14, 2020 point intercept survey. [right] Species Richness for the August 14, 2020 point intercept survey. Key: green = light growth, yellow = moderate growth, red = heavy growth, and black dot = no growth.

Curlyleaf Pondweed Surveys and Aquatic Plant Point Intercept Survey for Spring Lake, Scott County, Minnesota in 2020

Introduction

Spring Lake has an area of 592 acres with a littoral area of 290 acres (source: MnDNR). The objectives of the plant surveys were to delineate and recommend areas to treat nuisance curlyleaf pondweed and to monitor the non-native and native plants over the summer.

A curlyleaf pondweed delineation survey was conducted on April 30, 2020.

Treatment occurred on May 19, 2020 and covered 14.92 acres.

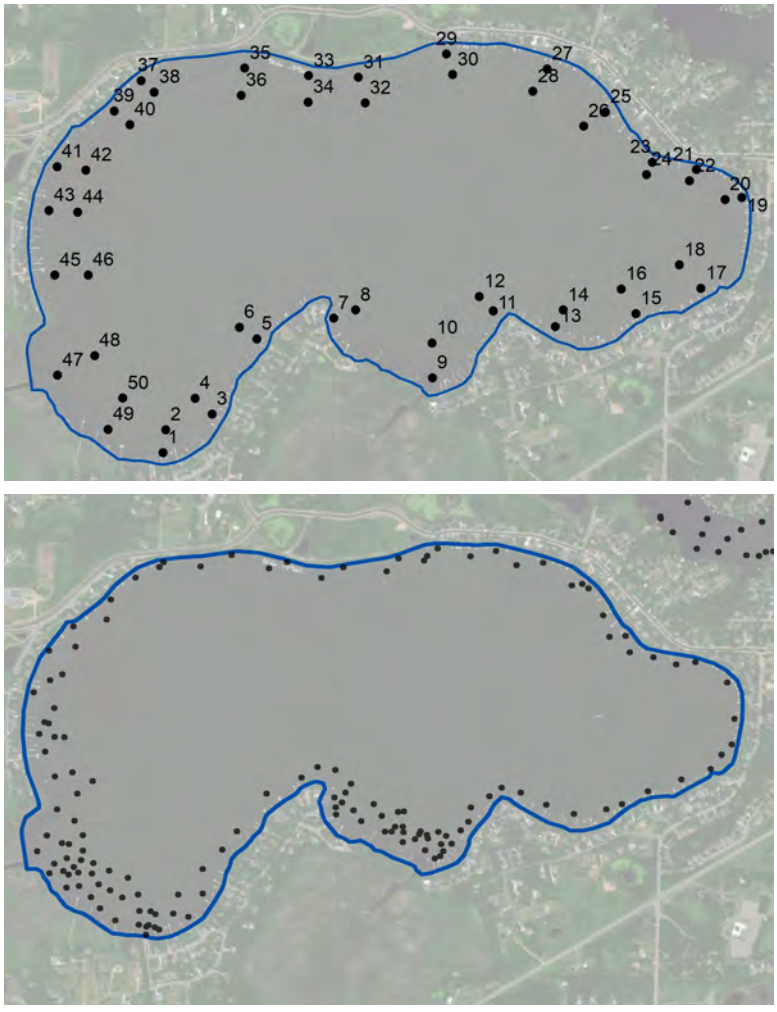
A curlyleaf pondweed assessment was conducted on June 11, 2020.

A summer aquatic plant point intercept survey was conducted on August 14, 2020 to check and inspect the native plant community in Spring Lake.

Figure 1. Rake sample of aquatic submerged plants sampled on April 30, 2020 in Spring Lake.

Survey Methods for Meandering and Line Transect Surveys: Determining what areas to treat to control excessive growth of curlyleaf pondweed has been an ongoing challenge. Curlyleaf growth in April and May is just starting to go into a rapid growth phase. However, not all early season curlyleaf growth will result in heavy curlyleaf growth in June. It appears there are factors that limit curlyleaf growth and significant variables are associated with sediment conditions. The question is how to best delineate areas to treat what could be heavy growth in June but not overtreat areas where growth wouldn't be a nuisance for the season. Currently, for Spring Lake, the method has been to use past treatment history combined with early season scouting and then a recheck to evaluate any treatment effects and see if curlyleaf areas were missed. A meandering survey was used to delineate CLP and a meandering survey was combined with a line transect survey to assess the CLP treatment (Figure 2).

Meander Delineation Survey: A meandering survey consists of using a meandering path around the nearshore area of the entire lake. Visual inspection along with plant sampling was conducted. At each sample point, plants were sampled with a rake sampler.



Line Transect Survey: We used 25 line transects with 2 depths per transect. The same transects have been used from 2000 through 2020. Plants were sampled with a rake attached to a pole to characterize species presence and its density along a transect. A total of 50 sites were sampled (Figure 2). For the assessment transect survey, plant density was estimated on a scale of 1 to 3 with 3 being the densest.

Figure 2. [top] Full lake transect survey sample sites. [bottom] Meander GPS sample points. The transect survey can be used for year to year comparisons and the meander GPS surveys help target abundant and nuisance non-native species.

Methods for the Point Intercept Survey: An aquatic plant point intercept survey of Spring Lake was conducted by Blue Water Science on August 14, 2020. A total 352 points in the growing zone out to 15 feet will be sampled. Sample points were spaced 50 meters apart on a grid that covered the lake (Figure 3). At each sample point, a sampling rake was lowered into the water and a plant sample was taken. 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 ranged from 1 to 3 with 1 being sparse and 3 being heavy growth. Based on these sample sites, plant distribution maps were constructed.

Figure 3. Point intercept sample sites for Spring Lake in 2020. Sample sites were spaced 50 meters apart.

Results of Curlyleaf Pondweed Delineation April 30, 2020: A curlyleaf delineation using a meandered survey collected a total of 254 GPS points around the lake. Curlyleaf was found at 62 out of 254 sites (Figure 4). Curlyleaf was observed growing in water depths of 2-6 feet, notably, no curlyleaf was observed deeper than 6 feet of water depth. Coontail, elodea, and chara were present but rare at this time. At total of 14.92 acres were delineated for treatment (Figure 4).

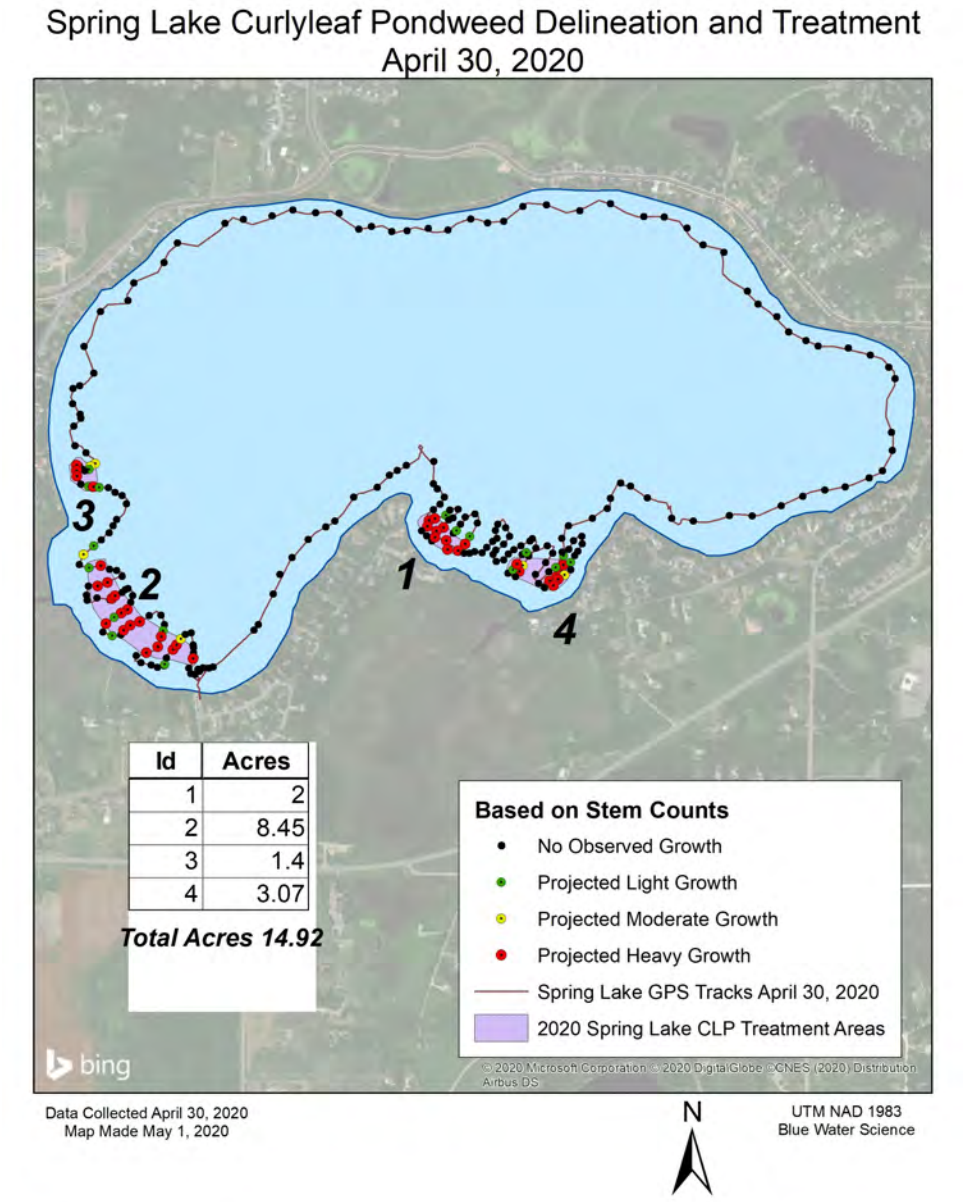


Figure 4. Map of curlyleaf pondweed for April 30, 2020. Colored sample areas indicate the growth in April of 2020 for curlyleaf pondweed. Key: green = light potential growth, yellow = moderate potential growth, red = heavy potential growth, and black dot = no curlyleaf.

Curlyleaf Pondweed Assessment, June 11, 2020: A curlyleaf assessment (post-treatment survey) was conducted on June 11, 2020, the survey included meandering survey collecting 64 GPS points and a line-transect survey which collect data on 50 established sites. Curlyleaf was found at 37 out of 114 of the total sites (Figure 5). Curlyleaf did expand and the curlyleaf treatment was poor to fair.

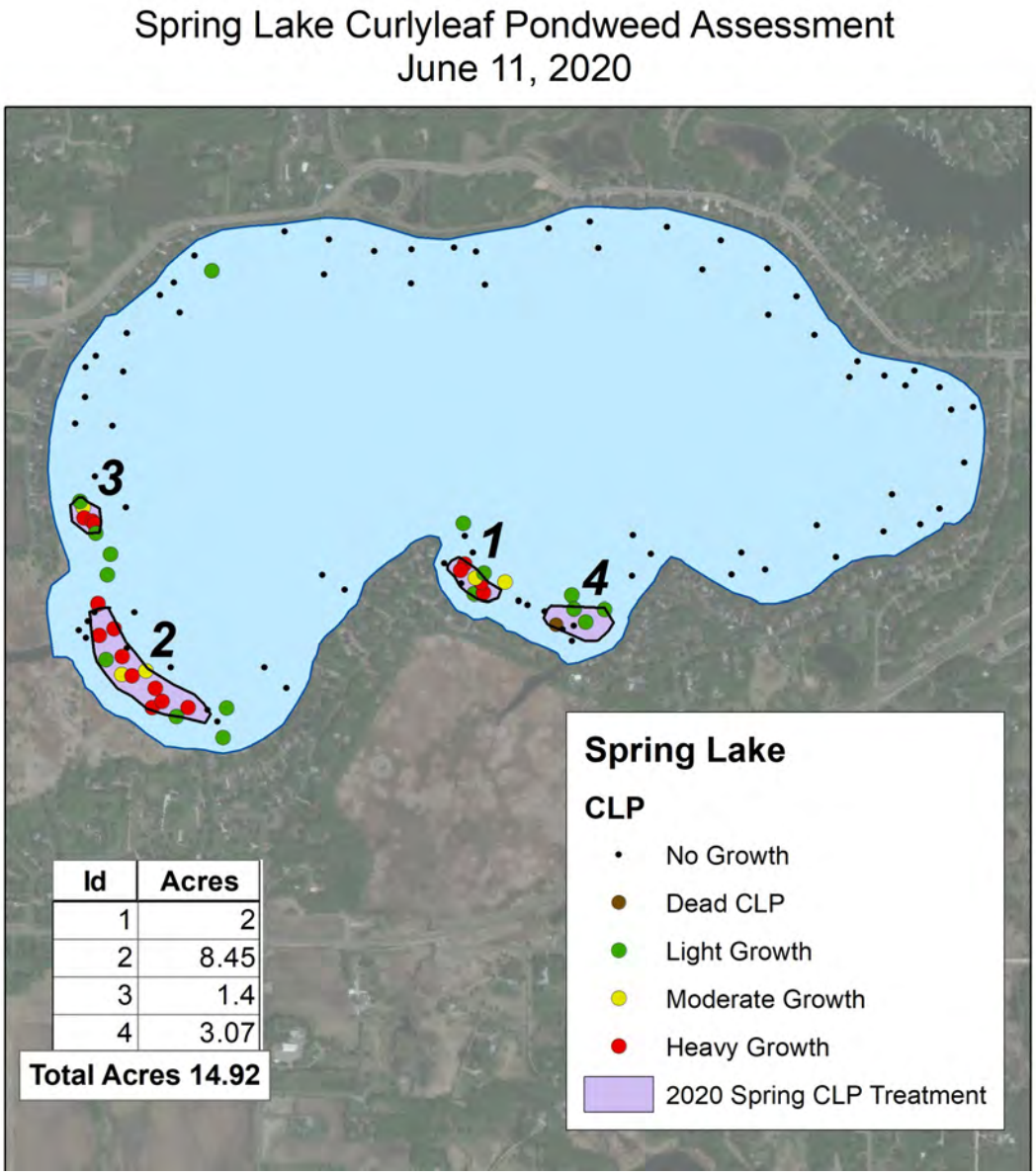


Figure 5. Curlyleaf pondweed assessment on June 11, 2020.
Key: green = light growth, yellow = moderate growth, red = heavy growth, and black = no curlyleaf.

Summary of Curlyleaf Pondweed 2000 to 2020

Curlyleaf pondweed growth has been variable from 2000 through 2020. For the years 2007 to 2015 there were no CLP treatments. There may be a correlation to the use of an iron dosing station on the County 13 ditch where flows eventually enter Spring Lake and a reduction in Spring Lake curlyleaf. The amount of iron dosed is listed in Table 1. Likely only a small percentage of the dosed iron makes its way into Spring Lake. Iron in the water column that may inhibit CLP growth is speculative but heavy CLP growth, as shown in Figure 6, did not occur from 2007 through 2015 when some iron from the iron dosing operation may have entered Spring Lake. After a dosing station upgrade, in 2013, it is likely less iron entered Spring Lake and curlyleaf growth may have increased.

Table 1. Curlyleaf pondweed occurrence and acres either harvested or treated with herbicides from 2000 to 2020.

	Iron (kg)	$FeCl_3$ (gallons)	Curlyleaf Occurrence (based on 50 sites unless noted)	Harvesting Acres	Herbicide Treatment Acres	Total Curlyleaf Treatment (acres)
2000	?		49			
2001	?					
2002	?		43	60	14	74
2003	0	0	35	74	14	88
2004	0	0	40		59	59
2005	2,629	4,232	29		59	59
2006	895	1,440	32		59	59
2007	920	1,481	22			
2008	726	1,168	4			
2009	109	176	5			
2010	0	0	25			
2011	1,491	2,390	10			
2012	0	0	6			
2013	1,248 (J-A)	?	3			
2014	>4,547	>7,275	10			
2015	2,800	4,480	10			
2016	4,206	6,730	11		20.4	20.4
2017	4,544	7,270	11		3.7	3.7
2018	3,656	5,850	4			
2019	3,675	5,880	29 (144 sites)		15.7	15.7
2020			62 (254 sites)		14.92	14.92

Figure 6. Curlyleaf pondweed growth was very heavy in 2000.

Results - Point Intercept Aquatic Plant Survey on August 14, 2020

Results of the summer aquatic plant survey conducted on August 14, 2020 found 14 submerged aquatic plant species, CLP was present in August, no Eurasian watermilfoil was observed. Plant growth was restricted to water depths of 8 feet or less in Spring Lake (Table 2). Native plants were found around the perimeter of the basin of Spring Lake. Aquatic abundance and species diversity was greater than previous years. Plant distribution and abundance are shown in Table 2.

Table 2. Spring Lake aquatic plant occurrence and density for the August 14, 2020 survey based on 298 sites. Density ratings are 1-3 with 1 being low and 3 being most dense.

Spring Lake August 14, 2020	All Stations (n=298)		
	Occur	% Occur	Average Density
Cattails (*Typha sp*)	3	1	1.7
Duckweed (*Lemna sp*)	3	1	1.7
White water lilies (*Nymphaea ordata*)	5	2	1.2
Coontail (*Ceratophyllum demersum*)	154	52	1.3
Chara (*Chara sp*)	3	1	1.0
Moss (*Drepanocladus sp*)	2	1	1.0
Elodea (*Elodea canadensis*)	14	5	1.0
Water stargrass (*Heteranthera dubia)*	56	19	1.2
Northern watermilfoil (*Myriophyllum sibiricum*)	2	1	1.0
Naiads (*Najas flexilis*)	116	39	1.2
Curlyleaf pondweed (*Potamogeton crispus*)	20	7	1.1
Fries pondweed *(P. friesii)*	1	1	1.0
Claspingleaf pondweed (*P. Richardsonii*)	59	20	1.4
Stringy pondweed (*P. sp*)	57	19	1.0
Flatstem pondweed (*P. zosteriformis*)	1	1	1.0
Sago pondweed (*Stuckenia pectinata*)	14	5	1.0
Water celery (*Vallisneria americana*)	64	21	1.4

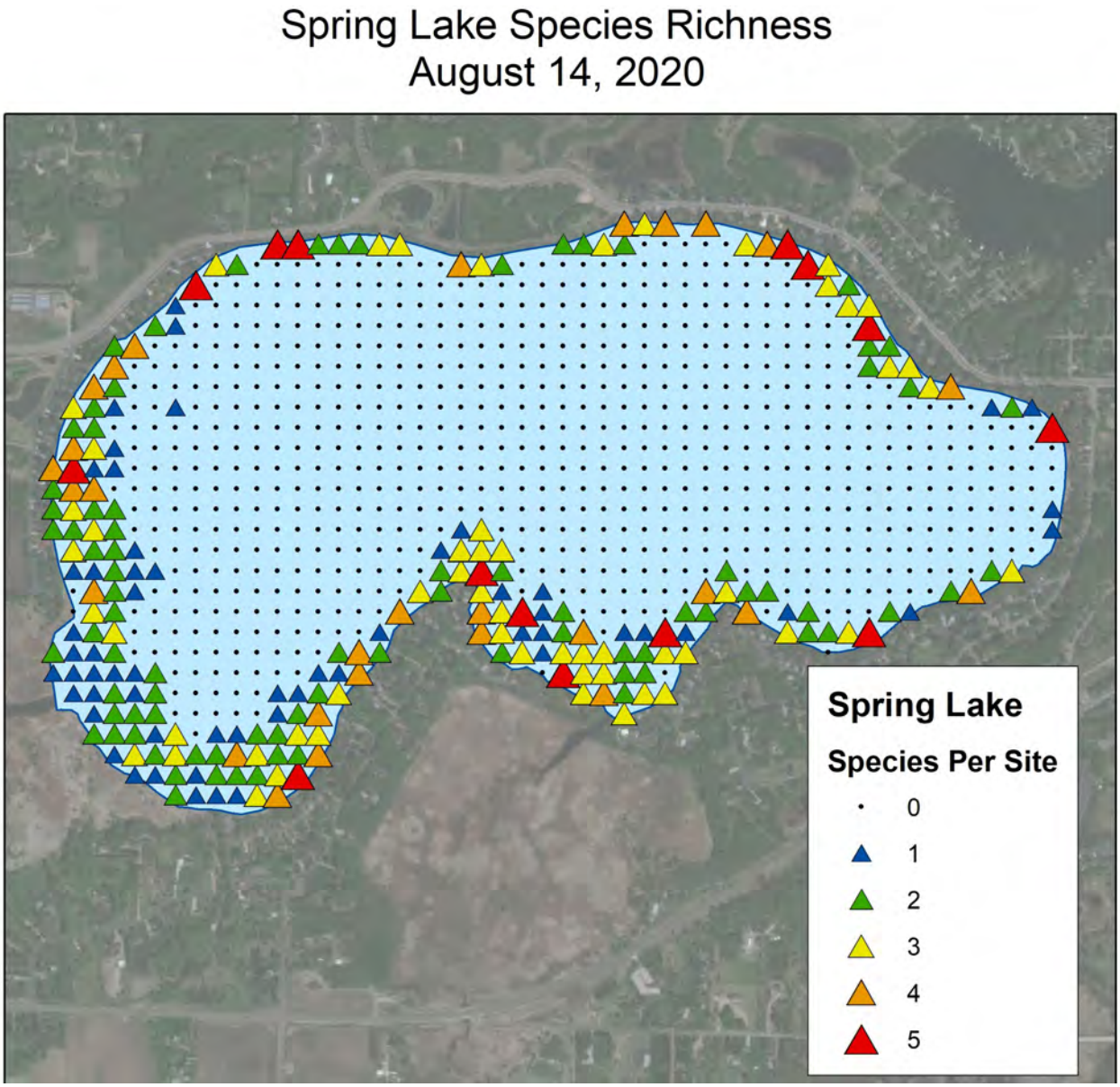


Figure 7. Species Richness or the number of species per site for the point intercept survey on August 14, 2020.

Spring Lake Point Intercept Survey Statistics: A summary of plant statistics from the point intercept survey is shown in Tables 3 and 4 and Figure 8. A total of 352 points were sampled and plants were found out to 9 feet of water which included 298 sample points out to 9 feet. But 95% of plant growth occurred from 1-8 feet. Plant occurrence and abundance for individual sites are shown in the Appendix.

Table 3. MnDNR Template Statistics

Total # Points Sampled	352
Depth Range of Rooted Veg	1-9 feet
Maximum Depth of Growth (95%) in feet	8.0
# Points in Max Depth Range	263
# Points in Littoral Zone (0-9 feet)	298
% Points w/ Submersed Native Taxa	50
Mean Submersed Native Taxa/Point	0.9
Mean Density of Submersed Native Taxa	1.1
# Submersed Native Taxa	14

Table 4. Aquatic plants sampled by depth.

Depth Bin (Feet)	# points sampled (0-9 ft)	% Sampling points with submersed species observed
0	0	0
1	4	100%
2	21	100%
3	64	100%
4	56	100%
5	35	97%
6	26	96%
7	35	63%
8	22	36%
9	35	14%
10	19	0
11	12	0
12	14	0
13	5	0
	298	

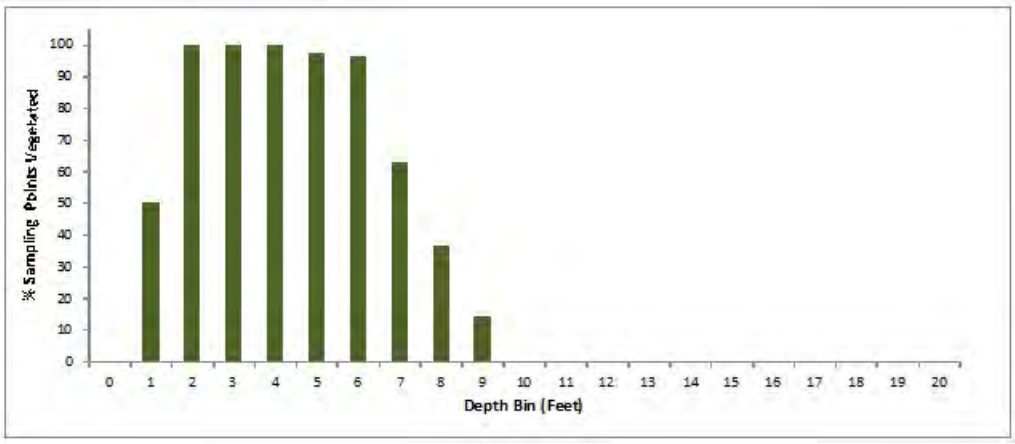


Figure 8. Depth of plant colonization (in feet).

Aquatic Plant Maps: Coverage of the select native plants species found in the August 2020 survey are shown in Figures 9 and 10.

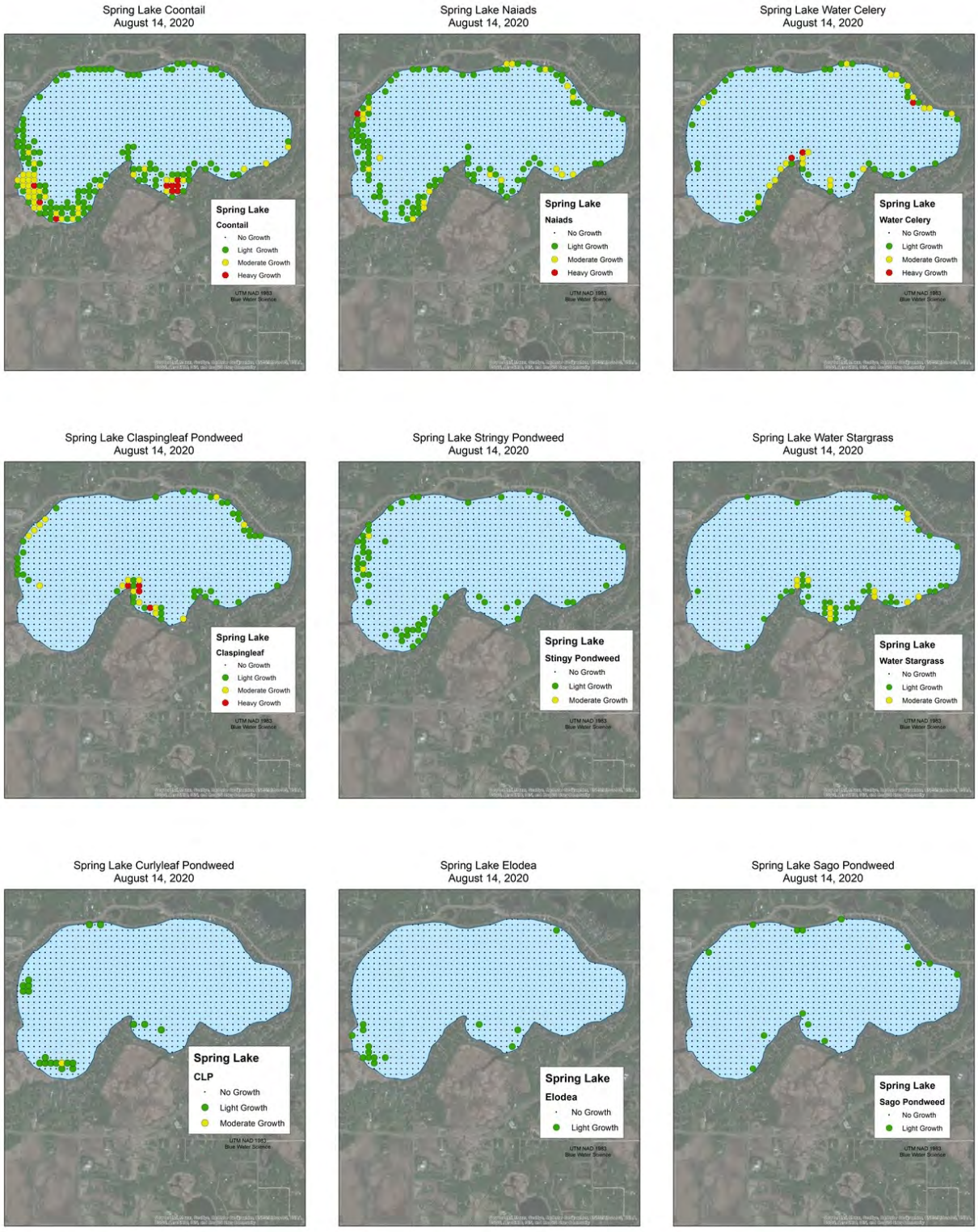


Figure 9. Distribution and abundance maps for common submerged aquatic plant species in Spring Lake on August 14, 2020.

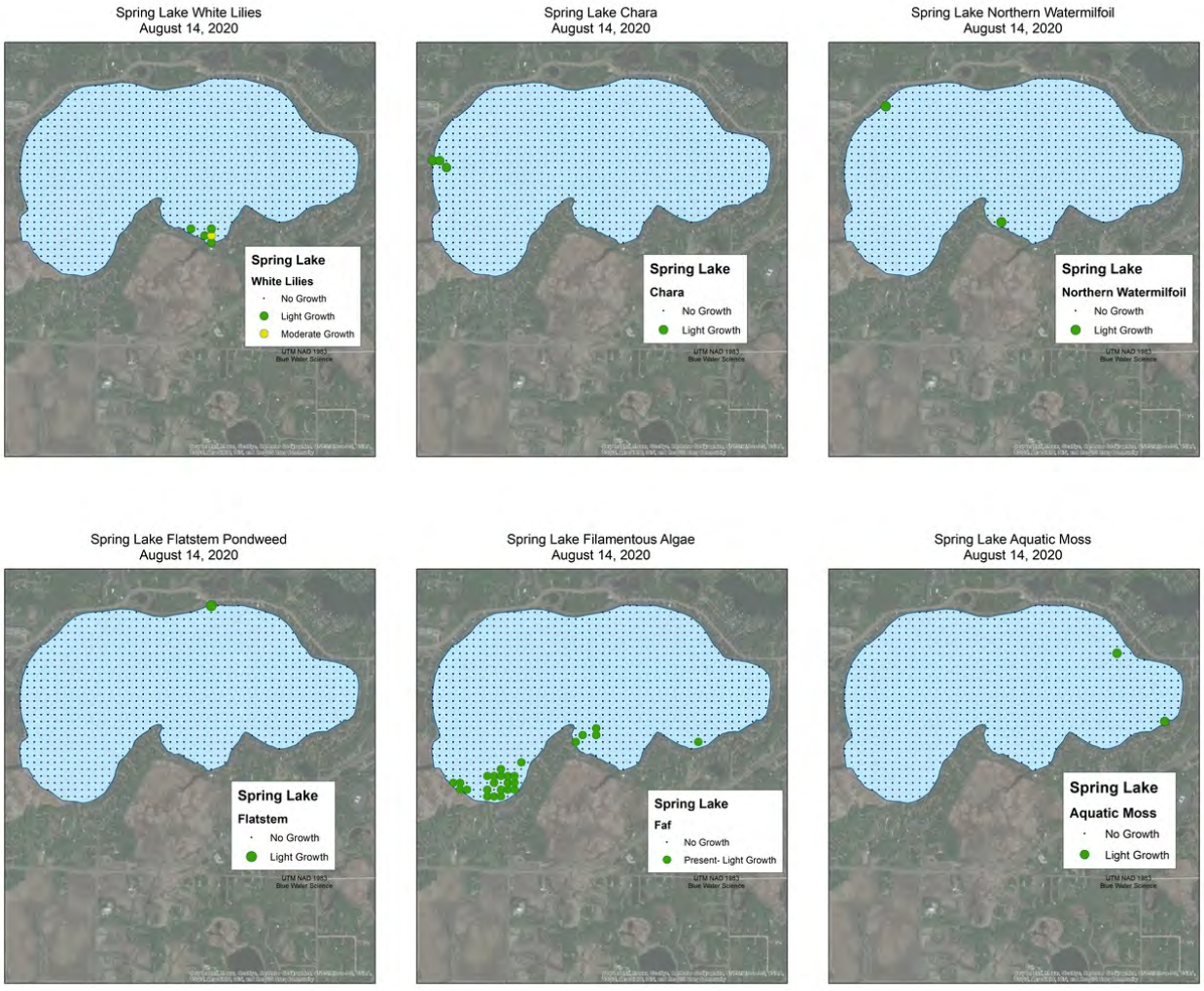


Figure 10. Rare aquatic plant species (Percent occurrence 5% or less) in Spring Lake on August 14. 2020. White lilies, chara, northern watermilfoil, flatstem pondweed, filamentous algae and aquatic moss. Key: green = light growth, yellow = moderate growth, and red = heavy growth.

Comparison of 2015, 2018, 2019, 2020 Point Intercept Surveys

Point intercept surveys were conducted on Spring Lake in 2015, 2018, 2019, and 2020, and results are shown in Table 5. In 2015, elodea was the dominant plant but since then coontail has been dominant (Table 5). Several species increased in occurrence since 2015 including coontail, claspingleaf pondweed, water celery, and water stargrass. Elodea and sago pondweed have decreased (Table 5).

Table 5. Spring Lake aquatic plant occurrence for the point intercept surveys conducted in 2015, 2018, 2019, and 2020.

	2015 % Occur (113 sites)	2018 % Occur (248 sites)	2019 % Occur (214 sites)	2020 % Occur (298 Sites)
Cattails (*Typha sp*)		1		1
Duckweed (*Lemna sp*)		1		1
White water lilies (*Nymphaea ordata*)		1	5	2
Coontail (*Ceratophyllum demersum*)	15	56	47	51
Chara (*Chara sp*)	4	2	2	1
Chara - 2 (*Chara sp*)		1		
Moss (*Drepanocladus sp*)		1	2	1
Elodea (*Elodea canadensis*)	42	36	3	5
Water stargrass (*Heteranthera dubia)*	5	12	10	19
Northern watermilfoil *(Myriophyllum sibiricum)*				1
Naiads (*Najas flexilis*)	21	23	9	39
Curlyleaf pondweed (*Potamogeton crispus*)	12	6		7
Claspingleaf pondweed (*P. Richardsonii*)	4	10	10	20
Stringy pondweed (*P. sp*)	29	7	4	19
Flatstem pondweed *(P. zosteriformis)*				1
Sago pondweed (*Stuckenia pectinata*)	17	11	9	5
Bladderwort (*Utricularia vulgaris*)		1		
Water celery (*Vallisneria americana*)	9	20	23	21
Number of submerged species	10	13	10	14

Native Plant Coverage Comparisons : Native aquatic plant distribution may have decreased slightly from 2015 to 2019 but then increased in 2020 based on point intercept survey results (Figure 11). In 2015, plants grew to a depth of 9 feet and covered an estimated 175 acres of the lake (29%). In 2018, plants were found out to a depth of 8 feet and covered an estimated 122 acres of the lake (198 sites with plants 21%). In 2019, plant coverage was estimated at 98 acres or about 17% of the lake area (150 sites with plants). In 2020, plants grew out to 9 feet and covered approximately 25% of the lake bottom (Figure 11).

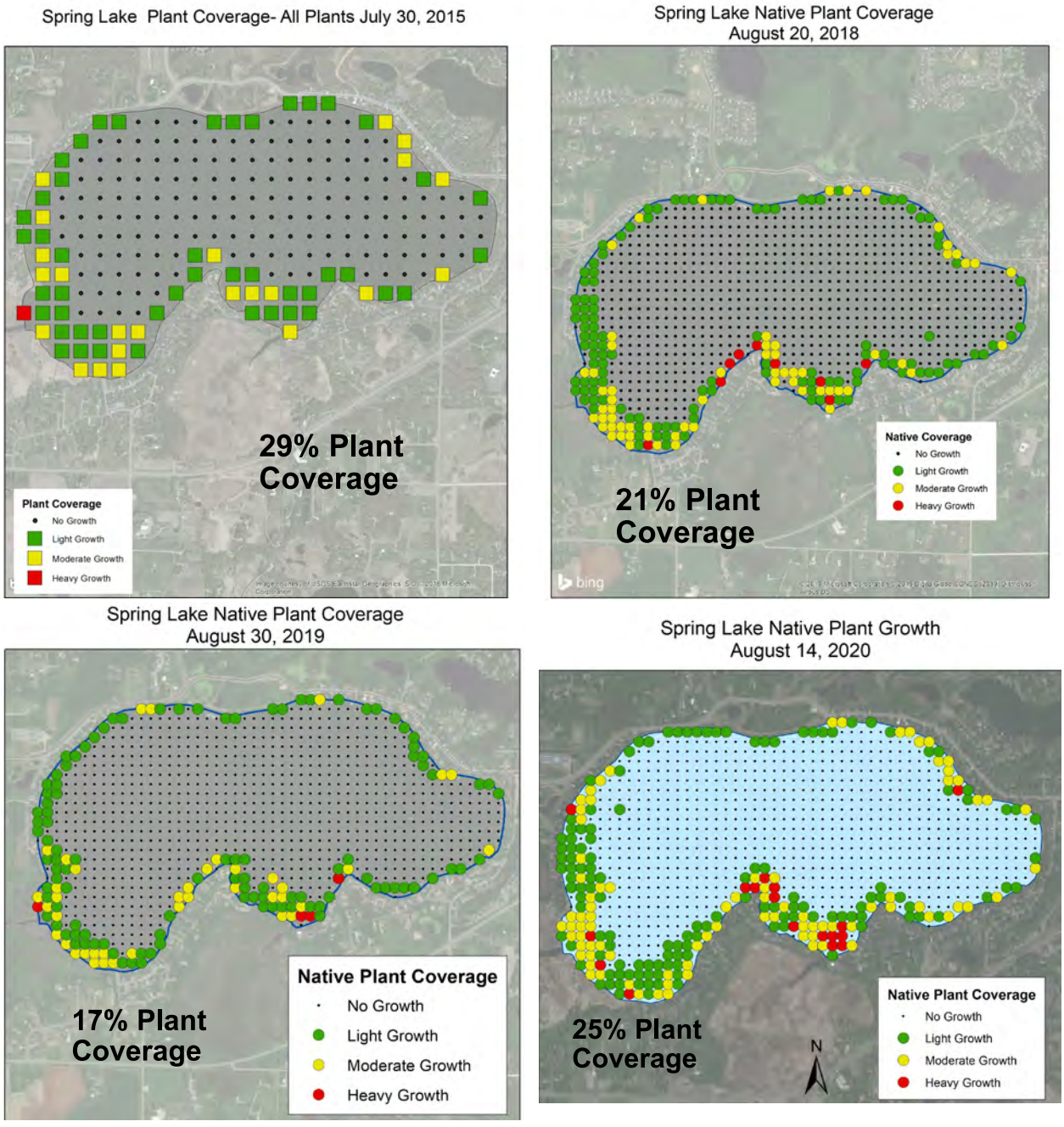


Figure 11. Aquatic plant distribution and abundance for the point intercept surveys in 2015, 2018, 2019, and 2020. Key: green = light growth, yellow = moderate growth, red = heavy growth, and black dot = no growth.

Summary of Aquatic Plant Surveys from 1948 - 2020

Since 1948, specific plant species in Spring Lake have appeared and disappeared (Table 6). For a number of years, stringy pondweed, likely a *P. pusillus*, was the dominant plant species. However, from 2018 through 2020, coontail was the dominant plant (Table 6).

The number of aquatic plant species has range from a low of 5 to a peak of 14 which was recorded in 2020 (Table 6).

Table 6. Aquatic plant status for 1948 to 2020.

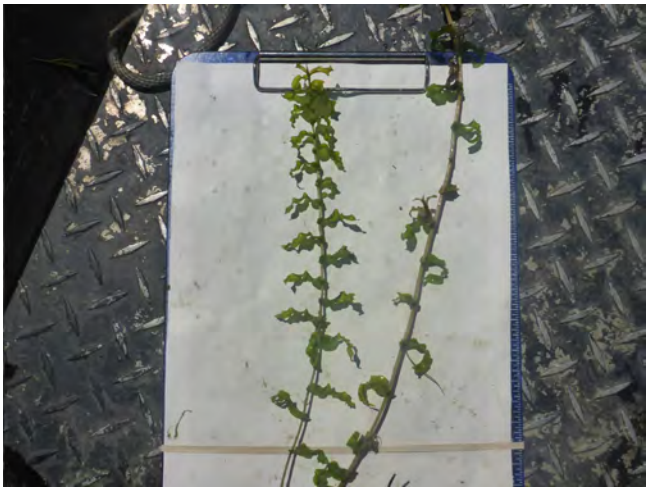
	Dominant Plant Occurrence (% occurrence based surveys)	Dominant Species in Mid Summer Survey	Number of Plant Species
1948	Rare (MnDNR)	All rare	7
1973	Rare-Common (MnDNR)	5 - common	8
1982	Rare-Common (MnDNR)	Coontail	8
1986	Present (MnDNR)	3 species	5
1988	Present-Occasional (MnDNR)	Sago + water stargrass	8
2000	40	Curlyleaf	9
2002	36	Sago	9
2004	68	Elodea	9
2005	76	Elodea	9
2006	48	Coontail	8
2007	30	Coontail	6
2008	24	Stringy	9
2009	66	Stringy	9
2010	34	Stringy	7
2011	64	Stringy	6
2012	72	Stringy	4
2013	19	Stringy	5
2014	48	Stringy	5
2015	42 (PI survey)	Elodea	10
2016	38	Elodea	6
2017	86	Stringy	8
2018	56 (PI survey)	Coontail	13
2019	47 (PI survey)	Coontail	10
2020	52 (PI survey)	Coontail	14

Supplemental Data For Spring Lake

Common Aquatic Plants in Minnesota

Chara (*Chara sp*)

Claspingleaf pondweed (*Potamogeton richardsonii*)



Coontail (*Ceratophyllum demersum*)

Curlyleaf Pondweed (non-native)(*Potamogeton crispus*)

Eurasian watermilfoil (non-native)
(*Myriophyllum spicatum*)

Flatstem pondweed (*Potamogeton zosteriformis*)(WDNR)

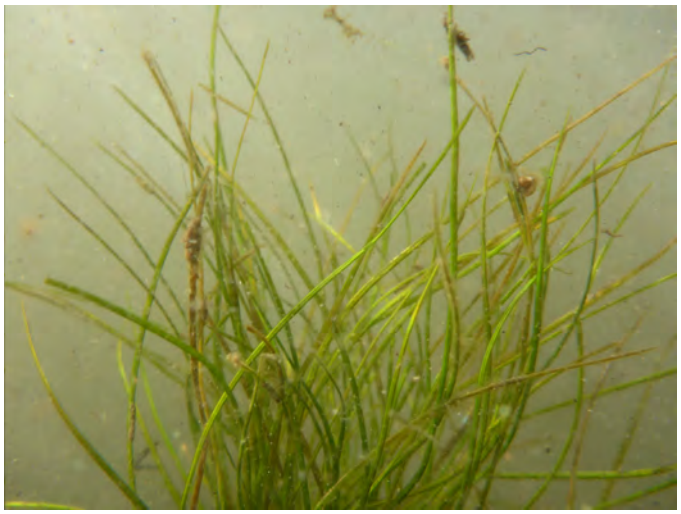
Naiad (*Najas sp*)

Sago pondweed (*Stuckenia pectinata*)

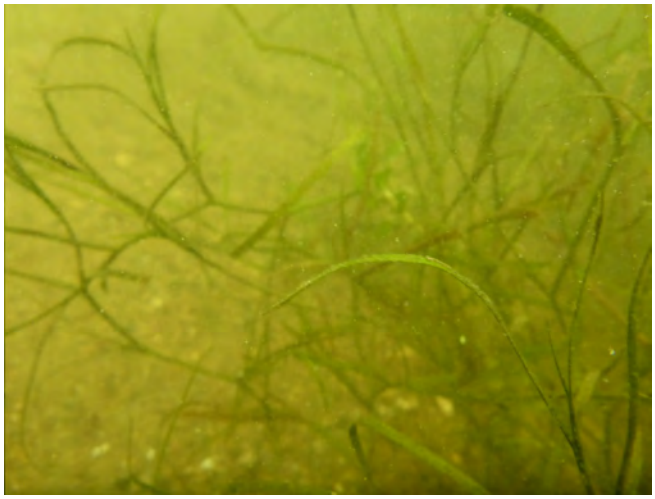
Water celery (*Vallisneria americana*)

Northern watermilfoil (*Myriophyllum sibiricum*)

Stringy pondweed (*Potamogeton pusillus*)



Water stargrass (*Heteranthera dubia*)



Spring Lake CLP Delineation, Individual Site Data April 30, 2020

Aquatic plant densities based on rake sampling for April 30, 2020. Densities are based on a scale from 1 to 3 with 3 being the densest. Curlyleaf stems per rake sample were also noted.

Waypoint	Depth (ft)	CLP-stems	Chara	Coontail	Elodea	No plants
1	5					1
2	5					1
21	5			1		
22	5	8	1	1		
23	3	9				
24	6	1				
25	7					1
26	7					1
27	6					1
28	6					1
29	5	6				
30	5	16				
31	4	10		1		
32	3			1		
33	4					1
34	4					1
35	4					1
36	4	6				
37	5	11				
38	5					1
39	5	1				
40	6					1
41	8					1
42	8					1
43	7					1
44	6	2				
45	3	6				
46	4	9				
47	4	7				
48	3					1
49	3					1
50	4					1
51	3					1
52	4					1
53	4					1
54	4					1
55	5					1
56	7					1
57	8					1
58	7					1
59	3					1
60	3					1
61	2					1
63	3					1
64	3					1
65	5					1
66	7					1
68	9					1
69	8					1
70	6					1
71	4	3		1		
72	3	14				
73	2					1
74	2					1
75	2	2		1		
76	3	6		1	1	
77	5					1
78	5	1		1		
79	8					1
80	7					1
81	3			2		
82	4			2		
83	4			1		
84	4	20		1		
85	5	20		1		
86	5	16				
87	5	8				
88	6	2				
89	7					1
90	8			1		
91	7					1
92	6			1		
93	6					1

Waypoint	Depth (ft)	CLP-stems	Chara	Coontail	Elodea	No plants
94	6			1		
95	5	1				
96	4			1		
97	4	3				
98	5	15				
99	4	16		1		
100	3			1		
101	5			1		
102	5	2				
173	6	3				
174	6	3				
175	6	2				
176	6					1
177	6					1
178	6					1
179	6	6				
180	5	8				
181	5	6				
182	4					1
183	5	2				
184	5	5				
185	5	1				
186	5					1
187	3					1
188	4					1
189	8					1
194	5	1				
195	4	3				
197	4	1				
198	5	14				
199	6					1
200	6					1
202	6	5				
203	5	12				
204	4					1
209	5	9				
210	5	7				
211	7					1
216	6	14				
217	5	12				
218	5	2				
219	4	6				
220	3					1
221	4	1				
223	4	5				
224	5	5				
225	5	12				
226	7					1
229	6	2				
230	5	10				
231	5	12				
232	4	8				
233	4					1
238	4	2				
239	4					1
240	5	7				
241	5	6				
242	6	3				
243	7					1
246	6					1
247	6					1
248	5	6				
254						1
Average		6.8	1.0	1.1	1.0	
Occur (254 sites)		62	1	20	1	63

Spring Lake CLP Assessment, Individual Site Data June 11, 2020

Aquatic plant densities based on rake sampling for June 11, 2020. Densities are based on a scale from 1 to 3 w ith 3 being the densest.

Waypoint	Site	Depth ft)	Chara	Claspingleaf	Coontail	CLP	CLP-dead	Moss	Sago	Stringy	Water celery	Water stargrass	No plants
	1	4			1	1							
	2	6			1	1							
	3	5			1								
	4	7											1
	5	4							1		1	1	
	6	10											1
	7	3		1									
	8	5		1									
	9	3			3								
	10	6			1	1							
	11	4		1									
	12	7											1
	13	4		1									
	14	8											1
	15	5			1								
	16	9											1
	17	5		1									
	18	8											1
	19	4						1					
	20	8											1
	21	4		1									
	22	9											1
	23	4		1							1		
	24	9											1
	25	4											1
	26	8											1
	27	4											1
	28	7	1										
	29	5			1								
	30	8											1
	31	4		1									
	32	8											1
	33	4			1						1		
	34	8											1
	35	4											1
	36	6											1
	37	4			1				1	1			
	38	7				1							
	39	5			1								
	40	8											1
	41	4		1	1					1	1		
	42	7											1
	43	4			1				1				
	44	7											1
	45	4			1	2							
	46	7											1
	47	4			1								
	48	7											1
	49	4			1	3							
	50	7			1								
273	3					1							
274	4												1
275	5					3							
276						3							
277					2								
278	4					1							
279	5					3							
280	5					3							
281	5					2							
282	5					1							
283	6					2							
284	3				2								
285	3				1								
286	3				1								
287	3						2						1
288	3			1									
289	4			1									
290	5			1		1							
291	5			3		1							
292	6					1							
293	7												1
294													1
295													1
296													1
297													1
298													1

Aquatic plant densities based on rake sampling for June 11, 2020. Densities are based on a scale from 1 to 3 w ith 3 being the densest.

Waypoint	Site	Depth ft)	Chara	Claspingleaf	Coontail	CLP	CLP-dead	Moss	Sago	Stringy	Water celery	Water stargrass	No plants
299													1
300													1
301													1
302													1
303	5			1									
304													1
305													1
306				1									
307													1
308													1
309													1
310													1
311													1
312	5					1							
313	5					3							
314						3							
315						3							
316	4					1							
317						1							
318						1							
319						3							
320													1
321	4												1
322													1
323						3							
324						3							
325													1
326	5					3							
327	5					1							
328	5					2							
329	5					3							
330	6					2							
331	5					3							
332	5					3							
333	5					1							
334	5					3							
335	6												1
336	6												1
All sites	Average		1.0	1.1	1.2	2.0	2.0	1.0	1.0	1.0	1.0	1.0	
	Occur:	114	1	15	20	37	1	1	3	2	4	1	47
Sites	Average		1.0	1.0	1.1	1.5		1.0	1.0	1.0	1.0	1.0	
	Occur:	50	1	9	16	6		1	3	2	4	1	22
	% occur		2	18	32	12		2	6	4	8	2	
Waypoint	Average			1.3	1.5	2.1	2.0						
	Occur:	64		6	4	31	1						25

August 14, 2020: Individual site data for the point intercept survey.

Site	Depth (ft)	Cattails	Duckweed	White lilies	Chara	Clasping leaf	Coontail	CLP	Elodea	EWM	Flatstem	Fries	Moss	Naiads	NWM	Sago	Stringy	Stringy-Narrow	Water celery	Water stargrass	FA	No plants
1	3						1							1								
2	3						3															
3	3						2														1	
4	4						1														1	
5	3						2							1					1		1	
6	2						1							2			1			1		
7	3						1														1	
8	3						1														1	
9	3						1							1								
10	3		1				2															
11	4						1	1													1	
12	5													1			1					
13	5						1	1													1	
14	4						2							1					1		1	
15	3						1							1		1	1		1		1	
16	3						2														1	
17	4						2	1	1												1	
18	4						1	1														
19	4						1	1									1					
20	5						1	1														
21	5						1	2														
22	6						1	1						1			1				1	
23	6						1	1									1					
24	5						2							1							1	
25	4						1							1							1	
26	2						1							2			1		1			
27	3						1		1													
28	3						2		1													
29	3						3		1													
30	5							1														
31	5						1		1					1								
32	6																					1
33	7																1				1	
34	7						1														1	
35	7													1			1				1	
36	6						1										1				1	
37	6						1							1			1				1	
38	3											1		2					2			
39	3						2															
40	4						2		1													
41	5						1							1								
42	6						2							1								
43	7																					1
44	8																					1
45	9																					1
47	8																				1	1
48	8						1															
49	7													1			1					
50	4						1							1			1		1			
51	2	1		1			1							1								
52	3						1															
53	3						2															
54	4						2		1													
55	6						2															
56	6						1							1								
57	8																					1
58	9																					1
60	10																					1
61	10																					1
62	9						1															
63	8						1															
64	7						1										1				1	
65	4						1							2						1		
66	2					1													1	2		
67	2			1			2							1						1		
68	3			2			3															
69	3						3		1					1								
70	2					2	1										1					
71	1		2				1															
72	3						2															
73	3						2															
74	9						3															
75	6						1															
76	7						1							1								
77	9																					1
78	9																					1
80	11																					1
81	11																					1
82	10																					1
83	10																					1
84	8						1															
85	5													1								
86	4						2							1			1		2			
87	1	1																				
88	2			1		2	1									1				1		
89	2					1													2	2		
90	3						3							1						1		
91	3			1			3															
92	4						3												1			
94	2		2				2		1													
95	3						2															
96	4						2															
97	6						2							1								
103	12																					1
107	11																					1
108	9						1									1						

Site	Depth (ft)	Cattails	Duckweed	White lilies	Chara	Clasping leaf	Coontail	CLP	Elodea	EWM	Flatstem	Fries	Moss	Naiads	NWM	Sago	Stringy	Stringy-Narrow	Water celery	Water stargrass	FA	No plants
109	5						1							1			1	1				
110	3													1					2			
111	3						1							1								
112	3					1	1								1							
113	3					3																
114	2					2	1													1		
115	2					1													2	2		
116	4						2							2						1		
117	6						2										1					
118	5						3													1		
119	5						2							1						1		
120	3						1							1						1		
122	3						2															
123	4						2		1													
124	6						2							1			1					
125	8																					1
126	9																					1
135	12																					1
136	9																					1
137	5						1															
138	3					1	2							1						1	1	
139	3					2								1					1			
140	4						1															
141	5																1					
142	5													2						1		
143	4						1	1						1						1		
144	8																					1
145	7						1															
146	9						1															
147	7						1		1								1		1	1		
148	5						1															
149	3					1													1	1		
150	3																		1	1		
151	4													2						1		
152	4						1										1		1		1	
153	4					1	1							2			1			2		
154	1	3																				
155	2								1					1					1			
156	5						1							2								
157	9																					1
169	10																					
170	4													1			1		2	1		
171	3					1	1	1											1			
172	4						1									1				1	1	
173	5						2	1	1					1			1					
174	7						1														1	
175	6						1							1								
176	9																					1
177	11																					1
178	11																					1
179	11																					1
180	10																					1
181	7						1							1								
182	3					1													2			
183	4					1	1												1	2		
184	5																					1
185	6						1															
186	5													2						1		
187	10																					1
188	9																					1
189	10																					1
190	5						2												1			
191	3																			2		
193	4						1							1					1	1		
194	4						2							1								
195	7						1															
196	8																					1
208	8																					1
209	3					1													2	1		
210	2																		1	1		
211	2					2								1					2			
212	3					3																
213	7																					1
214	8						1														1	
215	10																					1
216	12																					1
217	16																					1
221	9																					1
222	6					1	1							1						1		
223	3					1													1	1		
224	6													1						2		
225	9					1	1															
226	10																					1
227	11																					1
228	12																					1
229	16																					1
231	12																					1
232	9																					1
233	8																					1
234	6													1						1		
235	5						2							1					1	1		
236	3						1															
237	3						1															
238	4													1			1					
239	2					2																
240	6													2								
241	9																					1
252	10																					1
253	7																					1

Site	Depth (ft)	Cattails	Duckweed	White lilies	Chara	Clasping leaf	Coontail	CLP	Elodea	EWM	Flatstem	Fries	Moss	Naiads	NWM	Sago	Stringy	Stringy-Narrow	Water celery	Water stargrass	FA	No plants
254	3					2													3			
255	3					3	1													2		
256	1					1								1		1			2	1		
257	3					3														1		
258	9																					1
259	12																					1
267	7																					1
268	8													1						1		
269	12																					1
270	13																					1
271	12																					1
279	11																					1
280	9																					1
281	7																1			1		
282	3					1							1							1		
283	3						1							1			1					
284	4					1	2															
285	5						1							1								
286	7						1															
300	8																					1
301	6						1															
302	4					2	1													2		
303	2					1													3	1		
304	5					2													2	2		
305	15																					1
314	12																					1
315	13																					1
329	10																					1
330	7																					1
331	2					1	1															
332	3					1	1															
333	5						1							1			1					
334	6													1			1					
335	8																					1
336	9																					1
349	11																					1
350	10																					1
351	8						1															
352	7						1							1						1		
353	12																					1
379	12																					1
380	5						2															
381	3					1	1															
382	4						1							1			1					
383	5													1			2					
384	7						1							1								
385	9																					1
402	16																					1
430	7						1															
431	2					1								1								
432	4						1	1						1			1					
433	6				1			1						1			1					
435	10																					1
480	11																					1
481	2				1	1	1							1								
482	4				1		1	1						1			1					
483	6							1														
484	7																1					
485	10																					1
530	13																					1
531	3					1	1							1					1			
532	5							1						1			1					
533	8																1					
534	10																					1
579	13																					1
580	3						1							1								
581	5													2			1					
582	8																					1
583	10																					1
627	7																					1
628	4													1		1	1		1	1		
629	2					1								3			1					
630	4													2			1					
631	7													1								
632	9																					1
634	7																1					
673	12																					1
674	7													1								
675	4													1					1			
676	3																		2			
677	3					2								1			1		1			
678	6													2			2					
679	9																					1
680	12																					1
712	7																					1
717	5					1										1						
718	3					1								1					2			
719	3					1										1			2	1		
720	3					2								1			1		2			
721	7																					1
722	9																					1
756	9																					1
757	8												1	1								
758	4					1								1					3			
759	3					1													1	1		
760	2													1			1					
761	4					2	1									1			1			
796	10																					1
797	6													2					1			

Site	Depth (ft)	Cattails	Duckweed	White lilies	Chara	Clasping leaf	Coontail	CLP	Elodea	EWM	Flatstem	Fries	Moss	Naiads	NWM	Sago	Stringy	Stringy-Narrow	Water celery	Water stargrass	FA	No plants
798	3					2													2			
799	3					2													1			
800	7													1								
832	13																					1
833	7																					1
834	3					1								1		1			1	2		
835	4									1												
836	8																					1
849	8																					1
867	11																					1
868	4					1								2			1					
869	3					1													2	2		
870	4					1	1							1			1		1			
871	7																					1
872	9																					1
901	6													1			1			1		
902	4																		1	1		
903	3						1							1					1			
904	5						1										1					
905	7																					1
906	9																					1
907	9																					1
908	12																					1
909	11																					1
912	9																					1
913	9																					1
914	7																					1
915	4						1							1		1				1		
916	4						1									1	1					
917	5						1							1								
918	7																					1
919	9																					1
920	9																					1
931	8																					1
932	4					1	1		1					1					2			
933	3					1								1					2			
934	3						1							1			1		1	1		
935	4						1							1		1	1		1			
936	5						1	1														
937	5						1							1								
938	5						1	1														
939	4						1							1					1			
940	4						1							1					1			
941	4					1													1			
942	4													1					1			
943	6						1							1			1					
944	7						1							1								
945	9																					1
946	9																					1
947	9																					1
948	10																					1
950	4													1			1			1		
951	4					1	1							2						1		
952	4					2	1							1					1	1		
953	4										1			2		1			1			
954	4						1							2					2			
955	4					1	1							1					1			
956	4					1	1							1			1					
Average		1.7	1.7	1.2	1.0	1.4	1.3	1.1	1.0	1.0	1.0	1.0	1.0	1.2	1.0	1.0	1.0	1.0	1.4	1.2	1.0	
Occur:	352	3	3	5	3	59	154	20	14	1	1	1	2	116	1	14	57	1	64	56	26	112
% occur		1	1	1	1	17	44	6	4	0	0	0	1	33	0	4	16	0	18	16	7	