SPY POND

2020 Aquatic Management Program

SŌLITUDE
LAKE MANAGEMENT

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INTRODUCTION

This report will serve to document the herbicide treatment program and summarize results from the vegetation surveys performed at Spy Pond this season. Attached to this report are figures depicting vegetation distribution.

2020 Treatment Summary

Management Activity	Date
Received License to Apply Chemicals (#WM-0000185)	May 11, 2020
Early-season point-intercept survey	May 12, 2020
Initial Sonar treatment	May 13, 2020
Sonar booster treatment	June 16, 2020
Final Sonar booster treatment	July 23, 2020
Late-season point-intercept survey	August 20, 2020

Based on the 2019 post-management survey efforts, and the notable increase in Eurasian watermilfoil (*Myriophyllum spicatum*), curly-leaf pondweed (*Potamogeton crispus*), and spiny/brittle naiad (*Najas minor*) throughout Spy Pond, a low-dose, whole lake Sonar (fluridone) herbicide treatment program was undertaken in 2020. A total of three treatment events occurred at Spy Pond over the course of the 2020 management season; dates of treatment are provided in the table above.

Herbicide quantities applied were calculated to provide the desired target concentration of Sonar throughout the entire lake, however, application was performed only within the areas of known Eurasian watermilfoil, curly-leaf pondweed and spiny naiad growth, or the littoral zone (where sunlight reaches the bottom of the pond for plant growth to exist). By applying where the plants are growing, provides increased herbicide exposure directly to the beds of the target growth prior to natural dispersal of the herbicide throughout the remainder of the pond volume.

The overall goal of conducting multiple treatments (initial application and booster applications) was to maintain a low concentration of Sonar herbicide within the water column for an extended period of time in order to effectively control the target species. Timing and dosing of booster treatments was guided by historical knowledge of growth at Spy Pond as well as other low-dose whole lake Sonar treatment programs throughout New England.

Each treatment was conducted using a boat equipped with an onboard mixing tank, in which the liquid herbicide was diluted with pond water. Using a low-pressure pump, the liquid mixture was then applied subsurface throughout the littoral zone of the pond. An onboard GPS unit was used to provide real-time navigation and ensure an even application in the targeted treatment areas. At no time during any treatment event were fish mortalities or significant non-target impacts to other aquatic organisms or wildlife either observed or reported.

No other herbicide or algaecide treatment events took place at Spy Pond in 2020.

2020 Vegetation Monitoring

The point-intercept method was utilized during the pre- and post-management surveys. Point-intercept surveys of Spy Pond were based on a 100-m grid within the littoral zone which resulted in a total of 87 data points. These point-intercept surveys were supplemented with an inspection of the entire littoral zone to identify beds of the target species. This 'bed identification' method, detailed below, was employed each time SOLitude visited the pond so that any new growth of the target species may be identified and targeted for management as soon as possible.

Survey Methodology

Point Intercept Method

SOLitude Lake Management's biologists surveyed the water body using the aforementioned survey points uploaded to a GPS unit. The following data will be collected at each of the survey points:

Water Depth	Species Present
Relative Abundance of each species	Total Percent Cover of All Species
Biovolume Index	Total Percent Cover of Target Species

Species Identification

The rake toss method, based on protocols developed by Cornell University, was used to retrieve submersed aquatic vegetation from either side of the survey vessel. Two rake tosses will be carried out at each point; one on either side of the survey vessel. Each species found on the rake will be identified and recorded. Plant species observed in the immediate area, but not found on either rake toss was also recorded. Any species not readily identified *in situ* was placed into a plastic bag labeled with the data point number and preserved for further analysis. Once all species were recorded, the most prevalent species was noted as dominant for later use in presence/absence maps.

Relative Abundance

The abundance scale, developed by the US Army Corps of Engineers and modified by Cornell, was used to categorize total growth.

Notation	Description
Z	Zero: no plants on rake
T	Trace: fingerful on rake
S	Sparse: handful on rake
M	Moderate: handful on rake
D	Dense: difficult to bring into boat

Percent Cover

Percent cover was defined as the percent of bottom sediments obscured by vegetation. In general, an area in which no sediments are visible was classified at 100% cover; at times, however, bottom sediments are not visible due to water clarity, regardless of vegetative growth. These points will be given a null (∅) designation, for data recording purposes.

Biomass Index

The biomass for each data point was recorded on a scale from zero to four:

0	No biomass	No plants
1	Low biomass	Very low growth
2	Moderate biomass	Growth extending up, into water column
3	High biomass	Growth in water column and possibly to surface, may be considered a recreational or habitat nuisance
4	Very high biomass	Growth filling the water column and covering the surface

Percentage of Target Species

The immediate area around the boat was observed for growth of *P. crispus, M. spicatum, Trapa natans,* and any other target species. Each point will be assigned the appropriate percentage.

Target Species Bed Identification

In order to identify target species bed perimeters, a boat was used to navigate around the pond while surveyors recorded the visual density of each bed. A GPS unit was used to track the boat as it moved around plant beds. This GPS track was uploaded to a GIS-based mapping program (ArcMap) and used to develop a pre-management map detailing the overall invasive/nuisance species situation, including relative densities and acreage of beds.

Early Season Point-intercept Survey

The early-season point-intercept survey was conducted on May 12, 2020 by a SOLitude biologist. A 10-foot Jon boat was used to tour the waterbody, locating the data points via a hand-held Garmin GPS. A throw-rake and under-water camera (Aqua-view) was used to observe submersed aquatic vegetation at each data point.

At the time of the survey, two submersed aquatic plants, one macro-alga, and filamentous algae were identified. Curly-leaf pondweed was the dominant species, present at 39 points (45%), followed by thin-leaf pondweed (13%), filamentous algae (21%), and stonewort (21%).The average depth of data points during the May survey was 10.7 feet with an average biovolume (height of plants in the water column) of 1.1. The average percent cover (or overall abundance) of plant cover was 24% with an overall abundance of target species present at 23%. *No Eurasian watermilfoil was observed at this time.*

Late Season Point-intercept Survey

The late-season point-intercept survey was conducted on August 20, 2020 by a SOLitude biologist. A 10-foot Jon boat was used to tour the waterbody, locating the data points via a hand-held Garmin GPS. A throw-rake and under-water camera (Aqua-view) was used to observe submersed aquatic vegetation at each data point.

At the time of the survey, the same species was observed as the early-season survey; however, thin-leaf pondweed was now the most dominant aquatic plant present at 12 points (or 14%). Stonewort (macro-alga) was observed at 18% of points, and filamentous algae was present at 26% of points. It is likely that the drastic reduction in the invasive curly-leaf pondweeds population contributed to the increased growth of the native thin-leaf pondweed. *No Eurasian watermilfoil or curly-leaf pondweed was observed at this time.*

Table 1. Species List and Frequency of Occurrence			
Macrophyte Species	**Common Name**	**May**	**August**
Potamogeton crispus	Curly-leaf Pondweed	45%	0%
Potamogeton pusillus	*Thin-leaf pondweed*	13%	14%
Nitella spp.	Stonewort	21%	18%
Benthic Filamentous Algae		21%	26%

Table 2. Average percentages of parameters		
Averages	May	August
Total Percent Cover of All Species	24%	11.1%
Total Percent Cover of Target Species	23%	0%
Total Biovolume of Data Points	1.1	1.2
Depth of Data Points	10.7 ft	9.8 ft

MANAGEMENT RECOMMENDATIONS

It is recommended to continue with both pre- and post-management point intercept survey efforts. By conducting the same survey efforts on an annual basis, vegetation composition changes and data comparisons can be observed over time. Additionally, these efforts allow for better understanding and determining the best management approach each year to strive for the Town's goals at Spy Pond.

As curly-leaf pondweed is an annual plant that grows from seed (turions) each year, some degree of management on an annual basis will be required until the existing seed bank within the sediment of Spy Pond is depleted. Based on the density and distribution of curly-leaf pondweed plants that are observed during the early season survey in 2020, it is recommended to proceed with either diver hand-pulling (if growth is scattered and low density) or spot-treatments utilizing diquat herbicide, where applicable if areas are beyond feasible for hand-pulling efforts. Both approaches should be undertaken before the plants develop and deposit their turions – ideally before mid-June.

Minimal to no Eurasian watermilfoil is anticipated to grow within Spy Pond in 2021 as a result of this year's Sonar treatment program. However, if stems do begin to grow, a similar approach to curly-leaf pondweed management can be taken utilizing either diver hand-pulling or spot-treatments with diquat herbicide.

Similar to curly-leaf pondweed, spiny/brittle naiad also grows primarily from seed each year. Although no spiny naiad was observed in 2020 as a result of the Sonar treatment program, if growth does appear in 2021, it is recommended to target it with diquat herbicide spot-treatments as spiny naiad cannot easily be managed via hand-pulling due to its high affinity to fragment for dispersal of seeds.

Recognizing that Spy Pond has experienced cyanobacteria (blue-green algae) blooms in recent years, it is recommended that monthly (or twice a month) algae sampling and contingent algaecide treatments be budgeted for moving forward. By conducting algae sampling on a scheduled basis, the algal cell counts can be monitored before they may reach quantities in which the pond has to be closed for human health safety risks. If that monitoring indicates that counts are increasing, a proactive algaecide treatment can be conducted to control the algae growth. By having a proactive approach to algae management, less algaecide can potentially be used, depending on the severity of the bloom, as only half of a waterbody can be treated at any one time for algae in order to protect against any dissolved oxygen decreases that may cause a fish kill or otherwise impact aquatic wildlife. Monthly algae treatments can also be scheduled as similarly structured programs at drinking water supplies throughout New England have proven to be successful in keeping algal cell counts low and within safe thresholds.

Coupling an algae sampling program with a water quality monitoring program is also recommended. Conducting at least two rounds of water quality sampling each year (during pre- and post-management surveys) at Spy Pond, for a variety of common, indicative parameters would allow for a better understanding of nutrient levels and any issues that may be present. Further, if there are concerns or suspicions about specific locations of nutrient inputs at Spy Pond, those can be sampled for further understanding about their impact as well.

Based on the results of any water quality sampling and the history of algae blooms at the pond, it is recommended to begin considering utilizing aluminum sulfate (alum) to mitigate some of the available phosphorus within the water. Alum applications can be conducted annually with a low-dose application to "strip" the soluble phosphorus from the water column, or a high-dose application can be conducted. Annual, low-dose applications can have a cumulative effect on the phosphorus levels over consistent years of application. High-dose applications focus on creating a layer of alum along the bottom sediment in order to bind with and prevent any further release of phosphorus from the sediment itself. These applications require years of watershed and in-water studies for effective dosing purposes and have a significantly higher cost associated with them for a waterbody of Spy Pond's size (>$200,000).

Some level of ongoing management at Spy Pond will continue to be required to uphold the success and control achieved over the last few years. As such, we look forward to working with the Town again in 2021 to align our recommendations with the goals best suited for maintaining Spy Pond for all uses.

Appendix A: Treatment and Point-intercept Maps

FIGURE 1: Data Points

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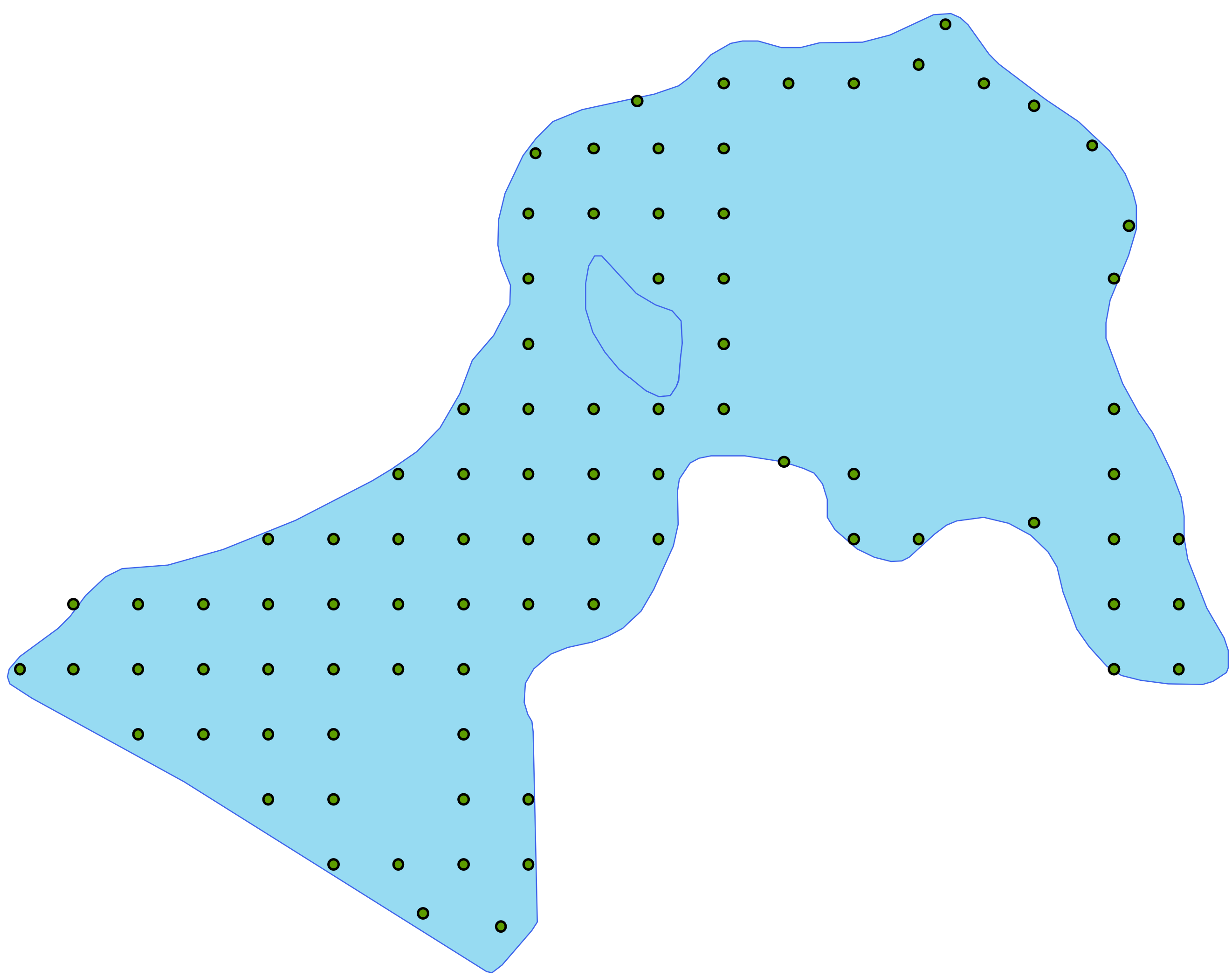
Legend

Data Points



Spy Pond
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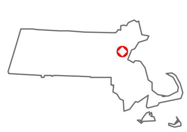

Spy Pond

0 500 1,000

1:6,500 Feet

N

Map Date: 12/2/2020
Prepared by: ALM
Office: SHREWSBURY, MA

FIGURE 2: Depth

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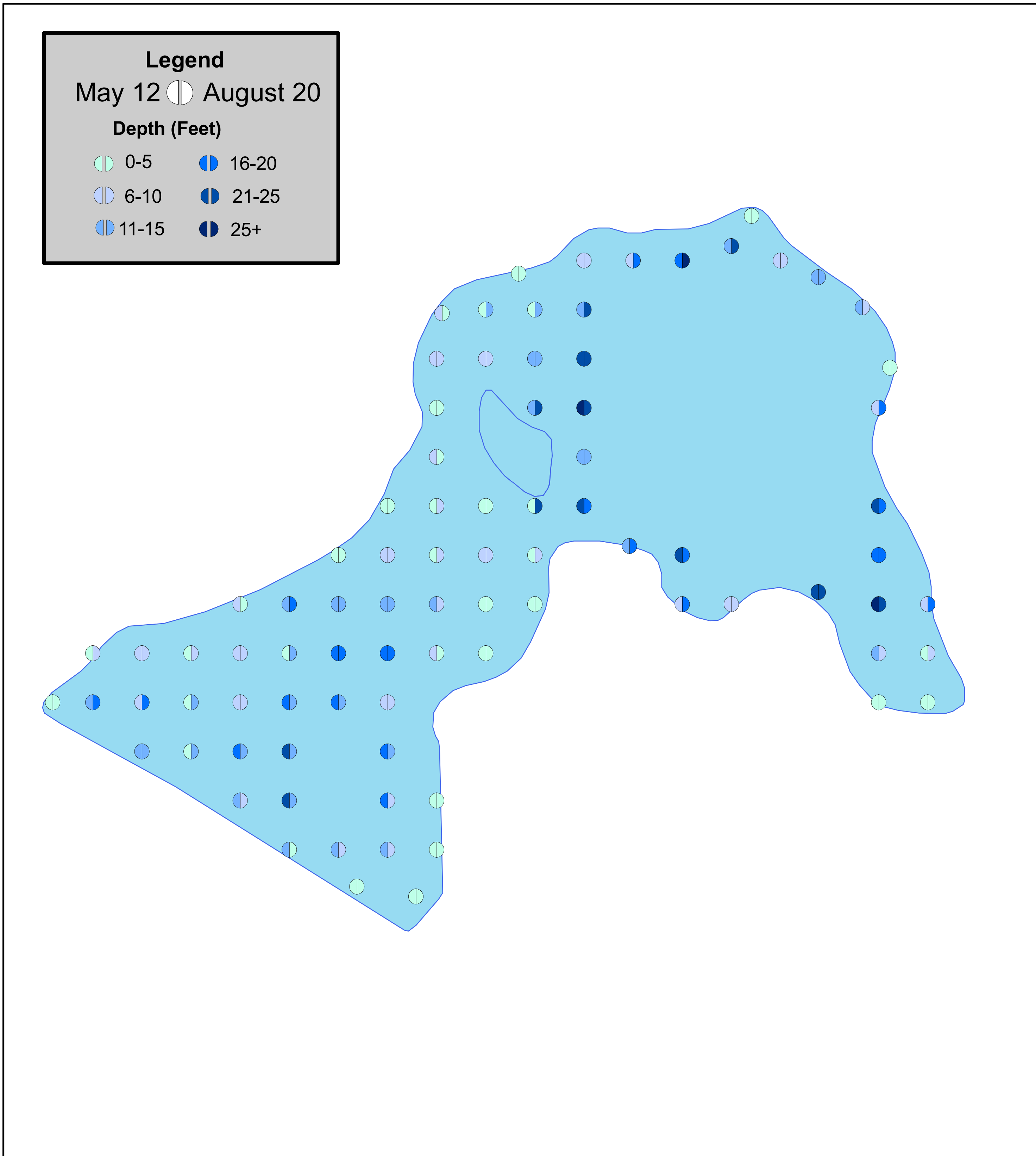

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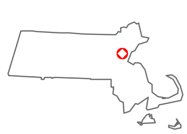
Arlington, MA



Spy Pond

0 500 1,000
1:6,500 Feet
N

Map Date: 12/2/2020
Prepared by: ALM
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FIGURE 3: Percent Cover of All Submersed Aquatic Vegetation

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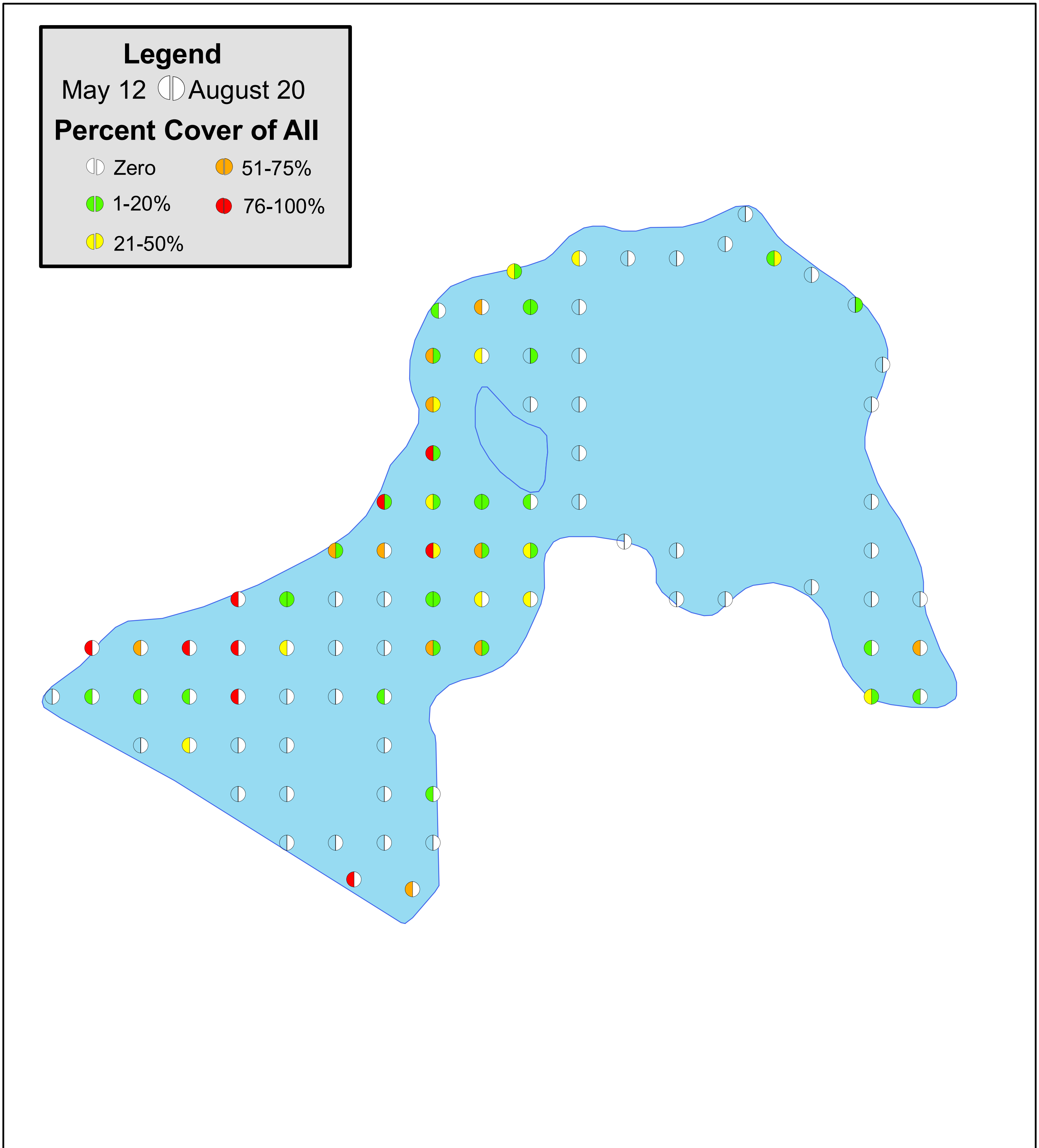

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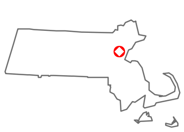

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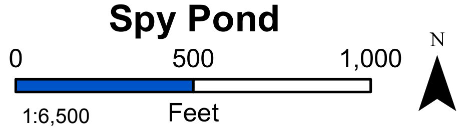

Map Date: 12/2/2020
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FIGURE 4: Percent Cover of Target Species

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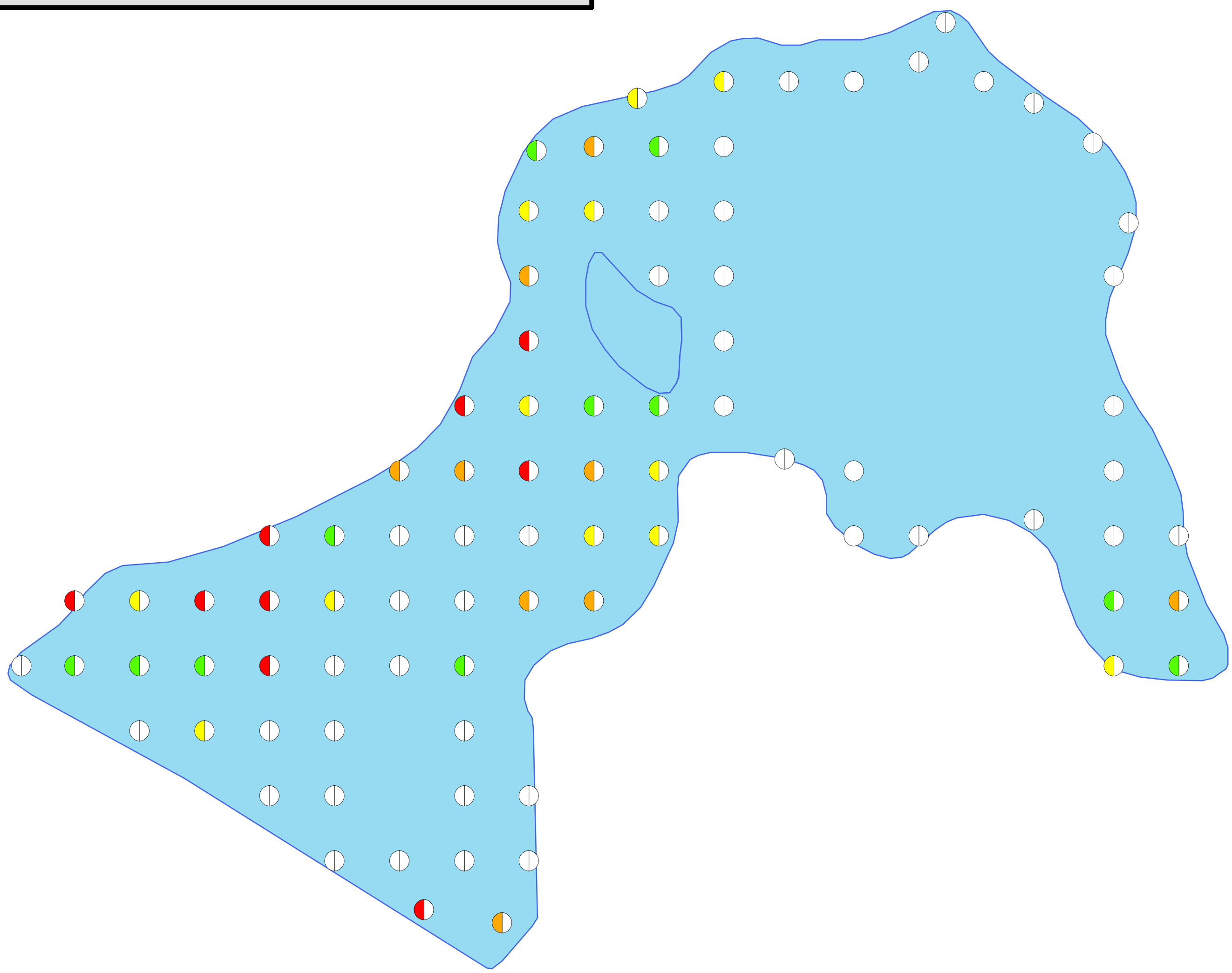
Legend

May 12 | August 20

Percent Cover of Target Species

- Zero
- 1-20%
- 21-50%
- 51-75%
- 76-100%



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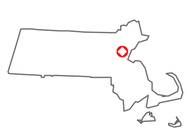

Spy Pond

0 500 1,000
Feet
1:6,500
N

Map Date: 12/2/2020
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FIGURE 5: Total Biovolume of Data Points

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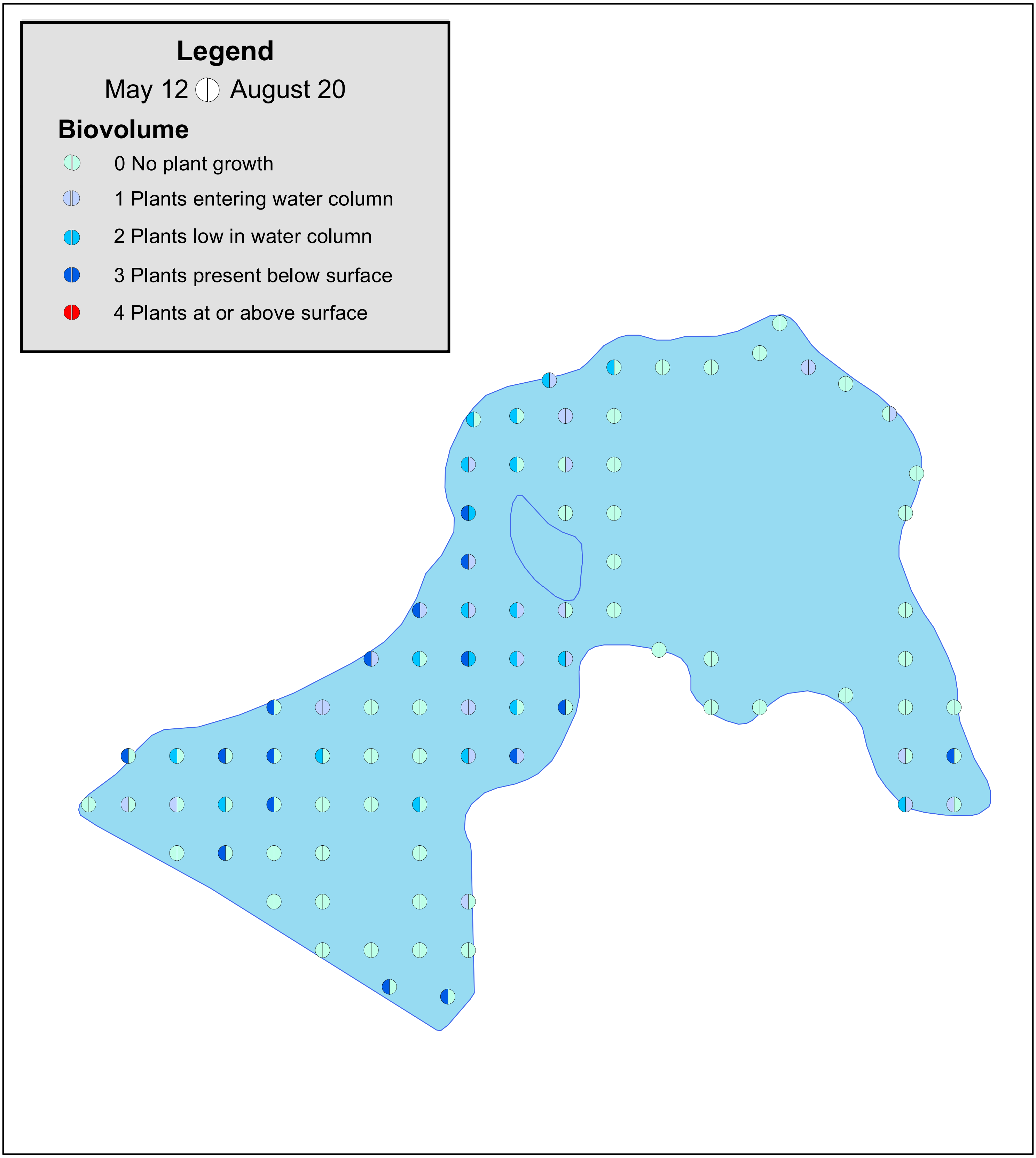

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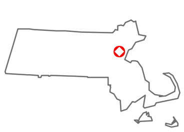

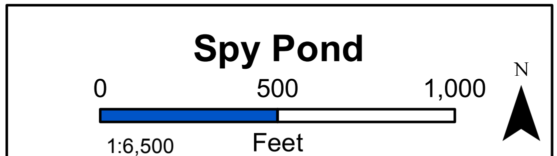

Map Date: 12/2/2020
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FIGURE 6: Relative Abundance of Curly-leaf Pondweed *(P. crispus)*

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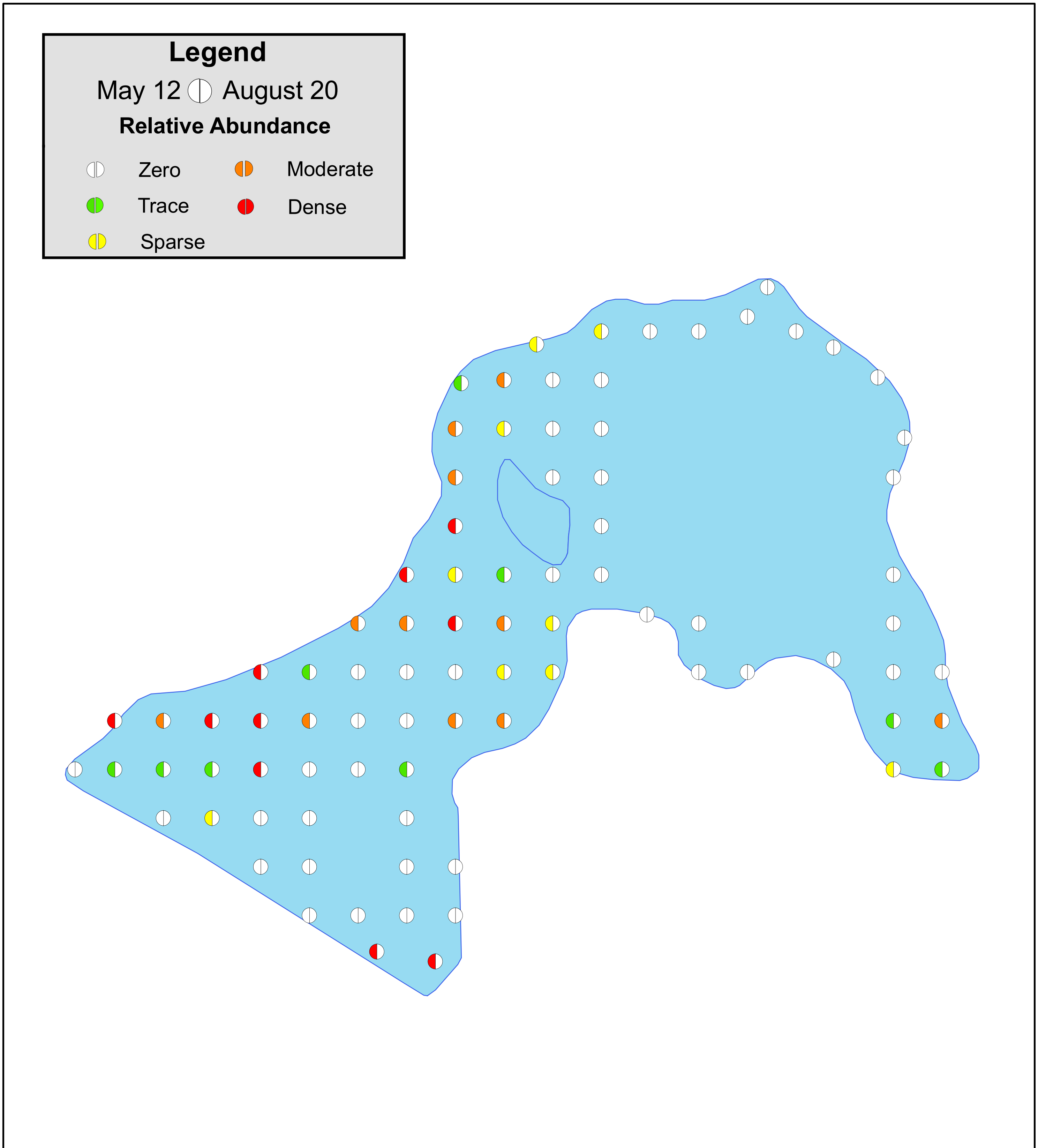

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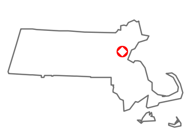

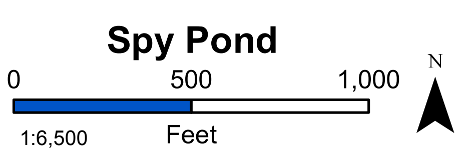

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FIGURE 7: Relative Abundance of Thin-leaf Pondweed *(P. pusillus)*

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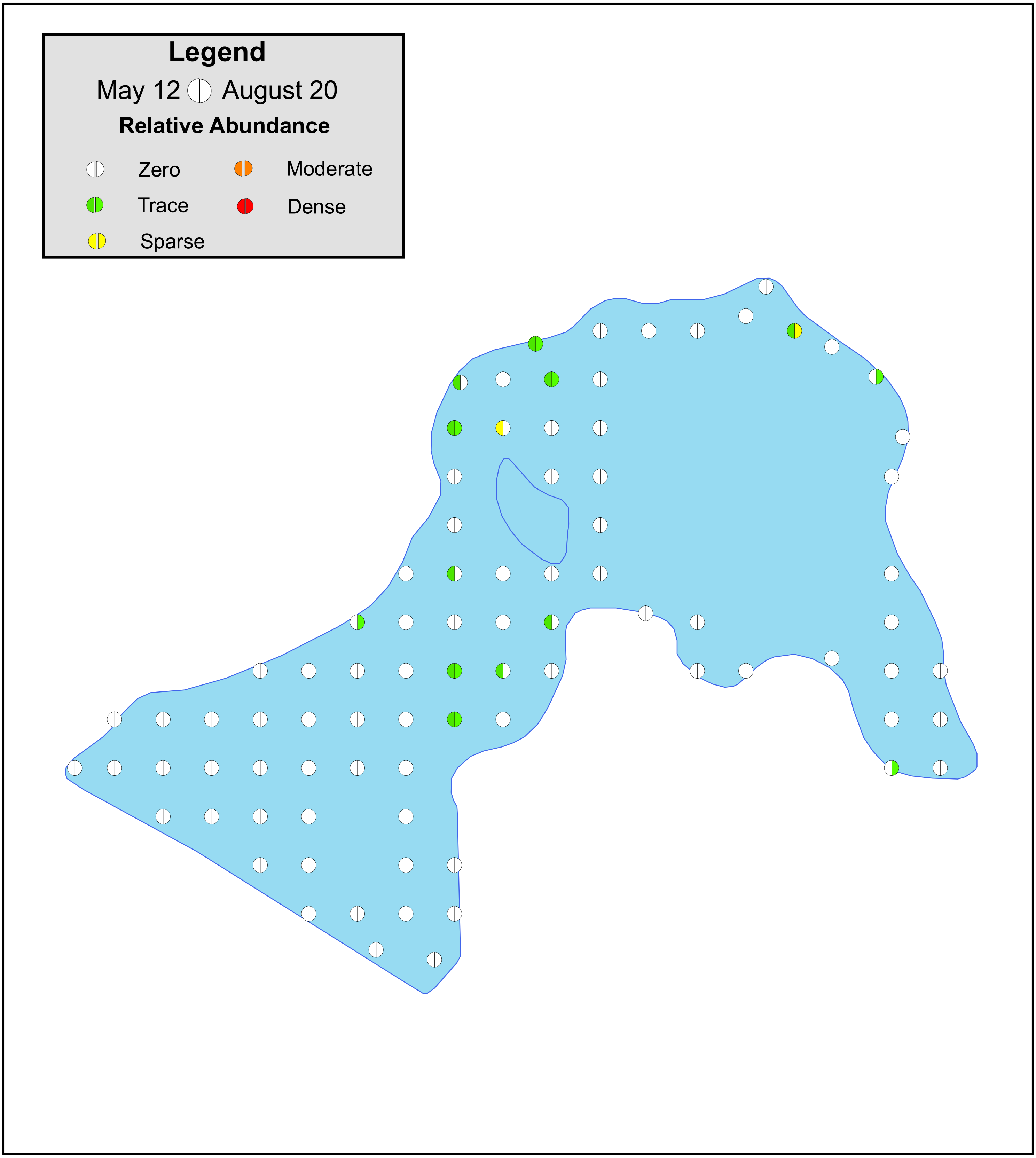

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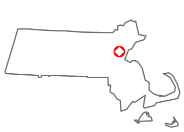

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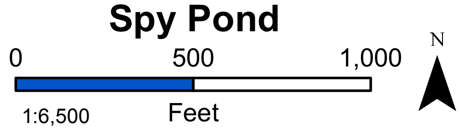

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FIGURE 8: Relative Abundance of Stonewort *(Nitella spp.)*

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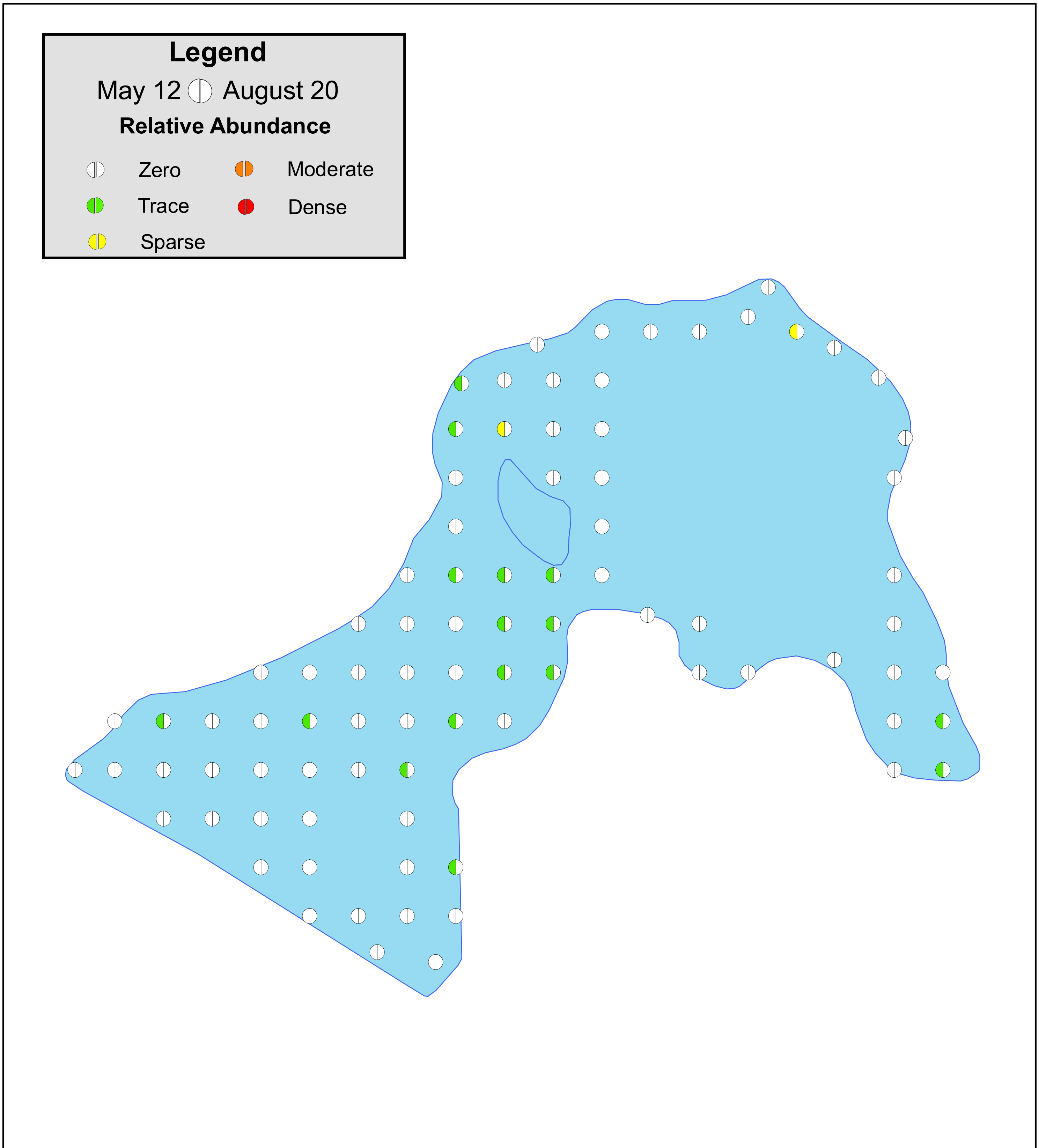

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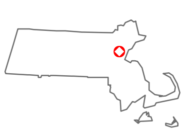

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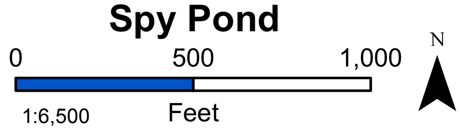

Map Date: 12/2/2020
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FIGURE 9: Relative Abundance of Filamentous Algae

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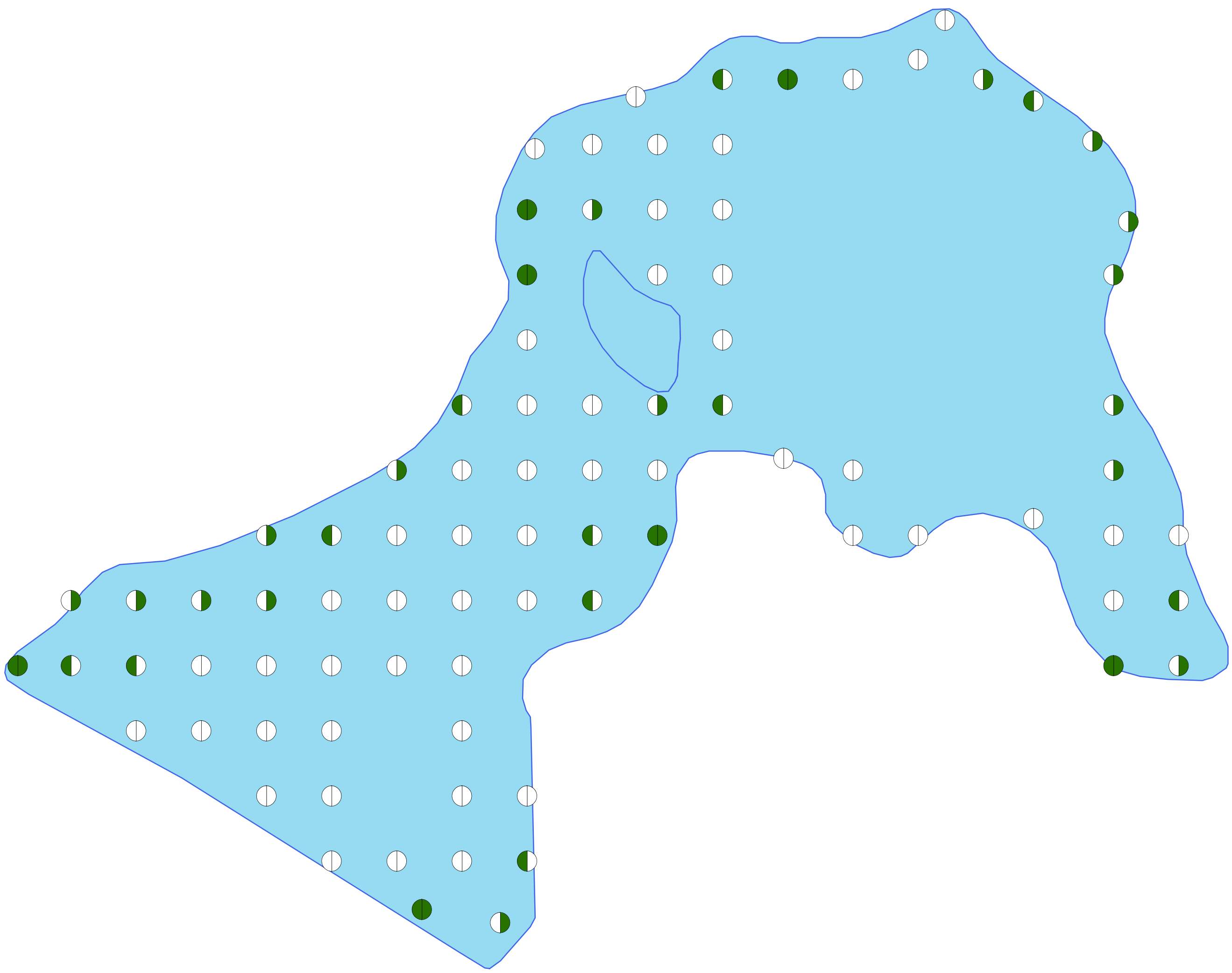
Legend

May 12 ◑ August 20

Relative Abundance

◑ Zero

● Present



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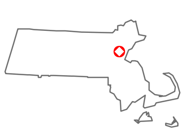

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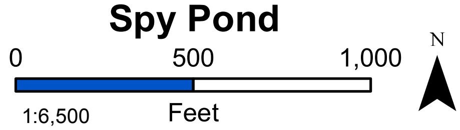

Map Date: 12/2/2020
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Appendix B: Raw Data

Data Point	Depth (Feet)	Biovolume	% Cover All	% Cover Target	Curly-leaf Pondweed	Thin-leaf Pondweed	Stonewort	Filamentous Algae
1	3.5	1	10	0		S	S	
2	3	1	10	10	T			
3	4.5	1	10	10		T	T	P
4	8.5	1	10	0			T	
5	6.8	0	0	0				
6	8	0	0	0				
7	8	0	0	0				
8	19.3	0	0	0				
9	10.8	1	25	25	S			
10	7.5	1	20	20	T			
11	3.5	2	75	70	M	T		
12	4.5	2	55	55	M			
13	16	0	0	0				
14	26	0	0	0				
15	28	0	0	0				
16	10	0	0	0				
17	8.8	0	0	0				
18	26	0	0	0				
19	2	0	0	0				P
20	6	3	100	100	D			
21	4.5	2	80	80	D			
22	5	3	90	90	D			
23	4	3	80	80	M			
24	8	2	30	25	S	T		
25	5	3	65	65	M			
26	7	3	95	95	D			
27	6	2	75	75	D			
28	10.5	0	0	0				
30	7	2	100	100	D			
31	6.5	2	70	60				
32	15.4	1	1	0		T		
33	14	0	0	0				
34	12.2	0	0	0				
35	5	3	90	90	D			
36	6	1	15	15	T			
37	7	2	65	65	M			
38	6	3	100	100	D			
39	6	3	100	100	D			
40	6	2	75	75	D			
41	7	2	70	70	M			

Data Point	Depth (Feet)	Biovolume	% Cover All	% Cover Target	Curly-leaf Pondweed	Thin-leaf Pondweed	Stonewort	Filamentous Algae
42	16.4	0	0	0				
43	17	3	75	0	M			
44	8	2	35	30	S	T		P
45	5	2	80	80	M			
46	15.2	0	0	0				
47	17.9	0	0	0				
48	15.8	0	0	0				
49	6	3	75	75	D			
50	6	3	80	80	D			
51	11.5	1	10	10	T			
52	13.5	0	0	0				
53	4	3	35	35	S			P
54	16.2	0	0	0				
55	10.5	1	5	5	T			
56	16.4	0	0	0				
57	21.7	0	0	0				
58	17.2	0	0	0				
59	2	0	0	0				P
60	17	0	0	0				
61	23	0	0	0				
62	11	0	0	0				
63	10.6	1	5	5	T			
64	10.2	0	0	0				
65	14.8	0	0	0				P
66	3	0	0	0				P
67	7	2	80	80	D			
68	6	3	75	75	M			
69	6	3	90	90	D			
70	6	3	65	65	M			
71	10.1	1	5	0			T	
72	27.8	0	0	0				
73	21.5	0	0	0				
74	22.8	0	0	0				
75	14.5	0	0	0				
76	8.8	2	75	75	M			
77	9	1	5	0		T		
78	8.5	2	45	45	S			
79	4.8	2	25	25	S			
80	5.2	1	5	5		T		
81	14.5	0	0	0				

Data Point	Depth (Feet)	Biovolume	% Cover All	% Cover Target	Curly-leaf Pondweed	Thin-leaf Pondweed	Stonewort	Filamentous Algae
82	5	3	75	70	M	T		
83	6.7	1	10	0			T	
84	11	0	0	0				P
85	12	1	10	10	T			
86	8	1	25	25	S			
87	2	0	0	0				

Data Point	Depth (Feet)	Biovolume	% Cover All	% Cover Target	Curly-leaf Pondweed	Stonewort	Filamentous Agla	Thin-leaf Pondweed
1	6	1	20	0			P	S
10	5			0			P	
11	4	1	10	0			P	T
12	10			0				
13	23			0				
14	22			0				
15	9			0				
16	17			0				
17	18			0				
18	19			0				
19	20			0				
2	15			0				
20	25			0			P	
21	5	1	5	0		T		
22	6	1	5	0		T		
23	4	1	5	0		T		
24	4	1	10	0			P	T
25	10			0				
26	7	2	20	0		S		
27	7	1	10	0		T		
28	6	1	10	0		T		
3	6	1	10	0			P	T
30	4			0			P	
31	5			0				
32	7	1	10	0				T
33	14			0				
34	15			0				
35	16	1	10	0		T		
36	3			0			P	
37	8			0			P	
38	6			0			P	
39	7			0			P	
4	3			0			P	
40	7			0			P	
41	13			0				
42	19			0				

Data Point	Depth (Feet)	Biovolume	% Cover All	% Cover Target	Curly-leaf Pondweed	Stonewort	Filamentous Agla	Thin-leaf Pondweed
43	17			0				
44	4	1	10	0		T		T
45	2	1	10	0		T		
46	8			0				
47	15			0				
48	11			0				
49	6			0				
5	16			0			P	
50	15			0				
51	16			0				
52	16			0				
53	1			0			P	
54	14			0				
55	12			0				
56	15			0				
57	15			0				
58	11			0				
59	2			0				
6	17			0			P	
60	9			0				
61	12			0				
62	9			0				
63	5			0				
64	8			0				
65	7			0				
66	1			0				
67	1			0			P	
68	3			0			P	
69	4	1	10	0		T		
7	18			0			P	
70	4	2	20	0		T	P	
71	22			0				
72	25			0				
73	12			0				
74	23			0				
75	15	1	10	0		T		

Data Point	Depth (Feet)	Biovolume	% Cover All	% Cover Target	Curly-leaf Pondweed	Stonewort	Filamentous Agla	Thin-leaf Pondweed
76	10			0			P	
77	8	1	10	0		T	P	T
78	4			0				
79	15			0				
8	19			0				
80	12	1	5	0				T
81	23			0				
82	4	1	5	0				T
83	9			0				
84	16			0			P	
85	26			0				
86	25			0				
87	0			0				
9	8			0				