Big Round Lake, August 27, 2020

Curlyleaf Pondweed Delineation for Big Round Lake, Polk County, WI, 2020

Aquatic Plant Surveys Conducted on May 27, 2020

Prepared for:
Big Round Lake Protection and Rehabilitation District, Polk County, Wisconsin

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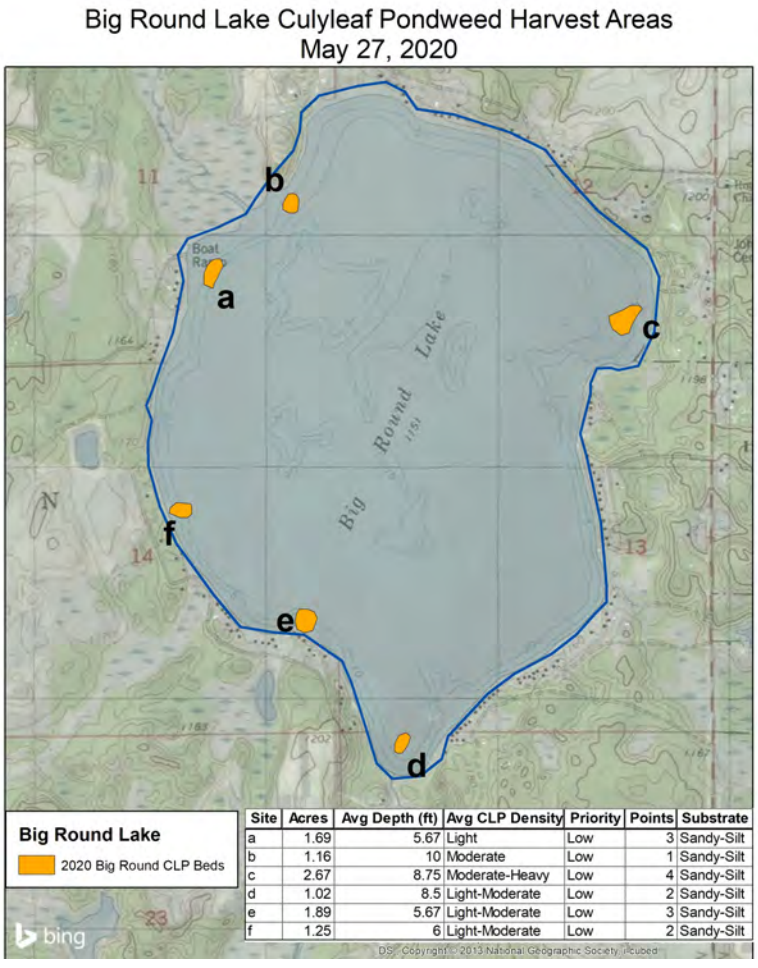
November 25, 2020

Curlyleaf Pondweed Delineation for Big Round Lake, Polk County, WI, 2020

Big Round Lake Statistics
Size: 1,015 acres
Average Depth: 10 ft
Maximum Depth: 17 ft

Big Round Lake Curlyleaf Pondweed on May 27, 2020: Based on a meander survey curlyleaf pondweed in Big Round Lake was fairly widespread but at mostly light growth. In 2020, curlyleaf pondweed was found in six areas with some clustering (Figure 1). Curlyleaf pondweed was the dominant species in these areas and other common plants that were found included coontail, flatstem pondweed, and northern watermilfoil. Aquatic plants were distributed out to 12 feet of water depth although they were most common in water depths out to about 9 feet. Plants were sparse in the deeper water.

Based on the CLP meander survey curlyleaf growth was found to be light to moderate. The delineated areas were a low priority for harvesting (Figure 1). No harvesting was recommended for 2020.



Site	Acres	Avg Depth (ft)	Avg CLP Density	Priority	Points	Substrate
a	1.69	5.67	Light	Low	3	Sandy-Silt
b	1.16	10	Moderate	Low	1	Sandy-Silt
c	2.67	8.75	Moderate-Heavy	Low	4	Sandy-Silt
d	1.02	8.5	Light-Moderate	Low	2	Sandy-Silt
e	1.89	5.67	Light-Moderate	Low	3	Sandy-Silt
f	1.25	6	Light-Moderate	Low	2	Sandy-Silt

Figure 1. The meander survey for curlyleaf pondweed, a non-native species, was found to be widely distributed but with mostly light growth.

Additional Information on Aquatic Plant Surveys and Water Quality for Big Round Lake, Polk Co, WI, 2020

Methods of Plant Surveys

Curlyleaf Pondweed Meander Survey: Based on the Aquatic Plant Management Plan that was accepted by the WDNR, curlyleaf pondweed delineations were to be conducted prior to mechanical treatment. A CLP meander survey using a zig-zag travel pattern around the entire nearshore area of Big Round Lake was conducted on May 27, 2020. Curlyleaf, along with other plants, were sampled with a rake. Visual observations were made between sample points. A density rating for rake sampling was assigned to each plant species for every sample. The density rating was on a scale from 1 to 3 with 1 representing a low density and 3 representing a surface matted growth condition (Figure 2).

Additional Points: To supplement the curlyleaf pondweed meander survey, a line transect survey with a random stratified sampling component was conducted on May 27, 2020. This survey method was briefly described by Nichols et al (2000)*. Based on the first line transect survey conducted in 2005, three depth intervals were established and include the depth zones of 0-4; 5-8; and 9-14 feet. Each depth interval was sampled once with a rake. A plant density was noted on a scale of 1 to 3.

Chart of Aquatic Plant Density Ratings

Figure 2. Aquatic plant density ratings.

* Nichols, S., S. Wieber, and B. Shaw. 2000. A proposed aquatic plant community biotic index for Wisconsin Lakes. Environ. Man. 26:491-502.

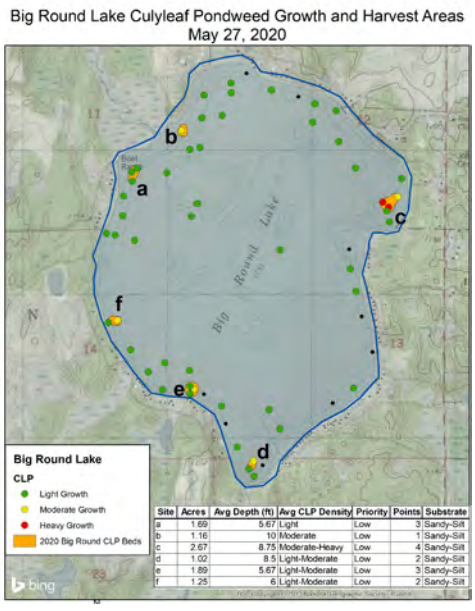
Early Summer Survey Summary in 2020: Survey results for aquatic occurrence for 2020 based on line transects with 3 depth zones per transect are shown in Table 1. Fourteen submerged plant species were observed in the May 27, 2020 survey (Table 1).

Curlyleaf pondweed was the most common plant and coontail was the next common on May 27, 2020. However curlyleaf pondweed abundance was mostly light to moderate and no curlyleaf control was recommended.

Table 1. The percent occurrence of aquatic plants for Big Round Lake found in 2020. Percent occurrence is calculated based on the number of times a plant species occurs at a sampling station on transects div ided into the number of total stations for the survey. For example, if milfoil was found in 25 out of 50 stations, its percent occurrence would be 50%.

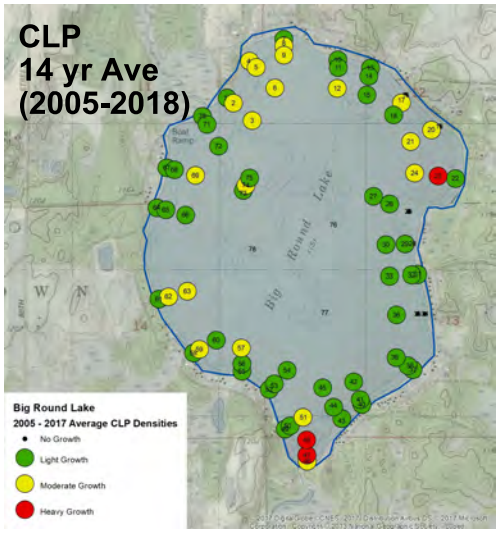
	May 27, 2020 % Occurrence (78 stations)
Cabbage	1
Chara	1
Claspingleaf pondweed	1
Coontail	26
Curlyleaf pondweed	42
Elodea	4
Flatstem pondweed	1
Fries pondweed	4
Illinois pondweed	3
Naiads	
Northern watermilfoil	8
Sago pondweed	
Star duckweed	17
Stringy pondweed	17
Water celery	
Water stargrass	1
Whitestem pondweed	8
Number of submerged species	**14**

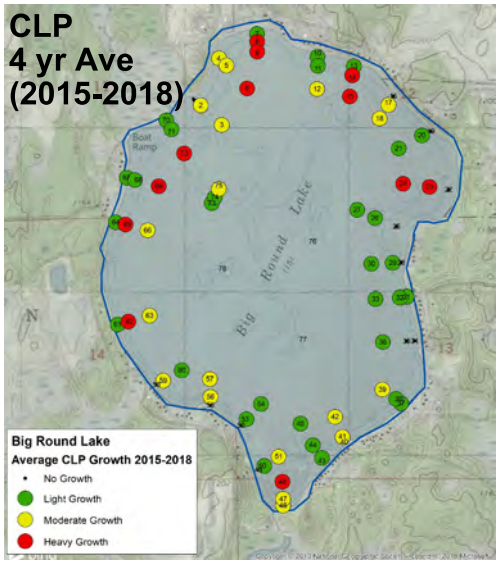
Curlyleaf pondweed sampled on May 27, 2020 in Big Round Lake.

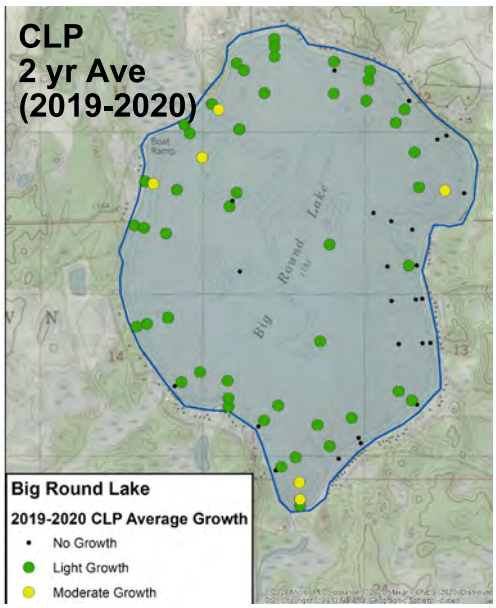


Map of all occurrences of curlyleaf pondweed.

Curlyleaf Pondweed Abundance Over the Years for Big Round







The distribution of curlyleaf pondweed has been fairly widespread in Big Round Lake. A 14-year average of CLP growth from 2005 through 2018, found CLP growth was mostly light to moderate.

However from 2015 through 2018, heavy CLP growth occurred in several areas around the lake. For example in the north end of Big Round, CLP growth was heavier compared to previous years (middle map)

Then in 2019-2020, CLP growth returned to less abundant growth, especially in the north end of the lake.

It appears CLP abundance varies over the years. Currently (in 2020), CLP growth is in a light to moderate abundance phase This is typically the more common status.

Figure 3. Maps showing average curlyleaf densities from 2005-2018 (top), 3 years of above average growth (middle), and average growth for 2019-2020 (bottom). Annual curlyleaf densities were rated on a scale from 0-3. For average densities on these maps light growth (green dot) had densities of 0.1-1. Moderate growth (yellow dot) had densities of 1-1.6 and heavy growth (red dot) had densities of 1.7-3.0.

APPENDIX

May 27, 2020: Plant Data for Meander Points and Transect Sites

Table 2. Big Round Lake aquatic plant occurrence and densities for the May 27, 2020 survey. Density ratings are 1-3 with 1 being the low and 3 being most dense.

Way Point	Site	Depth (ft)	Bulrush	Cab-bage	Chara	Clasp-ingleaf	Coon-tail	CLP	CLP feet below surface	Elodea	Flat-stem	Fries	Illinois	NWM	Star duck-weed	Stringy	Water star-grass	White-stem	FA
1		5					1	1											1
2		11						1											
3		10						1											
4		12					1	1											
5		9																	
6		10					1	1											
7		11																	
8								1											
9		10						1								1			
10		9						2										1	
11		9						3											
12		9						1											
13		7						1											
14		6																	2
15		6						1						1	1		1		1
16		9																	1
17		12																	
18							1												
19		11																	
20		10					1				1								
21		6					1	1											
22		6																	1
23		6																	1
24		6						2											
25		10						1											1
26		9						1											
27		10						1			1								
28		6					1	1											
29		6					2	1											
30		5					1								1				
	1	3					1												1
	2	8						2											
	3	10						1											
	4	4					1								2				
	5	6					3	1								1			
	6	9						1											
	7	4					1									1			
	8	7					2				1								
	9	11						1											
	10	4					3									1			
	11	8																	
	12	10														1			
	13	4																	
	14	8						1											1
	15	11						1								1			
	16	4																	
	17	6																	
	18	10						1								2			
	19	3																	
	20	6																	
	21	11						1											
	22	4			2														
	23	8						3	1										
	24	10					2									1		1	
	25	4														1			1
	26	8																	1
	27	10																	
	28	4																	
	29	8					2	1						1					1
	30	10																	
	31	4					1					1							
	32	8																	1
	33	12																	
	34	4																	

Table 2. Big Round Lake aquatic plant occurrence and densities for the May 27, 2020 survey. Density ratings are 1-3 with 1 being the low and 3 being most dense.

Way Point	Site	Depth (ft)	Bulrush	Cab-bage	Chara	Clasp-ingleaf	Coon-tail	CLP	CLP feet below surface	Elodea	Flat-stem	Fries	Illinois	NWM	Star duck-weed	Stringy	Water star-grass	White-stem	FA
	35	7																	1
	36	12																	
	37	5																	
	38	8					1	1							1				1
	39	11										1			1				1
	40	4																	2
	41	6				1				1					1				2
	42	9																	
	43	4																	1
	44	6						1											2
	45	12						1						1	1			1	
	46	4					2			1			1	1	1		1		
	47	8					1	1										1	
	48	11						2											
	49	4											1						
	50	8						1							1				1
	51	11					2												
	52	4																	1
	53	6						1											1
	54	12					1								1				1
	55	3						1											1
	56	8						1										1	
	57	10						1											
	58	3		1															
	59	6					1	1							1			1	
	60	12						1											
	61	4	1				1	1							1				
	62	8					1	2						1					
	63	11					1									1			
	64	5						1							1	1			
	65	7						1							1	1			
	66	11						1											
	67	4					1							1					
	68	7						1				1				1			
	69	11														1			
	70	4					1												
	71	6																	
	72	10						1											
	73	4						1										1	1
	74	4																	1
	75	10						1		1				1					
	76	8						1											1
	77	5																	1
	78	6													1				2
All data	**Average**		**1.0**	**1.0**	**2.0**	**1.0**	**1.3**	**1.2**	**1.0**	**1.0**	**1.0**	**1.0**	**1.0**	**1.0**	**1.1**	**1.1**	**1.0**	**1.0**	**1.2**
	occur (136 sites)		1	1	1	1	29	52	1	3	3	3	2	7	15	14	2	7	30
	% occur		1	1	1	1	21	38	1	2	2	2	1	5	11	10	1	5	22
Sites	**Average**		**1.0**	**1.0**	**2.0**	**1.0**	**1.5**	**1.2**	**1.0**	**1.0**	**1.0**	**1.0**	**1.0**	**1.0**	**1.1**	**1.1**	**1.0**	**1.0**	**1.2**
	occur (78 sites)		1	1	1	1	20	33	1	3	1	3	2	6	13	13	1	6	23
	% occur		1	1	1	1	26	42	1	4	1	4	3	8	17	17	1	8	29
Way points	**Average**						**1.1**	**1.2**			**1.0**			**1.0**	**1.0**	**1.0**	**1.0**	**1.0**	**1.1**
	occur (30 sites)						9	19			2			1	2	1	1	1	7
	% occur						30	63			7			3	7	3	3	3	23

Big Round Lake Early Season Aquatic Plant Surveys Over the Years

Early Summer Conditions 1978-2020: The number of submerged aquatic plant species has remained somewhat stable with a range from 10 to 16 species documented from 1978 through 2020 (Table 3). There is not a decreasing nor an increasing trend. The distribution of plants, expressed by the percent occurrence from transect surveys, shows typical year-to-year variability. Curlyleaf pondweed also shows year-to-year variability (Table 3).

Table 3. The percent occurrence of aquatic plants for Big Round Lake for 1978 through 2020. Percent occurrence is calculated based on the number of stations a plant species is found divided into the total number of stations for the survey. For example, if milfoil was found in 25 out of 50 stations, its percent occurrence would be 50%.

	June 20, 1978 % Occur (112 stations)	June 21, 2005 % Occur (75 stations)	June 6, 2006 % Occur (81 stations)	June 12, 2007 % Occur (75 stations)	June 18, 2008 % Occur (75 stations)	June 15, 2009 % Occur (75 stations)	June 14, 2010 % Occur (75 stations)	June 23, 2011 % Occur (75 stations)	May 30, 2012 % Occur (75 stations)	June 14, 2013 % Occur (75 stations)	June 24, 2014 % Occur (78 stations)
Arrowhead	1	--	--	--	--	--	--	--	--	--	--
Bulrush	20	9	6	3	4	--	1	4	4	1	1
Duckweed	--	--	--	--	--	--	1	--	--	--	--
Spatterdock	12	8	--	5	8	5	3	3	4	--	1
Waterlily	1	--	4	--	--	--	1	--	--	--	--
Wild rice	1	1	--	--	--	1	--	--	--	--	--
Buttercup	2	1	--	5	--	3	8	1	3	--	--
Cabbage	3	4	2	1	4	8	11	1	4	11	--
Chara	--	27	1	--	1	7	8	8	5	--	4
Claspingleaf pondweed	19	32	12	17	12	17	16	1	9	3	18
Coontail	13	28	27	28	39	24	33	12	17	29	63
Curlyleaf pondweed	2	53	41	49	65	43	27	37	59	36	32
Elodea	1	12	7	5	8	7	13	1	15	12	23
Flatstem pondweed	--	41	35	24	25	20	51	24	19	16	38
Floatingleaf pondweed	1	--	--	--	--	--	--	--	--	--	--
Fries pondweed	--	--	--	--	--	--	--	--	--	--	--
Illinois pondweed	--	7	--	--	--	--	--	--	--	--	--
Naiads	--	--	--	--	--	--	1	--	--	--	6
Narrowleaf pondweed	--	--	--	--	--	--	1	3	--	--	--
Needle spike rush	--	1	--	--	--	--	--	1	--	--	--
Nitella	--	--	--	--	--	--	--	--	--	--	--
Northern watermilfoil	6	53	15	17	27	40	53	--	3	1	21
Sago pondweed	21	3	--	--	--	--	--	3	--	--	1
Sparganium	1	--	--	--	--	--	--	--	--	--	--
Star duckweed	8	15	30	35	19	17	53	31	16	8	5
Stringy pondweed	14	28	27	24	32	39	29	40	24	29	42
Water celery	--	5	--	4	1	1	12	3	--	--	3
Water stargrass	--	--	--	--	--	--	1	--	--	--	8
Whitestem pondweed	--	32	12	4	19	23	9	1	1	1	12
Filamentous algae	--	12	37	20	25	26	24	31	27	19	1
Number of submerged species	12	16	11	12	12	13	16	15	12	10	14

Table 3. Concluded.

	June 15, 2015 % Occur (78 stations)	June 3, 2016 % Occur (78 stations)	June 12, 2017 % Occur (78 stations)	June 8, 2018 % Occur (78 stations)	June 21, 2019 % Occur (78 stations)	May 27, 2020 % Occur (78 stations)
Arrowhead	--	--	--	--	--	--
Bulrush	--	--	4	--	--	1
Duckweed	--	--	--	--	--	--
Spatterdock	3	--	4	--	--	--
Waterlily	--	--	--	--	--	--
Wild rice	1	--	--	--	--	--
Buttercup	1	--	--	--	--	--
Cabbage	3	3	--	--	40	1
Chara	17	1	4	3	1	1
Claspingleaf pondweed	5	3	3	6	--	1
Coontail	33	33	21	64	--	26
Curlyleaf pondweed	33	41	68	58	53	42
Elodea	13	6	3	9	8	1
Flatstem pondweed	21	6	18	23	22	1
Floatingleaf pondweed	--	--	--	--	--	--
Fries pondweed	--	--	--	--	--	4
Illinois pondweed	--	--	--	--	--	3
Naiads	--	--	--	--	--	--
Narrowleaf pondweed	3	--	--	1	--	--
Needle spike rush	--	--	--	--	--	--
Nitella	--	--	1	--	--	--
Northern watermilfoil	31	21	13	32	5	8
Sago pondweed	--	--	--	--	--	--
Sparganium	--	--	--	--	--	--
Star duckweed	14	5	5	9	17	17
Stringy pondweed	21	19	6	9	13	17
Water celery	4	--	--	1	3	--
Water stargrass	1	--	--	1	--	1
Whitestem pondweed	6	5	10	4	4	8
Filamentous algae	49	10	1	23	26	29
Number of submerged species	15	12	11	13	10	14

Curlyleaf Pondweed Distribution in Big Round Lake

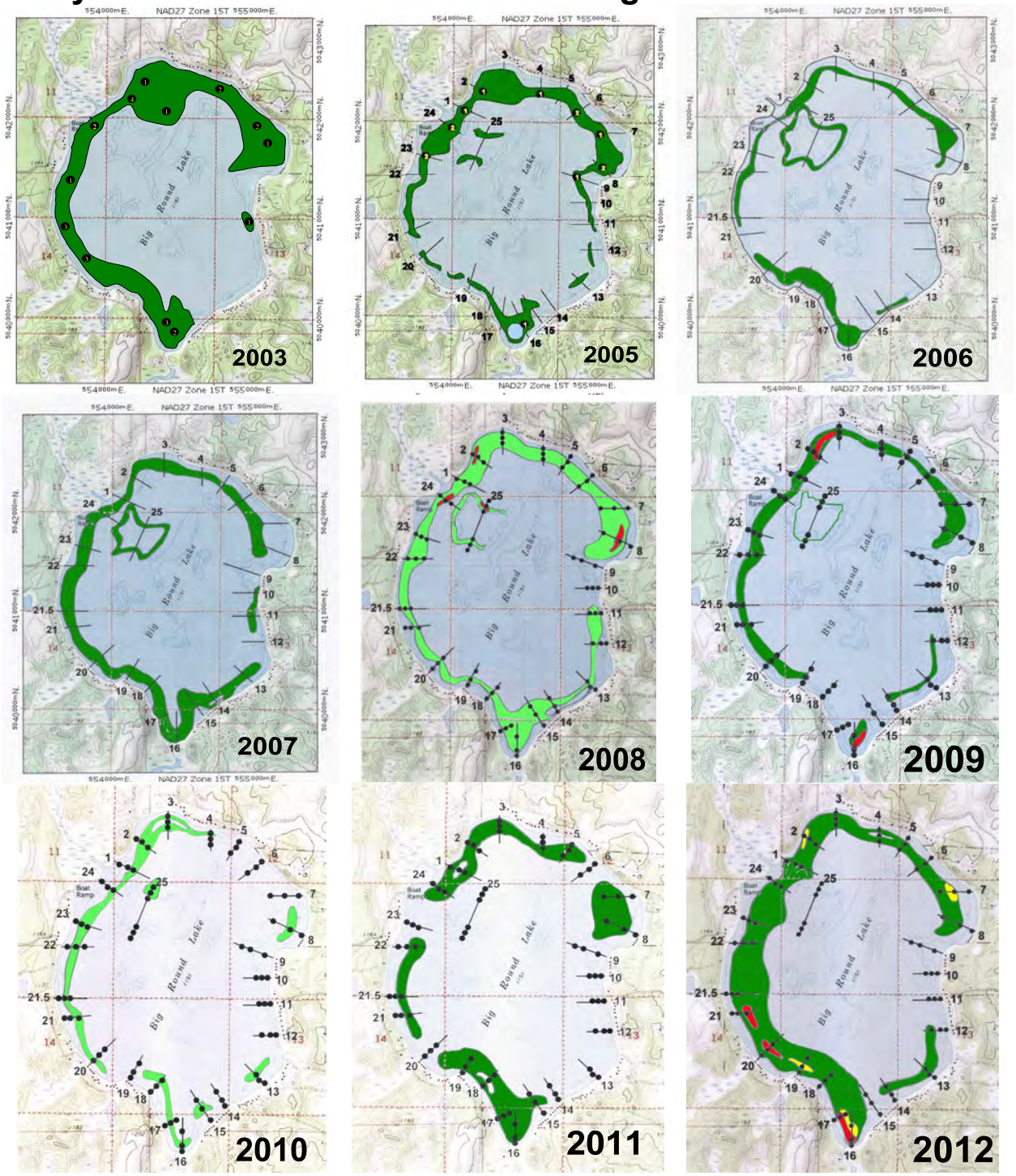


Figure 4. Curlyleaf pondweed coverage on May 7, 2003 was estimated at 315 acres. Curlyleaf pondweed coverage on June 21, 2005 was estimated at 260 acres. Curlyleaf pondweed coverage on June 6, 2006 was estimated at 160 acres. Curlyleaf pondweed coverage on June 12, 2007 was estimated at 210 ac. Curlyleaf pondweed coverage on June 18, 2008 was estimated at 250 ac. The red shading indicates curlyleaf at the surface and represents about 12 acres. Curlyleaf pondweed coverage on June 15, 2009 was estimated at 222 acres with approximately 10 acres of heavy growth of curlyleaf shown in red shading. Curlyleaf pondweed coverage on June 14, 2010 was estimated at 150 acres. Curlyleaf pondweed coverage on June 23, 2011 was estimated at 190 acres. Curlyleaf pondweed coverage on May 30, 2012 was estimated at 240 acres.

Curlyleaf Pondweed Distribution in Big Round Lake

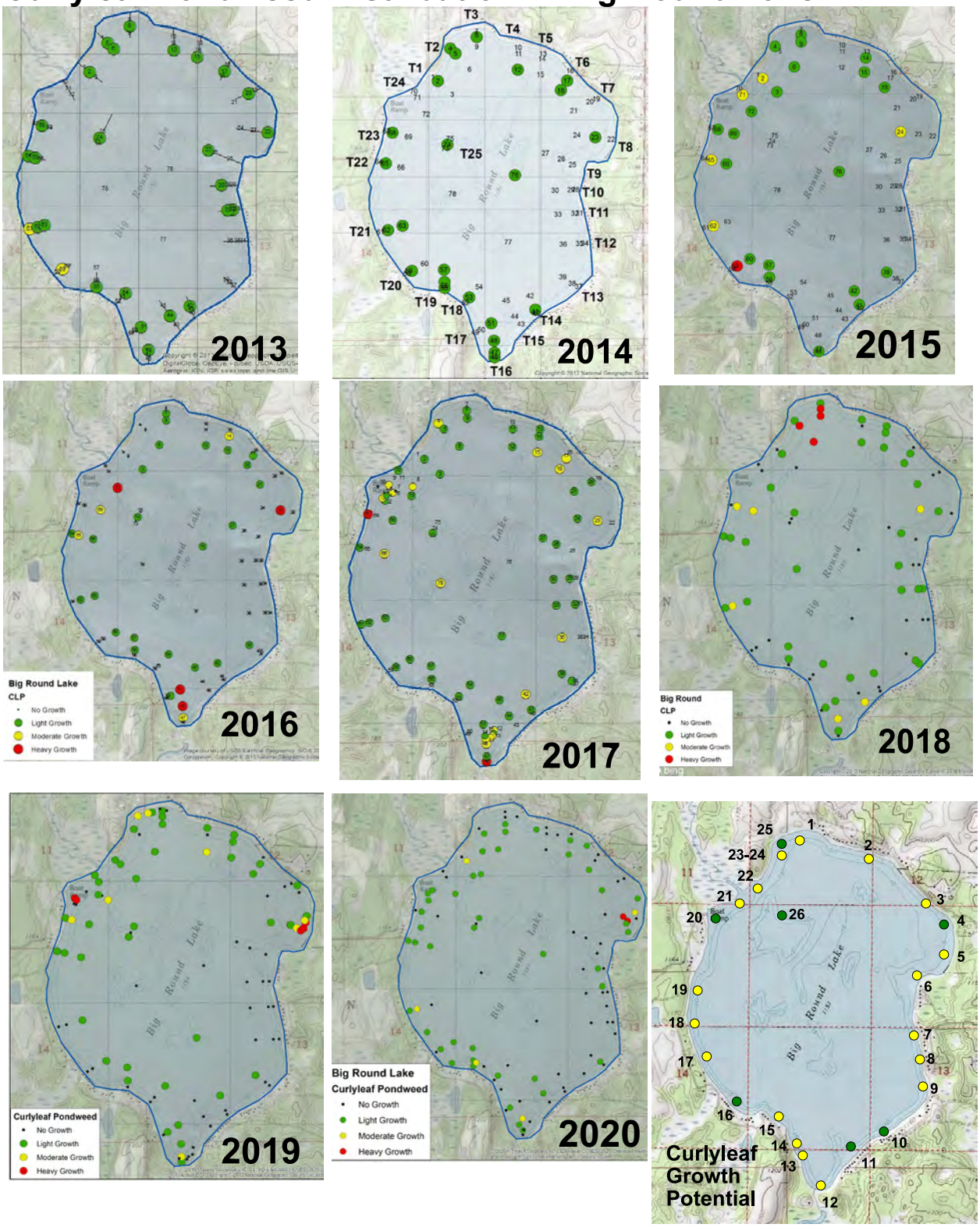


Figure 4. Curlyleaf pondweed coverage on June 14, 2013 was estimated at 215 acres. Curlyleaf pondweed coverage on June 24, 2014 was estimated at 190 acres of light growth. Curlyleaf pondweed coverage on June 15, 2015 was estimated at 200 acres of mostly light growth. Curlyleaf pondweed coverage on June 3, 2016 was estimated at 225 acres. Curlyleaf pondweed coverage on June 12, 2017 was estimated at 250 acres. Curlyleaf pondweed coverage on June 8, 2018 was estimated at 250 acres. Curlyleaf pondweed coverage on June 21, 2019 was estimated at 240 acres. Curlyleaf pondweed coverage on May 27, 2020 was estimated at 215 acres. Curlyleaf growth potential is shown on the lower right map.

Curlyleaf Pondweed in Big Round Lake from 1978 - 2020

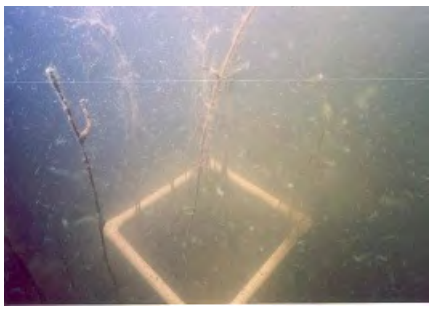
Curlyleaf pondweed is the only submerged non-native aquatic plant found in Big Round Lake. It was observed in 1978 at 2 out of 112 sites. Since 2003, curlyleaf has been widespread in Big Round Lake but growing at light to moderate densities (Table 4). A chart outlining growth categories is shown on the next page.

Table 4. Summary of curlyleaf pondweed occurrence in Big Round Lake.

Survey	Curlyleaf Acres	Curlyleaf Conditions	Percent Occurrence	Notes
1978 (6.20)	5	Moderate	2	Curlyleaf was not widespread
2003 (5.7)	315	No matted curlyleaf observed	--	Systematic survey was not conducted, just curlyleaf mapping. Mapping was early in the season, but later observations did not reveal much matting.
2005 (6.21)	260	Mostly light growth	53	No matted conditions observed.
2006 (6.6)	160	Light to moderate growth	41	No matted conditions observed.
2007 (6.12)	210	Mostly light growth, some close to surface	49	Curlyleaf was growing close to the surface in several areas, with some curlyleaf reaching the surface at T-8 and T-24.
2008 (6.18)	250	Light to moderate	65	Curlyleaf slightly more widespread than in 2007. Some curlyleaf reaching the surface, but less than 5 acres total.
2009 (6.15)	222	Light to moderate, with several patches of heavy growth	43	Curlyleaf frequency of occurrence was less than 2008, but there was heavy growth in the north and south ends totaling about 10 acres.
2010 (6.14)	150	Light to moderate.	27	Lowest curlyleaf frequency found since 2003. No matted conditions observed.
2011 (6.23)	190	Light to moderate.	37	Slightly more curlyleaf than 2010 but no matted conditions observed.
2012 (5.30)	240	Light to moderate with a couple patches of heavy growth	59	Curlyleaf pondweed was found around the perimeter of the lake. Matted conditions were observed in a few areas.
2013 (6.14)	215	Light to moderate	36	Fairly widespread distribution but slightly less then 2012. Mostly light growth was observed.
2014 (6.24)	190	Light	32	Curlyleaf pondweed was wide spread but growing at light conditions.
2015 (6.15)	200	Light	33	Light growth but fairly wide distribution
2016 (6.3)	225	Light	41	Light growth well distribution.
2017 (6.12)	250	Light	69	Light to moderated growth, distributed around Big Round Lake. Some heavy growth.
2018	250	Mostly light growth with some near surface	64	Transect 1 and 2 had heavy growth.
2019	240	Mostly light growth	53	Mostly light growth distribution around the lake.
2020	215	Mostly light growth	42	Light growth distribution around the lake.

Curlyleaf pondweed density rating chart which is a broad indicator of aquatic plant abundance.

Light Growth Conditions



Plants rarely reach the surface.

Navigation and recreational activities are not generally hindered.

Stem density: 0 - 160 stems/m^2
Biomass: 0 - 50 g-dry wt/m^2
Estimated TP loading: <1.7 lbs/ac

MnDNR and Blue Water Science rating: 1
WDNR rating: 1

Moderate Growth Conditions

Broken surface canopy conditions.

Navigation and recreational activities may be hindered.

Lake users may opt for control.

Stem density: 100 - 280 stems/m^2
Biomass: 50 - 85 g-dry wt/m^2
Estimated TP loading: 2.2 - 3.8 lbs/ac

MnDNR and Blue Water Science rating: 2
WDNR rating: 2

Heavy Growth Conditions

Solid or near solid surface canopy conditions.

Navigation and recreational activities are severely limited.

Control is necessary for navigation and/or recreation.

Stem density: 400+ stems/m^2
Biomass: >300 g-dry wt/m^2
Estimated TP loading: >6.7 lbs/ac

MnDNR and Blue Water Science rating: 3
WDNR rating: 3